



Imperial ENGINEER

JEFF MAGEE

AOUDA X SPACESUIT

FOUR-LEGGED FRIENDS

TRACKLAYING IN WALES

RED PROJECT IN BORNEO

ABONARAS & VIPS IN EL SALVADOR

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

ISSUE 26 *SPRING 2017*

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Front Cover photo:
Sunrise over the
Carpathian Mountains,
Romania
Taken en route to work on
the Aouda X spacesuit
(pp 16-17)

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Welcome to the Spring edition of Imperial ENGINEER.

2017 has started well for CGCA with one of the best Annual Dinners for some time, held at Saddlers Hall on 3rd March. Regular readers of IE will know that our guest speaker was Prof Isobel Pollock-Hulf and our principal guests included IC's Provost, Prof James Stirling, and the Dean of the Faculty of Engineering, Prof Jeff Magee. It was a delight for me to welcome Isobel as our principal guest and to reminisce with her and all of the attendees at the dinner about how we came to be founding members of the Imperial College Women's Boat Club along with Jenny Jones (now Jenny Body).

For those of you who didn't attend the dinner, the story is that on Morphy Day, members of the College Rugby Clubs had been invited for a number of years to provide the entertaining/fun rowing event ahead of the serious stuff. But in 1974, the rugby boys were otherwise engaged on said day and someone had the bright idea of putting some girls on the water to provide the entertainment. They should of course, have known better because we actually gave quite a good account of ourselves on the day, despite being complete novices, and went on to form the Women's Boat Club and take up rowing seriously.

Isobel not only shared her own recollections of being a Guildswoman back in the '70s but also had some inspiring words for the current cohort of students who attended the dinner.

Without detracting in any way from the quality of guest speakers, who were wonderful, the 'surprise' event of this year's dinner turned out to be a real highlight. Imperial College's own world champion a cappella choir – *The Tectonics* – performed for us at the end of the dinner and were so amazing they were called back for an encore. The feedback from all who attended the dinner was that this was a great innovation, and because of the high praise, we plan to invite them to join us again next year.

So, if you were unable to join us this year, make a resolution now not to miss out next year.

I would also like to praise Milia Hasbani (CGCU President) for arranging a Women in Engineering event in February. My old friends Jenny and Isobel joined the panel along with some younger inspiring women engineers. The debate was lively and feedback from the 80+ audience that attended was very positive. I was particularly heartened to see a number of male students in the audience and participating in the discussion. We were able to broaden our debate to cover diversity in its fullest sense and the benefits it brings to every organisation when they learn to appreciate the value of different perspectives.

Things have certainly changed for the better since the 1970s even though there is still progress to be made, not just in engineering but in attitudes more generally. On March 8th (International Women's Day), I received an email from an electrical retailer telling me that to celebrate International Women's Day they would like to present me with a £20 money off voucher for a washing machine!! How do you counter that??



**Judith
Hackitt**

PRESIDENTS REPORT



**Tim
Cotton**

The winter months have been busy for RSMA and RSMU and there have been a number of memorable events since I last wrote in September, last year. The 132nd annual dinner was held on Friday 26th November at the Rembrandt Hotel in Knightsbridge. This year saw 97 guests join the Committee and me, of which 35 were current RSMU students. We were entertained by a very informative, witty and fascinating speech by the Guest Speaker, Professor Peter Haynes, Head of Materials. Peter's speech drew parallels with one of the first students of the 1851 Government School of Mines in Jermyn Street (a precursor to the Royal School of Mines) and how the values of Hilary Bauerman are very much alive today and flourish in the current Departments. Once again the members of the RSMA were extremely generous and sponsored all the students attending. This level of support is very much appreciated by the students and I would like to personally thank all those members who supported the students.

The RSMU has had a number of events over the winter term including celebrating the birthday of the Union Bar in January (it is 60 years young by the way) and hosting the Camborne School of Mines in February for the Bottle Match sporting weekend. Some 10 matches were played across 9 sports and the RSM retained the Bottle and Sharpley cup. See inside for a more detailed account of each and every game.

There are a number of upcoming events for your calendars. RSMA will have a presence at the Alumni Weekend at the Imperial Festival on the 6th May 2017 during the day and in the Union Bar afterwards. Planning is already underway for the 2017 Summer BBQ for Final Year Students and this will be occurring on Thursday June 29th at a venue to be announced soon. Also, a date has been confirmed for the 133rd Annual Dinner: Friday November 24th 2017, the Friday before Mines and Money London starts.

Getting new members into the RSMA is critical for the ongoing survival of the Association and this remains one of our key challenges. We want graduating students to sign up AND we want former students who graduated and who want to re-engage with the RSM to sign up too. The RSMA is not alone in this challenge and every Association or Club is always looking for ways to get more members. Accordingly the RSMA and CGCA are exploring ways in which the two Associations can work closer together and work more closely with the Faculty of Engineering at Imperial College to establish a more attractive and sustainable graduate/alumni engagement process that is more relevant to current students, recent graduates and not-so-recent graduates! As and when new ideas or changes in the way we do things are devised, we will share this with the membership. Rest assured, the existing RSMA principles and assets are unchanged and will be untouched in this process. A step in this direction has been the support of the College's Development Department in the Faculty of Engineering, to facilitate running of the Associations' administration since the retirement of Teresa Sergot.

Lastly, we need to increase our fund-raising activities as new memberships are not enough to be able to continue to grow our support of the RSM. Our vision is to be able to provide more support to students, in terms of hardship, furthering academic-related activities such as field trips and bursaries. Last year the RSMA initiated the 100 Club fund-raising activity and this is continuing to grow, albeit at a slower pace than planned, so please do read the advert (on page 4) in this edition of the Imperial ENGINEER and sign up!!

ROYAL SCHOOL OF MINES ASSOCIATION: 100 CLUB GIVE BACK TO THE RSM THAT GAVE YOU YOUR START

In June 2016 the RSMA issued a funds appeal, a key feature of which was the creation of the "RSMA 100 Club". The response from many alumni has been excellent, for which the RSMA sincerely thanks you. However, we are significantly short of our target of 100 members so I am sending this further appeal via Imperial ENGINEER. I realise that there are many appeals for funds from various entities within Imperial, but the 100 Club is for RSM alumni to directly support the RSM students. The RSMA has minimal overheads, so all donations will directly benefit the students.

The "RSMA 100 Club" objective is for one hundred supporters to make a pledge (non binding) to each donate £200 per annum (~ £4/week) into the RSMA Trust for 10 years. This would guarantee an additional annual income of up to £25000, after Gift Aid, and would allow the RSMA committee to increase its efforts and expand its largesse to award annual "RSMA bursaries" or to increase its sponsorship for college-approved expeditions, summer research, field trips, industry visits etc. This should also help to raise the profile of the RSMA amongst the students and hopefully encourage them to join the association. The RSMA would work with college staff in determining the appropriate awards.

A fundamental role of the RSMA is to support the RSM constituent departments (Earth Science and Engineering, and Materials) and its students. Students are under increasing financial pressure these days which could restrict their ability to participate in academic-related activities such as field trips or college-approved expeditions. Endowments to the RSMA provide funds for both extra-curricular academic activities, particularly those that increase student links with industry and their chances of gaining sector-leading employment upon graduation, and also complement the long-established work of the RSMA Trust in helping to provide financial support for students undergoing genuine hardship.

As many of you will appreciate, IC and the RSM have changed dramatically over the last couple of decades but I firmly believe that a strong RSMA, supporting a strong RSMU, will ensure that the values we cherish and adhere to will be maintained throughout the coming years. The 100 Club could be a key contributor in ensuring the future of the RSM, so I would ask you to give this appeal your consideration.

Joining the 100 Club can be via the RSMA website (www.rsm-association.org) by clicking on Endowment Fund, or by cheque made out to the RSMA Trust, direct to the treasurer, stating clearly that the donation is for the 100 Club. For overseas members, donations in any currency are welcome (IBAN is GB53MIDL40053032059233 and BIC is MIDLGB2141W). Details for mail are:

RSMA Trust Treasurer, Level 2, Faculty Building, Imperial College London SW7 2AZ

As the RSMA Trust is a registered charity (registered no. 1015809), if you are a UK taxpayer, fulfilling certain HMRC criteria, for every £100 you donate, the Trust can claim an additional £25 if you sign the appropriate declaration. The required Gift Aid form is available on the website and this should be forwarded to the treasurer at the above address. On joining the 100 Club, please also send a confirmatory e-mail to the treasurer (David Bishop) at dave.bishop1950@gmail.com

Many thanks for your support.

The Bottle Match 2017

The Bottle Match 2017, held over the weekend of 17th/18th February, was the biggest and arguably best bottle match in recent years. In addition to the all-important rugby match, nine other matches were played over the course of two days with great play and sportsmanship from both RSM and CSM.

This year saw the re-introduction of Bottle Match Golf, held at Richmond golf club. A strong team of three Royal Miners, captained by Edward Andrews, along with their respective caddies, took to the green for eighteen holes. To seal the first victory, two birdies in the last two holes meant Edward emerged as the victor, beating his CSM opponent comfortably. Edward's twin and fellow Royal Miner, Will, also beat his CSM opponent despite a slight wobble at the start. Will eased ahead to a comfortable win on the back nine. The final pairing proved a more mercurial affair, with Luke Cottell displaying a blend of fantastic shots followed by some more interesting ones. Whilst

being composed throughout the game, Luke approached the 18th in a close-fought encounter, with an unfortunate loss at the very end. Nevertheless, the champagne was already in full flow and RSM celebrated a marvellous victory and already look forward to retaining the title in Cornwall next year.

The second match of the weekend was tennis, held in Fulham. Despite some very passionate CSM supporters, RSM managed to play extremely well. Captained by Charlie Singer, the team put on a solid performance and did RSM proud, despite only one of the team actually regularly playing tennis. In the end, RSM lost 4-0, but were in no way disheartened as they all showed fantastic skill and sportsmanship.

On the Friday afternoon, RSM set our sights on 'Squashing' the opposition back in South Kensington. The squash match saw a Bottle Match veteran, Kieron Creagh, captain a great team with some superb play. Unfortunately, CSM had the edge and the match ended

4-0 in favour of CSM. Meanwhile, the badminton was outstanding; 18/18 sets won; 9/9 matches won. The RSM badminton club have been working so hard all year. The club has seen its membership and training schedule increase twofold and club president Claudia Callard could not have been more proud of the Bottle Match performance.

The netball was held in Battersea on the Friday night, with both sides showing passionate support for their respective mining schools. RSM Netball President Sophie Butcher and Captain Jen Heyes, demonstrated how much the team have improved in just a year. With regular league games throughout the year, the girls fought hard and did themselves proud. At the final whistle the score was 50-11 to CSM, however RSM's match play and teamwork was the best it's ever been.

Bright and early on Saturday morning, the RSM headed out to Harlington for another day of



action. Some tactical pre-game carb-loading by the RSM hockey teams meant they were more than ready for the early pushback. First up were the ladies, captained by Alice Tidswell. The first 10 minutes saw a strong start, with CSM struggling to get the ball into our 25. Solid teamwork in the midfield meant that we held possession well. A lapse in concentration saw CSM score the first goal, and RSM had conceded 4 as the half-time whistle blew. However, in the second half, determined to put up a fight, RSM fought well and played some of the best hockey of the season. Excellent teamwork and some good defence meant that RSM didn't concede any goals from penalty corners. The final score was 6-0 to CSM, but we knew we could be proud of our efforts; putting up a hard fight and keeping the score in single digits. However, celebrations were put on hold until after the men's hockey match.

The men's hockey match was one of the most exciting of the weekend. The team were focused and well

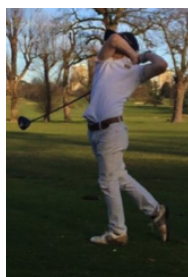


Photo by Rosie Blannin



prepared for the fast-paced game. Captain Ben Conway-Jones led by example, scoring the RSM's first goal within minutes. The rest of the team, however, did not let him take all the glory, with two more goals from ex-captain Jonny Jones and Henrik Dittmar. In defence, goal keeper Matty Hayward pulled out a world-class save on one of the few occasions that CSM had the ball in our half. The final score was 3-1 to RSM: Mr Sharpley will be glad to know that his trophy is yet again at home in the RSM, hopefully in one piece this year.

Lacrosse was a new addition to the Bottle Match weekend this year, with the RSM team comprising a mixture of experienced and new players. Despite RSM needing to learn which way to hold the stick and team kit consisting of mismatched neon bibs, play was soon underway and RSM meant business. Captain Arianna Guppy led the way,

Photo by Harry Fisher



tearing through the CSM defence and showing CSM how it's done. Even though tensions did rise on the pitch, with multiple yellow and red cards given to both teams, RSM held a convincing lead and won 10-3. Despite our very 'Sunday league' appearance, the players really showed the spectators their raw talent. CSM had better get training for next year!

Photo by Victoria Quigley



The penultimate game of the weekend was football. With poor results in previous years (RSM haven't scored in Bottle Match football for 11 years), expectations were not sky high, but captain James Smith and his team proved us all wrong. The champagne-moment was undoubtedly when an RSM free kick from 24 yards resulted in a shot from RSM's George Hedley, which was deflected by a CSM player into the goal!

This meant that the match ended 1-1. Unfortunately, CSM retain the trophy as they won last year, however RSM showed everyone just how much all their hard work throughout the year has paid off. RSM fresher Micky Yu summed up the match; 'the sportsmanship and endeavour of our players made us believe, in the near future, the trophy would definitely come back'.

After nine intense matches, it was time for the rugby; the reason we were all there... to bring home the bottle. Man of the match, Matthew Blackett, reports on the match:

On 20th February 2016, a tragedy befell the Royal School of Mines in the dark dingy depths of Falmouth. The Bottle was lost! In the midst of one the biggest storms the south coast has ever seen, the RSM rugby players fell victim to the CSM scum in the muddy trenches. A year later, in the leafy suburbs of Harlington, a new mining outfit strode out adorned in their new wind-stopper jackets. With both sidelines cheering the players on with effervescent merriment, the whistle sounded and Moorby got us underway. After some strong defence from RSM in the opposition half, we were rewarded with the first penalty of the match and a chance for Moorby to put the Black and Gold in front, which he duly took. CSM pitched the ball high off the kick off which RSM collected and kicked back deep, to keep the pressure on the Cornishmen. More good defence resulted in a quick turnover and after some good phase play from hard running forwards, Field spread the ball wide to Dunning who skillfully drew his man and offloaded to Moorby to canter over unopposed on the left wing, who once again held his nerve with the boot to put the Royals up by 10 points.

From the restart, which DNS collected in his usual over the head fashion, RSM kept with the same flowing and accurate style of play to give Moorby a chance to take another 3 points, this time from slightly further out, but the result was the same. 10 mins gone and with a 13 point lead, the bottle seemed like it was on its way back to the capital. CSM wouldn't be letting it go that easily and came storming back straight from the kick off, piling the pressure on the RSM forwards with good line speed and low tackles, from a turnover they worked it wide and with a slipped tackle, dived over the line to get themselves slightly back into the game, however they were not able to convert so they were still behind by 8. Having their lead cut seemed to spur the Londoners on as, from the next scrum on the halfway line with a sizeable blindside, Zabaronsky took off in his usual sideways fashion and, ignoring calls for a pass from the wing, broke through three tackles before finally offloading before he hit the ground, to set Amato up with some clear air ahead of him and only one covering defender to beat. Using his quick feet and outrageous pace, he rounded the last man to dot down and restore RSM's early dominance, to many cheers from the Black and Gold sideline. Moorby was once again impeccable from the tee, neatly bisecting the posts from near the touchline. This try seemed to get under the skin of those in blue and yellow shirts, with a few scuffles erupting in the following minutes, which the ref calmed down with a severe telling off...

There followed a mundane passage of play with both sides committing many errors and not being able to sustain enough pressure to trouble either defence. But as if he had sensed the game needed sparking up, out of nowhere, a thumping dump tackle by Wright landed a poor CSM player flat on his ass and doubled over in pain. The ref however deemed it to be illegal as he was concerned for the CSM players' dignity and showed Wright a yellow for his excellent technique. But even being down to 14 men did not

phase the RSM, as they fought back hard to get into the opposition 22 and Blackett won a penalty after collecting a loose ball only to be tackled high, with the CSM attempted tackler having to be taken off for a blood replacement. Moorby easily tapped over the penalty from in front. Shortly after, CSM were dealt another blow with their captain having to be stretchered off with a broken leg, thus ending the first half 5 minutes early.

Both teams came flying out of the blocks for the second period with more big hits and outrageous steps. Everything was going RSM's way though, as they got straight back into the opposition half and after some sustained pressure, once again we span the ball wide and this time Moorby turned provider to put Captain Dunne through for RSM's third try of the match. Moorby once again provided a kicking masterclass with the conversion to extend the lead by 2 more points. CSM came back with another try through some offloads and a bit of luck from the bounce of the ball but Moorby gave us some more breathing room with two more penalties after some good play from RSM. With 2 minutes to go, the Cornishmen converted from a wide move off a lineout in our 22. However shortly after the kick off, they knocked on and Blackett sent the ball into the crowds to the sound of the whistle, starting the wild celebrations and pitch invasion. Dunne was hoisted onto people's shoulders to receive the bottle which he held aloft to triumphant cheers from the Black and Gold army. The crowd and players then returned to the union to place the bottle in its rightful place and celebrate their success.

**Evelyn Mason RSMU
Honorary Secretary**



Photo by Evelyn Mason

Photo by Joshua Kishro



'5 & 10' Reunion Lunch re-unites old friends

Following a tradition started in 1979, CGCA members gathered at College last November for the annual CGCA reunion lunch. Historically, alumni who graduated an exact multiple of 10 years ago attend. However, this rule was changed for 2016 (and the future) to also include those who left a multiple of five years ago.

The lunch on this occasion was attended by contingents from 1956, 1961, 1966, a group of Chem Eng from 1976 and other years. We were also very pleased to have

along several officers of the City and Guilds College Union, including the mascot bearers and Bo's driver and co-driver. Bo himself was parked outside (much to the displeasure of College, who feared his ferocious weight might crack some paving slabs). However, I'm pleased to report no damage was done, although discretion suggests we do not let this happen again!

Customarily, at the end of each course, one or two alumni say a few words about what life was like at College in their day. These interludes

often offer a fascinating insight into the good old days, and include some excellent anecdotes reminding us of Morphy Day, Mr Mooney's catering and other memorable facets of College life. This year's lunch included some well-chosen words by Basil Evans (Aero '56), Edwin Heald (Chem Eng '76) and Turaj Ettehadieh (Civ Eng '66). Turaj is Iranian, and has spent his career working both in Iran and the UK; he decided to coordinate a visit to London to coincide with the lunch, and he was particularly welcome.

Alison Jackson, this year's CGCU Hon Sec, wrapped up the lunch with some great insights into life today at College, of interest to all who were there. The food was excellent – standards at College have risen considerably since what many of us remember from the last century!

But most of all, I would say there was a tremendous atmosphere of camaraderie and a warm glow generated from old acquaintances remade and memories relived.

Peter Chase (Comp '82-85)
'5 & 10' Reunion Lunch Organiser

Any members (of both CGCA and RSMA) who graduated in a year ending 2 or 7 would be most welcome at this year's lunch. This will be held at College on Saturday, November 25th and be three courses with wine and coffee. Tickets cost £42.50 each or, for groups of 5 or more, £40 each. A booking form is enclosed with this edition of Imperial ENGINEER. Why not contact some old friends, and arrange to come? This event is what our associations are all about.



Photo: Peter Chase



Photo: Peter Chase

Turaj Ettehadieh (Civ Eng '66)

City and Guilds shields on display once more

As part of the recent refurbishment of the Mechanical Engineering building, recently renamed as the City and Guilds Building in recognition of the founding of engineering education in South Kensington by the City & Guilds of London Institute as long ago as 1884 and the continuing strong links with the Institute today, the shields of the Corporation of London and of the 16 founding Livery companies, located in the building's main concourse, had to be taken down for safe keeping.

In a ceremony on the 28th March, led by Professor Jeff Magee, Dean of the Faculty of Engineering, the shields were unveiled in a new location in the building. This is immediately adjacent to where most people walk through to Dalby Court after entering the College's main entrance from Exhibition Road. The mechanism of the original clock from the façade of the old Waterhouse Building has also been re-instated in the same area, thus bringing together two displays related to the heritage of the college in a single and more obvious location – their erstwhile location in the concourse had meant that whilst they were seen by people using the building, they were much less obvious to anyone else within the college.

