



Imperial ENGINEER



MOTHER NATURE NEEDS HER DAUGHTERS
STUDENT RECRUITMENT & OUTREACH
SMALLER GLACIERS, BIGGER CARS
RED PROJECT BORNEO, 2018
MATERIALS IN SPARTA
PROJECT PENGUINS

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Front and back cover photo:
The Margerie Glacier in Alaska. (See pp 16-18)
Photo by Joan Fitzpatrick

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Starting with the AGM in June, on behalf of the Association I would again like to offer our thanks to Dame Judith Hackitt (immediate Past President) for giving a splendid address in relation to her conduct of an independent review of building regulations and fire safety, following the Grenfell fire, with a focus on their application to high-rise residential buildings. She was instructed to undertake the review by the then Home Secretary, Theresa May. We continue to wish her well in this important task.

I would like to mention two careers events. The first was held in the Department of Mechanical Engineering (organised by Charles Parry) and was another example of what is now developing into an annual event of careers advice. The second event was the Careers/Alumni evening held jointly by the CGCA and the Department of Bioengineering. The event was a sell-out, with over 60 of the students of the department attending, together with alumni and members of the CGCA. The evening began with reflections on their careers by four of the Department's alumni. Anil Bharath, who is now a Professor in the Department, Founder and Director of Cortexica Vision Systems – the company provides visual search services to eBay, John Lewis, Macys and others. He was followed by Ben Reeve, CTO of CustoMem – an advanced water filtration company, based on synthetic biology techniques. The third alumnus to speak was Stefan Claesen, CEO and one of the Principal Founders of Visbion Ltd – a world leader in secure medical image transfer, storage and display. The final speaker was Vanela Bushi. Vanela is a Director in the Portfolio and Transactions Strategy Team at Syneos Health – a life sciences-focused organisation with over 24,000 employees globally. All the speakers stressed how their time in the Department had been a highly valuable experience, helping to develop their subsequent careers. The presentations were followed by a Q and A session.

Now for a brief update on the Union Honour Shields. We have been able to make a replica of the 1901-1902, shield, which looks very good. Peter Chase has checked all the detail on the shields and we are now pretty close to getting the shields rehung. There has been a somewhat protracted discussion with the College about the positioning of the shields, due to concerns about fire risk. However, with the support of the Faculty of Engineering, it now looks as if the shields can be hung in the foyer next to the exit of the main lecture theatre of the City and Guilds Building. This is a good location because the shields will be viewed by those attending the many Inaugural and public lectures, and their associated receptions.

Once again, I would like to thank Peter Chase and Nigel Creswell and other members of the committee for their administrative support – for example in relation to GDPR alignment; Peter and Alison Buck for their splendid work in producing another two, excellent, editions of the Imperial ENGINEER; and Colin Kerr and his colleagues for organising yet another splendid CGCA annual dinner earlier this year. Work has already begun on next year's dinner, which will be held at the Stationers' Hall on Friday, 28th February 2020. Finally, I would like to thank Chris Lumb and the other board members of OC Trust for their fine work in supporting students and student activity.



**Richard
Kitney**

PRESIDENTS REPORT



**Tim
Cotton**

Rather embarrassingly, I find myself once again writing to you all in the capacity of RSMA President entering a fourth year in office. I recognise that this is not how it should be and will be looking to find a successor in the coming months. However we have seen, and continue to see, a turnover in Committee members and as such the Committee and I felt that for consistency I should stay another year. This motion was taken to the AGM in June this year and approved by the members present. Whilst the Committee has a good level of membership, time commitments of the members mean that filling the Executive roles in the Committee is becoming harder. If you do have time please do consider joining the RSMA Committee, it is truly worth it as you can see first hand the tremendous impact that giving back has on the current student body.

As a volunteer organisation, we will always do our best to respond as quickly as we can to your requests and comments so please do bear with us if we are a bit slow at getting back to you. We rely heavily on the College Alumni Relations team in managing the communication channels with members as they have the systems and people to do this type of work. The Committee has a good working relationship with these departments, and they are a great help in running the administration side of the Association and getting any feedback from Members out to the Committee.

I am very happy to report that due to the success in 2019, the RSMA once again launched the RSMA Final Year Student Bursary Prize in June 2018. This award is open to students who are beginning their final year in September 2019. As last year, the Committee is planning to award up to three prizes across ESE and Materials. The scheme was created to reward students who show the true RSM Spirit and act as an ambassador for the RSM. Successful candidates must be able to show commitment, achievement and excellence above that of their peers in areas such as academic excellence, community & RSM Union involvement, sporting prowess, or contribution to a sport or club within the RSM. Financial hardship will also be considered as a criterion. Working with Department Directors of Undergraduate Studies at ESE, Materials and the Faculty of Engineering, we have had eleven applicants and will be shortlisting and awarding the bursaries shortly. Remember the funds have been raised by YOU through your kind generosity at events and specifically by those members who have supported the 100 Club. This is an amazing achievement and is concrete example of former students of the RSM who want to give back to the current student body. Lastly, the 100 Club continues to slowly grow and I would encourage you, if you are able, to sign up and support the RSMA via the 100 Club or by a one-off donation. If you are already signed up then a huge thank you and please double check your banking details so that you are continuing to pay yearly. Your support is truly appreciated!

The 2019 Annual General Meeting of the Association was held on the 27th June at the Union Bar, followed by the final year Bar-B-Q, which was again well attended by the students plus a number of alumni. See the AGM report inside this issue for a full update and a few photographs.

The 135th annual dinner will be held on Friday 22nd November at the Rembrandt Hotel in Knightsbridge. Last year was a tremendous event with just over 100 members and guests and it is hoped that as many members as possible will attend this year. Last year's dinner was one of the first that had an almost equal number of student guests as members. The dinner remains the most significant event in the Association's calendar. With this issue of IE there is a flyer that contains the booking form and a group e-mail will also be sent out to all members telling them how to book.

The committee continues to maintain a very active relationship with the RSMU and for the 2019/20 academic year the new RSMU representatives are Chris Carter and Megan Facey, respectively President and Honorary Secretary. Between us we are looking to continue to engage with students on careers evenings and are looking at trialing an RSMA Mentoring scheme – if you are interested in finding our more please do get in touch at rsm@imperial.ac.uk.

I hope you find this issue informative and I look forward to seeing some of you in the RSM and /or at an RSMA event in the near future.

2019 RSMA AGM and Final Year BBQ

A dozen or so RSMA members congregated in the Imperial College Student Union Bar in Beit Quad for the Annual AGM of the RSMA.

The members heard various reports from the President, Treasurer and Chair of the RSMA Trust and salient points are noted below. The President, Tim Cotton, highlighted that technically this should have been his last meeting but due to significant turnover of Committee members it was felt best that Tim continue as President for another year to provide some consistency, all members present concurred. At the meeting, no new Committee members were elected and the existing members and officers as listed below were voted in.

The Treasurer reported that the RSMA and Trust are in good health and have the necessary funds available to continue to support the RSM, such as the Final Year £1000 bursary prizes. These will be awarded in the Autumn 2019 Term to final year students who show the true RSM spirit and act as an RSM ambassador. There have been eleven applicants and names are currently being shortlisted.

The Chair of the Trust reported that in terms of the Trust's Trust Deed, the President, Honorary Treasurer and Honorary Secretary of the Association and the President of the RSMU are appointed as trustees ex-officio. The following offered themselves for election as

trustees: Professors Rees Rawlings and John Monhemius, Fiona Cassidy, Coen Louwarts, John O'Reilly and Glynne Lloyd-Davis and were duly voted in.

In other Trust matters the following awards were made and presentations will be made at the 2019 Annual Dinner:

Peter Harding Memorial Award went to John O'Reilly

Rees Rawlings Young Member Award went to Hannah Bungey

Finally after an informed debate on the topics presented, the group adjourned downstairs to the Union Bar where the 2019 Final Year BBQ was being held. This was the second time the event was held in the Union Bar and the Imperial College Union Bar and Catering team did a fine job in feeding and watering the 60-odd members and guests. During the evening, the draw for the 100 Club was won by Martin Levy who has since re-donated the prize back to the RSMA. The added benefit was that the Union Bar is now air-conditioned and this, combined with good food and drink and a bit of singing, made for a very enjoyable evening. Once again, great thanks are due to alumnus Eddie Gadd who donated two pins of his finest Ramsgate Brewery Ale for the function. Go to <http://www.ramsgatebrewery.co.uk> and I guarantee you will not be disappointed with the products.

Election of officers and committee for 2019/20

President: Tim Cotton
 Senior Vice-President: *Vacant*
 Junior Vice-President: *Vacant*
 Past-President: John O'Reilly
 Hon. Secretary: Hannah Bungey
 Hon. Treasurer: David Bishop
 VP International: *Vacant*
 Membership Secretary: *Vacant*

Members: Lorraine Craig
 John Monhemius
 Rees Rawlings
 Daniel Hill
 Sam Argyle
 Eleanor Jay
 Ben Moorhouse
 Seb Turner
 Richard Griffiths
 Chris Carter (President RSMU)
 Megan Facey (Hon Sec RSMU)
 Kaja Sillett (DLB President)
 Schan Perera (MatSoc President)
 Isabel Wapenhams (GeoPhys President)

Overseas: Giles Baynham (Canada)
 Celia Hayes (Australia)
 Harry Fisher (Australia)

The Royal School of Mines Association and Trust Treasurer's Report 2018-2019

The Association and the Trust accounts both show their respective accounting years closing in acceptable financial health. Note that figures presented below are un-reviewed and un-audited.

ROYAL SCHOOL OF MINES ASSOCIATION

In financial terms, the Association's activities were in line with previous years.

Income from subscriptions was equal to 2016-17 at a little over £6000. Efforts have been made to contact members who still pay considerably less than the £15 rate. Some 12% of this income is paid through the PayPal account, as in recent past years. This incurs a small charge, which the Association committee believe is worthwhile given the convenience and member traceability it affords.

Of the Association's two social functions in 2018, income for the Final Year Barbecue, the first to be held in the Beit Quadrangle, was up on 2017's, and the event returned a modest profit of £247. The Annual Dinner was well attended, and prices were held at 2017 levels. The function broke even.

An award of £1500 was made direct to the RSMU, and £250 each paid to De La Beche and the Geophysical Society. As usual RSMA contributed its share of costs of the Autumn and Spring Imperial ENGINEER editions. At the year-end £3097 was left owing to CGCA for Imperial ENGINEER printing and distribution costs including the previous year's unpaid debt of £1167. The financial year cashflow deficit of £3591 does not reflect the Association's financial health as debtors totalling £12,410 (principally for Eventbrite functions) heavily outweighed liabilities of £6,076.

Association funds at the year-end (31/03/2019) stood at:

Account name	Type	Balance
Royal School of Mines Association	HSBC current	£7,183
Royal School of Mines Association	PayPal	£4,423
0.0.859114	Imperial College Loan	£30,194
	Petty cash	£66
	Assets less liabilities	£6,409
TOTAL FUNDS AVAILABLE		£48,275

ROYAL SCHOOL OF MINES ASSOCIATION TRUST

The RSMA Trust's general activities through 2018 were generally much in line with previous years but marked by the award of three bursaries, each of £1000. These are the first to come from the Hundred Club initiative, and demonstrate a significant step forward in the work of the RSMA Trust.

Hundred Club income dropped back slightly to £4750 from the 2017 level. Those generous enough to invest in students by contributing to this scheme are urged to ensure that their donations are repeated annually. The Trust has yet to be set up with HMRC to claim GiftAid, and this will be pursued next year.

Generous unsolicited donations were received (outside of the Hundred Club) totalling £1125. No new loans were issued. One outstanding loan of £1000 was repaid. Five grants were made, totalling £1125.

Whilst the Trust's capital investments are considered safe in CCLA, the investment income totalled only £179 in 2018. This is a poor return from an investment of nearly £40,000, albeit better than the £91 received in 2017. Alternative investment opportunities continue to be discussed by the Trust.

Trust funds at the year-end (31/12/2018) were as follows:

Account name	Type	Balance
RSMA Trust Main and Second accounts	HSBC current accounts	£16,659
RSMA Trust 55918	CCLA COIF	£39,488
	Assets less liabilities	£6,644
TOTAL FUNDS AVAILABLE		£62,791

David Bishop, Hon Treasurer, June 2019



The AGM adjourned to the Final Year BBQ in the Union Bar

Photos: Georgios Chatzitheoklitos RSMU

RSMA President's Report to the Annual General Meeting, 2019

The RSMA has been busy in this past year supporting the students and staff of the RSM both within the student body, the Faculty and the wider College. The Committee has been working closely with the College's Development team for the Faculty of Engineering and the Alumni Relations team. The Committee will continue to engage in a collaborative and transparent manner whilst ensuring the values and heritage of the RSMA are maintained.