The ceremony attracted an august gathering of representatives from the sixteen original Livery companies, together with members

of college staff, and of CGCA, RSMA and CGCU. In addressing those assembled, Professor Magee emphasised the importance of Imperial's continuing links with the City and Guilds of London Institute (CGLI), and how students of today need to understand the heritage of the institution they attend. Mr Morton Neal, FCGL, a former Chairman of the Council of CGLI, former Master of the Carpenters' Company and former President of the City & Guilds College Association, who had graduated from City & Guilds College as a Civil Engineer in 1953, also gave an eloquent speech explaining the history of the City and Guilds College (Morton himself had a close association with the display of the shields, having campaigned for some twenty years before the original display was inaugurated in July 2000).

Further speeches followed from Dr Simon Archer, College tutor and past master of the Armourers and Brasiers, and from Mrs Judith Cobham-Lowe, currently second warden of the Goldsmiths Company, who outlined many ways in which the Goldsmiths Company has supported the College since its formation in 1907.

The newly displayed shields make an impressive sight. Should you be at College, do stop for a few moments to take a good look at them.

Peter Chase (Comp '82-85)
Chris Lumb (Elec Eng '58-62)



Professor Jeff Magee and Mr Morton Neal

Photo: Chris Lumb



Photo: Peter Chase

CGCA Annual Dinner

On Friday 3rd March, CGCA held its Annual Dinner in the finery of Saddlers' Hall in the City of London.



Photos: Ziyuan Mao

While mascots Spanner and Bolt made their traditional appearance, including being held aloft for the Boomalaka, Bo was unable to make the trip due to some minor repairs



Guest speaker Professor Isobel Pollock-Hulf (Mech Eng 1976) OBE BSc(Eng) CEng Hon DSc FIMechE FCGI gave a thought-provoking speech



The after dinner awards included an engraved glass vase presented by CGCA President Dame Judith Hackitt to Teresa Sergot to mark her Honorary Membership



A champagne reception welcomed everyone to Saddlers' Hall, including CGCA and RSMA members, officers, past presidents, faculty staff and guests



The excellent three course meal was accompanied by wine and port from the CGCA's own cellars



In a well-received break with tradition, Imperial a cappella group 'The Techtonics' provided a tuneful and energetic entertainment after the meal – the all-male student group have been named the international champions of collegiate a cappella, the first non-US group to win the prestigious prize



DEVELOPMENTS AROUND THE ENGINEERING FACULTY

KIOS – Collaboration between Imperial and the University of Cyprus

The President of Cyprus, Nicos Anastasiades, helped launch a multi-million euro collaboration between Imperial and the University of Cyprus in March.

The EU-funded teaming project, KIOS, brings together the two universities to make critical infrastructure more efficient, resilient and economical. The KIOS Centre of Excellence, directed by the University of Cyprus' Professor Marios Polycarpou in partnership with Professor Thomas Parisini of Imperial's Department of Electrical and Electronic Engineering, will focus on major societal challenges to critical infrastructure like cybersecurity and smart control systems. They will improve the way critical infrastructure is monitored, increasing automation and efficiency, while heightening security. Imperial's Institute of Security Science and Technology will play a leading role in the Centre.

Representing Imperial at the launch event at the University of Cyprus, Professor Parisini was joined by Professor David Gann, Vice President (Innovation), Professor Nick Jennings, Vice Provost (Research), and Professor Chris Hankin, Director of the Institute of Security Science and Technology. Other attendees included the European Commission's Director-General for Research & Innovation Robert-Jan Smits and Professor Constantinos Christofides, Rector of the University of Cyprus.

Speaking at the event, Professor Jennings said: "This teaming partnership is the first of its kind for Imperial. It shows Imperial at its best: working with partners to tackle major societal challenges like cybersecurity and smart control systems – while contributing to economic growth.

"The University of Cyprus and Imperial are natural collaborators. We will build this cluster into a critical mass of knowledge, innovation and application. Our ambitions are high – but also achievable. We want to create the leading research centre for the monitoring, control and security of critical infrastructure in the region... There is a sense of excitement in both universities about how much more we can do together."

Professor Jennings added: "This teaming project has a special significance for Imperial right now. We have deep relationships throughout Europe.

"My colleague, Professor Thomas Parisini, submitted his proposal on the same day as the Brexit vote. That made for a bittersweet experience. But it also showed our determination to keep applying for and winning new European grants. This is exactly what we have been doing since the referendum. We will forge new European collaborations wherever we can... Imperial will remain a European university."

Nicos Anastasiades, President of the Republic of Cyprus, said: "A university leads by developing productive knowledge that induces growth, economic development and jobs. The KIOS Centre Teaming Project is an important boost in this effort."

Robert-Jan Smits, Director General for Research & Innovation at the European Commission, said: "If you're selected as a teaming project on Horizon 2020 by the European Commission, you belong to the very best that Europe has to offer in the field of science and innovation."

Professor David Gann said: "There is urgent need to improve the resilience, security and efficiency of what we call 'critical infrastructure' – the transport, energy and communications networks, healthcare, water and waste systems that support everything we do at work and in our leisure.

"Imperial is the UK's most international university and we are very pleased to deepen our partnership with this special relationship with the University of Cyprus. We plan to unleash a wave of innovation in the region. Cyprus is fertile ground for new thinking on cybersecurity, control systems and infrastructure. Together we will create a research and innovation capability and the talent to develop new ideas for infrastructure industries, resulting in new jobs and safer, better ways of living."

The €15 million project is funded through the Horizon 2020 Widespread-2016-2017 programme. When in-kind support from the College and co-funding from the Cypriot Government, the University of Cyprus and local and international industries is taken into account, the project's budget rises to over €40 million.

Imperial's Institute for Security Science and Technology is a hub of security research with expertise in cyber-physical security. The international partnerships and projects at the ISST have helped to raise the profile of security research for infrastructure at Imperial and at the level of UK Government.

The project underlines Imperial's growing ties with Cyprus. In the last five years, Imperial researchers have co-authored more than 600 papers with their peers in Cyprus. The College also has 160 Cypriot students and 43 staff from the country.

Following the event, Professors Gann and Jennings met with members of Imperial's 1,000-strong alumni community in Cyprus at a special reception.

<http://bit.ly/IE26-KIOS>

New Year Honours

Imperial engineers were among those recognised in the Queen's New Year Honours list.



Dept of Computing's Professor Guang-Zhong Yang, who is also Director and co-founder of the Hamlyn Centre for Robotic Surgery, received a CBE for his contributions to biomedical engineering.

Visiting Professor, Vernon Gibson, who works in the Department of Materials, was honoured with a CB for services to Defence. He was Chief Scientific Advisor at the MOD between 2012 and 2016.

Alumnus Thomas Hughes (MEng Aero 1991) was awarded an MBE for services to British graduates in Silicon Valley and San Francisco. Richard Barnes (EEE 1940) received a BEM for services to the community in Abingdon, Oxfordshire, and Professor Hywel Thomas (MSc DIC Civil & Env Eng 1973) was recognised with a CBE for services to academic research and higher education.



Photos: Imperial College, London

Elsewhere around Imperial, researchers and alumni honoured included Professor Amanda (Mandy) Fisher, who was made a Dame for her fundamental scientific discoveries in HIV, subsequent work on stem cell science and epigenetics, and her strong advocacy for women in science. Dame Mandy is Director of the MRC London Institute of Medical Sciences (LMS) at Imperial.

Professor Andrew George, who spent 21 years teaching medicine at Imperial until 2013 and chaired the Hammersmith Hospital Research Ethics Committee, received an MBE for services to the ethical governance of clinical research.

Sir Roger Bannister, a St Mary's alumnus and the first man to run a four-minute mile, was made a Companion of Honour – a special award for service of conspicuous national importance limited to 65 people at a time.

Several other Imperial alumni were recipients of the OBE: Dr Martin Warren (Botany and Plant Technology 1975) for services to the environment; Professor Mary Lumsden (St Mary's Hospital Medical School 1977) for services to women's health; and Professor Anne Willis (PhD DIC Chemistry 1987) for services to biomedical science and promoting the careers of women in science.

Jonathan Bloomer (Physics 1974) was awarded an MBE for voluntary services to children and young people.

<http://bit.ly/IE26-Honours>



The KIOS team

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Imperial Racing Green Showcase



Photos: Imperial College, London

In March, Imperial Racing Green teams presented the cutting-edge vehicles being built for the Formula Student and Shell Eco-Marathon races.

The Formula Student competition asks student teams to produce a prototype for a single-seat race car for autocross or sprint racing, and to present it to a hypothetical manufacturing firm; the final event for 2017 will take place on 13-16 July. The Shell Eco-Marathon challenges student teams around the world to design, build, test and drive ultra-energy-efficient vehicles. This year's Europe race will take place in London from May 25-28.

Dr Greg Offer from the Mechanical Engineering department, academic lead for the Formula Student entry, opened the event with a brief history of Imperial Racing Green, the different incarnations of the project, and the vehicles it produced throughout the years.

The evening continued with talks by the team principals, both Mechanical Engineering students. Hugo Stock (Formula Student team) and Oisín Shaw (Shell Eco-Marathon team) explained the challenges the crews encountered in the process of building the vehicles, and how these challenges differ according to the different goals of the two races.

The session ended with the team principals answering audience questions alongside Dr Greg Offer and Senior Teaching Fellow Jeff Barrie. After the talks, guests were able to enjoy refreshments and admire the vehicles exhibited in the main foyer of the campus.

Both Imperial Racing Green teams include primarily Mechanical Engineering students, alongside students from Aeronautics and other Engineering departments at Imperial. You can find more photos of the Racing Green showcase event on their Flickr account, and keep up to date with the latest developments in the teams on the Racing Green website.

<http://bit.ly/IE26-RacingGreen>

<http://bit.ly/IE26-RG-Flickr>

<http://bit.ly/IE26-RG-Website>



Hugo Stock, Oisín Shaw, and Greg Offer

European Partners Fund

The European Partners Fund, announced by the College in 2016, has begun its mission to foster collaborations with European colleagues. The Fund provides up to £100,000 per year for seed funds and travel grants for Imperial academics to initiate and pursue collaborations with European colleagues.

One of the first nine successful applicants is Dr David Payne, from the Department of Materials. He and his colleagues explore phenomena in 'quantum materials', principally the oxides of iridium, in order to understand further their known properties, or discover new and exotic condensed matter physics.

Dr Payne works with facilities in Italy to probe and synthesise these materials, with the hopes of building the core of a possible consortium for submitting proposals at both the national and European level.

He said meeting in person is invaluable for his work: "When you are dealing with abstract concepts in physics, it is sometimes almost impossible to demonstrate your ideas by email or on Skype. Face-to-face visits allow you to achieve a deeper mutual understanding of a problem (and hopefully its solution!) much quicker than if we tried to do this remotely."

<http://bit.ly/IE26-EuroFund>

Most heat-resistant material

A team from Imperial discovered that the melting point of hafnium carbide is the highest ever recorded for a material. Being able to withstand temperatures of nearly 4000°C could pave the way for tantalum carbide (TaC) and hafnium carbide (HfC) to be used in ever more extreme environments, such as in heat resistant shielding for the next generation of hypersonic space vehicles. Dr Omar Cedillos-Barraza of the Materials Department and colleagues developed a new extreme heating technique using lasers to test the heat tolerance of TaC, which melted at 3768°C and HfC which melted at 3958°C.

<http://bit.ly/IE26-HeatRecord>

Microsonix, miniaturised ultrasound imaging, wins Venture Catalyst Challenge final

Student start-up Microsonix took home the £10,000 prize at this year's Venture Catalyst Challenge (VCC) final in March.

The VCC is an enterprise pre-accelerator run by Imperial Enterprise Lab. Now in its fifth year, it remains Imperial's flagship entrepreneurial programme for aspiring entrepreneurs. Comprising a six-week programme of workshops and development, the VCC is designed to let teams develop their ideas and test their commercial viability. Bringing together workshops from experts, one-to-one mentoring sessions with industry leaders and group feedback sessions, the teams are put through their paces as they learn key skills vital in launching a successful start-up. The programme culminates in the VCC Final event where finalists pitch to a panel of expert judges in the hope of winning the £10,000 to help them bring their idea to market. This year's competition attracted over 300 applicants from across the Imperial student community. Microsonix was one of seven teams to make the final.

Founded by Bioengineering PhD students

Graham Peyton and Hamid Soleimani, Microsonix are shrinking the components of ultrasound machines down to a single chip. The outcome is a low-cost, portable medical imaging device that can connect to tablets or smartphones.

Designed to be produced on a mass scale, their current model is around the size of a pen. The technology allows this life-saving medical imaging to be brought to developing nations where the cost of ultrasound machines can be prohibitive, or to remote areas where it isn't possible to transport the large, bulky machines.

Graham said: "We entered with an idea and the VCC really helped us understand the commercial possibilities for the product and how to convert it into a realistic business."

Hamid said: "We identified a problem with current ultrasound technology both in its cost but also its lack of scalability. Our supervisor helped us shape our vision and use our technical expertise to scale it down to the size and cost we need."

<http://bit.ly/IE26-VCC>



Graham Peyton and Hamid Soleimani



£5000 runner up prizes went to:

(L) Openseense – low-cost paper pollution sensor designed to be stuck to smartphones;
(R) ThinAir – an innovative biomembrane which collects latent water particles from the air.

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Chatting with Prof. Jeff Magee

Professor Jeff Magee is the Dean of the Faculty of Engineering, but he will be retiring in September. We wanted to take the opportunity to have a chat with him about his career, life as Dean, and his future plans, before he sails off into the sunset.

Your first degree was electronics at Queens University in Belfast, you worked for the Post Office (Telecomms) and then came here to do your Masters. We almost overlapped in the Computing and Control Department – you started your MSc the year I graduated.

At the Post Office, they had this brilliant scheme where you could apply to do an MSc course in one of a fixed set of universities, and at that point I'd never heard of Imperial College, but I wanted to stay in London so I applied. I came here for a year to do the MSc course which was quite intensive. But then there was a gentleman's agreement that you went back for at least two years afterwards, and I went back for one year so you have in front of you only half a gentleman!

Then you came back to do a PhD?

Yes I did, because I'd met Morris Sloman and Jeff Kramer – Morris supervised my Masters project – and they were forming a new group. They'd got some funding from the National Coal Board of all people, which was to do with network systems and automation of coal mines, so I went down a few coal mines. That was fascinating! And it was a fruitful line of research. Then in 1984 when I finished my PhD, supervised by Jeff Kramer, I went on to become a lecturer in the Computing Department... lecturer, senior lecturer, reader... it used to be much slower in those days, you didn't have this rush to get through the grades. Now there's a move to have the equivalent American grades, so some academics would like to have associate professor mapped to reader and lecturer mapped to assistant professor. I always used to think that reader was a mysterious grade that Americans didn't understand, so I rather liked being a reader.

You became Principal and then Dean so now you're both at the same time. What's the difference?

Basically, Richard Sykes decided after the Medical School merger, that Heads of Departments couldn't report directly to him because there would be far too many of them and it wouldn't be scalable, so he came up with Faculties. At that point the heads of the Faculties were called Principals because there were already Deans who were elected by staff. They

sat on promotions committees and appointments committees and were responsible for quality and disciplinary procedures, so we did already have people called Deans. More recently we've moved to a model that's more understandable by the Americans so we now have Executive Deans, so I moved from being a Principal to Dean, it's just a change of title, and the existing Deans became Consuls.

In some web pages you're variously called Dean, Principal or Head of Engineering.

There is a certain amount of inertia so there are web pages where it still says Principal, but officially it is Dean of the Faculty of Engineering, but I use Dean of Engineering, which has the merit of brevity.

Do you live nearby, or do you commute?

I commute, but I've discovered in recent years the joys of electric bicycles, so I cycle in now. You can get a reasonable amount of exercise, if you choose the right setting, but I have a wonderful journey because I cycle through Richmond Park to start off with, and even when it's closed to cars you can still cycle through in the pitch black dodging deer. It's a way of winding down after work, but you have to be completely alert since it feels like motorists in London are trying to kill you.

You've been associated with Imperial for a long time, and have seen lots of changes. Students, the environment... what for you stands out as the most significant?

In the early days of my career, as for most academics, I was most concerned about my own academic career, my research, teaching students. I think a number of things have dramatically changed in the last few years. One is that there's a realisation of the importance of teaching. It used to be that the focus of academics was research and you could slightly ignore teaching – you didn't even have to be particularly competent at it. But with the advent of things like the student satisfaction survey, and the fact that students are now paying significant amounts of money to come to us, they insist, quite rightly, on being treated as part of the university and having a say in its affairs. So now we take much more cognisance of students and student affairs, and also when it comes to promotion

and appointing we now clearly recognise that an important part of an academic's career is teaching. We are still a research-led university, which informs what we offer to students – the fact that we are doing frontier research and so they are being taught by people who are world-leading experts in their field – however they need to be competent in communicating, there's no more standing in front of a blackboard mumbling away!

There were some maths lecturers in my day who shouldn't have been allowed to interact with students.

One of the other things that has changed is that the Mathematics Department used to require to do service teaching to make itself financially viable. With the change in fee structure and more overseas students, they don't need to do that any more. And the engineering departments felt that it would be much more successful if you taught mathematics in the context of its application to their engineering discipline, and that has been hugely successful. Now there's very little mathematics service teaching in engineering.

One of the things that seems to have improved since I was here is the number of female students. Although in my day computing was better than many other engineering departments.

At that point and for a while after that, we did attract quite a few women into computing, and the department has always had quite a large percentage of female staff. But then computing moved into the 'gaming' period with hackers and all that, becoming male dominated and the number of female students dropped off. It's about 15% at the moment which is not that different from all those years ago. The rest of the college is changing quite a bit. Some of the traditional departments struggle, but newer departments like bio-engineering have over 40% female undergraduates and nearly 30% in the Materials department. The new Dyson School of Design Engineering which we started two years ago, in the first year had 50%.

We had a great article by Peter Childs in Imperial ENGINEER just prior to it being set up, talking about what was happening.

It was really amazing fun setting that up. It came about because Peter Childs had come to talk to me, and

he said, "Look, this is something we should do...", because we have this wonderful joint Innovation Design Engineering course with the Royal College of Art, which brings together designers and engineers, and one of the things I wanted to do was emphasise the creative nature of engineering. People sometimes think it's a dull unimaginative profession, but it's exciting and creative. I also wanted to emphasise the fact that, even though we have these separate disciplines and one of our strengths is these fundamental pillars, people work together. So the first thing I tried to do when I became Dean was to see if I could get some group projects organised between departments, but actually it's very difficult to change things from within. So when Peter Childs came along and talked about the idea of a new department, doing exactly this sort of thing, I looked for an opportunity to make that happen. And the opportunity arose from two things: one, the Science Museum decided that, to raise development capital, they would sell off the old Post Office building. Secondly, I had a chat with Lydia Beaton who's our connection with the Dyson Foundation and they said they would be interested in funding it, so we got a substantial donation from them. We managed to convince the College that it would be a good thing to do, and once we'd got promise of premises then it gave us the means and impetus to start the school. But to convince the Dyson Foundation that we were serious about it we had to have a very aggressive timescale, so from the point where we decided that we wanted to buy it to the first year of the course was about a year and a half, which was amazing. We start a new department in Engineering about every 20 years – before that it was Bio-engineering and before that it was Computing, so I feel privileged to have been able to facilitate the start of another engineering department.

Do you get to do much teaching at the moment?

No, I did a bit of teaching when I was Head of Department, but because the Dean's role requires a huge number of meetings and meeting people in all the departments, it's really not fair on the students as I can't commit to regular teaching. My predecessor,

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Stephen Richardson, managed it, and he still does a course in Chemical Engineering, but I'm afraid I've failed in that regard. He's pretty unique in being able to keep up that enthusiasm, I think after a while it's better to pass it on to younger blood.

When you step down as Dean in September, are you going to go back to teaching?

No, I'm going to retire. I have a good quote for you, because I knew this interview was coming up, from a Shakespeare play. It says:

To shake all cares and business from our age,

Conferring them on younger strengths while we

Unburdened crawl toward death.