We continue to engage with our members as best we can under the new privacy laws, in order to manage subscriptions amounts and validity of members. We are seeing a slight drop in subscription revenue and will continue our efforts in getting all members fully paid up to the current £15 a year membership price. If you are paying less than £15 I would ask, if you are able, to change your banking arrangements to raise your annual membership up to £15 so that the Association can continue to support the students of the RSM.

The RSM profile on LinkedIn and Facebook is an important channel of communication with 2216 members on LinkedIn and 600 followers on Facebook and Twitter. In addition, we are launching a complete refresh of our web page, LinkedIn and Facebook pages to make it easier to engage and to update the content. It is recognised that social media provides an excellent communication media for alumni, especially for the younger generations, and that many may thus not see the need to also join the RSMA – however we will continue in our efforts to encourage membership.

As mentioned previously, the RSMA issued a funds appeal in June of 2016, a key feature of which was

the creation of the RSMA 100 Club. The response from many alumni has been steady for which the RSMA sincerely thanks you. However, we are still significantly short of our target of 100 members. As of today's AGM, we are over a third of the way there (40 active members) but have been able to start giving back to the RSM by once again launching the 2019 RSMA Bursary Prize. The RSMA Final Year Student Bursary Prizes are to reward those students who show the true RSM Spirit and act as an ambassador for the RSM. Students must be able to show commitment, achievement and excellence above that of their peers in an area such as Academic excellence, Community & RSM Union involvement, Sporting prowess and/or contribution to a sport or club within the RSM. There are three awards available to students currently enrolled in either the ESE or Materials Departments and entering the final year of their Bachelors or Master's Degree course in September 2019. The Association awarded three of the Bursaries in 2018, each for £1000 and the students who received were truly worthy of the award. This is a significant example of how you are directly supporting students at the RSM. Remember ALL the funds for this Bursary have been raised by YOU through your kind generosity at events and specifically by those members who have supported the 100 Club.

The highlight of the year was of course the 134th annual dinner, which was held on Friday 23rd November at the Rembrandt Hotel in Knightsbridge and saw 107 guests join the Committee and I, of those 50 were current RSMU students. A great night was had by all with students almost outnumbering members; the trick now is to get

all these students signed up! At the dinner, we were able to award in person the *Peter Harding Memorial Award* to Professor Rees Rawlings and the *Professor Rees Rawlings Award* to Dr Eleanor Jay. In addition, we drew the third winner of the 100 Club Draw and this went to Bernie Pryor; Bernie has very graciously re-donated the prize back to the Association. Our speaker for the evening was Dr Eleanor Jay on her career journey since leaving the RSM. Once again, the members of the RSMA were extremely generous and sponsored the vast majority of 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.

Following the success of the last four years' events, in February the committee again gave a presentation to the students on the history, aims and membership of the RSMA. This was combined with a careers evening where a dozen Alumni gave some insight to approximately 40 students into how the RSM had helped shape their careers. A key theme that emerged from this event was the students' desire to connect with Alumni on a more professional basis. The Committee has taken this on board and is in the process of planning an RSMA mentoring programme by which RSMA members can use their experience to help (under)graduates in the early stages of their careers through a mentoring scheme. The Committee feels this will provide an effective engagement between its members and the current/recent students at the RSM. Additionally, it will likely provide a pathway for more student memberships.

The involvement with ESE remains strong and the Committee has furthered the links in ESE and Materials by engaging with the key societies within them such as De La Beche, MatSoc and GeoPhysicsSoc. The Committee now has more student representation on the Committee with each of the Presidents of the respective societies attending the meetings. Accordingly, the RSMA has also increased the level of funding to these societies to help raise the profile and hopefully get more student membership. The Committee has had a very active relationship with Marta Wolinska and Sam Casement, respectively President and Hon Sec of the RSMU. Both have strongly contributed to the RSMA activities within the college, and have encouraged student participation in RSMA events. I extend the thanks of the Committee to both for their support and

friendship. The rapport between the RSMA and the students is as strong as ever and it is a real pleasure to be part of it. On the sporting front, in the contests against Camborne, some ten matches were played across 9 sports, and the RSM Rugby Team won the Bottle (15-5), lost the Sharpley cup in men's hockey (0-1), but won the football (1-0).

The RSMA will likely not be at the Alumni Day in 2019, it is end of June just after this AGM, as the Committee feels that there has been little support from RSM Alumni at this event which makes it hard for the RSMA to justify attendance. Of course, if our members feel we should attend, we shall reconsider our position in 2020.

Tonight we entertain the students for the traditional final year Bar-B-Q and even with exam results due in the morning it was felt that this was the most appropriate date and venue to celebrate them leaving the RSM. Once again, great thanks are due to alumnus Eddie Gadd who donated two pins of his finest Ramsgate Brewery Ale for the function. Go to <http://www.ramsgatebrewery.co.uk> and I guarantee you will not be disappointed with the products.

In conclusion, I would like to thank all the Committee for their support and guidance. We have an excellent span of Royal School of Mines involvement and experience on the Committee and we embrace many generations of alumni. A special mention goes to Coen Louwars and John Skyes who are stepping down from the position of Membership Secretary and VP International respectively. They have served the Committee for over 10 years and we thank them for all their help and support. For those Committee members who have full time employment, many in high-pressure jobs, their commitment is especially appreciated. I am looking forward to the next year and believe the Association, with the support of the College and student body, will thrive. Technically, I should be giving up my role at this AGM as I will have served three years. Unfortunately, our succession planning for the Committee has taken a few knocks and the Committee felt it prudent to extend my tenure for another year to allow a period of stability for the new Committee. I am happy to do this but I do feel that I should rotate out this year. Therefore, I will end my report with a plea. We need some new Committee Members: so if anyone wants to become a Committee member then please do let one of us know.

Tim Cotton June 2019



Past and present RSMA Committee members

(L to R):

Chris Carter, Incoming RSMU President;

Megan Facey, Incoming RSMU HonSec;

Tim Cotton, RSMA President;

Marta Wolinska, Outgoing RSMU President;

Sam Casement, Outgoing RSMU HonSec

CGCA Younger Members – A fountain of youth?

At the June AGM, something almost miraculous happened. Unprecedented in recent times we had a significant number of new and recent graduates put themselves forward to become Officers. Several have come direct from the CGCU and since then this core has been joined by others. It may not seem that extraordinary, but for at least the five years I've been involved with the CGCA we have been struggling to recruit full members, let alone new officers (with a few notable exceptions). For a while I seemed to hold my position by virtue of being the only younger member.

The reasons behind us not attracting new members are complex and something our Committee has been grappling with for several years, making many valiant attempts to both understand and rectify the situation. This new crop of Officers presents an opportunity to tackle the issue with a group better able to understand the target audience and with contacts amongst recent graduates. The Operations Committee asked us to form a working group to investigate and begin taking steps aimed at increasing recruitment.

I do not condone three-hour long meetings. Usually. But as the chair of our new working group that's how I made my debut. Eight of us in the Alumni Visitor Centre's small meeting room, very much taking advantage of the free refreshments. We approached the problem in a broad sense, first considering what our hopes and dreams were for the CGCA. It was heartening to note the similarity between the vision expressed there and the current objectives of the association. An independent and international network founded on a community of engineers from Imperial. It is the

shared experience of College that bonds us through the generations and across disciplines.

We then considered the challenges to achieving this. Some are external and out of our control; the changing student experience, the creation of the Faculty at the cost of the constituent colleges, the increasing internationalism of our graduate body. But there were other items small and large were we could make a difference. These fell into the following themes:

1. *Membership Journey* – the process by which student and graduates become members.
2. *Membership Offering* – the reasons that anyone would join.
3. *The Way We Work* – how the association functions.

Each of these was reviewed in detail and solutions proposed. Looking into automation so that welcome emails are sent immediately as members join; attending graduation to sign up new members at peak interest; holding more events aimed specifically at younger members; storing jointly held documents on 'the cloud' to enable easier access; greater use of social media; forming a Young Graduates Division; and many more besides. We have since held another (thankfully shorter) meeting and expanded further on how these can be implemented.

These proposals are being taken to the Operations Committee in October, we are hopeful it will receive their support. Already though, to monopolise on our current momentum, the working group has begun to put into motion some of these ideas. Its first event, a successful bar night was held on the 20th September, the majority of those who attended were signed up

as either student or full members by the end of the evening.

I'm very grateful to the members of the working group for their hard work so far. And I am confident that this opportunity marks a change for the CGCA that will help to secure its future and purpose for the next generation of Imperial

Engineers. And if nothing else when I now attend CGCA meetings I face good natured mocking; at 26 I am apparently old. Younger Member no more?

**Tim Munday (Civils 15)
CGCA Younger Members
Honorary Secretary**



Photo: CGCU

The first CGCA Engineering Alumni Bar Night in the Union Bar on 20th September



Photo: CGCU



Photo: Claudia Caravello

The Working Group in their marathon first meeting. (L to R) Millia Hasbani, Tim Munday, Owen Heaney, Tom Cross, Andrew Hill, Andrei Pogan, Haroon Chughtai, Claudia Caravello.



Photo: CGCU

What's the collective noun for CGCU Presidents? A Calculus maybe? Although in this case it's more like a barfull. Current and Past CGCU Presidents bearing Spanner and Bolt at the CGCA Bar Night.

Student Recruitment and Outreach: How alumni can help

Imperial's Student Recruitment and Outreach (SRO) team are responsible for discovering the College's future talent whatever their background. Working with schools, colleges and other universities, they advise and inspire the next generation of engineers and scientists, attracting the most able students from the UK and across the globe to study at Imperial. Always keen for alumni to get involved, Amanda Cerny, Head of International Student Recruitment Strategy, and Annalisa Alexander, Head of Outreach and Widening Participation, welcomed the opportunity to tell Imperial ENGINEER's readers more about what SRO do and how alumni can help.

Who we are

We're a dedicated mix of trained scientists and expert advisors on higher education. Our diversity of experience is reflected in the wide variety of ways we work with schools and colleges, from providing tutors to support their science activities, to delivering workshops to advise and prepare students to apply and study with us.

Outreach – widening participation

Our Outreach team help and support students from backgrounds less represented in Higher Education to nurture their interest in science and fulfil their potential from primary school through to Year 13.



Photo: Thomas Angus, Imperial College London

The team are dedicated to widening participation at a local and national level in the UK. Our new Makerspace in White City provides students in the local community with the tools, resources, support and skills to innovate and create. Students who have taken part have developed exciting ideas and prototypes for improving environmental issues: designing and building technology to help with their everyday lives. Examples include PlantBox – a fully sustainable and modular vertical wall that aims to tackle climate change and SnorZZZ – a cradle that uses sensors to deduce when a baby needs rocking to sleep.

At South Kensington, the Wohl Reach Out Lab, championed by Professor Lord Robert Winston, is a state-of-the-art STEM lab dedicated to hands-on activities. Pupils, at primary and secondary level, experience science and engineering in a university setting where we help them to develop crucial experimental skills which they can take back to the classroom.

Our long-term focussed STEM activities include a mixture of residential and non-residential cohort programmes and summer schools for high achieving young people from disadvantaged backgrounds. These programmes work with individuals to improve their attainment in STEM subjects, supporting them to gain the requirements needed to study at Imperial and ultimately fulfil their dreams whether that be to become a doctor, engineer or scientist.

Further afield, we use the Outreach van to deliver activities to schools across the country. We bring space travel and STEM activities to the school halls, with our planetarium and other pop-up STEM activities.

Student Recruitment and Marketing

The Student Recruitment team advises thousands of students, across the UK and internationally, about study at Imperial.

Our recruitment officers attend recruitment fairs and visit schools and universities all around the world, promoting Imperial and all that we offer. Where it's not possible to visit in person, we run a variety of information sessions via our webinars to be inclusive of all



Photo: Dan Weill, Imperial College London

students wherever they may be.

We provide students with support about applying to university, including advice on writing a personal statement and making sure they are aware of the application process and deadlines, which is particularly important for overseas students who may be unfamiliar with the UK system.

On Campus we run three Open Days a year bringing over 12,000 prospective students and their

parents on Campus to visit our departments and find the course that's right for them. Those unable to come to an Open Day can meet one of our President's Ambassadors and join one of our weekly Campus tours where we showcase our South Kensington Campus.

We provide students with all the information they need to make an informed decision, both in print and on the website and of course via social media.

How you can help

Our prospective students love talking to and hearing from our alumni whether it be at our recruitment fairs or visits to schools, webinars or simply reading an alumni profile in one of our publications or on the website.