However, it's a quote from King Lear, and things didn't go too well for him! But in my case it's not crawl towards death but sail, because I'm very interested in boats and sailing, so I have a few plans in that direction.

I suppose that is my cue to ask if you have any children!

Yes I do, two sons and a young daughter and we all meet up from time to time for Sunday lunch or best of all time together at the ends of the Earth (Finistère) in France.

Are you going to move down to the coast?

I'll remain where I am, but for the last 10 years we've had a holiday home on the north coast of Brittany in Finistère. I've got a small boat there, with two lobster pots, which is brilliant. But also, in planning for retirement, I have a friend who convinced me to go in with him so we've got a share in an old boat that we've done up in the Ionian Sea in Greece, so I'm looking forward to that as well. I'll keep my hand in, hopefully I'll be available to both the Department and the College if they require my services, but sometimes it's better not to hang around. You do get to the point where you think 'I'd like to do something completely different'. It's supposed to be that you have all these structured plans for your retirement, but actually I have to say that the idea of looking for new things to do really appeals to me.

You've been involved in discussions with CGCA and RSMA over closer working of the alumni associations.

It's interesting, I think because, as I say the faculty structure was started by Richard Sykes and to start off with there was a certain amount of hostility between the departments and the Faculty which they felt had been imposed

on them. I have seen, started by Stephen my predecessor, that now the engineering departments in particular identify with the Engineering Faculty and they see the benefit of working together. I think that one of my greatest achievements is that they now think of the Faculty as being 'us' rather than 'them', and that's a big change. And of course, since it encompasses departments from both City and Guilds and the Royal School of Mines it does make sense to look at the entirety of that structure, because we have to keep the traditions going. But it slightly confuses some of our students. I think recognising our history is important. For example, we have been successful in renaming the refurbished Mechanical Engineering Building as the City and Guilds Building. This project was something that I started with my Faculty Operating Officer Richard Martin in the first year that I became Dean. We got the funding for it and it's going to finish nearly exactly as I finish, six and a half years later. It's about £85M now but we've ended up with a completely refurbished building which is up to modern standards. It's got Aeronautical Engineering moving into it and it's 21st century rather than celebrating a Victorian structure. Since Aeronautical Engineering are moving into it, to maintain calling it the Mechanical Engineering building would have been inappropriate. It's been like a jigsaw, because we don't have space to decant people so you have to move people out, refurbish a bit, move them back again, it's been very complicated.

Have you enjoyed your time as Dean?

Hugely. The thing about Imperial College, the people are very bright, they are very directed and it's a real community. You were in the Computing Department which is in the Huxley Building which is at one end of the campus. Since I've become Dean and before that Vice-Principal for Research, getting to see the richness and complexity and depth of expertise that goes on in 10 departments of engineering has been wonderful. I mean here we are in South Kensington, some of the most expensive real estate in the world and we have enormous wind tunnels, a large hydro-dynamics lab, we have a pilot plant for carbon capture in Chemical Engineering, and these are huge facilities. If you tried to decide where is the least appropriate place to build them, it would be South Kensington.

The City and Guilds Building has got the capability of doing combustion experiments in its basement which can generate up to a megawatt of heat. The heat is dissipated through the building by a very complex cooling and exhaust system so that whenever pigeons are flying overhead they don't get fried. Beside the walkway as you head towards the Huxley Building there's a low building and inside that there's a gas gun which is quite powerful, and a hypersonic wind tunnel.

The other thing that I've found interesting is that we have a staff survey every now and again. One of the worrying aspects of the last one was that there was some indication that people were worried about speaking out when they found problems, so we ran a Campaign called 'Have your Say'. We had an anonymous 'helpline' where staff could talk about the issues they faced and we did a 'roadshow' to go round and talk to staff at all levels in the Departments. A result of this is that we've been able to make explicit policies about things like publication authorship, which outline a shared view of the right thing to do. We have the reputation that Imperial College is a ruthless place, but in my experience it provides a supportive environment for people committed to putting the effort in. There has to be a focus on excellence.

My role, I always felt, was to support initiative and be in a position when people came to me with propositions, to be able to say, "Yes". I always say to people, Imperial College is very flexible, if you come to us with something that has the support of your colleagues and you can find the funding or we can help you find the funding and it's not illegal we should be able to do it!

It's been a huge privilege being Dean, I was quite nervous when I took it on but actually it's a joy. It's a set of really strong departments. If you look at the last research evaluation framework, which examines our research ratings, all of our departments were rated in the top three.

One of the things I've noticed and found very encouraging is the amount of cross-discipline activity that's going on.

Yes, and that's enabled by the departments being confident that there are no penalties to collaborations and no barriers. For example, I was in an interview today and somebody said that in their university if you aren't



My role, I always felt, was to support initiative and be in a position when people came to me with propositions, to be able to say, "Yes".

the principal investigator you're penalised and you're not credited. Whereas here we encourage people to work together to put in joint grant applications and we recognise that; so if somebody is a co-investigator we take recognition of that at promotions time. It's idiotic to say that people can't work together. I think we've done a lot to make that atmosphere, so that people realise the benefits of collaboration, and of course all of the grand challenges that face us today are multi-disciplinary problems. South Kensington is a constrained small space, but it means it's very easy to get from one department to another. So we have set up a set of institutes that provide networks and meetings for researchers from different disciplines to meet on particular topic areas. I think the best example of that is the Energy Futures Lab which has built up a huge community and been very successful in building consortia that get funding. And here in South Kensington we have artists and musicians around us. The collaboration with the Royal College of Art for the IDE has been hugely successful. But space is a problem, there are now about three times as many students on campus as when I was first here.

The new White City campus is really going to enable a lot of possibilities that we couldn't have considered in the past, although it's going to be a challenge as to how we manage it so that we don't lose that ease of communication between the departments.

Thanks Jeff for an interesting chat. Peter Buck

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

The Dyson School of Design Engineering

Two years ago, Professor Peter Childs wrote a fascinating article for Imperial ENGINEER about a major new activity in the design engineering domain at Imperial College: the Dyson School of Design Engineering. We persuaded Sam McKenney, the School's Operations Manager to bring us up to date. His article charts the School's development from its roots through the first undergraduate students and research projects to the present.

'Design Engineering' as termed within this School is used to mean the fusion of design thinking, engineering thinking and practice within a culture of innovation and enterprise, and the launch of the School was Imperial's first foray into design engineering. Since the first ever conference on design methods at Imperial in 1962, the discipline has held significance here, coalescing in 1980 into the Innovation Design Engineering (IDE) Masters' programme launched jointly with the Royal College of Art (RCA).

This programme (initially called Industrial Design Engineering) sought to integrate existing design teaching at the RCA with the engineering and manufacturing capabilities of Imperial. Over the subsequent 37 years it has evolved and has now delivered approximately 700 graduates, many still working within the design engineering ecosystem, either within established companies or their own start-ups. Whilst IDE was the only programme at Imperial bearing the 'design engineering' moniker, design engineering grew thematically against the backdrop of many amazing project innovations and of research and innovation at Imperial, both within IDE's academic staff and in the wider research landscape of bioengineering, aeronautics, and other engineering fields.

By 2013, student demand for the IDE programme had grown to the point that Imperial and RCA offered a new joint Master's programme: Global Innovation Design, exposing design engineering students to diverse innovation cultures worldwide (initially at Keio University, Japan and the Pratt Institute, USA). This was to be a further step towards the School.

The School

In 2014, the convergence of these factors gave rise to the formation of the Dyson School of Design Engineering:

- The James Dyson Foundation, and their eponymous founder, offered a donation to Imperial to support design engineering education.
- The proposition of a four-year undergraduate (MEng) degree run solely within Imperial received support from across the College and was ratified.
- The Science Museum placed their Director's Suite and the former Post Office on Imperial College Road for sale.

These three factors together gave means, motive, and opportunity for the foundation of the School.



Photo: Imperial College

Staff and students gathered in Summer 2016, celebrating the first anniversary of the School's full operation

The MEng

James Dyson amongst other industry leaders identified that, whilst UK universities produce graduates highly specialised in traditional engineering disciplines, there is a distinct lack of engineers trained across these disciplines who also hold an appreciation of design, usability, and market context. The undergraduate MEng programme was developed to provide students with essential skills in both engineering, design, and enterprise disciplines, addressing this skills gap in the engineering workforce.

The School accepted its first MEng cohort in October 2015; 42 British and international students, each seeking a programme that catered to their diverse technical and entrepreneurial interests. These were joined in 2016 by 55 new students, and the programme is set to grow to 90 as the School expands to fill the new Dyson Building. Unusually within engineering courses in the UK, this MEng receives an approximately equal balance of male and female applicants and has been highly competitive for entry since the outset, rising to 8:1 applications to places in this round of UCAS as awareness spreads through domestic and international applicants.

Within Imperial, the MEng degree represents a distinct offering, in which teaching is led by application. This year's first year mechanics module assessment included student teams calculating projectile trajectories and testing their calculations by shooting these projectiles at a target from the School's own catapult. Finite element analysis simulations of water towers were assessed against destructive testing of student-built replicas of their structures. Theory taught throughout the programme is placed alongside practical demonstration and application of these principles wherever possible.

Next year will see a major transition in the

programme as students for the first time move from fundamental skills modules towards the open, project-oriented modules of the third and fourth year syllabus. Students will gain hands-on experience within industry, as six-month industrial secondments begin in April 2018 which will see all MEng students working on site with industrial hosts on specific commercial projects. Students will take their first elective modules, whether taught within the School or within the modules of Imperial's other engineering programmes.

It is in these next two years that will see MEng students, alongside IDE and GID students, launching their own enterprise projects and competition for investment and public recognition. Three School students were recognised in Forbes' 30 under 30 this year.

Research

Research themes within the School's academic staff have formed around engineering design, human factors, robotics and manufacturing. Labs will come online for these themes over the next year to house the expanding facilities required by staff, researchers and students. Substantial research projects have begun, with funding from the EU, EPSRC, P&G, to name a few. One of the largest of these is Dr Lorenzo Picinali's 3D-Tune-In consortium, an H2020 project to improve user experience of hearing aids through the gamification and simplification of tuning software.

The School has grown rapidly from the outset, and will not reach steady state on staff or students until at least 2022. These first years, though, have set the scene for what it will become; and the collaborative, innovative culture of engineering embodied within both the programmes and the design engineers of the School.

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

The Dyson Building



The site purchased from the Science Museum is a complex mix of spaces, ranging from original Edwardian libraries and boardrooms, through Post Office sorting rooms, to modern offices. In order to reimagine these spaces to the needs of the School, planning for a £24m refurbishment project began from the School's inception, and broke ground in December 2016. This project will deliver the teaching spaces, workshops, and research labs required to deliver on this vision.

The project will also retain the building's historic features and introduce new spaces suited to the unique working practices of the School's staff and students, through new exhibition spaces and group working space incorporating prototyping facilities and encouraging fortuitous meetings and ideation.

Within this model, staff share open-plan studios; whether professors, administrators, teaching fellows, or post-doctoral researchers, everyone occupies these studios communally, fostering an open innovation and collaborative culture across the School.

The project will be completed in three distinct phases: first with the former Met Office observatory in May to house staff and new PhD students in studios and accommodate teaching. Second, the main building in October, delivering the School's workshops, studios, and communal areas, at which point the School will vacate its temporary offices within Garden Halls. Finally, in October 2018, the Science Museum's Smith Centre will become the School boardroom and largest learning space.

Aeropowder

Photos: Imperial College



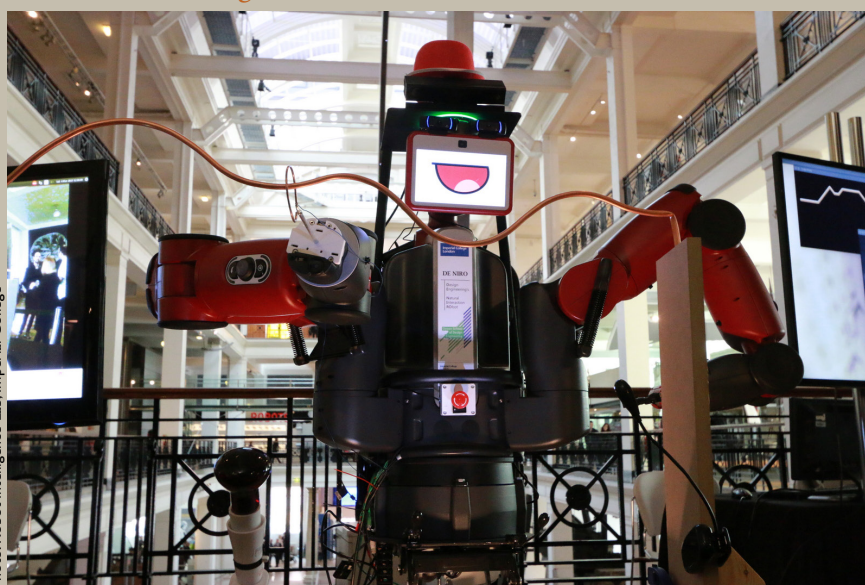
Elena Dieckmann (IDE alumna) and Ryan Robinson (NHLI PhD) co-founded Aeropowder, a low carbon home insulation made by using waste feathers from the poultry industry. Their concept began from a recognition that the waste stream of poultry feather, normally destined for slow decomposition in landfill, provided an ideal low-weight, sustainable thermally-insulating material. In first experiments, the pair hot pressed, milled, and freeze-dried feathers, trying to find ways to get the best performance from their composite materials. Aeropowder won £20,000 of funding at the 2016 Mayor's Low Carbon Entrepreneur Competition and Elena continues with the School, beginning her PhD in sustainable materials whilst co-directing her growing company.

Robot Intelligence Lab

Part of the Dyson School of Design Engineering, the Robot Intelligence Lab researches into artificial intelligence for robots, concentrating on the physical aspects – how to transfer motor skills from people to robots. They have built a robotic research platform called Design Engineering's Natural Interaction ROBOT (or Robot DE NIRO) which is based on a Baxter robot.

As artificial intelligence becomes more advanced, it's not enough to just pre-program a robot with rigid instructions to follow. Machines are increasingly able to learn how to recognise patterns in data, but learning how to interact with the physical world is a different matter. Robot DE NIRO is learning how to use its two arms and hands to manipulate objects and interact with people by observing and modifying its own behaviour. The Director of the Lab, Dr Petar Kormushev provides an introduction to the purpose and approach of the lab, along with a demonstration of Robot DE NIRO in a short video that can be viewed online at: <http://bit.ly/IE26-RobotDeNiro>

Photo: Robot Intelligence Lab, Imperial College



In March Robot DE NIRO had its debut appearance at the Science Museum where it performed live demonstrations of its physical skill learning capabilities

Geothermal heat: an episodic heat source in oceans

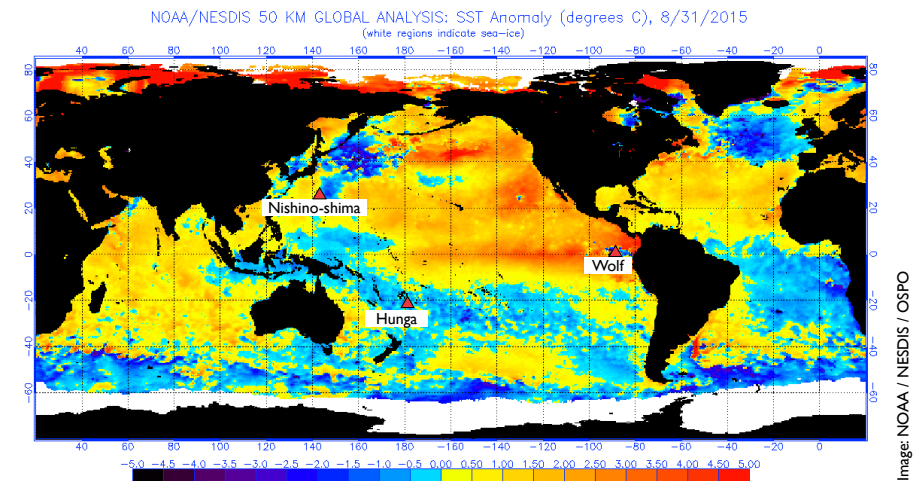
Plate climatology (www.plateclimatology.com) is a theory introduced in 2014 by James Kamis. Unlike the Sun which is the first order driver of earth's climate, it is an underestimated second order driver which can contribute significantly to regional natural variations. The overall theory contends that periods of active earth tectonics and volcanism can be correlated to periods of active climate change and/or climate related events.

According to the National Atmospheric and Oceanographic Administration (NOAA), 2015 was the hottest year since record began in 1880 from globally averaged temperatures over land and ocean surfaces following the 17-year pause since 1998. A popular explanation is an immense amount of heat released from the Pacific Ocean caused by the strongest and longest El Niño year this century during 2015 but what triggered such a condition is unresolved. Proponents of anthropogenic global warming including the United Nations have used the temperature rise as signaling a return to global warming.

In this article, two initially submarine volcanic eruptions and one subaerial volcanic eruption all contributing to the regional warming of the Pacific Ocean are investigated using available information including satellite records of sea-surface temperature anomalies and ocean surface topography. In conclusion, geothermal heat is a reminder of a dynamic earth in spite of overpopulation and resource usage on planet earth.

The Pacific Ocean and the Atlantic Ocean are the two oceans with connections to the two poles. Because an estimated three quarters of the world's active volcanoes are located within the Ring of Fire, the release of geothermal heat through volcanism in the Pacific Ocean is the highest and may provide a heat source additional to the sun for triggering El Niño years. This is supported by 'Explanation for the northern Pacific Blob' featured in the Autumn 2016 issue of *Imperial ENGINEER*. Currently such geological forcing by plate tectonics on climate is not well appreciated by climate scientists probably because of their atmospheric bias.

Three volcanic eruptions generating positive sea-surface water anomalies in different parts of the Pacific Ocean from before November 2013 until November 2015 based on reported information are analysed. Two of the eruptions were initially submarine followed by subaerial eruptions after new islands were created while the third eruption is entirely subaerial with basaltic lava flows at ~1000°C entering the ocean. All three eruptions contributed geothermal heat to the longest-lasting El Niño this century in 2015 perhaps even stronger than the 1997 to 1998 event. Important environmental impacts included the suppression of heat loss from the ocean during winter, record high summer temperatures over parts of land in the Pacific northwest, record sea-surface temperatures in the Pacific



Global map of sea-surface temperature anomalies showing the El Niño conditions on August 31, 2015 under the influence of the northern Pacific blob and further exacerbated by the May 25, 2015 Wolf eruption with lava flows into the sea. The locations of the Nishino-shima, Hunga and Wolf volcanoes are also shown. The severe contraction of Arctic sea ice in the north Pacific compared to the north Atlantic and the cold water upwelling in the northwest Pacific can also be explained by the sea-surface temperature distribution.

northeast for February since the 1980s, record high sea-surface pressure for the years 1949 to 2014, acceleration in the contraction of Arctic sea ice during the summers of 2014 and 2015, catastrophic ecological damage such as coastal algal blooms and coral bleaching, and, the return to La Niña conditions after sea-surface temperature returned to equilibrium during 2016.

Events related to the three volcanic eruptions which contributed to the development of the abnormally strong El Niño conditions in 2015 are shown in the summary table opposite.

Out of the three eruptions, the longest lasting and the most powerful in terms of the quantity of geothermal heat released was from the Nishino-shima volcano located 940 km south of Tokyo. The Volcanic Explosivity Index (VEI) based on the volume of subaerially erupted materials from November 20, 2013 to November 17, 2015 was rated 2 but this is not reflective of the severity of the submarine eruption because such a measurement scale is not currently available. On November 20, 2013, the beginning of the northern hemisphere winter, the appearance of a new island adjacent to Nishino-shima was reported. An examination of NOAA satellite sea-surface anomalies map archives has revealed that hot sea-surface water was already in existence at the site during the end of March 2013 six months earlier when the submarine eruption started. In late 2013, the patch of warm surficial water spread into the Gulf of Alaska to form the northern Pacific blob. The interaction between the warm ocean's surfaces with the atmosphere generated a long-lasting high-pressure condition referred to as the 'Ridiculously Resilient Ridge' which resulted in weird weather conditions in the Pacific northeast. Surveys by the Japan Coast Guard show the new land area of the volcanic island increased from a total area of 0.01 km²

on November 20, 2013 to an area of 1.08 km² on July 7, 2014, and, to a maximum area of 2.71 km² on August 18, 2015. The continuous expansion of the volcanic island through episodic lava flows means geothermal heat was available to sustain blob through ocean circulation changes until early 2016 since seawater is a poor conductor of heat. During the peak stage, the warm water covered a total area exceeding 9M km² from Mexico to Alaska, an area larger than the contiguous US.