All of you, as alumni, have a story to tell about how your experience of studying at Imperial has helped you. So, wherever you are in the world, if you're a recent graduate or even more established as a successful entrepreneur or career engineer and would like to be part of shaping the future of our young engineers, please get in touch by emailing us at:

sro@imperial.ac.uk



Photo: Fergus Burnett, Imperial College London



Photo: Imperial College London

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Birthday Honours List



Photo: Dave Gurtridge, Imperial College London

Imperial physicist Dr Jess Wade was awarded a British Empire Medal for services to gender diversity in science. She has led a series of public engagement initiatives to promote women in STEM. This includes schools outreach work in physics, coordinating international women in physics academic conferences, and writing hundreds of Wikipedia pages to improve recognition of women scientists.

Planetary scientist Professor David Southwood has been awarded a CBE for services to Space Science and Industry in Britain and Europe. He founded the Space and Atmospheric Physics group at Imperial and later became head of the Department of Physics.

Molecular pathologist Professor Gerry Thomas has been awarded an OBE for services to Science and Public Health. She has advised on the risks of radiation from both Chernobyl and Fukushima. At Imperial, she established the West London Genome Medicine Centre as part of the UK's 100,000 genomes project and is Director of the Imperial College Healthcare Tissue Bank and the Chernobyl Tissue Bank.

Alumnus Anthony Meggs (MSc Chemical Engineering & Chemical Technology 1979) has been made a CB for public service. Alumna Valerie Cain (MBA 1998) has been awarded a CBE, also for public service.

Four alumni were awarded OBEs: Dr Christopher Dorman (PhD Physics 1997), for services to laser and photonic technology and exports; Professor Lee Major (MSc Science Communication 1994), for services to social mobility; Dr June Chatfield (Botany and Plant Technology 1965), for services to conservation and natural history education; and Geoffrey Forder (MBA 1996), for services to naval logistic support.

Two alumni were honoured with MBEs: Jessica Baker (MSc Mechanical Engineering 2011), for services to global supply chains; and Dr Navnit Chana (Charing Cross and Westminster Medical School 1986), for services to clinical education and primary and community care.

<http://bit.ly/IE31-Honours>

2019 Kabiller Young Investigator Award in Nanoscience and Nanomedicine

Professor Molly Stevens, of Imperial's Departments of Materials and Bioengineering, has won the 2019 Kabiller Young Investigator Award in Nanoscience and Nanomedicine.

This \$10,000 award, given by Northwestern University in the US, recognises her recent work in developing connected diagnostics technologies. A number of technologies have been designed and applied, including using smartphone technology to track outbreaks of Ebola in low income countries.

The award selection committee said: "These mobile health connected platforms (could) transform the way we respond to epidemics by enabling rapid, accurate and cheap testing, data sharing, and geographical tagging."

Professor Stevens will officially receive her award at a celebratory banquet in Chicago on 13 November.

She said: "I am delighted that my team's work has been recognised by this award and am very proud of the



Photo: Colin Smith, Imperial College London

talented multidisciplinary postdocs and students in our group, and indebted to our collaborators within the Regenerative Medicine Platform Hub and the i-sense consortium.

"Together, we hope to make a difference in the engineering of nanomaterials to detect diseases earlier and regenerate organs."

<http://bit.ly/IE31-Awards>

New Fellows of the Royal Academy of Engineering

Four eminent Imperial academics have been elected as Fellows of the Royal Academy of Engineering.

The new Fellows include Imperial's President, Professor Alice Gast; Founding Head of the Dyson School of Design Engineering, Professor Peter Childs; Professor Martin Blunt, Chair in Petroleum Engineering in the Department of Earth Science and Engineering; and human-robotic interaction expert Professor Maja Pantic, Professor of Affective and Behavioural Computing, Department of Computing.

Becoming a Fellow of the Royal Academy of Engineering is one of the highest honours that an engineer can receive in the UK. The Imperial Fellows join 54 engineers from around the world who were

elected this year in recognition of their outstanding and continuing contributions to the profession.

The announcement brings the total number of Imperial Fellows at the Academy to 91.

Professor Dame Ann Dowling, President of the Royal Academy of Engineering, said: "Our Fellows are at the heart of all Academy activities and I am delighted to welcome these highly successful, creative and inspiring engineering leaders to the Fellowship.

"There has never been a more important time for the Academy to advance and promote excellence in engineering so that the engineering profession can continue to contribute to societal wellbeing and economic growth."

<http://bit.ly/IE31-Fellows>

British Geophysical Association Bullerwell Prize

Dr. Rebecca Bell, a lecturer in the Department of Earth Sciences and Engineering, has been awarded the British Geophysical Association (BGA) Bullerwell Lecturer Prize for 2020. As the prize winner, she will give the keynote Bullerwell Lecture at EGU 2020. The prize is given to "An outstanding early career British Geophysicist" and is one of the principal events in the BGA calendar, which has been presented every year since 1981. Rebecca studies tectonic evolution in a variety of settings using advanced controlled source methods and drilling data.



Photo: Thomas Angus, Imperial College London

Roger Needham Award



Photo: Sean Conner, Imperial College London

Dr Cristian Cadar, of Imperial's Department of Computing, has won the British Computing Society's Roger Needham Award for 2019, to recognise his pioneering work in dynamic symbolic execution (DSE), a program analysis technique used by companies such as Fujitsu, IBM, and Microsoft to find errors and security vulnerabilities in complex software systems.

He said: "I'm delighted to have my work recognised in this way. I am grateful to my research team, mentors and collaborators for making this research possible. I also find it heartening that software reliability techniques are receiving so much attention, as these techniques can help create safer and more secure software systems."

Dr Cadar will give this year's Needham Lecture at The Royal Society this autumn.

<http://bit.ly/IE31-Awards>

UKRI Fellowships

The Future Leader Fellowships, funded by UKRI (the national body which brings together the seven Research Councils, Innovate UK and Research England) were established to provide early career academics with the flexibility and time they need to make progress on pressing global challenges. Imperial was one of the most successful universities in this round, with eight fellowships awarded out of nine interviewees.

One fellowship was awarded to Dr Yuval Elani, Department of Chemical Engineering. His aim is to devise an engineering rulebook to enable the manufacture of synthetic cells from scratch, out of the building blocks of biology like DNA, lipids and enzymes, but engineered from the bottom up.

The fellowship is entirely unique in the UK funding landscape – seven years of generous funding, supporting highly multidisciplinary research, and allowing flexible partnerships with industry.

<http://bit.ly/IE31-UKRI>

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Imperial working to encourage green tech innovators with Vodafone

Imperial is supporting Vodafone's Future Changers, a worldwide competition for young adults to find tech solutions to environmental challenges.

Running until October, entrants were invited to submit ideas through the Vodafone Future Changers online hub. The competition was open to entrants from 14 participating markets, including Imperial students and researchers from any discipline or level of study.

A panel of expert judges, including Imperial's Director of Entrepreneurship, Ben Mumby-Croft, will select a winner, who will be offered support to develop their technology idea.

The programme will make use of the College's vibrant ecosystem of programmes and services that support technology development and entrepreneurship, offering the winner the opportunity to join Imperial's Techcelerate business accelerator, which helps participants to test the market potential of their technology ideas. Vodafone will further support the winner with mentoring and a £5,000 green tech fund to assist in the development of their idea.

Jacqueline Field, Global Head of Resourcing at Vodafone said: "Young people can make an enormous difference to the future, and our Future Changers competition is a real opportunity for Vodafone to find and nurture the best ideas from digital pioneers that can help the environment through technology."

Ben Mumby-Croft said: "At Imperial we're passionate about nurturing entrepreneurial talent and supporting the next generation of gamechangers and pioneers to think big, be bold and make a difference. As part of this mission, we're delighted to be supporting Future Changers and look forward to working with the winning idea."

Dr Simon Hepworth, Imperial's Director of Enterprise, said: "At Imperial, we have a strong track record of bringing together industry partners with a new generation of researchers, entrepreneurs and innovators. Our work with Vodafone for the Future Changers competition is a great example of how we facilitate connections and collaborations to create real benefits for society."

<http://bit.ly/IE31-Vodafone>

Science key to global Britain, says Imperial Vice-President at Labour party conference



Photo: Imperial College London

Professor Maggie Dallman joined a panel to discuss 'global Britain' at the Labour Party conference in Brighton. The event was initiated by Imperial in partnership with think tank the Institute for Government and the Wellcome Trust. It set out to explore what Labour party policy on the UK's role in the world once outside the EU should be, how the UK would have an opportunity to redefine this role and how science needs to be central to this.

Professor Dallman, Imperial's Vice-President (International) and Associate Provost (Academic Partnerships), was joined on the panel by Barry Gardiner MP, MP for Brent North and Shadow Secretary of State for International Trade, and commentators from think tanks and

the media. She set out that a global Britain needs investment in science and an open environment that attracts global talent, saying that EU and international researchers and students are the "bedrock of any university."

She added that the political distinction between alignment with either Europe or the US did not work for science which needs to be universally open to collaboration and that if EU partnerships were diminished, this would affect the quality and standard of UK research.

Barry Gardiner MP highlighted that the net zero target and climate change are a huge area where, like in science, the UK punches above its weight: "We are seen as a leader, always pressing for greater ambition."

Professor Dallman added that here too UK scientists need to be able to work with anyone across the globe to solve global challenges like climate change.

Imperial co-hosted a similar event at the Conservative party conference in Manchester.

<http://bit.ly/IE31-global>

2019 Blast Injury Conference brings together Engineering, Science and Medicine



Professor Molly Stevens giving her Plenary on using cell-material interactions to help heal injuries

Imperial's Centre for Blast Injury Studies hosted engaging research, lively debate, and a Royal visit at the Blast Injury Conference 2019.

The event at Imperial welcomed 220 delegates from ten countries, as well as His Royal Highness Prince Harry the Duke of Sussex, who visited as a friend of the Centre after officially opening it in 2013.

Blast injuries are often associated with military personnel in war zones, but in today's style of indiscriminate warfare they increasingly affect civilians and children by way of land mines, terrorist attacks, and abandoned unexploded devices.

Thanks to advances in both military and civilian medicine, more people are surviving blasts, but often with life-altering injuries.

That's where the Centre – and its annual gathering of world-leading blast injury experts – comes in.

Funded by The Royal British Legion, the Centre addresses the disabling injuries of conflict with a clinically-led approach. The Centre enables civilian engineers and scientists to work alongside military medical personnel, all of whom are dedicated to investigating the research issues surrounding blast injury, to deliver change through new technology, equipment and policies.

Professor Anthony Bull, Director of the Centre and Head of the Department of Bioengineering, said: "The Centre focuses on improving treatments and recovery through medicine, prosthetics and rehabilitation, and develops better ways of protecting those serving in current and future conflicts."

"The research discussed at this year's Blast Injury Conference is a shining example of how bringing together scientists, engineers, medical professionals and military personnel, for preventing and treating blast injuries, can really change lives."

The Centre, which is housed within Imperial's Department of Bioengineering, previously held networking and research events



Prince Harry was greeted by Centre Director Professor Anthony Bull, Imperial President Professor Alice Gast, Provost Professor Ian Walmsley, and Admiral of the Fleet, The Lord Boyce.

each November, but these were upgraded to full conferences in November 2018.

The 2019 conference was the first international one of its kind, and the first to be held over two days instead of one. It touched on blast-related brain and musculoskeletal injuries, as well as the changing face of war and life beyond blast injuries.

The four Plenary speakers were: Professor Molly Stevens from Imperial's Departments of Materials and Bioengineering

Dr David Brody from the Uniformed Services University of the Health Sciences

Dr Ghassan Abu-Sittah from the American University of Beirut Medical Centre

Alistair Spearing, former British Army lieutenant

The next International Blast Injury Conference will be held on 8th and 9th July 2021 at the Royal Institution, with a smaller, national meeting in 2020.

<http://bit.ly/IE31-BIC2019>



Dr Spyros Masouros chaired the Conference

Photos: Imperial College London

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Carbon taxes alone cannot reduce emissions enough to reach the Paris Agreement targets

The Paris Agreement, signed in 2015, requires nations to collectively limit global warming to 2°C by 2100, and to pursue efforts to limit the temperature increase even further to 1.5°C.

This goal requires human-caused carbon dioxide (CO₂) emissions to reach zero by 2070 and become negative afterwards, using strategies that remove CO₂ from the air, such as carbon capture technologies or planting trees.

However, a new study by Imperial researchers shows that carbon taxes, which are the currently favoured system for reaching this target, will not be enough to avoid catastrophic climate change.