The existence of the north Pacific blob in the Gulf of Alaska which is connected to the Arctic Ocean through the Bering Strait is consistent with the record of sea ice contraction observed during the summers of 2014 and 2015. Based on monthly maps of the National Snow and Ice Data Centre during the northern hemisphere summer and early autumn, Arctic sea ice contraction was much more rapid and extensive in the Arctic Ocean portion adjacent to the northern Pacific Ocean compared to the northern Atlantic Ocean.

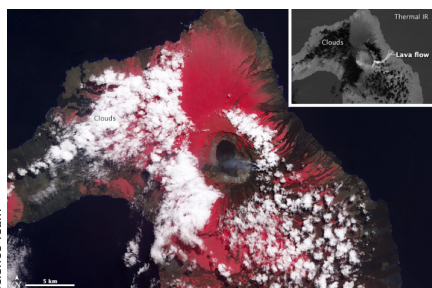
The second eruption, Hunga volcano, from November 2014 to January 23, 2015 during the peak of the southern hemisphere summer is also the second long lasting. The VEI based on the volume of erupted materials with a reported plume height ranging from 7-10 km was rated 2. There is again an underestimation of the severity of the submarine eruption because of the absence of a measurement scale.

On December 19, 2014, local fishermen reported a tall white steam plume rising from the ocean over the submarine volcano. On December 29, satellite images taken showed the eruption continuing, with discoloured seawater possibly caused by smoke and ash released below the surface, or by disturbance of the seabed. The eruption entered a new stage on January 11, 2015, when the volcano began sending ash plumes as high as 9 km. On January 13, the large amounts of nitrogen and

phosphorous released underwater caused an explosion in the growth of algae and causing a red tide. At the end of the eruption, a new island 1 km wide, 2 km long and 120 m high was created. Subsequent environmental impacts of the warm sea-surface water included coral bleaching of the Great Barrier Reef from January 2015 and the development of severe tropical cyclone Pam which devastated Vanuatu in mid-March 2015.

The third eruption, the Wolf volcano from May 25 to June 2, 2015 is the shortest in duration. The high VEI 4 rating is in response to the much larger volume of subaerially erupted materials. Lava flows were reported to first reach the sea on May 28 (see satellite image) exacerbating the already strong El Niño conditions.

NASA Earth Observatory image by Jesse Allen, using data from NASA/GSFC/METI/ERSDAC/JAROS, and U.S./Japan ASTER Science Team



Thermal infrared image of the Wolf volcano, Galapagos acquired on June 11, 2015 after the May 25 to July 2, 2015 eruption, showing lava flows reaching the sea to the east.

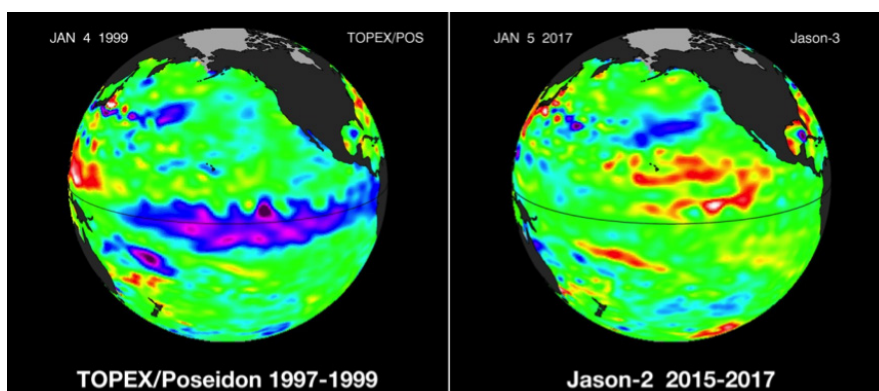
The NOAA sea-surface temperature anomalies map of August 31, 2015 (opposite) highlights the pattern characterised by the longest-lasting event this century is distinctly different from El Niño events in the past covered by satellite observation records. The causation factors for each event must therefore differ.

A comparison of ocean surface topography during the two strongest and longest El Niño years this century, 1997 to 1999 and 2015 to 2017, is shown (right). The hot sea-surface water generated by the three volcanic eruptions during 2013 to 2015 described in this study provides the best explanation to both the pattern and the timing of the ocean surface topographical changes observed.

The three volcanic eruptions causing regional warming in different parts of the Pacific Ocean over the three-year period from 2013 to 2015 is supported by the satellite sea-surface temperature anomalies records and ocean surface topography records. The warm sea-surface water was responsible for oceanic and atmospheric circulation changes regionally which cannot be accounted for by carbon dioxide variations.

For future work, Smithsonian's Global Volcanism Program (GVP) should be extended to include coverage of submarine volcanic eruptions. A severity scale based on the amount of geothermal heat released from such eruptions taking into account the eruption history should be devised assisted by an expanded ARGO monitoring data buoy network.

Date	Event(s)	Observation(s)
Mar 2013	Submarine eruption of Nishino-shima	Warming first detectable in sea-surface temperature anomalies maps (start of submarine eruption).
Nov 2013	Submarine and subaerial eruption of Nishino-shima	Source: en.wikipedia.org/wiki/Nishinoshima_(Ogasawara); during northern hemisphere winter.
Feb 2014	Temperature measurement	Sea-surface temperature ~2.5°C above normal was reported.
Jun 2014	Island ~2.3 km in diameter; ~110 m above sea level	Name Blob was coined by Nicholas Bond; size reached 1600 km by 1600 km and 91 m deep; spread to the coast of North America with patches off Alaska, Victoria/California and Mexico.
Jul-Sep 2014	Mass coral bleaching in Hawaii	Reported by the University of Queensland; area of warm water exceeded 9 million km ² during peak stage; rapid contraction of Arctic sea ice during summer and early autumn.
Jan-Aug 2014	Episodic eruption of Nishino-shima with lava flows	Japanese Coast Guard reported increase in area of the island through lava flows; onset of El Niño conditions; abnormally hot summer in Pacific northeast.
Dec 2014	Submarine and subaerial eruption of Hunga, Tonga	Source: en.wikipedia.org/wiki/Hunga_Tonga; occurred during southern hemisphere summer; year without winter in Pacific northeast.
Jan 2015	Eruption of Hunga ended	Strong El Niño conditions forecast; coral bleaching in the northern parts of the Great Barrier Reef.
Mar 2015	Severe tropical cyclone Pam	Most intense tropical cyclone of the South Pacific in terms of sustained wind; Vanuatu's worst natural disaster.
May-Jun 2015	Eruption of Wolf, Galapagos	Lava flows entered the ocean exacerbating the already strong El Niño conditions; rapid contraction of Arctic sea ice during summer and early autumn.
Early 2016	Blob dissipation	Change to La Niña conditions.
Summary table of events attributable to three volcanic eruptions releasing geothermal heat in different parts of the Pacific Ocean, contributing to the development of the strongest and longest-lasting El Niño this century. For further details on the environmental and ecological damage see 'The Heat Wave' featured in the September 2016 issue of <i>National Geographic</i> .		



Satellite-based ocean surface topography still image comparison of the two strongest El Niño years this century

Thanks are due to Wikipedia, NOAA, NASA, GVP and miscellaneous media reports for providing information to assist this article.



Professor Wyss Yim DSc PhD DIC FGS was at Imperial College in the Department of Geology from 1971-1974. After that he spent 35 years until retirement at the University of Hong Kong where he taught civil engineering, geosciences and environmental management students, and, helped found the Department of Earth Sciences. He was awarded the DSc by the University of London in 1997. Wyss served as the Deputy Chairman of the Climate Change Science Implementation Team of UNESCO's International Year of Planet Earth 2007-2009.

Aouda X Spacesuit

Last year we heard from final year Aero student Sergiu Iliev about his trip to Samara State University in Russia. Now he tells us about his experience working on the Aouda X spacesuit project with the Austrian Space Forum. Since writing the report on which this article is based, Sergiu has graduated and is hoping to work on future Mars missions.

First of all, I would like to thank the Old Centralians' Trust for making this expedition possible through the prestigious 'Jessel Rosen' Graduate Overseas Experience Award. Working on a project on the Aouda X Spacesuit with the Austrian Space Forum was truly unforgettable. This adventure was set in Innsbruck, located in the high Austrian Alps. It took place for the entire duration of the month of July 2016. The following article presents my experience in a chronological order, accompanied by pictures taken during the journey.

My first day in the Austrian Alps was preceded by a 16 hour-long trip from my home in Constanța, România. The journey was quite long having changed 3 busses, 3 trains and 2 planes! However it was very enjoyable. After leaving Constanța in the night, I arrived in Bucharest and was 12,000 m up in the air by the time the sun rose over the horizon. After changing planes in Vienna, I flew to Munich over a cloudy Germany.

Now reading through my travel journal, one observation struck me as notable. I remarked the evolution of aviation from a traveller's perspective: "It is now possible for me to cross Europe in the same time and with a comparatively similar budget (adjusted for inflation) as it would have taken my father to cross the country when he was my age. It is not often we stop to think about this remarkable feat of engineering." I am happy and proud to have chosen a career that will enable me to directly contribute to this and perhaps one

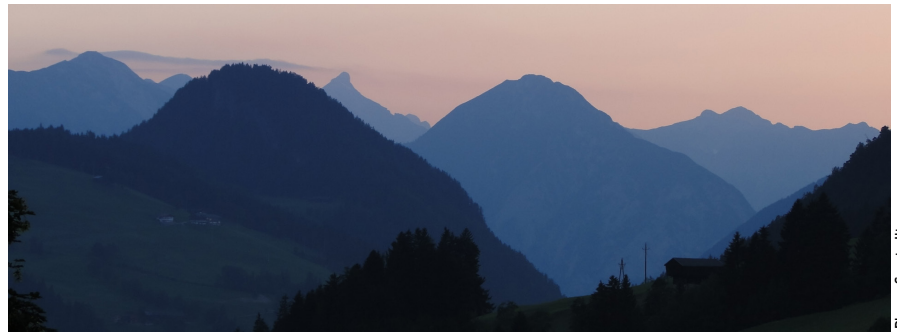


Photo: Sergiu Iliev

Sunset over the Austrian Alps from Innsbruck

day my grandchildren will be able to write a similar observation in their travel journal whilst enroute to a colony on Mars.

Upon landing in Munich, I took a train to the heart of the city, where a 2 hour wait for the next train offered me the opportunity to climb 299 steps up the mediaeval tower of St. Peter's Church (Peterskirche) overlooking Mary's Square (Marienplatz).

On top of this tower I learned this is the historical location where the traditional Munich beer festival (Oktoberfest) started. More than a million people fly into Munich every year to join the celebration. I believe this is a remarkable example of how affordable and fast flights enable people from all around the world to experience this tradition together.

Subsequently, I caught a ride on the ÖBB Inter-City Express (ICE) train to the south. With the city behind and the Alps ahead I travelled for another hour, reaching the Bavarian Alps and the southern border of Germany. Here I changed trains and entered the Austrian side of the Alps.

I did not notice when I transitioned from one country to the other. In this area borders

are merely lines on the maps and citizens are free to cross from one country to the other. This made me think about the UK Astronaut Timothy Peake, whom I had the pleasure of meeting in person before his launch to the International Space Station. When he looks down from space, he sees no borders. It seems utopian, but I believe that in the future we will have the pleasure of experiencing the same feeling of unity and cooperation down here on Earth, when crossing between many other countries in the world that shall follow the example of Austria and Germany.

That evening I took a moment to reflect on my travels. I only reached the end of a journey to start another. My summer experience of working and learning in Austria was just about to begin.

Every morning was equally beautiful and provided a spectacular and serene start for the day. Throughout the project, I found that admiring the environment was a great way to 'recharge my batteries' and enabled me to work more intensely on the project.

A remarkable parallel can be drawn between the work carried out inside the Austrian



Photo: Sergiu Iliev

View of Marienplatz from the tower of Peterskirche, Munich



Photo: Sergiu Iliev

(Above) Panorama, morning at the edge of Innsbruck, home of OeWF.

(Below) Panorama by Curiosity Rover, Martian valley created by a meteorite impact



Photo: NASA/JPL/MSS/Emily Lakdawalla



Photo: Sergiu Iliev

Space Forum (OeWF) laboratories and their location. The project involves the development of a spacesuit capable of empowering humans to explore and eventually colonise the surface of Mars. Looking at the environment in which the laboratory was located and the environment where the spacesuit is designed to operate, it is possible to get a sense of the challenges that need to be overcome before we can turn Mars into a second home.

The geological formations of Mars are remarkably similar to those of Earth, with mountains, riverbeds, caves, valleys and plains. The Martian atmosphere is composed mostly of carbon dioxide with an atmospheric pressure of about 0.6% that of Earth's mean sea level pressure. The surface temperature varies wildly from night to day. On a summer day on Mars it may get up to 20° C near the equator, but at night the temperature can plummet to about -73° C. However, Mars has deposits of frozen CO₂ and water. If heated, the CO₂ can cause a greenhouse effect similar to that on Earth. This would warm the planet and increase its air density, making it suitable for O₂ generating plants. This process is called terraforming and is the key to making Mars our second home in space. However, for the first stages spacesuits are needed to endure the harsh environment. The Aouda X is at the forefront of research in this area.

I experienced a remarkable feeling when I noticed that the knowledge I have gained through my studies at Imperial could be effectively applied in designing an engineering solution to empower humans to walk on Mars! This is why I am passionate about engineering, as it provides tools to advance our civilisation



Photo: Sergiu Iliev

The Aouda X working prototype

Photo: OeWF/Claudia Stix

Successful demonstration of a satellite antenna deployment that uses a tripod system, in the Aouda X spacesuit

in remarkable and previously inconceivable ways, bringing the realm of science-fiction to that of science-fact.

The Aouda X spacesuit is entirely self-contained and can meet all of the requirements of exploring the Martian surface. Furthermore, experiments will be carried out by the European Space Agency as part of the CAVES project. The suit will be tested for the rigours of exploring Martian caves. In such an environment, communication with the Martian base will be a challenge and mobility requirements also increase significantly.

I found that working in such an engineering project is a privilege and a reward in its own right. The suit is tested on a regular basis by the Austrian Space Forum and changes that have been made from a previous iteration are thoroughly assessed. Only analogue astronauts, who undergo a strict scientific and physical training programme, are allowed to use the suit. During the testing sessions, a command and control centre becomes operational at the lab. Here, the data provided by all of the sensors on the suit, including life support systems, is collected and analysed in real-time. When the suit is utilised on Mars, part of the crew will remain at the base to monitor the data and provide assistance if required, whilst the other astronauts explore the surface.

Throughout my work, I practiced the use of various engineering software suites (such as Pro Engineer for Finite Element Analysis and Star CCM+ for Computational Fluid Dynamics modelling) and applied the theory I have acquired in lectures. After each day, I learned so much that I would need an entire report to sum it all up. This is why I chose to include a number of pictures in this



Photo: OeWF/Claudia Stix

Photo: OeWF/Claudia Stix

Back view of the equipped prototype showing base communications antenna (top). Mobility and visibility test (bottom).

article to show the work environment of the project.

In retrospect, this experience has greatly enhanced the value of my formal studies from university. I am truly grateful for CGCA's assistance to undertake this expedition in Austria. It has also allowed me to hone my engineering skills in a real international context and to make new friends in several countries.

We have a saying in Romania, "when you owe the moment to someone, then you better live it." I took every opportunity to develop my skills further and make a difference to honour the vote of confidence given to me in the form of the 'Jessel Rosen' Graduate Overseas Experience Award. The history of City & Guilds spans more than a century and I hope I can contribute to its future so that others that would be in my situation can be helped. Thank you very much for your support!

Finally, I would like to conclude with the image below taken at OeWF, showing that above all else, the Aouda X spacesuit has the power to inspire the next generation of STEM students.

Sergiu Iliev



Photo: Sergiu Iliev

Rural Education Development in Borneo, Malaysia

The Rural Educational Development (RED) Project is a completely student-led society established in the Department of Civil and Environmental Engineering in 2015 with the aim of bringing about sustainable educational development to rural communities in Borneo. There is a large disparity in education standards between rural and urban areas and this has left many rural villagers unable to compete in the current economic market. This issue is getting worse as time progresses, with these communities being marginalised even further. RED was created to bridge this gap by supporting current efforts of local charities to educate and empower these communities with the skills and knowledge necessary to progress. RED holds activities throughout the year to raise awareness on this issue, as well as funds for our yearly expedition to Borneo. For 2016, RED partnered with a local NGO, Life Empowerment Berhad (LEB) to build a kindergarten. Through LEB's subsidiary organisation, pre-school teachers will be trained and sponsored to teach at this kindergarten. These pre-school teachers are local villagers that have been selected by a committee (usually chaired by the village chief) and equipped with the necessary skills and knowledge to teach children from the ages of three to six.

The Old Centralians Trust was a major sponsor of the Summer 2016 expedition, and also provided support for one of the volunteers, Jana Tian. This article is based on a report Jana wrote of her experience.

Over the summer break, a team of students from Imperial College are sent by the RED Project to Borneo. The aim is to design and construct education centres fully funded by our local charity. By providing them with the necessary infrastructure, RED will ensure that sustainable, long term development is achieved. Alongside construction, there are rotational teams set up to teach the locals English during the weekly sessions. Our ultimate goal is to empower and assist those that have not been given the same opportunities as we have in receiving proper education.

The journey

We landed at the Kota Kinabalu (KK) airport, and took a 3 hour bus ride to a small town called Ranau. The construction site and our accommodation was located in a small village called Gaur, which was an hour further west from Ranau. The overall journey from the main city KK was relatively straightforward, which meant that transporting various materials including sand, cement and stones should not pose any problems.

Accommodation

RED team arranged the accommodation to be in the Pastor's house, which had 2 bedrooms, a living room and a kitchen downstairs. It was big enough to accommodate thirteen people, although sometimes it did get cosy. The accommodation was provided free of charge, as the Pastor was away studying, and rumours said that he was doing a PhD abroad. The house was only 5 minutes away from the construction site, which was extremely convenient. In addition, right next to the house was a village church, where on Sundays Holy services are held and in the evenings the children come to play music and dance. The accommodation was more luxurious than we had anticipated.



The RED team's accommodation



Photos: Project RED

Daily Routine

On weekdays, we would normally wake up at 7 am, sometimes even earlier depending on what time the roosters would start crowing loudly. Julie and Angeline, who are extremely lovely, would prepare breakfast. Julie is planning to teach at the constructed kindergarten, and she is currently studying in KK in the hopes of obtaining a formal teaching diploma. Julie has a daughter called Oyen, who would be attending the kindergarten in

the coming September. Oyen was initially shy, but after only few minutes, she became one of the liveliest kids I have ever met. She soon became our regular guest, and we would play hide and seek, football and dance, but she was happy with just running around in circles. Julie and Angeline are excellent cooks. For breakfast they would usually prepare stir-fry pork noodles, rice and sometimes bread with jam and peanut butter. For drinks, we would



Jana in traditional Bornean dress with some of the village children

have their local Sabah tea, coffee or Milo (hot chocolate). We would then get ready for construction and head off by 8 am. Midway through construction around 11 am, Julie and Angeline would bring snacks, which included a variety of local food, including deep fried bananas, battered cabbage and carrots, and peanut butter sandwiches. This was a great break time, where we would chat and utilise this time to reflect on the work we have done or plan the rest of the day. The construction would continue till 1 pm, and after that we would head back to the house for lunch. We all looked forward to lunch, as the cooks would surprise us with the large variety of food they were able to make. For example, we had our all time favourite lemongrass chicken curry, beef ragu, river crabs and deep fried fish.

After lunch, we would relax for 30 minutes, before heading back to construction at 2-3 pm. In the afternoon, we would take it easier, as the heat could reach up to 35°C. We would aim to complete the construction before sunset around 6-7 pm. Then we would head back and shower. There was no hot water; however we soon got used to it, especially on the hot and sweaty days when a cold shower was quite refreshing. For dinner we would have the usual village food such as fish with vegetables, curry and spicy chicken with large portions of rice. They would also feed us assortments of fruits including home grown pineapples, papayas, mangos and tarok. Dinner was our social time, where we would open up to each other and reflect back on the day or any changes we would like to make in the future. After dinner was our free time, except Tuesdays and Thursdays where we would run two classes in parallel to teach kids and adults English. Normally, during the free time we would read, play chess or simply chat. We would aim to sleep by 11 pm; I slept like a baby most days, as construction was quite tiring.

Construction

The construction of the kindergarten started with cleaning up the site by digging and flattening it. The first challenge we encountered was that there was spring water accumulation at the site. This can affect the foundation of the structure, especially during rainy days when water would flow down from the mountains. To solve this, we decided to dig trenches on the upper end of the site, so that both the spring and surface water would be diverted down the hill avoiding the kindergarten. Digging the 1 m deep trench was a set back in terms of time, as it took a couple of days to complete. The trench was filled with gravel to capture the surface water but to also prevent blockages from the soil.

RED hired two professional labourers named Mickey and Lassius, who had a profound knowledge of construction and had even been offered a building contract in Australia. They were paid the normal salary for a builder in KK, which would be around 200 RNG a week (~£40). Alongside trench building, Mickey and Lassius helped us to cut timber from the nearby forest and use

it to construct a wooden framework for the structure. This required precise measurements and lots of levelling making sure that it was in the right position and orientation. Once the framework was completed, it was time to put on a roof to give us shade and protection from the rain, making working under the heat more bearable.

The next part of the construction was concrete pouring to give the structure a foundation and a floor. The first mix was with aggregate and cement, followed by the top layer, which was sand and cement to give a smoother floor. To ensure that the floor was level, Mickey taught us to make moulds of trapeziums and lay it over the first aggregate layer making sure that they are all spaced almost equally apart. This would be the new indication of the level of pouring required for the depth of the floor. Concrete pouring was the most labour intensive job, and it required us to finish the floor in a single day, otherwise there would be visible cracks on the floor. Knowing this, we woke up earlier at 6 am for concrete pouring. Unfortunately, even working till sundown and through the rain we weren't able to complete the entire floor in one day. During our team meeting, we decided to hide the cracks by putting walls on top of it, as part of partitioning into a separate 'reading' room.



Once the floor was completed, the next job was to install a steel framework to be able to fix the outside cement boards and the gypsum boards on the inside. The cement boards were used on the outside, as they are weather resistant and are extremely rigid, whilst gypsum on the inside are lightweight and easy to install. The steel framework took almost 10 days to fully complete, and an extra day to fit the wooden windows and doors. In addition to the kindergarten itself, RED decided to invest in a rainwater harvesting system to provide water for the kitchen, which will be part of the school. The rainwater will be collected from the roof using the simple guttering system and stored in a 2,000 litre water tank.

Once the framework was completed, it was time to place the cement boards by drilling them into the framework. The whole process of attaching the cement and gypsum boards to act as walls took over a week. A gap of around



10 cm was left between the gypsum and cement board to allow for good insulation to keep the rooms cool, especially on hot days. Also, using these boards instead of normal bricks to build the structure made the construction much easier and faster. One of the key challenges during framework construction was planning on how to use the limited boards, calculating and working out the best way to cut the pieces. Also, as a group it was difficult for everyone to work on the framework at the same time, due to the lack of equipment to be shared around e.g. drills that are too expensive to buy in multiples. As a solution, we split into teams, one taking charge of the morning shift at 6 am skipping breakfast, and the other team would leave site later than the first team. From this, I have learnt the key to being organised, people management and keeping people motivated.

After the steel framework, we needed to



Jana drilling the cement board onto the steel frame

plaster the walls, ensuring every screw was protected. Then fitting and partitioning the space into three separate rooms: the main teaching room, kitchen and a reading room. Finally, we were able to install the ceilings using foam boards, and paint the walls.



FEATURES

Overall, the construction ran very smoothly with minor challenges, which we were able to overcome without losing much time. I think we were extremely lucky with the local support, that all materials arrived on time and that the labourers were able to provide help when needed. However, the most challenging part was that we had only 6 weeks to build this structure from scratch, and that meant we were running on a tight schedule where we couldn't afford for things to go wrong. This made it quite exhausting, especially towards the end where we were slightly behind schedule and therefore chose to wake up at 5 am to get more construction time. In the future, we agreed to extend the trip time to at least 7-8 weeks to take the pressure off the volunteers, and if anything goes wrong, they will have time to fix it.

Free time

On the weekends, including Friday afternoons, the RED team decided to organise weekly expeditions or spend more time with the locals as part of integration. The locals loved going down to the river to swim and play, so we went down with them many times and had a lot of fun. Most of the locals work as farmers, as Borneo is known for its palm tree plantations and other vegetation. They also tend to marry young and raise kids, whilst working. The villagers are mostly Christian and pray every Sunday.



At the river with the locals

On some other weekends, our expeditions included visiting Sandakan to see the Orangutan and Sunbear preservation centre, Kudat for the beach and Kota Kinabalu for shopping. It was also the time where we bonded as a team and relaxed to recharge for the following week.



Catherine, Kasia and Sher Lynn at the Orangutan Rehabilitation Centre in Sandakan



Education/ English Lessons

As part of the program, RED agreed to teach the locals some practical English. We decided to split into two classes, children and adults, as we found that the children are more advanced than the adults. The lessons would be fully planned by us and taught on Tuesdays and Thursdays from 8.30 pm to 10 pm. In general, for adults we tried to teach them conversational English, such as forming sentences, how to greet, basic words describing who they are, what they do and where they have been. In the kids' sessions, we would teach more complex vocabulary, present and past tense and English grammar, as foundation English is mostly taught in schools. We would try to make the lessons as interactive as we could by playing various games, including hangman to teach them how to spell certain words, Chinese whispers to teach them how to form sentences and story telling for more advanced English speakers. The lessons would normally end in a song, where we would teach them the lyrics and all sing together.

The lessons were quite successful, as we have received lots of positive feedback and the attendance was always great. We could also see the immediate improvements during the recap sessions, where the locals would remember the new words we taught them, and in general they became more comfortable in speaking English. The RED team particularly enjoyed teaching English, as we used these moments to bond with the locals and find out more about their culture.



Flo, Jana, Edrea, Sher Lynn and Hippolyte with LEB representatives at the building opening ceremony (traditional Dusun tribal outfits were given to us to wear on the day)

In Conclusion...

This was a rewarding trip, where I met such great people, especially children, who are so positive and happy at all times. I am so grateful to be part of the RED team, which was able to build a full kindergarten from scratch in 6 weeks. Hopefully, this educational centre will give the children a better chance in getting the proper education they deserve and take the pressure off adults having to watch their children whilst farming. I would like to express my sincere gratitude in receiving the Old Centralians' Trust Award, without it this trip would not have been possible and I would not have been able to learn as much as I have. I hope that this report highlights the great work the RED charity does and the impact it has on the community. Your continuous support and faith in RED is utmost appreciated.

You can find out more about RED at:

<https://www.redprojectborneo.com>



Group photo on site. Clockwise from top left: Qui Hong, Jack, Chloe, Anam, Flo, Neoh, Catherine, Sher Lynn, Edrea, Hippolyte, Kasia, Jana and Fiona

The RED team 2016

Organisers

Edrea Pan – Project Manager and Chair of RED Project Borneo 2015-2016

Chloe Detanger – Project Assistant and Treasurer of RED Project Borneo 2015-2016

Volunteers

MEng Civil and Environmental Engineering :

Anam Balbolia – 1st year

Qui Hong Dong – 1st year

Hippolyte Mounier-Vehier – 1st year

Sher Lynn Wong – 1st year

Arthur Mun – 2nd year

Xiao Binn Neoh – 2nd year

Xiaoxiao Catherine Ding – 2nd year

Florian Grossman – 3rd year

Jack Wilkinson – 4th year

Fiona Walport – 4th year

Kasia Swiatek – 4th year

MEng Chemical Engineering:

Jana Tian – 4th year

Supporting Team Members

Fundraising

Capucine Tong – 1st year MEng Material Science

Xin Jin Ho – 1st year MEng Civil and Environmental Engineering

Structural Design

Wen Yi Gao – MSc Concrete Structures

Wei Qiu – PhD Structures

Four-legged friends

Millie Tsang, CGCU Welfare Officer, was looking for ways to help students overcome homesickness and stress. She was guided to an innovative solution by some four-legged friends. In the process she not only helped many fellow students, but also managed to raise some money for the charity involved. We asked her to tell us more...

Being a Welfare Officer was a huge responsibility and had its challenges, but as with most challenges, the only way forward is trying to face them productively.

One recurring issue among a few that cropped up frequently was the sense of homesickness, from undergraduates in both the home and international community. Particularly for students where it was their first time in a completely new country, not just a place away from home, you could sympathise with the culture shocks and appreciate the strength it takes to adapt to unfamiliar environments. It was this loneliness that isolated students with their problems and stress. Naturally this leads to a cycle of further isolation and escalation of other concerns.

However, what surprised me most was which aspect of home life students missed most. Dare I say it, but for some it wasn't so much the lack of time to see their parents or siblings that bothered them, but the emptiness without their animal companions they were most upset about. I even came across a study that proposed the death of a pet psychologically hurts as much as the death of a family member, if not more. Surprising findings but whether we accept them or not is a discussion best left for another day.

Time to do something about this, I decided. I already tried to support students to the best of my ability, but it was clear that this was something that was missing and needed. Moreover, attempting to fill this void would need extra pairs of hands. I consulted a few therapy dogs in the UK – the ones who would bring joy and happiness to hospital beds, prisons and mental health institutions. Many were in high demand so finding friendly canines would be an arduous process.

However, not as long as the challenge to have it fully approved by both College and Union. Armed with case studies of other universities and a paper provided by my academic tutor about the benefits of looking at 'kawaii' images while at work, I proceeded to take action on my cause. Following lots of meetings, calls and appointments, I was grateful and ecstatic to announce that, despite a recent rule banning any dogs on campus, the health and safety officers were happy to call my proposal an exception.

We managed over 300 signups within 24 hours. Word spread rapidly of the opportunity to queue up to cuddle fluffy pooches. A hectic day it was, but definitely worth it. What came as a result was a good bonding experience between students of different courses to chat and relate on their hopes and worries, and more importantly a chance for me to talk to students where possible.

An inspirational moment was when we even had a student with a phobia come in to confront their fear of dogs. I heavily commend their bravery. We went to a separate room and let them stay with this very calm and chilled spaniel, the whole thing really added gravity to the impact we were having on student welfare. Thankfully it was a positive experience for them too: *"it was beneficial, every little bit helps... Thank you so much for your help and everything, I really hope there will be more of it next year. I really think it is a great idea against stress and fear, the latter is also quite common and I'm sure it could help more students than just me."*

This form of therapy against stress has been a firm favourite and adopted in many universities in the UK and US such as Harvard and the Universities of London – at a few they even give students the opportunity to 'hire'



Photo: CGCU

puppies to look after. Whether or not people will question the effectiveness of it as a stress reliever – surprisingly I haven't come across any objections so far – safe to say it provided the CGCU with many good outcomes (even if we did have a brief 'brown accident' in the middle of the road by Skempton!). The chance to bring students in to speak to us and each other; seeing students giggle with excitement "oh he reminds me so much of Harvey!" and the humbling experience of helping a person confront a phobia. Surely this is more than enough to deem the event an innovative success that needs to continue, alongside the refreshing smiles and laughter that engineering faculties often don't realise they need.

With most grateful thanks to the College staff (in particular Steve Greenwood) and students who made this all possible. Most of all, thank you to the ladies and furry friends from All Dogs Matter for some wonderful afternoons.

Millie Tsang



Photo: Rocio Alvarez

Millie with Carlos



Photo: Andrew Olson



Photo: Andrew Olson



Photo: Millie Tsang

El Salvador Project 2016: Aboneras and VIPs

The El Salvador project is an entirely student-led volunteering project based at Imperial within the Civil and Environmental Engineering Department, supported by the UK charity 'Engage for Development'. The project was established in response to the devastating earthquake which hit El Salvador in 2001. Every summer since then, teams of students have worked with the Salvadorian Non-Governmental Organisation, named 'Fundación Salvadoreña para la Reconstrucción y el Desarrollo' (REDES), on a variety of projects ranging from the construction of earthquake-resistant housing and retrofitting of existing homes for earthquake resistance, to the implementation of sanitation systems. The OC Trust support the project and in recent years we have featured articles here in IE based on the report of the returning team. This article is derived from the 2016 report.

The El Salvador Project strives to provide simple and sustainable engineering solutions to rural communities in El Salvador, and also to educate the locals regarding infrastructure maintenance and construction techniques so that they can better themselves in the future. The 2016 project team focused on sanitation. In the summer, a team of seven students from Imperial spent five weeks in two rural communities in El Salvador constructing thirteen latrines. The team also informed and educated the locals of the importance of sanitation practices, how to use and maintain their new latrines, and involved them in the construction process.

The 2016 project followed on from the sanitation systems project in 2015, which evaluated the sanitation situation in several rural communities and enabled effective preparation for the 2016 project. Following their recommendation, as many composting-latrines (Spanish: *aboneras*) were constructed in the 2016 project as possible, as these have the most benefit to the locals.

The El Salvador Project collaborates with several organisations in order to ensure our work is delivered as effectively as possible. Our main partners are REDES, Engage for Development and Imperial College Union.

The vast majority of the work in El Salvador was undertaken with REDES. They collaborated with Imperial College and Arup to develop earthquake-proof housing in the wake of the 2001 earthquake. For twelve years, REDES has worked closely with the El Salvador Project, further developing the housing. However, in the past two years it has been mutually agreed that focus should be shifted towards sanitation. Hence REDES this year assisted primarily with the design of the latrines and the acquisition and transportation of materials.

Engage for Development is a UK charity that focuses on facilitating engineering projects for development in poverty-stricken countries, and share engineering knowledge for further development. Founded by a group of Imperial College alumni that had been on the El Salvador Project, they decided to establish a formal body that could facilitate the El Salvador Project and other initiatives, such as Raincatcher, another project led by students from Imperial College with similar objectives to those of the El Salvador Project.

The El Salvador Project 2016 was carried out in a small town just outside San Salvador, the capital of El Salvador, called San José Villanueva, where we worked with two communities, barrio Santa María and barrio Santa Lucía. The thirteen families we worked with lived in these two communities. Their houses were walking distance from one another so it was easy to move from one family to the next, always accompanied by Leonel Segura, a REDES employee who was in charge of our safety. San José Villanueva is one of the most dangerous villages in the country, heavily affected by the presence of gangs and drug cartels. It is located near the border between two major gangs, leading to constant violence and terror in the communities. Thus, the presence of Leonel was crucial to the success of the project and safety of its members.

The 2016 Project

The project in El Salvador lasted five weeks from 26th June to 31st July 2016.

Once the team had congregated in El Salvador, we met with Carlos Melendez and the lead-builder, both from REDES. Together, the schedule for the upcoming weeks and the organisation, including health and safety measures in and outside the construction site, were discussed. On the 28th June, the team left early in the morning to the community in San José Villanueva, 40 minutes by car from San Salvador. There was a welcoming ceremony where the team was introduced to the leader of the community, Isaías, and

Leonel, who escorted us on week days, at all times, throughout our stay in the country. Following the ceremony, the team headed to two different houses, splitting into two teams and commenced the work.

The construction process of the latrines started with setting out, where the lead-builder outlined using a stick, the construction site and where the latrine was going to be built. From there, the team started digging and levelling to prepare the site for construction. In the first week of construction, the team familiarised with themselves with the community, spoke to the families and tried to involve them in the project by explaining the project to them. By the end of the week, the team had divided into three groups: Leonie, Hamish and Leire composed one of the groups, Paloma and Leah formed another one, and the third group was Jack and Stephanie. We each worked in a different house with an albañil (local construction worker), building a latrine for each assigned beneficiary. Leonie, Hamish and Leire first built a composting latrine, while the others built VIP latrines. Because only one albañil, Raul, specialised in composting latrines and only a total of three were to be built, Raul switched groups once a group had completed a composting latrine to give each group the opportunity to build one. The rest of the teams then focused on VIP latrines.

Organisation was key in such a time-constrained project, since the team had five weeks to build thirteen latrines (three composting and ten VIP), and six washing

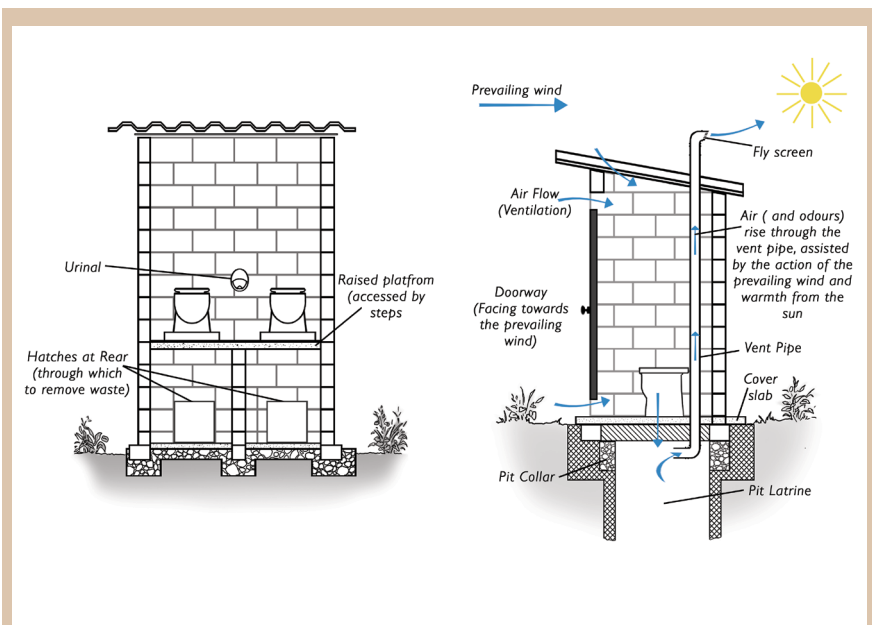


Cutting the bricks for the Pit Collar



Laying the bricks

Photos: El Salvador Project 2016 team



Abonera (Composting Latrine)

Features of composting latrines are the two chambers that store human waste and once filled the waste is allowed to decompose into compost. The structure is all above ground, which allows access to the compost in the chambers. This is a more beneficial and sustainable sanitation system, as the latrines can easily be reused and the compost helps the family's agriculture, however it is more expensive than a VIP latrine.

Ventilating Improved Pit latrine

VIP latrines store the human waste in a 3m deep pit in the ground. The waste can be removed once filled, however this is rarely carried out in practice. There is a vertical vent pipe that is installed in the latrine which helps to remove odours from the pit, as well as trap flies. These latrines are cheaper and easier to construct than aboneras; however, once filled with waste, a new latrine may often be constructed.

finished installing the doors and roofs of the final two latrines, work in which the team was not involved as it was only a one-person job.

Throughout the project, the team tried to involve the families as much as possible, taking into consideration the language barrier that existed between English-only speakers, and the locals, who only spoke Spanish. It was charming to see how many of the locals, especially the teenagers and young adults, showed off their English speaking skills to the team. The generational differences of the locals were obvious from their mentality and attitude towards us. For the El Salvador Project 2016, it was crucial to involve all the families, no matter the age and gender, in the construction process, in order to guarantee that they understand the construction and the importance of sanitation for the development and progress of their country. Having them involved in the construction process created a bond between them and the project, which makes it more likely for them to use their latrine appropriately and carry out adequate maintenance.

Project Outcome

At the end of five weeks, we had aided in the construction of 10 VIP latrines, 3 aboneras, and 6 pilas. However, the local albañiles and families constructed an 11th VIP latrine after the project was completed on the 31st of July, due to excess materials and additional unused labour time.

The families chosen to receive the latrines were carefully selected by REDES and, as such, there was an agreement that they would regularly keep the latrines sanitary and in operational condition by following the specific maintenance guidelines outlined to them by REDES. This was done through meetings with the local community leader, who is an employee of REDES, where he outlined instructions for maintaining the latrines in good condition.