Study lead author Habiba Daggash, from the Centre for Environmental Policy (CEP) at Imperial, said: "The current system of penalising greenhouse gas emissions through carbon taxes is not sufficient to avoid catastrophic climate change, even if very high taxes are enforced. Therefore, using this strategy alone, the Paris Agreement that most countries have committed to could not be delivered.

"The system needs to be adapted to recognise that not only do emissions need to be penalised, but actions that result in permanent removal of greenhouse gases from the atmosphere must also be credited."

Placing a price on carbon, usually in the form of taxes on emissions,

has been touted as a way of allowing market forces to produce a low-carbon economy, in which using low-carbon forms of energy is seen as an advantage.

Using the UK as an example, Daggash and Dr Niall Mac Dowell, her colleague from the CEP, modelled the future UK energy system based on several scenarios concerning levels of carbon taxation and incentives for carbon removal.

Their analysis shows that much higher carbon taxes than current levels are enough to create a push for low-carbon technologies that satisfy emissions goals in the short term.

However, higher carbon taxes are not enough to incentivise the development and deployment of carbon removal strategies, which are necessary to reach long-term goals.

If, instead, governments incentivised carbon removal strategies much earlier, then carbon taxes could remain lower while still encouraging removal strategies to be developed and deployed on a large scale.

Habiba said: "Early incentives could both reduce the cost of delivering the Paris Agreement and satisfy our long-term need for negative emissions."

The team say that the UK case study could apply to other regions, and are now investigating the situation in developing economies, using Nigeria as a case study.

<http://bit.ly/IE31-emissions>

Imperial student uses plant waste to create sustainable alternative to petrochemical dyes

Nicole Stjernswärd, a student on the Innovation Design Engineering Master's course, offered jointly by Imperial and the Royal College of Art, is using plant waste to create natural powder pigments that can be used for paints, inks or textiles as an alternative to colours made from petroleum.

Historically, colour came from plants and minerals, but with the onset of industrialisation, cheap, petrochemical colours became the norm, at huge environmental cost. Nicole thinks that pigments are due for change as we start to scrutinise everything for its sustainability.

Many plants and fruits eaten every day, such as avocados, onions and pomegranates, have valuable colours within their skins and peels. Normally these are left to rot in landfills, but Nicole's KAIKU Living Colour project transforms this waste into a high value resource.

Her colour-making machine

converts plant dyes into paintable pigments, allowing the user to create custom colours and have total control over the source of the colours. Plant dyes, added to the machine's reservoirs, are vaporised into dry powders. This process takes minutes and results in pigments that can be used for traditional artists' paints, inks and textiles.

Depending on how it is cared for, natural plant colour can fade in just a few months, making it perfect for items used for a short time. Items needed for a longer time can be re-dyed or re-coloured as needed.

Nicole's inspiration for the project began with oil paints, which used to be made more naturally, but are now mostly made from synthetically-derived materials and chemicals. She then met textile designers, who spoke about wanting to use more natural dyes, but found that these must be used quickly as they go mouldy. Nicole says her

Shifting the focus of climate-change strategies required in order to benefit younger generations

Strategies to limit climate change that focus on warming in the next couple of decades would leave less of a burden for future generations.

Research led by Imperial College London and the International Institute for Applied Systems Analysis (IIASA), Austria, suggests a new underpinning logic for strategies that seek to limit climate change.

Most strategies seek to limit climate change by the year 2100. The strategies may include tactics such as deployment of new renewable technologies, removing carbon from the atmosphere (through planting trees or new technologies), or mandating energy efficiency targets.

However, by focusing on the year 2100, these strategies are inconsistent with the Paris Agreement climate goal – to keep warming below 2°C, and ideally below 1.5°C, at any time in the future.

Strategies that focus on the year 2100 could allow potentially dangerous warming to happen in the short term – in the next couple of decades – and then rely on removing carbon dioxide from the atmosphere in later decades to reach the overall targets by 2100.

These strategies place a burden of both higher climate risk and necessary investment on later generations, and also rely on carbon removal technologies being widely available, which is in no way certain and thus a risky approach.

Instead, the team suggests climate change strategies should consider when maximum warming will occur, what that level of warming should be, and whether warming is stabilised afterwards, or efforts are made to slowly reverse it.

The researchers suggest it is more sensible, and fairer, to limit warming faster before 2050 and rely less on unproven technologies and investment by future generations – or at least make these

intergenerational value judgments explicit when designing climate change strategies.

Lead researcher Dr Joeri Rogelj, from the Grantham Institute at Imperial and the IIASA, said: "When climate-change strategies were first proposed, more than 20 years ago, the planet had only warmed about 0.5°C, so there was time for a long, smooth transition to energy systems and economies that kept warming below 2°C by 2100.

"Now, however, we are at around 1°C warming and science of the last decade has shown that 2°C cannot be considered a safe limit. The need to stabilise warming more quickly is paramount, and therefore we suggest a focus on reaching net zero carbon emissions as a key milestone of any climate strategy.

"Turning the focus from the far future to the next decades, where push will come to shove in terms of adequate climate action, will help us reach the Paris Agreement goals without placing undue burden on future generations."

The research team suggests net zero carbon emissions should be the focus of climate change efforts in the short term, to limit warming that occurs in the next couple of decades and until it is stabilised.

From net zero carbon, countries could then decide their strategy based on how much they need to further reduce their global warming contributions through added carbon removal.

Dr Rogelj said: "Shifting the focus to more short-term warming will underpin the next assessments by the Intergovernmental Panel on Climate Change (IPCC) and we hope it will also help policymakers formulate realistic strategies.

"Policymakers want to know how and when we can reach net zero carbon, and our new logic for strategies could make these questions answerable."

<http://bit.ly/IE31-strategy>

system is easier to use and has a better shelf life.

She said: "The project uses existing, old knowledge that people might have forgotten about, incorporating new technologies."

Studying at both Imperial and the RCA allowed Nicole to "access specialists in the field and experts on both sides. I really liked working with different disciplines, and I'm exploring how I can continue to do this after graduation."



Photo: Nicole Stjernswärd, Royal College of Art

To see KAIKU in action watch the video on Nicole's website at:

<http://bit.ly/IE31-KAIKU>

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

European universities collaborate to encourage sector leadership on equality, diversity and inclusion

Imperial has collaborated with the League of European Research Universities (LERU) to investigate approaches to advancing equality, diversity and inclusion.

On 19 September, LERU presented its policy paper on equality, diversity and inclusion, at an event in Brussels chaired by Imperial's Vice-Provost (Education), Professor Simone Buitendijk, the lead author on the paper. Professor Stephen Curry, Assistant-Provost EDI (Equality, Diversity and Inclusion), co-authored the paper and also spoke at the event.

LERU's 23 members, including Imperial, assert that a new approach is required if significant progress is to be made with EDI in universities.

The paper argues that by taking comprehensive, joined-up approach encompassing all aspects of university life, universities can better promote EDI. According to the paper, although strategies targeting specific under-represented groups can be useful, a more effective approach is to create an environment which is inclusive for all.

Taking the form of a series of best practice case studies from LERU members, the paper also emphasises the importance of university leadership to prioritise EDI. Leaders are encouraged to familiarise themselves with research on bias and discrimination, and take responsibility familiarising themselves with the context of their own institution. Leaders who take the time to engage with this evidence are found to be better equipped to identify solutions that work. Crucially, leaders are called on to empathically listen to under-represented minority members of the university community to understand their lived experiences.

The LERU report also



Imperial's Vice-Provost (Education), Professor Simone Buitendijk

Photo: Thomas Angus, Imperial College London

highlights the importance of making universities' research and curriculum content more diverse and inclusive. Embedding inclusivity across research-intensive institutions is found to encourage practice that benefits all members of the university community as well as the population at large.

Widespread implicit bias within the higher education sector has been identified as an underlying challenge to delivering much needed change. All authors and member institutions agreed that the sector is past the point of debating the existence of bias, and that it is critical that universities learn lessons from the large body of research that now exists.

Professor Buitendijk outlined these findings to an audience of higher education policy experts and politicians: "It is time for universities to act to ensure we are using the vast talent in our institutions, improving staff and student satisfaction, and enhancing our societal and global impact.

"We know that issues around equality, diversity and inclusion are already well documented elsewhere. This paper serves as a manifesto setting out specific and identifiable challenges that can be tackled by university leadership right now."

After Professor Buitendijk's presentation a panel of speakers including Mina Stareva, Head of Gender at the European Commission, and Tomas Brage, Professor of Physics at Lund University, discussed EDI from a policy perspective, with examples of actions from LERU universities' senior management. "By joining together with policy makers,

business, funders, publishers and others, we can make a significant contribution to making the world a better place."

Taking a lead

LERU is a prominent advocate for the promotion of basic research at European research universities that believe that frontier research plays an essential role in the innovation process and significantly contributes to the progress of society.

Alongside members such as Imperial, the League aims to further politicians', policy makers' and opinion leaders' understanding of the important role and activities of research-intensive universities. The 23 members bring together representatives to work on LERU policy development and engage in mutual learning in many areas.

As part of this mission the League continually commissions its members to "think big" and explore issues such as equality, diversity and inclusion across institutions. However, what the paper does not do is provide a simplistic blueprint applicable to all universities. Professor Kurt Deketelaere, Secretary-General of LERU, said: "Universities work in different national and local contexts, and with different strategies for education, research, innovation and societal engagement. We are confident in our hope that the leadership of LERU members will continue to develop and refine their strategies for comprehensive, long-term strategic change in their own institutions.

"As an organisation, LERU will encourage further collaboration among its members on these issues and will engage with other universities, policy makers,

governments and funders in Europe and beyond."

Imperial's inclusive community

From an education, research, staff and student experience, perspective, Imperial is hard at work ensuring that equality, diversity and inclusion is implemented in full across the College.

The Equality, Diversity and Inclusion Strategy builds on existing initiatives and projects across the College. The most visible parts of this work are schemes that benchmark the College against other institutions, such as the Athena SWAN awards, the Race Equality Charter, the Disability Confident employer scheme and the Stonewall Workplace Equality Index.

A number of actions in the strategy apply specifically to students, and support the work on learning, teaching and student experience that is already underway. Developing an inclusive curriculum that will attract, engage and support students of all backgrounds and identities is also an integral part of the College's Learning and Teaching Strategy. Interactive teaching based on inclusive research allows students to bring their gender experiences, their cultural background, their experiences based on disability and sexual orientation, and their unique identity into the classroom as part of their learning experience.

Professor Stephen Curry, Assistant Provost (Equality, Diversity and Inclusion), said: "I was very pleased to be part of the group that has produced this new LERU position paper on the role and responsibilities of research-intensive universities in promoting equality, diversity and inclusion. There is something a little ironic in an exclusive group of universities speaking out about inclusivity, but it is vital that we commit to this agenda.

"As we have laid out in Imperial's own strategy, published last year, integrating considerations of equality, diversity and inclusion into everything that we do will help to ensure that we thrive in a world that has never been more diverse. It will help us and other research-intensive institutions to harness the creative vigour that comes from diverse perspectives, and to build a culture that considers the interests and well-being of staff and students. Success in this endeavour will require action across many fronts but we will progress faster by sharing best practice with our partners in LERU."

<http://bit.ly/IE31-LERU>



Professor Stephen Curry, Assistant-Provost EDI

Photo: Dave Guttridge, Imperial College London

Learning and Teaching

In November 2016, the College embarked upon a widespread consultation process to assess the views of staff and students about the future of learning and teaching within Imperial, which led to the development of a learning and teaching strategy, launched in October 2017.

In Imperial ENGINEER Issue 30, spring 2019, our first article set out the aims and objectives of the strategy, based around 4 key themes, namely a review of the curriculum, the need to make teaching more interactive, the importance of an inclusive and diverse community and finally, the development of online and digital learning. This article describes the responses that the Faculty of Engineering (FoE) has undertaken so far and includes some thoughts about how the strategy is being implemented elsewhere in the College, in the Faculties of Natural Science and Medicine.

CURRICULUM REVIEW

Objectives of the strategy included innovation, multidisciplinary, modularisation, deepening understanding, mastery, breadth and assessment; all the key buzz-words and all very worthy.

General

Within Engineering, there is a regular requirement to review and develop the curriculum as part of the accreditation process for engineering degrees. For this reason, there was no resistance in principle to the idea of curriculum change; after all, curricula in Engineering are based on the need to prepare students for the professional world and therefore always have to be maintained and updated. However, some staff were concerned about timing, believing that the requirement to start the new curriculum in October 2019, meant that the process was unduly stressful and rushed.