All families were very willing to observe and aid during the construction process, which gave them the opportunity to learn the necessary techniques so that they can possibly construct similar latrines in the future (with the appropriate supervision). Involving the families in the construction process also gave them further incentive to properly maintain their latrine as they directly contributed to its construction and thus would be more encouraged to ensure its sustainability. The sustainability of the project will benefit the local communities in which we work, such that they can continue to improve their level of development, enabling them to have a better quality of life.

Every family was grateful for everything we built, as they were in need of a renovation of their current facilities. They also valued the interaction with people from other cultures, as they were able to gain a different perspective on life and learn from our cultural differences. The experience also had a profound impact on the students involved. It allowed us to deepen our understanding of the importance

basins or 'pilas'. The composting latrines could be constructed without disruption, whereas the VIP latrines required that, after the Pit Collar was built, the family dug the 3m deep hole. Because many families worked long hours in their jobs, very often construction was interrupted by the fact that they had not finished digging the hole in a timely manner. Therefore, the team had to be flexible and commence work at other households. This delayed construction, because often the families would not inform the community leader of their inability to dig the hole in

time. However, action was taken to ensure the delivery of the project.

The construction of the pilas were started once the third composting latrine was completed at the end of the third week. The pilas only required one worker and one albañil. Therefore, the team did not work on the pilas, as a member of the beneficiary family helped the albañil in order to ensure their involvement in the project. By the end of the five weeks, the construction of all thirteen latrines and six pilas was complete. The following week, after the team had left El Salvador, the albañiles



Foundations of VIP latrine

FEATURES



Abonera foundation trench filled with rocks and reinforcement on top

and functionality of sustainable infrastructure in rural communities. In addition, we were immersed in a different culture and way of living where we were directly making an impact on people's lives. We also gained practical experience in engineering techniques. As impactful as the experience was for the local families, it was as gratifying for the students.

Project Team Experience

As soon as we arrived at the house we would live in for five weeks, we immediately felt at home in what was otherwise a vastly different culture and environment for us all. It did help that the house had a flushing toilet, running water and even electricity, a stark contrast to some of the houses where we were building. What really made us feel so welcome though, was the family we stayed with, who always went above and beyond to make us comfortable, and the immensely friendly locals.



Building the walls



Building the two composting units



Complete structure of an abonera



Completed VIP latrine (side view)

Our host family was a family of five, including three hard-working boys (even if two were also playful four/five year olds). The family were the ones who fed us daily and plentifully, at their local restaurant for lunch, and at home for breakfast and dinner. An idea of a typical day's food would be: for breakfast, pancakes and fruit; for lunch, chicken with vegetables and rice; and for dinner, the Salvadorian special pupusas (stuffed rice or corn flour tortillas) or tamales (corn filling steamed in a corn leaf).

By the time we left, it was almost unimaginable that we would not be coming back to the amazing army barrack style beds and 'hammock-life' that most of our evenings had become. More unimaginable was not seeing this inspiring family who had hosted us for five weeks.

Despite the inevitable language barriers from having only two fluent Spanish members in our team, the local community had really become a second home during our brief time there. Their perpetually happy attitude and



Project team on the border with Honduras at El Pital – highest point in El Salvador

dreams, despite their daily troubles and having so comparatively little, are things we will all try to remember ourselves in future.

Weekends

We only worked during the week, so made the most of our time and followed the trend of past teams by travelling around El Salvador on weekends, seeing more of the local culture as well as some lovely natural sites.

On the first weekend we went to what we affectionately dubbed ‘Canada’ (but in reality was called El Pital) due to some colder weather conditions for which we were not prepared and generally more coniferous surroundings. A couple of hour’s hike took us up to the highest point in El Salvador (at 2.7 kilometres above sea level) and some gorgeous views of the valleys below. At one point we even crossed an open border into Honduras.

Our want for more relaxation on the second and last weekends took us to the surfer-hotspot, pebble beaches in El Tunco and the more sedate beach of Barra de Santiago respectively. In Barra de Santiago, we also had the opportunity to be taken into the usually crocodile infested waters of Mangrove Forest by a local tour guide. Unfortunately we only saw one sleeping crocodile on a bank, due to an earlier motor boat disturbing the waters and driving the animals away, but leisurely boating down the river and later swimming (in the non-crocodile infested parts!) were worthwhile in themselves.

On the penultimate weekend, we spent one day in the historic town of Suchitoto before going around the local villages and markets of La Ruta de Las Flores on the Sunday. The highlight for most of us being the gorgeous waterfalls we visited near one of the villages.

Acknowledgements

The project team would like to thank all of the sponsors who support the El Salvador Project, and all the individuals and organisations who helped us prepare and complete the project this year.



Project team at the Mayan ruins of Tazumal



Beneficiaries with their new VIP latrine



**Project Team with Maria Berta, one of the beneficiaries.
L to R: Stephanie, Hamish, Leah, Paloma, Leonie, Leire, Maria Berta, Jack**

2016 Project Team

Project leaders:	Leire de Mariscal Perez	Civil Engineering 2nd year
	Hamish McGregor-Smith	Civil Engineering 3rd year
Treasurer:	Leah Redon	Physics 2nd year
First Aid officers:	Stephanie Pinto	Physics 4th year
	Leonie Mester	Civil Engineering 3rd year
Team members:	Paloma Rebuella Merino	Civil Engineering 1st year
	Jack McCarthy	Civil Engineering 2nd year

Tracklaying in Wales

Members of the Imperial College Railway & Transport Society spent a weekend in February laying track on the Ffestiniog and Welsh Highland Railway, thanks to some financial help from the OC Trust. ICRTS Chair, Owen Harcombe, and Johnny Yeung told us about the experience. Tim Cotton says reading this brought back memories of laying track underground as a young miner!

Friday 24th February

We set off from Imperial College at about 1.30pm on minibuses rented from the Union. With a jubilant gang of fellow train and transport enthusiasts, we headed towards Minffordd Volunteers' Hostel and Training Centre in Snowdonia, Wales.

The entire journey lasted for about 8 hours. In between, we made stops at a service centre near Oxford for resting, as well as near Warwick to gather some more gloves and PPE. As per previous years, we were largely on time with our schedule and we stopped for dinner at a Fish and Chips restaurant at about 7.30 pm.

After our hearty meal we headed into the Snowdonian mountains and promptly reached Minffordd Hostel at about 10pm. Ian Andrew, the warden on duty on that day, welcomed us and gave us a short briefing on our stay before everyone retired to shower and sleep after a long ride.

Saturday 25th February

This was our first day of actual work on the railway. The morning commenced with us waking up at 7am to cook breakfast and prepare lunch for the day. After eating and dressing up warm (it is Wales after all, so there would be 100% chance of rain!), we then went down for our briefing into the new mess room that has recently been constructed in the yard, including a safety briefing for those who haven't been before. We were then taken out into the yard where the engineering train was waiting to take us to where we would be working.



In the coach on the Engineering train

Our first job when we arrived on the site was to fetch all the equipment we would need for the day's work. This involved walking up to Penrhyn Station to retrieve the works trolley and load all the sleepers and tools onto it.

Before the new sleepers and rails could be laid, we first needed to remove the old rails which they would be replacing. This was achieved through undoing the fishplates and removing the screws which held the rails and the baseplates onto the sleepers. Once this had been done, a group of us could pick the rail



Using the rail tongs to lift off one of the old rails

up using rail tongs, before placing it on some rollers to allow it to be moved further down the line and out of the way. This would allow a train to come along later and pick up all the waste materials.



Putting the rail onto the rollers

Due to Storm Doris wreaking havoc the previous day, the permanent way team (who were meant to bring more sleepers up to the worksite to allow for a whole length of rail to be laid) had been called elsewhere and could not do it. We therefore had to take the train back down to the yard to collect a small wagon and load it up with the sleepers needed to allow the new rail to be laid.

Once all the sleepers were in place, we could use the Roland Rail Movers to bring the new rail down from Penrhyn Station to where it was needed. These machines were designed by one of the volunteers on the railway to allow for the easy movement of rail whilst the Welsh Highland Railway was being constructed. They use a combination of levers and special



The Roland Rail Movers



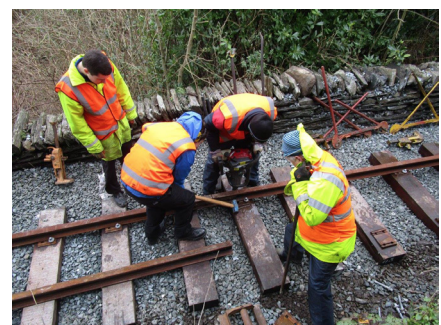
The section of track where the rail had been removed

rail tongs to enable two lengths of rail to be picked up and carried down a section of track between the two movers (one supporting either end). They proved a very useful tool as we are sure they have done countless times in the past!



Lifting one of the new rails into place

When the outside rail was on the sleepers, we needed to get it as straight as possible before attaching the fishplate to join it onto the end of the rail that had already been laid. We then had to curve it round using crowbars and jacks to ensure it was in the correct position. Unfortunately, with time getting on we had to stop here for the day, but we were happy with our progress despite a few setbacks and the weather.



Attaching the fishplate to join the two pieces of new rail

In the evening, we went down to Spooner's Pub which is the railway owned (and themed!) pub and restaurant located in Porthmadog Harbour. Here we all enjoyed an excellent meal – well needed after the day's work.

Photo: Owen Harcombe



Sunday 26th February

Similarly to the previous day, we woke up at about 7.30 am to prepare breakfast for our friends staying in the same module. After another hearty traditional English breakfast, we continued work, picking up from where we left off the previous day. Our task for the morning was to lay down a rail segment. Ian first refreshed us (as he had already explained to us the previous day) on how to align the fish plates and the need to secure the rails in a V-shaped alignment for best stability, due to the conical nature of a train's wheels. He demonstrated how to use the electric drill, and described how much to drill into the sleepers such that the holes were deep enough to accommodate the rather large nails.

Photo: Ian Andrews



Using crowbars to ensure sleepers were in the correct place and evenly spaced

With that, we set off to work. We divided ourselves into 2 groups working on one half of the line. It was just amazing to see how everything is scaled up; simple activities such as drilling a hole and securing the nails in our daily lives become much more intense when the sizes of nails and holes are magnified, and require high power machinery operating on petrol. With all the holes drilled and nails driven into the sleeper, we moved on to lay down the next rail segment. Since half of the group did not manage to use the Roland Rail Movers (RRM) the previous day, Ian invited this half to have a go at using the RRM. It was indeed inspiring to be able to use the RRM after hearing about it first-hand from its inventor at Spooner's yesterday. Thus, with the help of the RRM and rollers, we were able to lay down the next rail segment before calling it a day. Overall, the team was satisfied with the progress, for we managed to lay down both

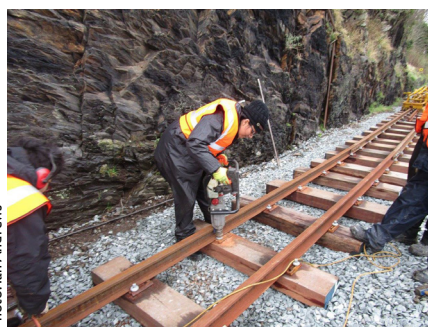


Photo: Ian Andrews

Securing the rails and baseplates onto the sleepers using the screws

sides of the rail segment.

Taking the engineering train back to Porthmadog, the team was rewarded for our hard work with a breath-taking view of Porthmadog Harbour. We also had more tangible benefits, as Spooner's offered tea (free of charge) and coffee (20p) to all volunteers. Lunch consisted of sandwiches made in the morning as well as crisps and chocolate. After lunch, we headed back to hostel on the engineering train to get changed for a visit to Boston Lodge.

At Boston Lodge, we were led on a quick tour of its functions and history. We were amazed by the inner anatomy of various steam engines, as some of their boilers were removed

for repairs and we were left with a skeleton showing the mechanism of the engine function in its entirety. We also witnessed some work in progress, which was truly unique for many of us.

After the Boston Lodge visit, it was unfortunately time to say our goodbyes and return to London. Stopping for refuelling at Coventry and dinner at Oxford service station, we dropped off our members at their respective residences as it was late into the night. Time indeed passes quickly while we are having fun and we are looking forward to the next trip.

Photo: Owen Harcombe



The tamping machine used to pack the ballast under the sleepers



Photo: Owen Harcombe

The signalling frame in Porthmadog signal box which controls signals and points in the station

Photo: Owen Harcombe



A view of the footplate on Lyd, where the driver and fireman work tirelessly

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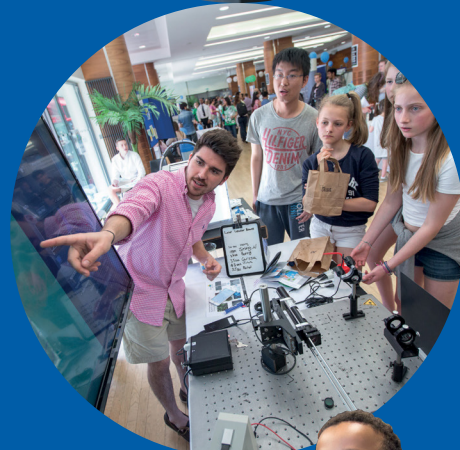
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*"A brilliant
day out"*



Borders and refuge. A suggestion.

Recent events have prompted Nigel Fitzpatrick (Metallurgy 1962-65, 65-68), to think about borders, isolationism and refuges.

Age brings educational experiences that slow travel. In a surgical recovery ward Joan and I thought an Imperial College reunion at our Vancouver home would mitigate the downsides of vegetation. June 11th 2016, we welcomed fifteen alumni and 6 partners. An icebreaker was provided by our neighbour Lorna Warren whose late husband, John, had been the founding director of world class TRIUMF on the UBC campus¹. A handwritten October 1936 letter from John's IC supervisor, George Ingle Finch, was much read by all. George won fame when, championing oxygen use in 1922 on Everest². Finch's letter deplores the ongoing aerial bombing in Spain. History spanned, our multicultural IC group touched on the comparative nationalism and isolationism of 1936 and 2016 amidst the sharing of memories which include mine of George Ingle Finch being a guest at a 1963 dinner.

Later in June our local theatre company was staging James Goldman's 'Lion in Winter'³ set when the aging Henry II has been at war with three sons. Only four silent monks were in 12th century garb. When the correct BBC projection of the Brexit results came through on June 24th, I was playing one and sitting beside a Scot, also gloomily clad. With Henry II and sons tearing Europe and themselves apart behind us, we 'monks' may be forgiven for thinking another dark age might come if isolationism prevailed.

Happily fit again, Joan and I raced around England and South Wales by rail to catch up with family and friends including David Hando, who while training teachers in Kampala, had helped the 1965 Imperial College Uganda Expedition succeed⁴. One early September day began in Roman Bath and ended at

"Broad, wholesome, charitable views of men and things cannot be acquired by vegetating in one little corner of the earth all one's lifetime."

Mark Twain, Innocents Abroad, 1869

a village hall in Blencarn, Cumbria, hearing MP and author Rory Stewart tell how Hadrian's Wall had divided indigenous people. He touched also on walks across Afghanistan and adjacent countries and his year in Iraq. Walking inevitably brings close understanding of what a border means to related peoples divided by a border defined by distant powers.

We were reminded of our own short walks in the Southern Sudan in Jan. 2007 with a Uganda Museum archaeological team taking further the work begun by ICUE in 1965.

The walks are detailed in a section credited to me in a report to the Royal Geographical Society by Merrick Posnansky of UCLA⁵. In 2004 and early 2006 Merrick and I reconnoitered Emin Pasha's station (or fort) at Dufile in Moyo District to determine if it was safe to take a full archaeological team including students. We had mentioned on those visits that A. J. Mounteney Jephson says: "The original station was built by Gordon; but Emin finding it unhealthy moved it a few hundred yards up river, where the banks are higher."

Extant maps show the suspected location of Gordon's original station to be well inside Uganda and it was agreed that we could try to find it. On Saturday 13th January 2007, Joan and I set off with two villagers, two councilors, five of the archaeology team, three privates and one sergeant. The party arrived at a stick barrier across the pathway well within Uganda according to our maps. Shortly we came to a small, and very neat, cluster of huts where six uniformed SPLA (Sudan People's Liberation Army) were acting as game wardens and were as well armed as our escorts. A circle of chairs awaited us in the shade. The location we were looking for was in a game park under the management of the then still nascent Southern Sudan. The meeting, begun through

interpreters and finished in English, concluded cheerfully with hand shakes all around. A request to visit Gordon's fort could be made in person by meeting in Nimule to which all (minus the soldiers) went by motorised canoe and truck.

There was quite a contrast between Dufile and Nimule. The area of Dufile was still green and lush as the dry season had had a late start. Nimule was dry and dusty and the hills around brown. There we all gathered in the shade (and chairs were kindly fetched) at two locations. At the second a surprised Colonel considered the matter, largely in English. He ruled that archaeology in the game park had to be decided between Kampala and Juba. I thanked him. The result was expected. Before climbing into the truck we walked through the large market at Nimule. The fresh food was from Uganda. The fish came via ferry from Dufile and the vegetables by truck from Gulu. As our ferry returned to Dufile against the current, we were further from the north bank than when we came. We could see animals running in the distance. We were witnessing successful conservation where Uganda's 'Dufile Animal Sanctuary' and the Southern Sudan's 'Nimule National Park' adjoin. The externally decided international border was agreeably managed and animals could safely come down to the river.

Independent in 2011, Southern Sudan nurtured 'Nimule National Park' but civil war and Climate Change have led to a dire famine. Refugees are moving south close by the park. UNHCR numbers suggest that a new camp in Uganda's Moyo District, wherein Dufile lies, has doubled the district's population



July 1965: the ferry at the Laropi Nile crossing, looking North⁶

since December.

This year on the 10th anniversary of our arrival in Dufile, Joan and I visited Hawaii's Puuhonua o Honaunau National Historical Park, called the City of Refuge. Mark Twain described a specific stone there and says that King Kamehameha's Queen Kaahumanu sought refuge beneath it when she feared the King. On finding her there he forgave her.



The rock where Queen Kaahumanu sought refuge

The picture here is to bring luck to us all as 'Sanctuary cities' expand in number as a result of the global refugee movement. They are an adaptation to refugees, but if we do not also help at source and mitigate the flow we may suffer the worst effects of isolationism that followed George Finch's 1936 letter.

Mark Twain's "Broad, wholesome, charitable views" would help and they would spread across electorates the more that young people walked relevant borders like Rory Stewart and met people from different cultures. Expeditions that Imperial College's Exploration Board endorses mitigate isolationism. How could the benefits extend to a wider electoral base? Would joint school and university teams be a step?

**Nigel P Fitzpatrick
Vancouver BC Canada**



Sept 2016, Nigel and David Hando in Newport



3 similar hats in January 2007 – Merrick, Joan and I at Dufile

Photos: Nigel P Fitzpatrick

1 <https://en.wikipedia.org/wiki/TRIUMF>

2 [https://en.wikipedia.org/wiki/George_Finch_\(chemist\)](https://en.wikipedia.org/wiki/George_Finch_(chemist))

3 https://en.wikipedia.org/wiki/The_Lion_in_Winter

4 David Hando whose 1965 film is now with the Exploration Board is the epitome of Mark Twain's charitable person influenced by travel. Training teachers in Uganda when we arrived he spotted an article about ICUE 65 and set out to find us, film us. David and Mary adopted and hosted us in Kampala between our surveying trips to North and East Uganda. He was awarded a British Empire Medal for services to football and to the community in Newport in the 2016 New Year's Honours.

5 Merrick Posnansky suggested the RGS support what became ICUE 1965 to survey Emin Pasha's fort at Dufile when he was at Makerere University, Kampala. The RGS endorsed but did not provide funds to our 2006/7 project.

6 This is the main road from Gulu to Moyo and is the route that supply convoys took during the LRA uprising and in 2006 was the way the archaeological team came up from Kampala. It will be one of the supply routes now in the ongoing refugee crisis.

47th Triode meeting 6th January 2017 (record numbers!)

This time 19 Triodes (i.e. Elec Eng graduates of 1973) appeared at the George for our 47th reunion (first Friday after 1st January). Many Triodes had arrived much earlier, some at 17:30, and had already taken over the Fleet Street end of the pub. Even so, in the confines of the pub it was difficult to circulate so we are giving some thoughts as to how else we could arrange things.