Reviews within individual Departments for undergraduate degrees have now taken place and have considered the need to ensure mastery of the discipline, the breadth of the choices available to students and the contexts in which engineers will operate in the wider world. This has involved the consideration of the role of project work, non-engineering topics such as business, finance, entrepreneurship, etc, and the need to apply different assessment methods and pass criteria to reinforce learning and understanding, all of which has been set out in documents called programme specifications. This has been a large and thought-provoking task for busy academic staff, but it is generally recognised that doing this, and doing it well, is a vital part of the learning and teaching process.

Modularisation and the Structure of Courses

Essentially, this means structuring components of degree programmes into blocks of fixed amounts of student effort, to make them comparable, interchangeable and measurable by a common standard. The system is known as ECTS (European Credit Transfer System), with one standard module generally equivalent to 5 or 7.5 ECTS or a multiple thereof.

Whether or not the College wishes to organise its work in this way, it is now a requirement of the Office for Students (OfS – a national body and regulator) that all universities do this, so there is no getting away from it. Much of the FoE had been moving in this direction for some time, so the basic change did not have such a big impact. However, OfS will also in future require universities to gather a lot of detailed information, such as the numbers of students studying each module, the numbers of teachers and teaching assistants providing and supporting each module, etc., which can be quite a big data collection exercise.

One new aspect of the curriculum structure for the College, which is common practice in most universities, was the introduction of a standard set of exit awards for each degree programme. These awards allow a student to gain a qualification for the work they have successfully completed if they leave their intended degree part way through. All departments agreed that introducing these exit awards across the Faculty was a positive approach, and would provide a recognition route for students who would have otherwise left the College with nothing.

Generally, a curriculum review is considered a 'good thing', and can be beneficial in terms of lightening the load on students and staff and meeting the course outcomes more efficiently. Many courses within FoE were in good shape anyway, but the requirement for a curriculum review has reinforced the need to keep up to date, tidy up course structures and make aims, objectives, progression rules and pass criteria more transparent. The job is now largely done for undergraduate programmes, but the next thing is to maintain the momentum and move on to the review of taught postgraduate degrees over the next few years. Perhaps the requirement to undergo regular accreditation will underpin this.

INTERACTIVITY

Here, the strategy sets a direction for teaching to go beyond students sitting passively in lectures, soaking up and trying to retain information. Instead, there would be new teaching methods, new spaces and better use

of data to support teaching.

Passivity

The modern idea is that lectures are a bit old-fashioned, stuffy and didactic, and do not involve students sufficiently in active and engaged learning. There is some truth in this, but it is far from the whole story. Although educational research has shown that different and more active learning strategies can be very beneficial to students, it is also the case that staff employing traditional lecturing methods can be amongst the best and most effective teachers and some of the most popular and highly regarded by students.

The climate has changed recently, given the increasing role of the 'student voice' and the National Student Survey (NSS), a national opinion survey of all students graduating from UK universities, which has become very influential in how students perceive their studies and how prospective students choose their courses. The NSS is also a factor in the Teaching Excellence Framework (TEF) another national scheme, which assesses teaching quality in universities. Within the FoE, many Departments already have good NSS results. However, while we should not be complacent about this, we should not jettison existing good practice in a rush towards innovative gimmicks. We should embrace change but only when the need can be demonstrated and there is a clear benefit to students.

New Teaching Methods

New methods have been introduced where appropriate, such as online tools for assessment, demonstrations within lectures, the use of portfolios in engineering design, filming of lectures, etc. Many staff within the FoE have been open to these ideas all along, and by providing access to funding, the strategy has enabled Departments to employ Strategic Teaching Fellows to undertake the not inconsiderable task of design and development of these new methods. Their approach has been to advise and help, not to enforce, and this has generally worked very well.

There are some genuine concerns about

Strategy - Responses

some new methodologies. For example, using Panopto, a procedure for filming all lectures so that students can play them back in their own time raises concerns that students will not bother to turn up for lectures. Happily, thus far this has not proved to be a big problem.

Another approach, known as flipping the class, involves asking the students to do a significant amount of preparation and pre-reading before a lecture, which then becomes part-lecture, part tutorial and problem-solving class. This approach has a place, but is perhaps not suitable for all subjects e.g. mathematics, where students probably cannot absorb much of the theory by reading it on their own.

New spaces

Given that student numbers at Imperial have increased massively over the past 30 years, there is always the need to develop, improve and extend space, making it flexible for teaching and suitable for student learning and social interaction. There has been some progress in Engineering, particularly during the period 2008-2015, when there was considerable investment in the south east part of the campus, but progress is uneven and the needs vary widely across the College.

INCLUSIVITY

The idea here is that the College, a global institution, should recognise and cherish different cultures, genders and learning styles. This means the research-teaching balance as well as the different backgrounds of our diverse student population. Inclusivity would be promoted by better staff training and provision of more and better student services.

Cherishing different cultures

Who can object, but what does this actually mean? Taking a broad perspective on cultural difference usually means ethnicity and gender. Imperial is already a multicultural place with a massive ethnic mix within the staff and student communities. While stressing the need to avoid complacency, members of the Faculty, both staff and students, cope with this pretty well; indeed, they welcome it. Although we must keep the situation under constant review, there are no particular or insurmountable problems to be overcome as a result of our ethnic mix. However, there are some issues which need ongoing attention, such as the wish of students in certain ethnic groups to want to stick together in project teams; this is relatively easy to manage and it is commonly found that diverse project teams are usually more dynamic and innovative anyway.

Engineering is traditionally seen as a male environment, but all Departments have been making significant efforts to break down this stereotype. Many now have recognition



Photo: Thomas Angus, Imperial College, London

for this via the Athena/Swan Programme, a national scheme established in 2005 to promote good practice in gender equality in UK higher education, and women now hold major academic and management positions across the College. However, although there has been some progress in this regard, there is still work to be done.

There are also other important matters which require attention. If we go beyond gender and ethnicity and look at different student types, we find those who are introverted, outgoing, meticulous, broad-brush, theoretical, practical, conceptual, detailed and so on. These people may well require different approaches from the teacher to stimulate their learning and understanding. The teacher should be attuned

to these differences and take them into account when designing a course. Dealing with such diversity is clearly a sensible thing to do. Staff are increasingly aware of this and are taking such issues into account in their teaching.

Resilience

Increasingly, students nowadays are much more likely to report their concerns about anxiety, pressure and stress and we hear of many more incidents of self-harming and attempted suicide. Mental health, particularly amongst young people, is now high on the agenda. Being a student these days seems to be much more difficult than in the past and the College is rightly obliged to respond. The FoE is taking this matter very seriously



and will be appointing up to 6 Wellbeing Tutors, with the specific role of handling these growing problems, for the start of term in October 2019.

It is encouraging to note that, in the process of filling these posts, there were more than 400 very well qualified applicants, which augurs well for the way the Faculty will be able to deal with this in the future. In addition to these new posts, a number of existing academic staff across FoE departments have taken on additional responsibilities dealing with matters such as harassment, bullying, and the general wellbeing of students, in recognition that these are important matters which need to be addressed.

Parity of Teaching and Research

This has always been an issue at Imperial, with many people believing that the sure route to promotion is to develop a strong research profile rather than focus on teaching.

In the past, there has certainly been some truth in this, but now progress is being made in achieving parity. At senior management level, there have been continuing efforts to introduce changes in the promotion procedures to allow progression for excellent teachers who are perhaps not at the forefront of research and even, it is said, to hold back excellent researchers who may have paid insufficient attention to their teaching duties. There are now new promotion routes for Teaching Fellows and the possibility of being promoted to the position of Professor of Higher Education, which recognises the individual's teaching quality and research in education theory and practice. Some traditionalists might still be sceptical, feeling that research should be the main criterion for a professorial post at Imperial, but the culture of the place is slowly changing.

Staff training

This is becoming more prominent and is about awareness and changing the culture. For example, there are now well-supported programmes for staff in active bystander and unconscious bias training, which equip staff to recognise and deal with incidents where bad behaviour turns into abuse and bullying, or to ensure that students, colleagues and job applicants all receive fair and just consideration.

Students as partners

The notion of the lecturer handing down knowledge and wisdom to the grateful student is now increasingly a thing of the past. Although some traditionalists may still be somewhat sceptical, student involvement is now taken much more seriously. For many years, Departments have held feedback sessions in which students give their views about the course, the teaching quality and the learning environment. These are now more formalised and more prominent and students are now much more likely to be consulted about planned changes as well as current practice.

Increasingly, some senior students, usually

Photo: Thomas Angus, Imperial College, London

in their final year, are now involved in tutorial classes, giving practical help to their younger compatriots with their studies and also acting as a 'buddy' or role model; this can work well when used as a supplement but can, if used unwisely, be seen as a 'cheap option', taking the place of high quality tutorial support. At a time when students are paying high tuition fees, this is an approach which should be used with care.

DIGITAL

The strategy made clear that a key part would be the enhancement of digital work, the development of a Digital Learning Hub, transformation of pedagogy and the development of students as global citizens.

The Digital Learning Hub (DLH) is now in place, having been established in 2017, and provides support for Departments in setting up new programmes, by giving advice on platforms, technologies and data analysis. It has new space, facilities and staff on the South Kensington and Charing Cross campuses. This is something much welcomed by FoE, which has been active in campaigning for something like this since 2009 and which had already taken steps in this direction by devoting resources to staff and equipment for this purpose. However, the aim in the FoE has always been that digital developments should complement, but not replace, existing teaching styles, many of which are good, effective and highly regarded by students. Alongside the DLH, the Faculty, in a joint bid with Natural

Sciences, secured significant funding to provide additional digital learning expertise embedded in the Faculty teams, charged with assisting academic staff and teaching fellows with transformation of their teaching.

Developing and managing these digital developments is a complex exercise, involving non-academic parts of the College such as ICT and Facilities Management, and tricky discussions about budgets and responsibilities, but the actual and potential benefits can be considerable.

VIEWS FROM OTHER FACULTIES

Within the Faculties of Medicine and Natural Sciences, some take the view that the need for change is perhaps stronger than in Engineering; for example, the National Student Survey suggests that there is less student satisfaction in some Departments in these Faculties than in Engineering, which generally does quite well in the survey. However, there was certainly some resistance to the top-down nature of the project and it took some time to get staff interested, willing and engaged.

Certain specific reservations were identified in other Faculties, particularly the notion that a one-size-fits-all approach would not necessarily work. Students and their motivations are different. Medical students are perhaps more likely to work in groups, to be empathetic and holistic; students of the hard sciences are perhaps more likely to be single-mindedly concerned with deep understanding

for its own sake and less focussed on transferable skills. Teaching methods which suit one type might be anathema to the other. Interactive teaching, studio work, team projects and so on may all have a role to play, but they should be introduced only where appropriate, taking into account the motivation and needs of individual students as well as the overall need for progress and development in pedagogy. There were also some reservations about the idea of students as partners. As indicated above, anything that could be seen as a replacement of experienced teaching staff with a 'cheap option' could be very problematic.

CONCLUSION

As indicated previously, the general view within the FoE is that the learning and teaching strategy sets a pathway to a number of important changes in the College, building on those that have already been identified and acted upon. There is also a strong view that change should be introduced where and when appropriate not just for the sake of change, as well as reservations about the significant additional administrative and management burden that these activities place on academic staff. However, Engineers are pragmatic people and, in general, staff have set out to meet the requirements of the strategy, usually willingly enough, though sometimes not without justified reservations.



Photo: Thomas Angus, Imperial College, London

Smaller glaciers, bigger cars,

Back from a cruise to Alaska where they saw at first hand the dwindling glaciers, our regular, peripatetic, correspondent from Canada, Nigel Fitzpatrick (Metallurgy 1962-65, 65-68), reflects once again on damage to the environment, in particular from the upward trend in domestic vehicle size in North America. On a more positive note, Nigel and Joan have provided us with some beautiful photographs!

The Port of Vancouver is the base of an Alaskan cruise fleet [1]. Joan and I lived 20 minutes from the cruise terminal for a quarter century before trying Holland America's vintage *MS Volendam*.

In a week we saw Skagway, Juneau, Glacier Bay and Ketchikan. We saw glaciers in splendid weather, meeting ardent naturalists and park rangers almost in tears over climate change. There were sightings of humpback and killer whales, seals, otters and eagles, sometimes distant. Dinners aplenty brought us into social contact with occasional climate change skeptics. Perhaps their skepticism weakened but it was at the expense of the ground level and GHG emissions from the 479 metric tonnes of fuel that brought us back home, less (for example) the 20,000 eggs consumed on board. That fuel leaves a visible trail.

In IE 29 we noted that cruise ships and ferries are more under the public eye than commercial vessels. Heavy fuel oil is still used off the west coast. [2]

At long last, the International Marine Organization is in gear on low sulphur fuel, in common use ashore. "The year 2020 marks a major turning point in international shipping: On January 1, a lower global limit for the sulphur content of ship fuels will enter into force. Instead of 3.5 per cent, the allowable maximum will be 0.5 per cent." [3] And the IMO is targeting halving GHG emissions by 2050. New ships will mean newer equipment, new fuels, and shore power while docked; and there will be retrofits.

Hopefully there is no maritime equivalent to a surprise found on land and presented at a 2009 climate change technology conference in Hamilton, Ontario (see Table 1). SUVs, (termed then by government 'passenger light trucks') were taking over from passenger vehicles in Canada. US fleets did likewise and the trend continues: "American consumers have moved en masse from small cars to crossovers, SUVs and trucks in the last half decade" [5]. Though fuel economies were improving, savings were lost as families migrated to larger heavier vehicles.

Vehicle size may impact building construction. The condominium hotel we stay at in Whistler opened in 2001. The underground car park spaces are a mixture of sizes. We can park our 2006 Subaru Forester with bikes on the back in any space. However most present day 'suburban utility vehicle' SUVs have trouble. A similar hotel adjacent opened in 2008 with larger parking spots.

Jevon's paradox, or economic rebound, is



Photos by Joan and Nigel Fitzpatrick

GHG by Mode (Mt of CO ₂ e)	1990	2005	Total Growth 1990-2005	% in 2005
Small Cars	25.1	22.4	-10.9%	16.2%
Large Cars	27.1	23.0	-15.0%	16.7%
Passenger Light Trucks	14.9	29.0	94.6%	21.1%
Freight Light Trucks	6.7	11.5	71.2%	8.3%
Medium Trucks	9.4	11.0	17.1%	8.0%
Heavy Trucks	14.9	37.0	147.5%	26.8%
Motorcycles	0.2	0.3	54.9%	0.2%
School Buses	1.0	1.1	8.6%	0.8%
Urban Transit	2.1	1.9	-9.9%	1.4%
Inter-City Buses	0.7	0.6	-8.9%	0.5%
	102.1	137.8	34.9%	100.0%

Table 1: Greenhouse Gas Contribution by On-Road Vehicles in Canada
 Extracted from Government of Canada data [4]



First stop. Our 2015 visit to Skagway on the White Pass and Yukon train (see IE 24) helped us grasp the struggles to survive.

reduced-sulphur ship fuel

invoked to explain the tendency of energy efficiency to lead to greater rather than less use of fuel. We can be less academic and perhaps more direct with an anecdote.

In 1990, Hal Sperlich explained the coming enthusiasm for SUVs over dinner at the London Chop House in Detroit [6]. Hal had moved from Ford to Chrysler and risen to President on the success of the front wheel drive Chrysler Caravan that he developed with Lee Iacocca, who rose higher. That evening, Hal was an ardent supporter of combining electric drive with an Alcan's lightweight structure that now takes >700 lb off (for example) the weight of Ford's F150 [7]. Hal spoke with passion about the lack of effort to lighten vehicles to make electric drive easier. Saying, "you do not need a 2000 pound car to move a lawyer and a briefcase", Hal hit his wine glass. The front wheel drive Chrysler Caravan aka Minivan introduced a wider group to the benefits of a higher sitting position. Drivers had felt more secure and the SUV or passenger light truck sitting position introduced families to the larger vehicles in Table 1.

A 'war footing' is said to be required to tackle climate change [8]. 'War footing' proponents will be aware that it took time to get from prototype to the products that fought in 1939, as for example the first prototype Hurricane flew in November 1935 and the first Spitfire four months later. It takes time

"you do not need a 2000 pound car to move a lawyer and a briefcase"

Hal Sperlich



At Juneau, Alaska's capital, most passengers on board were driven 20 km to firmly retreating Mendenhall Glacier where U.S. Forest Service Visitor Center staff sadly explain the changes.



The stop after Juneau. Margerie Glacier at the end of Glacier Bay National Park. The Volendam was silent and poised for an hour or more, allowing us to hear almost explosions as ice calved off.



Joan's picture of Margerie – not too hard to get through the crowd when you have an hour in calm weather and the best view the crew has had all season! Reminds us, we saw the backs and spouts of Humpback Whales as we went down Glacier Bay (for some pictures see <http://bit.ly/IE31-Humpback>). The ship had a naturalist on deck (Ross) with us and US Parks folk came on board also. Ross told us that the whales we saw, with binoculars provided in all cabins (but too far for pictures, so we just listened), bred off the coast of Maui in Hawaii and came to Glacier Bay to feed. Joan and I went to Maui last January and saw humpback mother and calf, learned that they didn't feed there and wondered! It seems the cycle needs the nutrients that the glacier brings down to the Ocean.

FEATURES



Last stop! Ketchikan. Salmon that first brought the Tlingit still teem in Ketchikan Creek within a walk. Currently 500 annual cruise stops bring a million passengers a year and give 8000 residents a busy summer.



Although we got away from wifi we couldn't escape the BBC and the continuing UK gloom.



Sunset view from our starboard cabin on the last evening shows our effect on quiet air



We have no trouble parking in Whistler, even with bikes on the back.

to implement evolving technologies to mass production. And we may barely succeed if a market tide overcomes efficiency changes (lean burn engines, hybrid and electric vehicles, continuously variable transmissions). Technology can help but, to be sure, rules of use must be added to our quivers. We may need to ration fuel and limit speed and even travel.

Could we change? During the oil crisis which began in October 1973, a Republican



But many newer cars can't fit in the parking spaces (even without bikes).

President limited vehicle speed to 55 mph to reduce fuel use. Such a rule could be more effective if aided by communications companies and the smart, semi-autonomous vehicles with us now.

Watch out for the vehicles that start when you have paid the carbon fee for your weight and all you are carrying except one briefcase per person.

The young ones need us, also, to never say never.

Notes

1. <http://bit.ly/IE31-Vancouver>
2. <http://bit.ly/IE31-NABU>
3. SMM 2020 Publishes Maritime Industry Report <http://bit.ly/IE31-SMM>
4. Fitzpatrick, N., *Electric Drive Choices For Light, Medium, And Heavy Duty Vehicles To Reduce Their Climate Change Impact In Canada* 2nd Climate Change Technology Conference May 12-15 2009, Hamilton, Ontario, Canada
5. Sam Abuelsamid, *New Vehicles Keep Getting Heavier – Or Are They?*, *Forbes* Jan 3, 2019, <http://bit.ly/IE31-Forbes>
6. <http://bit.ly/IE31-Detroit>
7. The technology stems from British Leyland via Alcan
8. <http://bit.ly/IE31-IPPR>

Project Penguins

Having graduated from the Civil Engineering Department in 2015, Dominik Sznajder joined Shell and moved to The Hague, Netherlands, to start his career at one of Shell's Engineering Hubs. Since then, he has been involved in many projects around the world that have helped him grow and develop as an engineer. In a recent article for CGCU's *Guildsheet* he wrote about one of the most exciting opportunities he's had so far – the chance to work on the Penguins Redevelopment Project in the UK North Sea. This is based on Dominik's article.

The Penguins field is located around 160 km from the Shetland Islands and is adjacent to the UK/Norway border. It is currently producing oil and gas through one of the iconic Brent Platforms. However, the Brent field is being decommissioned and, there is now a need for something to replace it.

The selected concept is a brand new Floating, Production, Storage, Offloading (FPSO) unit, that is currently being built in Qingdao, China. Its peak production is expected to reach 35,000 barrels of oil per day and the storage capacity will be 400,000 barrels of oil. The project targets delivery of first oil from the new host in the early 2020s. I have been working on the project for over a year. One of the main tasks for me last year was to prepare and attend an offshore campaign with a purpose of collecting soil data in 165m water depth at the location of the future FPSO. The preparations for the campaign involved a close collaboration between other members of the project team, vessel contractor and the government to obtain relevant permits. As part of the job, I went offshore last year and acted as a junior Client Representative with a responsibility for overseeing the Geotechnical activities.

The crew mobilised from Aberdeen at the beginning of October and travelled 290 nautical miles, passing various offshore installations, up to the Penguins Field. Even though the first few days onboard were slightly rough in terms of adjusting to the ground constantly moving, the whole crew quickly adopted the can-do attitude and we were ready to start the work.

As a Client Rep, my role was to set an example as a safety leader. This included working together with the contractor on risk assessments, and specifically the work procedures, attending toolbox talks, and stopping the work if the activity was unsafe. When you are offshore, the most important thing is safety. You really do start understanding why the handrails are so important!

My time offshore was a great learning opportunity to see all the safety guidelines and standards being used and lived by at the work site. Closely following the Geotechnical Investigation helped me understand the importance of the in-situ testing, as explained during my Geotechnical classes with Prof. O'Sullivan. It is a truly amazing experience to see that the data you are collecting, by

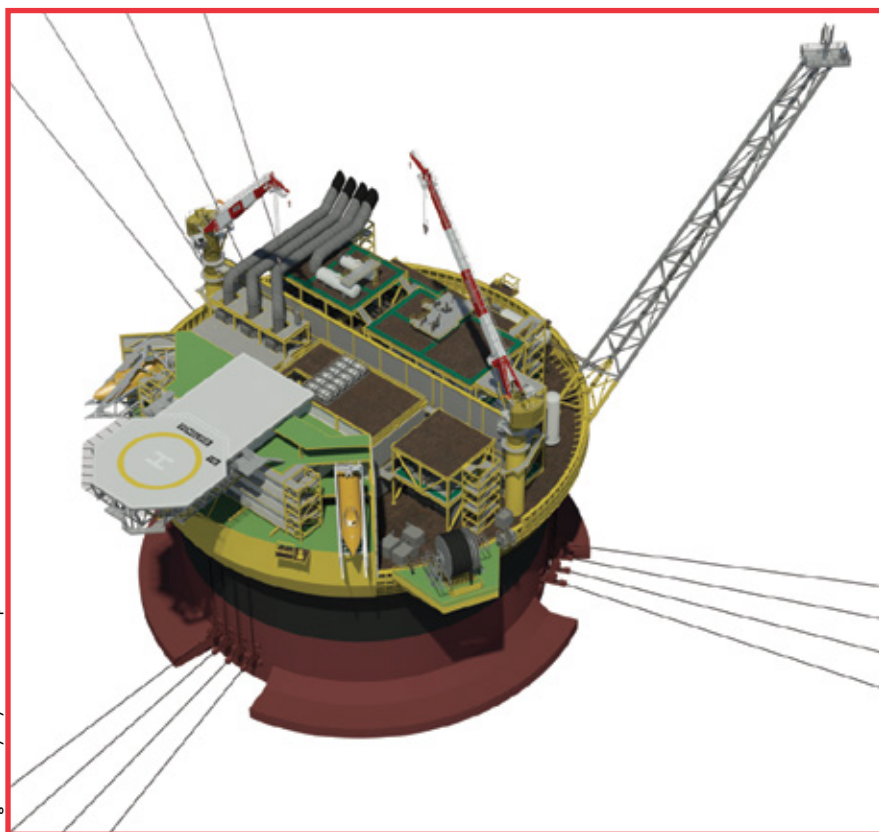


We had to adapt to the ship's deck constantly rocking and moving beneath us. Safety was a number one concern.

deploying a 10-tonne Cone Penetration Test equipment, will be used during the design in a couple of months.

Following the offshore campaign, I have been working hand in hand with both Geotechnical and Structural Design houses to deliver a design of twelve 2.4m diameter and 30m long mooring piles that will keep the FPSO in place. Later on, Shell will offer me an opportunity to see the construction and offshore installation of the vessel, which I am already excited about! In summary, since I've joined Shell, I have been offered opportunities to develop professionally as a Civil Engineer and work in multidisciplinary teams.

I have also been exposed to both technical and commercial parts of projects and managed to travel quite a bit, including remote places such as the middle of the sea. Shell provides you with a lot of responsibility, yet there is support out there, if you need it. If I were to choose whether I would want to work for Shell again, I would definitely say yes!



The Penguins field FPSO

Why are there not more

Last Christmas, Madeleine Hann travelled to Antarctica on a ship with 80 other women as part of the Homeward Bound leadership training program.

Why? Because we need a radical new model of leadership

Q. What's the easiest way to change leadership? A. Include more women.

Women are 70% of the world's poor and are the most affected by climate change. Women leaders are legacy-minded, collaborative and competent, but are chronically under-represented in every part of global decision-making. So why are there so few women in charge?

Intersectionality, influence on interest, competition, the 'leaky pipeline', poverty, bias in peer review, bias in workplace, risky appointments, token advancement, world not designed for you, family, pay-gap, micro-aggressions, unconscious bias, invisible labour, lack of mentoring...

...and the list goes on.