After much catching up we moved on to have dinner at the Strand International Hotel's Indian restaurant. As tradition dictates, we stopped at the Triode Loo and got a damp passer-by (it was raining) to photograph us! At the restaurant, Sid and Hari selected a delicious meal for us and we continued on until late in the night. The best reunion yet I was told, certainly the best attended. Will we break the record next year?

The next Triode reunion, the 48th (we had 2 meetings in year one, 2 in 2003, and 2 in 2013!) will be on 5th January 2018 at The George, Fleet Street, from 7 pm-ish. The 49th will be on 5th January 2019. But Decade Reunions will now be every 5 years ('Demi-Decade?'). Our next one would have been in 2023 (if it was 10 years) but now it will be in 2018 and our 49th reunion. That would make the 5th of January 2019 reunion our 50th! Maybe we should do something special?

Those who came on the 6th January (there were 19 of us!):

Geoff Banks said that although much has changed over the past year he is still very busy; he and his wife Pat do the school run for their youngest grandson (7) and also take his spoodle dog for a walk on school mornings. It definitely helps to keep them fit! His other daughter and family (2 grandsons, 11 and 7) live in Guildford (a 440 mile round trip) so they only see them three or four times a year. Also keeping him busy are his elderly parents; even though they are very independent they still require regular visits a couple of times a week to replenish food stocks etc.

Graham Castellano said "I have definitely retired". After a hiatus of about 30 years he has finally let his electrical business go and now he is enjoying meeting up with a bunch of like-minded people, like us! He said that next year's reunion is already in his diary.

Joan Clemow continues to enjoy her retirement. She has a wide variety of interests at home, plus she really enjoys travelling, but actually it turns out that most of her time is spent volunteering for the National Trust. The best time (as always) is spent with her grandchildren.

Martin Clemow is still in the recording industry, not music



(L to R) **Tony Godber, Graham Castellano, Peter Wright, Steve Glenn, Dave Mansfield (with umbrella), John Harding, Alice Spain, Joan Clemow, Richard Lewis, Martin Clemow, Peter Marlow, Sid Seth, Rut Patel, Phil Harris (kneeling), Hari Singh, Nick Hiscock, Martyn Hart (on his knees!), Pat Mason and Geoff Banks**

but with a company who supply recorders for Air Traffic Control. His company has equipment in all but two of the major airports in the UK. However, it is about to relocate from Somerset to South Wales and Martin has declined the invitation to move with them! This means that he will be working from home for an undefined period of time while things sort themselves out and he recruits his replacement. He hopes to have joined the 'retired camp' by the next reunion in 2018. He still participates in motorsport (sprinting and hill climbing) though not in single-seaters any more, he now competes in 'real' Minis with his middle son. He thinks once retired he might even get around to restoring his MGC which hasn't run since he bought it in 1980.

Steve Glenn says that he is still happily employed with MOD, 3 to 5 days per week, engaged in interesting work that he cannot talk about. His family/grandchildren keep him busy the rest of the time. His wife Anne is now part time teaching and part time Granny which suits her well, he says.

Tony Godber made it to London this year from Western Australia where he still works for Rio Tinto's iron ore rail network, dividing his time between engineering offices in Perth and operational areas in Karratha. He has no firm retirement plans yet; there are still some interesting projects under development. Remaining in the workforce is also of benefit to his family cash flow, with two of his children (Felicia and Justin) getting married this year! He is continuing to use his accumulation of long service leave by taking holidays with his wife Deb; the most recent was an Asian cruise in October 2016 and now a European tour in mid-2017 is in the planning stage.

John Harding is still a managing consultant with CACI. He's been

working with the two biggest UK mobile telecommunications companies in the Thames Valley on their business processes. His wife Anne is retired but John says that she seems to be always busy and he doesn't know how she ever found time to go to work. His children continue to pursue their careers in the great metropolis of London.

Phil Harris and Lina still appreciate retirement and have taken up country dancing, enjoying twice weekly sessions that provide exercise for body and brain in great company. They also look after their grandson Theodore (2); Phil says Theo is into everything (going to be an engineer?) but he has a winning smile and gets away with it!

Martyn Hart works three days a week (often 4 or 5) in the public sector, mainly in the commercial area (large outsourcing/framework contracts). Now settled in the Triangle House in Ingatestone in Essex, he's involved with the local cycling, photography and other clubs even the Parish Council, he says!

Nick Hiscock shows no signs of returning to Electrical Engineering; he has become established on the Executive Committee of the Warsash Sailing Club, recently becoming the Hon Sec (or general dogsbody depending how you look at things). His other hobby (working on his antique weapon collection) continues and anyone who wants to see 'The Collection' needs to allow a couple of hours at least. He still supplies refurbished weapons to the team that provide the cavalry skill at arms displays at the UK Battle Proms.

Nick's wife Sue has now notched up 40 years as a veterinary surgeon, so has much more staying power than her husband. Elder daughter Jenny has a full-time lectureship at Kent University and continues her research inventing molecules. Nick's younger daughter Pippa had

been awarded 'Young Engineer of the Year' at Roche Manor Research, despite being a mathematician, and is currently working in London.

Unfortunately **Richard Lewis** started 2016 with a severe attack of Crohn's disease but slowly recovered with the help of immunosuppressants. By March he had gained a 'permanent' post teaching A-level maths three days a week at Haberdashers' Aske's Hatcham College from September onwards. He also did some interim supply teaching for a month in April/May. Now he's happily teaching single and further maths to one Year 12 and two Year 13 classes and seems well-liked by all his students – meaning they don't see him as a 64-year old fuddy-duddy! Richard has no thoughts yet of permanent retirement, he is having too much fun working with young people. Plus with all three of his children having left home and with his wife at work he says it can get a bit lonely all day every day at home by himself!

Dave Mansfield has been managing ongoing building projects resulting from his late father's estate. He has had real hassle getting planning consent to convert his father's old house into five self contained flats – employing a good architect was key to success – then followed structural engineering designs, party wall surveys, building control, CIL developer 'tax' (a tax for helping to solve the housing crisis!). But thankfully he has got a great Polish builder who seems to be able to cope with every problem thrown at him. During the year Dave and his wife enjoyed a trip to northern Norway in the spring and saw the Northern Lights, an amazing experience, and then went back on a fjord cruise in the summer.

Both of Dave's sons are working in London; the elder back from his overseas assignment at the FCO, and the other working in investment banking.

Peter Marlow and wife Sally are enjoying the freedom of retirement, travelling around New Zealand in February and March 2016. They flew out via Hong Kong and met up with Paul Cheung for an excellent lunch. Peter continues as Director of Project Managers Against Poverty (PMAP, www.projectmanagersagainstopoverty.org), a not-for-profit organisation mentoring project managers in developing countries. He is still managing to avoid the golf course but does enjoy using his bus pass!

Patrick Mason was bowled over with our restaurant. "What a brilliant old fashioned Indian," he said, "great food; I can't believe I didn't know of it before." Pat is still involved with



Peter and Sally Marlow with Paul Cheung in Hong Kong

his company GlobalWebPay (www.globalwebpay.com) which allows anyone to send money abroad with "excellent service and exchange rates". Pat even offered preferential Triode rates if anyone was in the position of wanting to move a sizeable amount (i.e. over £20,000); just contact him.

Rut Patel really has been busy; at the beginning of the year he went to India to see his guru in Gujarat, whom Rut found very uplifting. Then he went on to see Asiatic lions in the Gir forest and even managed to climb 7,000 of the 10,000 steps of Mount Girnar. That took him around four hours which is not bad for an oldie! He has some sad events with both his Guru and Father-in-law passing away but happily later in the year his daughter gave birth to her first child and Rut's first granddaughter. With two grandsons from his son he now has grandchildren aplenty to keep him even busier!

Rut went to see his team Spurs play at Wembley twice and they lost both times. He was beginning to think he was a jinx so for the last match at Wembley he didn't go and they won! Now he doesn't know whether to go in February for the Europa League even though he has the tickets – we said "Go!" Meanwhile he likes to walk and visit gardens, especially Wisley as he is a RHS member.

Sid Seth is still working on his 'secret' projects. He won't tell us what they are but it's something to do with IoT. He has also tried trading on the market but decided to rethink. "I've stopped for a bit," he said, "because it all seems more like luck than judgement". Maybe he'll be a multi-millionaire by the next reunion?

Hari Singh's news was that this year he had more holidays in USA and India. And of course more golf. He won his club's (Downshire Golf Club) Handicap Championship (well done Hari!) and came second in the Scratch Championship. His handicap has gone from 6 to 9; he said that every year it is getting harder to maintain his single number handicap! A good excuse to play more, Hari!

Alice Spain continues to renovate her old rectory in Norfolk. Most of the major repairs are in hand but there is still work to be done on the roof. She is hoping to have a working kitchen by the end of 2017 (currently underfloor heating is being installed). At the same time the garden is being reclaimed; a Victorian garden is in the middle of being planted in the field adjacent to the house including a maze (but you can cheat and walk through the trees at the moment!). There is still scaffolding around the house and it's not yet habitable but a bit of light is appearing at the end of the tunnel at last.

Peter Wright is still heavily involved in running his local Scout District as Secretary, Appointments Chair and various other roles including caretaker and handyman. He says that he has resumed circuit design (diodes, transistors and relays) and installation work with his trusty soldering iron. His latest projects include electric door locks, SMS senders and plumbing repairs. A side benefit of all this Scout stuff is that he gets to go on lots of (adult) training walks in Snowdonia, Lake District, etc.

Those who couldn't make it and we've heard from:

Addy Adesara says that he is sorry he missed the reunion; unfortunately customers got in the way, but he sends everyone his best. He is working at Vodafone, although he is not sure for how long, currently he is looking at legacy networks. He still plays hockey for the past master team and on the home front both his girls are qualified doctors now. But Addy adds that they never want to know about his aches and pains!

He is hoping to go on an overland trip to India via Russia and China later in the year so he is getting into the planning stages right now. That's something to tell us about at the next reunion!

Peter Cheung wrote to say he would again be away over New Year visiting Hong Kong and China, mostly related to work, so missing the reunion. He is still at IC Electrical Engineering; Martyn visited him in the summer and he was doing very well with many challenges, mostly about electrical engineering. He hopes to see us next year.

Although **Hugh Culverhouse** had many trips to England from Germany earlier in the year, mostly to do with cycle racing but also for sad things like funerals, he couldn't manage another for the reunion. Unfortunately he broke the kneecap of his already damaged left leg and he now has very limited flexion both in the hip and in the knee, making sitting (in a plane for example) very difficult. Walking is tough too! So he says he is nearly legless at the

moment, a state which he often enjoyed in the Union Bar at IC! He hopes to be able to get to see us in 2018.

Meanwhile he is still teaching Business English as a part-time retirement venture. On the sporting front he has been very active cycling this year and luckily all cycling goals were reached before the kneecap fracture. The main goal was a 24 hour race in England in July (his first since 1985); he did 372 miles, a great result just 200 metres off winning M60 in spite of using only one leg!

Tim Dye says he is still pottering about as a retiree in Norfolk. His wife has also retired so they do far more walks and cycle rides than before. A couple of grandsons keep them on their toes and, believe it or not, he still operates a TV camera for the new owner of the old Anglia studio there, now in full HD. After many years at the dizzy heights as a Chief Engineer in an ITV company Tim feels that it is good to get back to the basics on a studio floor, covering music gigs, wrestling, boxing or political discussion shows just for fun. Just like the good old days in STOIC!

Snowstorms caused chaos for **George Gabrielczyk** and he ended up missing his flights. So, stuck in Warsaw with -12°C outside and dropping, he sent his 2016 news. No retirement, in fact he is chairman of two companies listed on the Warsaw Stock Exchange. He has entered two off-road events, won one and came second in the other. He has been elected vice-chairman of FEDFA (Federation of European Deer Farmers' Associations, remember George has 2,000 deer); in that respect he has also been co-opted onto an advisory board at the Polish Ministry of Agriculture. Currently he is helping his son to rebuild (from scratch!) a Land Rover Defender 110, 1998 County model; much rust, new galvanized chassis, but will be very nice if ever finished. Finally he sent us a photo demonstrating his previously unused architectural skills – his farm's 'German' barn complex (all his design) which is almost complete.

A Christmas card from **Chris and Daphne Giles** said he is still working for the small company (even though he retired for the 3rd time in 2015). We believe that he may have moved away from Berkhamsted and the canals to Kent. Hopefully we will have learnt more by next year's reunion.

Those who didn't make it and we haven't heard from (can anyone help?): John Baird, Jackie Buzzard. Al Farbridge, Chris Gaukroger, Ian Heap, John Macfarlane, Keith Marshall, Alistair Rogers, Have a great 2017.

Martyn Hart, Arch Triode

DIARY

Sat-Sun, 6-7th May 2017

Imperial Festival / Alumni Weekend
South Kensington Campus
(see p28)

Wed, 14th Jun 2017 (TBC)

CGCA

AGM and President's Evening BBQ
South Kensington Campus
(Refreshments from 17:00)

Thurs, 15th Jun 2017

Friends of Imperial College

Antartica: Terra Incognita – Prof.

Martin Siegert

SAF Building

Tickets must be purchased in advance
<https://www.friendsofimperial.org.uk/FOIC-Index.php?pg=BookingEvent&ev=241>

Thurs, 22nd Jun 2017

Dept. of Bioengineering

Bioengineering Lecture –

Prof. Sangeeta Bhatia, MIT:

The Power of Miniaturisation in Medicine

Sir Alexander Fleming Building

Register by email to a.glyes@imperial.ac.uk

Thurs, 29th Jun 2017

RSMA

AGM and End of Year BBQ
Venue TBC

Fri, 24th Nov 2017

RSMA

Annual Dinner

Sat, 25th Nov 2017

CGCA

'5 & 10' Reunion Lunch
South Kensington Campus
(see p6 and booking form)

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

Hugh Kendrick elected Fellow of the American Physical Society



Hugh Kendrick (Mech Eng 1958-61) was elected as a Fellow of the APS in September 2016, in recognition of his outstanding contribution to Physics. The citation reads:

"For original technical innovations in nuclear materials safeguards, security, and nonproliferation; and for policymaking in national security and the environment."

The number of APS Fellows elected each year is limited to no more than one half of one percent of the membership.

Pioneer of international conflict resolution



ANTHONY VIVIAN SMITH de REUCK (Physics, Chem Eng 1951-57)

Tony was born in London on 3rd September 1923, to a Belgian father and English mother.

As a child, spending holidays with relatives in Belgium, he was deeply affected by their memories of the wars of 1890 and 1914-18, and their dread of future conflict. He would later recall 1933, and the first time he saw a swastika on the side of a barge sailing on the river near his grandfather's house; the appalled and tearful reaction of the adults around him made a lasting impression.

Educated at Christ's College, Finchley, Tony then joined the RAF in 1942. He became a Flight Lieutenant, working as a meteorologist in both India and France, providing weather forecasts for allied airmen. His love of weather forecasting led to his later becoming a member of the Royal Meteorological Society.

Leaving India in 1947, on the very day of Partition between India and Pakistan, he witnessed the terrible civil war which then broke out.

Tony's experience of conflict and its aftermath: as a child; during his time in the RAF; and in post-Partition India, led to his identifying the need for a scientific approach to analysing the factors that led to conflict, specifically to WW2 and thence to the US-Soviet confrontation in the Cold War.

In 1951, Tony took up a place at Imperial. Here he met his fellow physics student, and future wife, Marjorie. They were both studying at a time when the emphasis was on Nuclear Physics. He said later that this "might have equipped us for the nuclear power industry or, indeed, for the nuclear weapons industry... none of us felt that this was appropriate."

Both Tony and Marjorie were drawn into a circle of other physicists. One of these, Sir Joseph Rotblat, became known as the keeper of the nuclear conscience, following the Russell-Einstein Manifesto in 1955 which called on all scientists to meet and to find ways to avert the threat

to civilisation created by the advent of thermonuclear weapons.

A first meeting, of scholars and scientists from across the globe, was held in the Canadian village of Pugwash and that name remains today as the name of the organisation. With its regular meetings, Pugwash has been able to facilitate a better understanding between countries and governments which has helped to pave the way for important treaties such as the Partial Test Ban and the Nuclear Non-Proliferation Treaty. Tony and Marjorie were Honorary Members of the British Pugwash Group.

Graduating in Physics he moved to Chemical Engineering to gain an MSc, DIC and PhD in 1957. He began work at CIBA (a foundation for promoting international co-operation in medical research). While there, he played a major part in bringing together some of the other early pioneers of the conflict research movement and edited one of the first of the collections of papers, *'Conflict in Society'*, which began to study conflict from multi-disciplinary perspectives.

Between 1964 and 1988, Tony was co-founder of at least seven peace organisations, including: the Conflict Research Society, in London; the International Peace Research Association, in Sweden; and the Foundation for International Conciliation, in Geneva.

In the late 1960s, having helped to arrange and conduct the first of John Burton's problem-solving workshops, Tony became a key member of the Centre for the Analysis of Conflict, at UCL. He went on to establish the study of social conflict, at the University of Surrey (where he was to lecture in International Relations for the last 18 years of his working life) and to play a major role in developing the linking of conflict research and general systems theory, at City University in London.

Ironically, for someone devoted to resolving conflict without resort to war, Tony had a life-long interest in historical weapons and armour. In retirement, he volunteered in the Armoury at the Tower of London and went on to become Vice President of the Arms and Armour Society. He also amassed a large personal collection – of helmets, breastplates, gauntlets, swords and chain mail – throughout his life.

Tony and Marjorie were happily married for nearly 60 years.

His 'sizzling intelligence', charm, and ready wit made Tony a delightful and unforgettable character.

A 'rock star' among masters runners

EDWARD FREDERICK WHITLOCK (Mining Eng 1958)

Ed Whitlock, was born in Kingston-upon-Thames, London on 6th March 1931.

As a schoolboy, he was a county-standard cross-country runner and ran a 4:34 mile. However, an injury to his Achilles' tendon while at college temporarily curtailed his running career.

After graduating, Ed moved to Canada, where he settled and worked as a mining engineer, eventually making his home in Milton, just outside Toronto, Ontario.

Ed married Brenda and they had two sons. Busy with work and family, Ed was not to run seriously again for nearly twenty years.

However, at the age of 41, Ed returned to running and soon began winning masters races at 800 and 1500 metres. In 1975, he and his then teenage son, Clive, took part in, and completed, their first marathon.

From this beginning, Ed went on to become what one scientist has called a 'rock star' among masters (veterans) runners. Ed's greatest masters race came at the Toronto Marathon in 2004. Then aged 73, he became the first person age 70 or older to run a sub-3 hour marathon, finishing in 2:54:48.

He remains the only one.

Still running, even in the year before his death, Ed became the oldest person ever to run 26.2 miles in under four hours when, at 85, he finished the Toronto Waterfront Marathon in 3 hours 56 minutes 34 seconds. No one in their mid-80s had ever run 26.2 miles so fast.

Ed took a straightforward, no-frills approach to running, having no coach, following no special diet, and taking no medication other than a supplement for his knees. His training involved running laps for three hours or more, around a cemetery near his home. This no-nonsense approach was also evident in what Ed wore; some of his racing shoes were 15 years old and his running singlet, 20 to 30 years old.

Ed described the training as drudgery, saying that, "The real feeling of enjoyment is getting across the finish line and finding out that you've done O.K."

Far from being just 'O.K.', Ed's performances were, according to Amby Burfoot (winner of the 1968 Boston Marathon and editor at Runner's World magazine), "so far out there beyond what anyone has done or could imagine."

"We worshipped him as a god even though he had no interest in being a god. He didn't run to inspire us, to impress us. He ran for higher reasons – he ran for himself. In the end, that's why we all run. He was a pure athlete."

Ed's amazing running records forced scientists and fellow runners to look again at established thinking on age, training methods, performance and endurance.

At 81, Ed underwent physiological tests at Montreal's McGill University. His oxygen-carrying capacity was found to be the highest ever recorded in the literature for someone of his age. In addition, his retention of muscle mass was remarkable, when compared to that of most of his age group.

Dr. Michael Joyner, a researcher at the Mayo Clinic who has made a study of performance and aging, said Ed was, "about as close as you can get to minimal aging in a human individual."