There are so many answers to the question 'Why are there not more women leaders?' some are specific to science subjects but many more are universal.

Bound for Better Leadership

Homeward Bound is an unprecedented initiative, facilitating women in STEM (science, technology, engineering, mathematics and medicine) to take on global leadership and decision-making roles. Through teaching collaborative, constructive, courageous practices and connecting women

to each other, Homeward Bound is changing the faces of our leaders.

Part of the work of Homeward Bound in the past 3 years has been to compile a modest 200 studies of the walls built in front of women in STEM – walls that isolate and impede progress.

Here are 5, perhaps surprising, facts...

The Cold Hard Facts

- 1. Intersectionality builds higher barriers**
Non-white or non-Asian women are even more significantly marginalised. The pay gap also increases with age and even more dramatically for people with a disability. When we consider equality, it needs to be cross-cultural and across all societal sectors.
- 2. Men and women think John is more competent than Jennifer**
Yale researchers used different genders on two identical job applications. Regardless of selectors' gender, most evaluated John as significantly more competent, more hireable and offered Jennifer a 12% lower salary and less mentorship.
- 3. Likeability and competency are needed for success in the workplace. What**

happens when, as a woman, being competent makes you less likeable to men?

People judge women to be less competent than men in 'male' jobs unless they are clearly successful. When a woman is clearly competent in a 'masculine' job, she is considered to be less likeable. Because both likability and competence are needed for success in the workplace, women in STEM fields can find themselves in a double bind.

- 4. Generations of conditioning gives women a tough internal critic**
Girls assess their mathematical ability as lower than boys with equivalent past mathematical achievement. Girls hold themselves to a higher standard in subjects like maths, where boys are considered to excel. Because of this, girls are less likely to believe that they will succeed in a STEM field and are, therefore, less likely to express interest in a STEM career.
- 5. Most women experience sexual harassment – it's a shared reality**
55% of women in senior leadership, 48% of lesbian women, and 45% of women



women leaders in STEMM?

in technical fields report they've been sexually harassed. A common thread connects these groups: research has found that women who do not conform to traditional feminine expectations – in this case, by holding authority, not being heterosexual or working in fields dominated by men – are more often the targets of sexual harassment.

Look Below the Tip of the Iceberg

Creating equality is not just a nice thing to do, or a box to tick. It is integral to creating a sustainable world in which everyone can prosper.

Knowing the key facts is the first step needed. Only by knowing the detail of the inequality can you begin to target specific structural, conscious or unconscious bias.

Women in STEMM: It's not in your head.

You are not alone.

But women cannot change the system alone. Expecting only women to solve these problems means taking away time that they need to do their job, care for others and care for themselves, which only exaggerates the inequality. We need everyone to step up, to improve leadership in science.

Look around you.

What kind of leadership do you want to see?

You can see the full Homeward Bound Gender in STEMM Fact Sheet at:

doi.org/10.26183/5d22d5fbc2349

Find out more about Homeward Bound Projects for women in STEMM at:

homewardboundprojects.com.au



Photo: Kylie Lewis



Photo: Kylie Lewis



Madeleine Hann is a geologist, geographer and advocate for women in STEMM. She is an alumna of Homeward Bound.

During her 4 years studying at the Royal School of Mines (2013-17), Madeleine was heavily involved in sports and Student Union activities. She played 3 Bottle Matches, as keeper for the RSMU Hockey team, and acted as Vice President for Clubs and Societies.

Madeleine is now a Doctoral Researcher in Physical Geography, at the University of Manchester, UK. Her current research examines the impact of past climate change on river systems in the High Atlas Mountains of Morocco.

Investigating Materials used

Kutsi Akcicek was a recipient of an award from RSMA to support a summer project that was relevant to his Materials Science degree. He went to the Ure Museum at the University of Reading, learning more about ancient civilisations by looking at how the use, extraction and trading of materials in the ancient world was influenced by scientific limitations, political tension and economic fluctuations. In this article, Kutsi describes the investigations he undertook on a previously little-studied collection of Spartan votive vases.

I am a keen materials historian, with a passion for looking at how the use, extraction and trading of materials in the ancient world was influenced by scientific limitations, political

tensions and economic fluctuations.

It is rare to find a degree course which has modules in ancient materials and unfortunately my own one falls into that

category. Not wishing to neglect my interests, I thoroughly researched potential internships and discovered the Ure Museum of Greek Archaeology at the University of Reading. It was founded in 1922 by Percy Ure whose collection of Greek vases has grown to become the 4th largest collection in the UK. After speaking to the curator, Professor Amy Smith, I was offered a 5 week internship straight after my exams.

My internship began with general reading to fill the gap in my knowledge about the Classical world. Regular trips to the library and reading books on the history of Ancient Greece and the theory and significance of Greek vases set me on the course to be fully prepared for my internship.

My supervisor had found a collection of seven Spartan votives which had never been studied in detail. These small vases were miniature replicas of the far more expensive and finely decorated Greek vases which we might think off when considering the artefacts.

Votives or miniatures were used by the ancient Spartans to give an offering to the Gods of the time. A small amount of wine, perfume or oil would be placed in the votive and later placed in the sanctuary of the chosen God to honour them.

The small vases measure no more than 4 cms in diameter for the largest one and hence were perfect for chemical analysis. As with any artefact, the desire to carry out non-destructive analysis is strong and there were a number of characterisation methods available at our disposal which would ensure no damage was caused to the vases.

By the second week of my internship, a lab session with the scanning electron microscope (SEM) had been booked to carry out both SEM and Energy-dispersive X-ray spectroscopy (EDX) analysis. All 7 samples were analysed to determine the chemical compositions of both the glaze and the main clay of the vases. The results presented us with a consistent ~50 weight% SiO₂ content and ~20 weight% Al₂O₃ content in the Spartan vases however there was some variation in the MgO, Na₂O P₂O₅ and CaO contents. Determining the reason for this required looking at statistical variation in soil composition both laterally and vertically, and considering the attitudes and practices of the potters, who have been known to reuse and mix unsatisfactory batches



Photos: Kutsi Akcicek

in the Ancient World

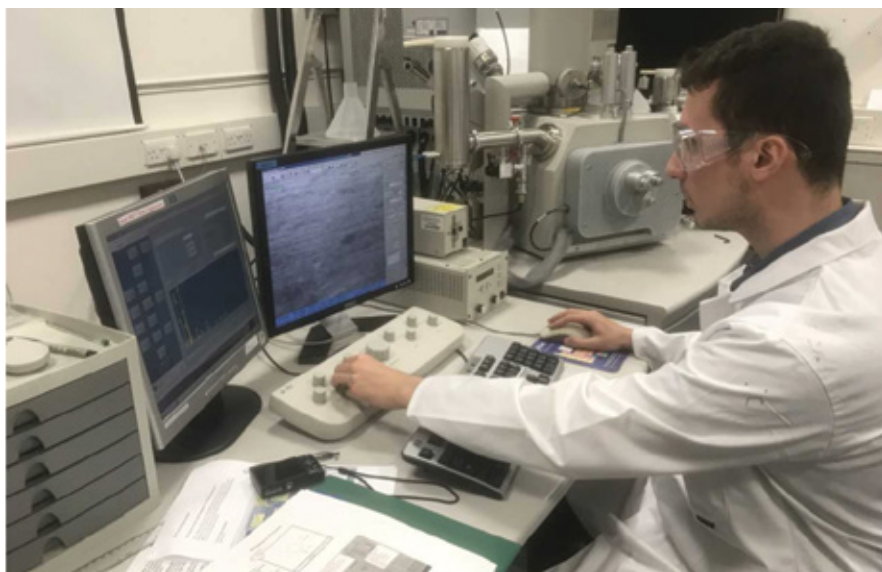


Collection of Spartan votive vases

of clay.

Another problem was that the vases had a variety of colours, suggesting that either different firing techniques had been used, or that the varying composition was responsible. Via SEM, it was determined that all the vases were produced at 800 °C in a reducing atmosphere and hence the variation in minor oxides is considered responsible for the variation in colour.

The final problem we faced after analysis was that EDX could determine how much iron was in the samples but could not determine whether this was in the form of FeO, Fe₂O₃ or any other common oxide. There are of course methods such as X-ray Diffraction (XRD) which could easily do this, but all require a powder. Destructive analysis



of these artefacts is simply not an option for the museum and hence a different approach was required. A non-destructive technique such as IR or Raman spectroscopy could give us a qualitative result but our desire for quantitative results was still not met.

By the final week, the portable X-Ray Fluorescence (pXRF) machine had been booked for further compositional analysis.

One of the main aims of this project was to compare EDX to pXRF, which is a common characterisation method used by archaeologists due to the relative ease of travelling with a portable characterisation method to your

chosen fieldwork destination.

By comparing the two, one was able to see that both techniques do give the same trends and proportions of oxides, however the results from pXRF have a much larger variance which may be down to the larger probe size or due to the use of a portable XRF device which will be less accurate than the full size version.

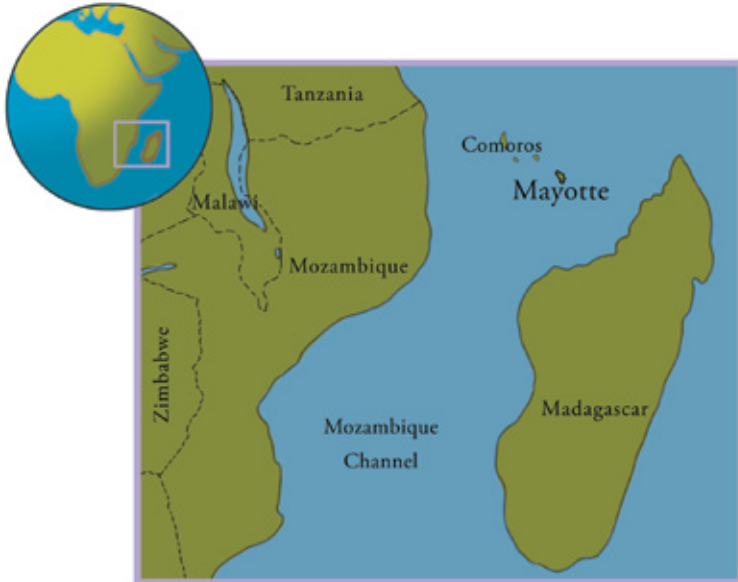
Very little work has been done on Spartan miniatures in scholarship which has given us the rare opportunity of writing a cross discipline Materials Science and Classics article which we hope to publish soon.

Overall, my time in Reading allowed me to discover a world of Materials Science about which I had only read in books up until now and, following this internship, I hope to pursue ancient Materials Science through further education or another internship this coming summer.

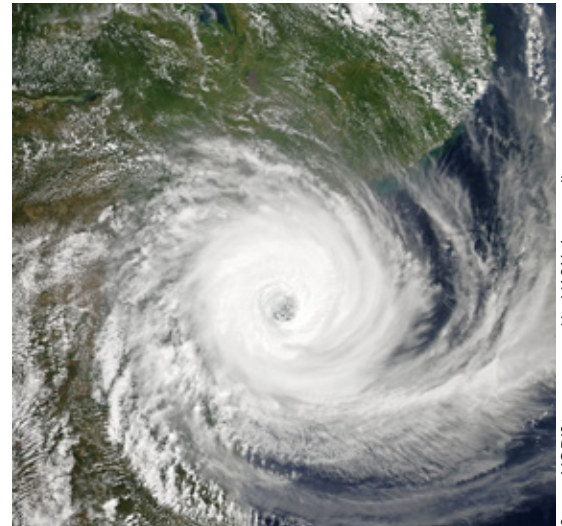
Kutsi Akcicek is a third year Materials with Nuclear Engineering student. His course allows him to view science from a political, economic and environmental perspective while still retaining the strong theoretical aspect which will, one day, make him an engineer. When not in the library writing up lecture notes, he enjoys gaming, cartoons and has recently started getting into polaroid photography, which is a great way to model and document his perpetually expanding collection of colourful vintage shirts.

Climatic impacts of the

Climate has always changed throughout Earth’s geological history. The present study is another investigation of a submarine volcanic eruption causing regional ocean warming as a cause of climate change over and above anthropogenic carbon dioxide, in true scientific tradition.



Map showing the location of Mayotte. The submarine volcano is located to the southeast of the island.



Tropical cyclone Idai

Source: MODIS image captured by NASA's Aqua satellite

Patches of abnormally hot seawater beneath the ocean surface, referred to as Blobs, are naturally generated by submarine volcanic eruptions. A recent example is the North Pacific Blob¹ which caused weird weather conditions accompanied by major ecological changes in the Pacific northeast including two years without winters in 2013 and 2014². This was featured as a ‘heat wave’ in the September 2016 issue of National Geographic and was used to support the anthropogenic global warming alarm. However, based on the study of available information including satellite and ARGO data buoy records, the release of geothermal heat from the Nishinoshima volcanic eruption 940 km south of Tokyo³ from March 2013 to August 2015 was identified by the present author instead to be the likely culprit^{4,5}.