Sadly, in the last few months of his life, Ed's running routine was interrupted by various pains in his shoulder, knee, hip and groin. His weight also dropped. When Ed died, on 13th March 2017, in Toronto, his family confirmed that his death had been caused by prostate cancer. He was 86.



Photo: Todd Fraser/Canada Running Series

Ed is survived by Brenda, his wife of 58 years, sons, Neil and Clive, and a sister, Catherine Hunt.

Despite being seen as an outstanding role model and inspiration for many, and in spite of the many records he set, and the global attention he attracted, Ed remained modest. He said, "I don't believe I should be a hero" and, when asked what advice he would give other runners, he said, "I'm not sure what I'm doing is good for me, let alone anyone else."

Quietly reliable and dependable

ALLAN JOHN KINLOCH GOODE (Mech Eng 1959-62)

Allan was born on 9th June 1941. He graduated in 1962 and was a life member of CGCA.

He pursued a varied career, working for ICI and BR Mining Consultants Limited. For the latter part of his career, he worked for AEA Technology Limited at Harwell Laboratory, Oxfordshire, fulfilling the role of a Projects Manager.

Allan was an only child, and was unmarried, but much of his spare time in recent years was devoted to two organisations in the Oxford area – the Oxford Bus Museum and the Abingdon and District Model Railway Club.

In the absence of any relatives, his funeral, which was attended by over 30 people, was arranged by these two clubs, in conjunction with the firm of solicitors who were his executors.

An article in 'Bus Lane' – the magazine of the Bus Museum, which he had joined in 2003 – refers to

him as being a man who was, 'Happy in his own company'.

He was a regular attendee on the two days each week when the museum was open, and was described by the other members as 'Friendly and Helpful', 'Quietly reliable and dependable' and 'An officer and a gentleman who will be sorely missed, especially amongst the workshop crew, where he was always willing to help or lend tools or give advice whenever necessary'.

To quote from the Bus Museum's report on the funeral:

'Allan's death will be a great loss to the museum. Not only in the workshop, where his engineering skills were so productive, but also in the shop, where he readily helped out, and in the café, where he was always prepared to lend a helping hand with the washing up.

He was an able, willing and cheerful member, whom we shall all greatly miss.'

Allan died suddenly on 4 August 2016.

Rowing prowess

Lt Col DAVID HART McLELLAN DL, OBE (Chem Eng 1943-44, Elec Eng 1944-46)

David studied Chemistry for one year, but then transferred to Electrical Engineering, completing his studies in 1946.

Throughout his career – most of it spent in the British Army – he was a very successful participant in, and supporter of, the sport of rowing.

David rowed in the winning Imperial College crew in the Danesfield Cup in the one-day Henley Royal Regatta in 1945.

He later rowed for the Royal Engineers in the Wyfold Challenge Cup, from 1952 to 1954 (winning in 1954).

Subsequently, he was a member of MacMillan's crew in the Stewards Challenge Cup in 1956 and in the Thames Rowing Club eight in the Grand Challenge Cup in 1956 and 1957. He was a FISA (World Rowing Federation) umpire from 1974 to 1991, and officiated (along with Desmond Hill) at the Lightweight Worlds, in Bled in 1979.

Following the death of its first

and founding Chairman, Desmond Hill, David served as Chairman of the National Schools Regatta (NSR), from 1984 to 1996.

Under his guidance, the NSR continued its growth, with the introduction of events open to girls from 1985 onwards.

In 1990, the ongoing expansion of the programme led to the introduction of a two-day regatta, with further innovations to follow, including the addition of J14 Octuples in 1991.

In the Queen's Birthday Honours for June 2000, David was awarded the OBE for services to the Soldiers', Sailors' and Airmen's Families Association in Knutsford, Cheshire.

At the time of his death, on 31st January 2017, David was living in Oldmeldrum, Aberdeenshire.

Sadly, Mary Isobel, his wife of 41 years, also died, just four weeks after David.

They are both mourned by Mary's children from her first marriage, Beth & James.

'Good at anything he put his mind to'

HENRY GRAHAM KING (Mining Eng 1956-59)

Graham was RSMU President from 1958 to 1959, Hockey Captain and Chap.

Graham was born in Mill Hill, on 17th July 1933, to 'Babs' and Lesley. A sister Sally was born 2 years later and a younger brother Peter after a further 10 years.

A bright child, Graham attended a good local grammar school, the Sir William Borlase School.

Graham was a very keen scout, attending the group at the Union Baptist Church in High Wycombe – he eventually became a King's scout.

At 18, he left school to do his national service, where he was described as being 'excellent officer material'.

On his 21st birthday, after being demobbed from his national service Graham spent the day at Silverstone with his friends and later, at a dance, a striking redhead, Bridget, caught his eye.

Graham and Bridget were married in Moreton-in-Marsh in the cotswolds in 1956. The couple moved into a tiny London flat in Fulham. Graham was studying to be a mining engineer at Imperial College. He was president of the union and captain of the hockey team in 1958-9 and a member of the Chaps Club.

After graduating, Graham's work



Plan of Tywarnhale Mine, drawn by Graham

took him all over the UK and the world.

In 1960, he and his growing family moved to Canada for three years, staying first in the recently-created mining town of Schefferville, on the shores of Knob Lake in Quebec Province – a place so remote that, even to this day, the only ways of reaching the town are by air or by rail as there is no road connection.

Then they moved to an even more recently created mining town, built once again by the Iron Ore Company of Canada – this time in

the province of Newfoundland and Labrador. Labrador City still calls itself the Iron Ore Capital of Canada.

On the family's return to the UK, Graham's work took them to Cornwall, Middlesbrough, and Stockton-on-Tees.

Things settled down a bit when the family moved to Hemel Hempstead, in 1965. By then, Graham was working for Gunson Sortex, who manufactured mining engineering equipment, and in time he would join Mitchell Cotts doing similar work.

Graham's job still required a lot of travel. He would be away for up to six months in the year, talking to customers behind the Iron Curtain, in South Africa and in China, from looking through his passports the family found he had visited at least 20 countries.

In June 2014, he kindly bestowed to the College a plan of the Tywarnhale Mine which he drew up whilst a student at the RSM in the late 1950's. This is prominently displayed in the undergraduate room in the Department of Earth Science and Engineering.

Graham's interests were very wide, and he tended to be quite good at anything he put his mind to. On the sporting front: he continued to play hockey well after leaving college; he enjoyed watching formula 1; and later swam regularly. He was well travelled and conversant in French, German and Spanish.

He became a very good gardener and had a go at home brewing with the obligatory exploding bottles in the shed. He took up pickle and chutney manufacture and most members of the family still probably have a jar of his piccalilli or green tomato chutney in their cupboard.

Graham died in Watermills Care Home on Friday, 17th February, aged 83. He is survived by sons, David and Henry, his daughter, Caroline and eight grandchildren.

An expert in water conservation



PETER HUMPHREY ENGLISH MBE
(Civil Eng 1958-61)

Peter was born in St Ives on 24th February 1939, to a family who had been 'Fensmen' in East Anglia for six generations.

He was educated at Kingswood School, Bath, before coming to City & Guilds College to study Civil

Engineering in 1958, and graduating with BSc(Eng)(Hons) and ACGI in 1961.

Whilst at college, he played trumpet in the Imperial College Orchestra, and was President of Fencing, for which he won full colours. He also played rugby and tennis.

In more recent years, he maintained an interest in Rowing, and was President of Reading Rowing Club from 1991 to 1995.

On graduation, Peter joined Taylor Woodrow, and spent the next 35 years of his career with the company.

In 1984, he was a 'founder' Director of Taylor Woodrow Management Limited, and in 1989 he was part of the team with the newly privatised Thames Water PLC. He served as Director in Charge

of the project 'Extended Arm' which, between 1990 and 1995, satisfactorily completed some 137 individual design, management and construction schemes covering both 'dirty' and 'clean' water. During this period, he became a member of the then Guild of Water Conservators. At the time of his leaving the firm in 1994, he was Chairman of the Taywood Construction Consultancy, and a Director of TAYMEL Ltd. as well as of Taylor Woodrow Management Ltd.

After taking early 'retirement', Peter became a consultant to WS Atkins, advising on construction management techniques for the Millennium Exhibition at Greenwich.

He joined the New Millennium Experience Company as Deputy to the Construction Director and was 'Clients Representative' for

all aspects of the construction and engineering of the Millennium Dome and Experience. This role was conducted with constant exposure to press and parliamentary scrutiny and comment, in spite of which the Dome was spectacularly completed and opened on time on the 31st Dec 1999. He was awarded the MBE in the Millennium Honours list for services to the Millennium Dome.

Peter maintained that his greatest personal achievement at the Dome was the promotion and inclusion, again in collaboration with Thames Water Plc., of the Recycled Water System, and being able to state that all water used for flushing toilets at the Dome was 'reclaimed'.

Peter, a long-term member of CGCA, died on 15th December 2016, and is survived by his wife Angela, his daughters and grandchildren.

'An engineer's engineer'

JOSEPH ALEXANDER MODRO
(Civil Eng 1952-57)

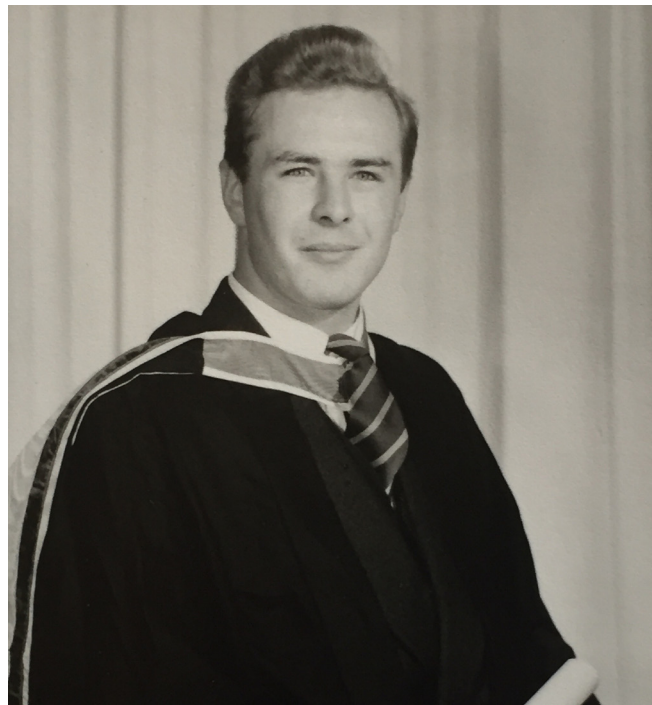
Joseph Alexander (Joe) was born in Lodz, Poland, on 11th February 1934.

He left the country in September 1939, at the age of five, due to the Nazi invasion. He escaped with his mother and older sister, while his father, who was based in London, at his shipping company's Head Office, used his many contacts to enable their often dangerous journey.

They travelled across occupied Europe, to Marseille and then to Algeria. Here they spent about 18 months, during which they had to stay at several refugee camps. They then travelled on from Tangiers to Seville, before finally taking a flight from Lisbon, arriving in London in December 1942. Joe was always eternally grateful for the 'kindness of strangers' and the support from the Red Cross, in his 3 year escape to London.

Joe was educated at St Martin's prep School in Northwood and Mayfield College, Sussex, where he first started playing rugby – and developed a passion for the game that would be with him, throughout his life. He was captain of the cadets and school captain at Mayfield. He also attended Clapham College, London, and during that time played for Blackheath Rugby Club, as a regular prop for the 2nd team, but sometimes getting games for the 1st team.

In 1952, he gained a place at City and Guilds to study Civil Engineering, graduating in 1957. (It is advised by his mates, that the 5 year study period and the fact that he was a founder member of the



University Wine Tasting Society, were not in any way connected!). While at Imperial, Joe continued playing rugby and gained University colours for the sport.

On graduation, Joe worked for Consultants Sir Bruce White, Wolfe Barry and partners and was posted to Northern Ireland as Assistant Resident Engineer in Lisburn. Here, Joe joined Northern Ireland Rugby Football Club (known as 'North'), in Belfast.

More importantly, working in Belfast also enabled Joe to meet Maisie Henry, a staff nurse at the Royal Victoria Hospital. Joe and Maisie were married in March 1961.

By 1960, Joe was back in London,

now playing rugby for London Irish Rugby Football Club and, by the end of the 60s, working for contractors MJ Gleeson, on power stations and dams. Joe was specifically involved in the British Aluminium Company smelter near Newcastle, the Sheffield Crucible Theatre, and the Crystal Palace National Recreation Centre in London. Joe was particularly proud of his involvement in the 1,800MW Dinorwig Hydroelectric Power Station in N.Wales.

In 1979, Joe joined Balfour Beatty Civil Engineering Ltd and was UK Chief Engineer in Head Office Engineering Department, with his team being responsible for Engineering support for both major

tenders and operations. Some of the contracts included: the Jubilee Tube Line Extension; the Channel Tunnel Rail Link; the M1-A1 Link road; the Sheffield Supertram and the West Coast Main Line railway refurbishment.

The wide range of Joe's project involvement provided invaluable experience for his passion to train younger engineers to become Chartered Civil Engineers. Joe was a Member of the Institution of Civil Engineers (ICE) for more than 50 years and was elected a Fellow of ICE in 1997. He was asked by ICE to be a Reviewer and fulfilled this role for many decades. He was highly respected by both ICE and Balfour Beatty senior management for his professionalism. In later years, Joe greatly enjoyed evening meetings of the British Tunnelling Society, where it was possible to meet up with a wide range of industry contacts over a jar in the bar after the lecture.

Probably the best way to sum up Joe's life was that he was an "Engineer's Engineer". Often a Managing Director, reviewing a tender at a meeting, would ask "Has Joe signed off the Engineering issues?" If the answer was "Yes", the next agenda item would then be discussed!

Joe was a member of the Old Centralians, later to become CGCA. His love of CGCA throughout his career was so great that, when he sadly died, on 2nd February 2017, a few days before his 83rd birthday, he was dressed in his CGCA tie for the funeral.

Joe is mourned by his wife, his three children, as well as by five grand-children.

A family man

RICHARD GODFREY OXBORROW (Civil Eng 1942-44, 47-49)

Richard Godfrey (Dick) was born on 22nd June 1925, at Wandsworth Common. His father was an accountant in private practice. When Dick was three the family moved out of London to where new estates were being developed. This enabled Dick and his younger brothers to spend their childhoods in the open country.

Aged 14 when World War II broke out, his teenage years were spent in wartime conditions, with food rationing and the blitz. But he enjoyed touring England by bicycle, covering about 120 kilometres in a day, and staying at youth hostels. Dick started a course at City & Guilds College in 1942, but towards the end of the war he was called up into the army, joining the Royal Engineers. In the army, he went to Egypt, where the bright lights of Cairo were a contrast to the drabness of wartime Britain.

By the time he had finished training, hostilities were over. Dick later reflected that he had been exposed to more danger from enemy action as a civilian than as a soldier!

On leaving the army, Dick returned to City & Guilds College and completed his degree in civil engineering. He joined Demolition and Construction Ltd and his work took him to various parts of England, and then to Australia, where his first two years were spent in Darwin, working on the construction of a wharf. He then went to Gladstone, again on wharf construction. In Gladstone he met Mary, who had recently been widowed with three small children. Dick and Mary married and spent the first two years of their married life on the Atherton Tableland where Dick was engaged in work in connection with the Tinaroo irrigation scheme. At Atherton, their daughter Margaret was born.

On completion of Dick's work at Tinaroo the family moved to England where they settled in Caterham,

close to his boyhood home. Some of Dick's friends, who had watched him depart for Australia five years before as an unattached bachelor, were surprised to see him reappear as a family man with four small children!

Peter, Mary's third child, did well at school and won a place to Oxford in 1974. This left him with a 'gap' year which he decided to spend with the Bush Brotherhood, an Anglican organisation serving the Australian outback. Whilst driving near Burke he was involved in a single-vehicle accident and was killed. This tragedy cast a lasting shadow over Dick and Mary's life together.

The picture below shows Dick and Mary in 2011, with a photograph of Peter.



After spending 25 years in England Dick and Mary took advantage of the opportunities for travel afforded by Dick's work, and lived for over three years in Singapore and Malaysia. Whilst in Malaysia, Mary and Dick gained an Indonesian daughter, Lien. By this time two of their daughters, Patricia and Margaret, had found their way back to Queensland, and Dick and Mary subsequently joined them, settling in Rockhampton.

Dick's prime interest was always the family. During his latter years, he derived much pleasure from the achievements of his eleven grandchildren and ten great-grandchildren.

Dick died on 13th July 2005 at the age of 90.

No two days were the same

Prof KEITH WILLIAM ARTHUR GUY (Chem Eng 1962-70) FCGI, FREng, CEng, CSCI, CEnv, FICHEME.



Keith was born on 14th December 1943, studied Chemical Engineering from 1962-70 and gained: BSc(Eng), MEng, DIC and PhD. As chairman of the entertainments committee for three years, he had the pleasure of putting on many top acts, including Jimi Hendrix's last concert at the Royal Albert Hall!

Keith went to work at Air Products, where he held executive management roles in engineering and commercial areas. In 1970, he persuaded oil refineries to remove sulphur from most of their products and developed an expertise in production and marketing of large volumes of hydrogen, for sale to oil companies. This developed into an interest in the hydrogen economy.

Keith left Air Products after 28 years, to start an industrial gas consultancy, advising companies about industrial gases, and industrial gas companies about their customers' needs. He became a visiting professor at Imperial and chaired a number of IC spin-off companies through their early years. He became Chairman of the Board, Interdisciplinary Research Centre at Imperial College in 1989.

He held a number of directorships, chaired several spin-off companies and served as a board member for various other enterprises, as well as for the Science & Engineering Research Council.

Keith once said that no two days are ever the same, and that was the way he liked it. He died on 1st December 2016, at the age of 72.

'A quiet person and an excellent IT engineer'

STEPHEN JOHN HANKIN (Elec Eng 1969-74)

Stephen was born on 16th January 1950, and was brought up in Shrewsbury, where his father, Frederick Hankin, was a well known garden market trader.

Stephen studied at Imperial, in the Department of Electrical Engineering between 1969 and 1974, with a one-year gap in 1970-71.

As a young graduate, Stephen worked at ITT Business Systems where, according to his former manager and friend of long-standing, Ron Carter, he developed into an excellent IT Engineer.

Stephen later moved to work for Hewlett Packard in Birmingham, where he became a Senior Customer Technical Support Engineer. Stephen was still working in this role at the time of his early death, at the age of 58, in March 2008.

Deeply shocked by his death, his family and friends described Stephen as 'a quiet person who did not enjoy being in the spotlight'. Ron Carter, who acted as executor for Stephen's estate, recalled having enjoyed many curry meals with Stephen over the years.

Stephen is survived by two former wives and a partner, a brother and a niece.



NOTICES IN BRIEF

DUDLEY JAMES CLAPHAM (Civil Eng 1940-42)

Dudley was born on 23rd April 1921. He studied Civil Engineering at City & Guilds College between 1940 and 1942.

In 1954 he was working at Somerville-Barnard Construction in London SE14, and remained with that company for the rest of his career, rising to the position of Managing Director in 1969.

Dudley died peacefully on 27th August 2016, at the age of 95.

DAVID HENDERSON (Civil Eng 1943-44)

David was born on 16th July 1924, studied in the Department of Civil Engineering between 1943 and 1944, and was a life member of CGCA.

He worked initially for the Anglo-Iranian Oil Company, later working for British Petroleum.

David died on 11th January 2017, aged 92 years. He is mourned by his wife Helen, by Susan and John, John and Claudia, his five grandchildren and a new great grandson.

JOHN HUGH GARTH BILNEY (Mech Eng 1941-43)

John was born on 17th September 1922. He served in the Royal Electrical and Mechanical Engineers, where he was involved with oil-fired locos.

Later, he worked as a fuel technologist with Shell Petroleum – CGCA's records suggest that he worked for Shell International Petroleum for much of his career.

John was part of the Management Team for construction of the

'Tornado' steam locomotive, based on his expertise in relation to oil firing.

John died after a short illness on 14th August 2016, aged 93 years. His death is mourned by his sons, Mike and Chris, and by his grandchildren and great-grandchildren.

NOEL CHARLES RAINBIRD (Mech Eng 1942-45)

Born on Christmas day, 25th December, 1925, Noel died on 21st July 2015, at the age of 89.