This study examines the climatic impacts of another Blob, created by a new submarine volcanic eruption on the floor of southwest Indian Ocean, off Mayotte in the Comoros.

Subsequent ocean circulation changes led to the development of an exceptionally strong positive phase of the Indian Ocean Dipole (IOD)⁶. Regional climatic impacts in the southwest Indian Ocean included torrential rainfall and the establishment of a new record of 10 intense tropical cyclones during the 2018-2019 season. In the east of the Indian Ocean, the corresponding cooling of sea-surface waters gave rise to severe drought conditions in the land areas of Indonesia and

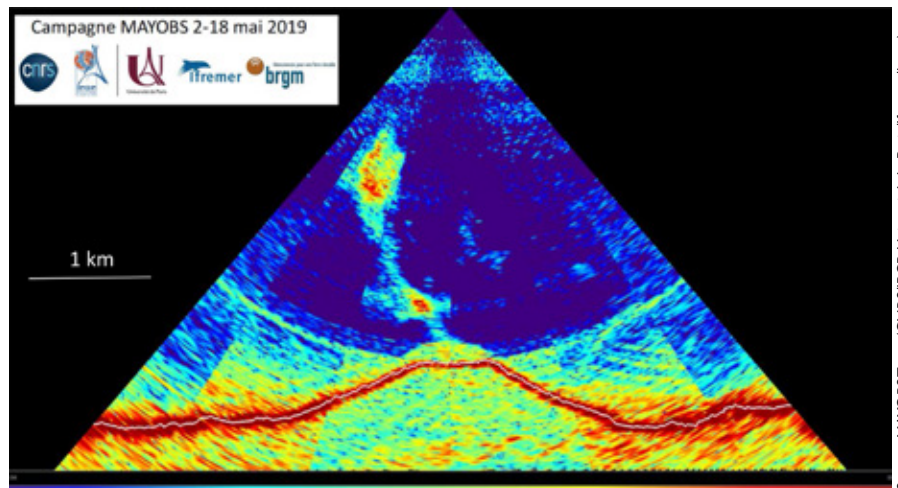
Australia.

Marc Chaussidon, director of the Institute of Geophysics, in Paris, was responsible for the discovery of the new as yet unnamed submarine volcano off the southeast coast of Mayotte⁷. Through looking at seafloor maps and a recently concluded mission, Chaussidon identified a new submarine volcano 800 meters high and 5 kilometers across, rising above the ocean floor in 6 months since November 2018 between Africa and Madagascar.

Multibeam sonar mapping of the sea floor indicated as much as 5 cubic kilometers

of magma had erupted onto the seafloor. Based on the Volcanic Explosivity Index measurement scale for terrestrial eruption, the scale is 5, which is moderately strong. The sonar was able to detect plumes of gas-rich water rising from the flanks and central part of the volcano.

An examination of NOAA satellite sea-surface anomalies map archives has revealed that this Blob was already well developed in early December 2018, the beginning of the southern hemisphere summer. This hot seawater was responsible for setting the new



Multibeam sonar waves, reflecting off the sea floor southeast Mayotte, showing an 800-m-tall volcano (red profile), with a 5 km diameter and a rising gas-rich plume

Source: MAYOBS Team (CNRS/IFREMER-Université de Paris/IFREMER/BRGM)

SW Indian Ocean Blob

record of 10 intense tropical cyclones during the 2018-2019 season. Of the 10 cyclones, the most severe was intense tropical cyclone Idai. The total cost of damage caused by Idai was estimated to exceed US\$2 billion and the minimum death toll given as 1007, many

bodies not having been recovered. Storm surge flooding was the worst on record with the destruction of numerous homes.

In late May, 2019, as a result of an extremely dry summer, Sydney Water, Australia announced the enforcement of

water restrictions throughout the greater Sydney area. As of May 29, 2019, Greater Sydney water supply levels are 53.4%, which is significantly lower than in May 2018, during which supply levels were 73% in major catchments. These water restrictions began on June 1, 2019.

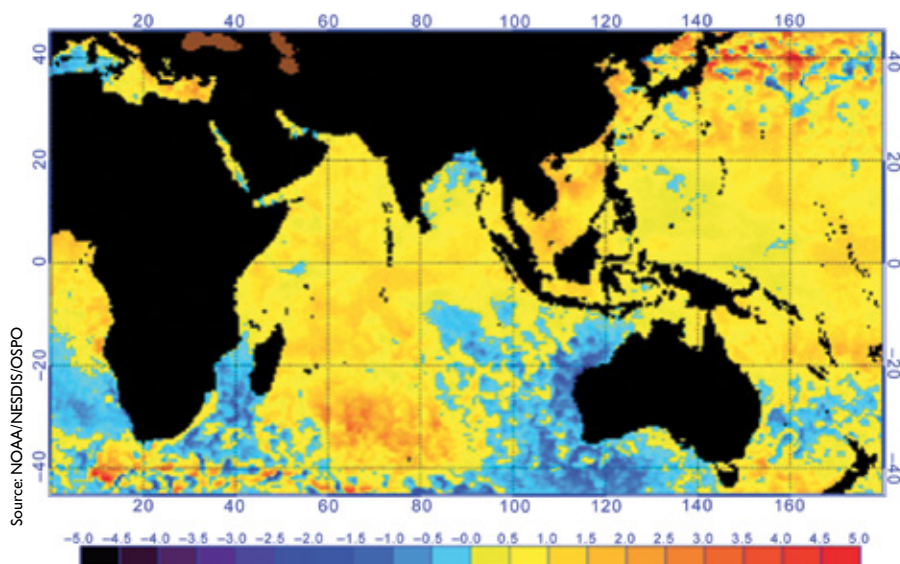
In conclusion, severe weather events including tropical cyclones, droughts and floods may be caused by blobs formed by the natural release of geothermal heat through submarine volcanic eruptions acting, in combination with the sun, to warm the surface waters of regional oceans. The warming in the west Indian Ocean was responsible for the development of an exceptionally strong positive phase of the Indian Ocean Dipole. The warm sea-surface water was responsible for oceanic and atmospheric circulation changes regionally which cannot be accounted for by carbon dioxide variations.

The release of geothermal heat into oceans is currently underestimated by the scientific community and may represent a significant proportion of the missing heat in oceans proposed to explain the post-1998 pause in global temperature rise.

Name	Date	Wind speed km/hr	Pressure hPa	Countries affected	Damage&Death toll
Alcide	5-12 Nov	165	965	Agaléga, Madagascar, Tanzania	-
Kenanga	16-22 Dec	185	942	-	-
Cilida	16-24 Dec	215	940	Mauritius	Minimal
Funani	3-10 Feb	195	940	Rodrigues	Minimal
Gelena	4-14 Mar	205	942	Madagascar, Mauritius, Rodrigues	US\$ 1 million
Haleh	28 Feb - 7 Mar	175	945	-	-
Idai	14-16 Mar	195	940	Mozambique, Malawi, Madagascar, Zimbabwe	≥ US\$ 2 billion & 1007
Savannah	17-19 Mar	165	962	-	-
Joanina	18-30 Mar	185	939	Rodrigues	-
Kenneth	21-29 Mar	215	934	Seychelles, Madagascar, Comoros, Mozambique, Tanzania, Malawi	≥ US\$ 100 million & 52

Summary table of the 10 intense tropical cyclones during the record breaking 2018-19 season in southwest Indian Ocean⁸

NOAA/NESDIS SST Anomaly (degrees C), 12/3/2018



Sea surface temperature anomalies showing the development of a hot Blob southeast of Madagascar, on 3 December, 2018

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8. <http://bit.ly/IE31-Cyclones>



Professor Wyss Yim DSc PhD DIC FGS was at Imperial College, in the Department of Geology, from 1971-1974. After that, he spent thirty-five 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.

RED Project

The RED (Rural Education Development) Summer Expedition is an annual summer construction project organised by members of Imperial's RED Project Borneo. The OC Trust is one of the sponsors of the project. 2018's summer expedition was held in Sabah, Malaysia for 5 weeks, where volunteers built an education centre for the villagers of Kampung Kuala Punteh, Keningau. The volunteers had a great experience learning construction methods and contributing to a marginalised community in Borneo, and the villagers were grateful for the volunteers' contribution towards the village. This article is derived from the report by the student volunteers.

Background

RED Project Borneo is a student-led project started in 2015, with the aim of establishing sustainable rural education development within marginalised communities of Borneo. Founded in the Department of Civil and Environmental Engineering at Imperial, RED's primary focus is to develop educational infrastructure for the rural communities. With a strong aspiration to integrate engineering and education into projects, RED collaborate closely with a local project partner, Life Empowerment Berhad (LEB), to realise educational development in Borneo.

RED's programme provides a platform for Imperial students to develop transferable skills and gain practical experience. During the academic term, students participate in college-wide fundraising and devise strategies for project development. Over the summer, students volunteer in Borneo to build an education centre for the underprivileged.

Our mission

From initiation to completion of the project, all activities were established to align with RED's mission to:

Focus on Educational Infrastructure

RED members design and construct schools, community centres and other educational facilities to develop skills within marginalised communities in Borneo.

Promote Exchange of Knowledge

Projects are carried out with the assistance of local builders in the village to bring about an exchange of knowledge. Through this, the locals will learn safer and more efficient construction techniques. Their experience in construction, knowledge of buildability and practical construction techniques will also allow us to improve our design for future projects and allow volunteers to gain technical skills. Apart from participating in construction, student volunteers assume teaching roles in bi-weekly tutoring sessions for the villagers during our summer expedition.

Enhance the Student Experience

Students are provided with the opportunity to apply their engineering skills and gain hands-on experience during the design, planning and construction process. This allows them to consolidate their engineering

knowledge acquired at Imperial as well as hone their transferable skills and problem-solving techniques. Living in the villages during the course of the projects also allows volunteers to explore the local culture when interacting with the local communities. This enriches their volunteering experience and promotes global citizenship within the university.

Ensure Sustainability

Strategies are devised to ensure all projects embody the three pillars of sustainability: Social, Economic, Environmental.

Social

RED's partnership with LEB ensures that the members' efforts are able to impact the lives of the local communities in meaningful ways. LEB identify suitable project beneficiaries, provide us with technical support and assist in logistics and procurement. Additionally, LEB assure the longevity of the project by providing support to the educators to receive proper training to teach at the villages post project completion.

Working together with the villagers promotes educational equity that is integral to sustainable development. The local villagers employed in each of RED's projects are heavily involved in the project both before and during construction, giving them ownership of the project, and ensuring that the buildings are well used and well maintained after handover.

Economic

A large effort is made to guarantee an efficient, affordable and replicable design. Construction material and equipment are sourced locally to ensure the project contributes to the local economy. This also shortens the supply chain, reduces delivery times and saves logistical costs.

Environmental

Green technologies such as solar energy systems and rainwater harvesting systems are incorporated into the design to educate the locals on harnessing resources that are affordable and abundant in Borneo.

Improve Safety

Structures in rural villages of Borneo are typically traditional timber structures built following no fixed guidelines. RED aims to introduce safe building practices, implementing building designs compliant with the Eurocode standards. This ensures that the structure functions throughout its design life within a serviceable state. Structures are designed to suit the tropical

Milestones

2015 Feasibility Study Kampung Indrasan, Kudat

RED's founders, Edrea, Chloe and Jack, conducted a 3-week feasibility study at Kampung Indrasan, Sabah. The study was done by assessing the region's climate, geological conditions and availability of locally- and sustainably- sourced construction materials.

2016 Pilot Project Kampung Gaur, Ranau

RED launched its pilot project with fourteen Imperial students who completed a 6 m x 9 m education centre equipped with a rainwater harvesting tank within 6 weeks.

2017 Project Kampung Palipikan, Kota Marudu

Following the success of the pilot project, the 2017 team replicated the design of the first building and incorporated a simple off-grid solar panel system for electricity supply.

2018 Project Kampung Kuala Punteh, Keningau

Drawing from two valuable experiences, the 2018 team had the chance to explore and improve on the building design and construction efficiency.

Borneo, 2018

climate. Building processes are simplified to minimise inherent construction hazards, thus creating a safer environment for volunteers and local builders to learn and apply their engineering skills.

2018 Project Preparation

During term-time, the RED team focused on organising college-wide events and meetings to raise funds and gain publicity. This year, RED members dedicated their time and effort to prepare Christmas crafts for sale during the Christmas fundraising event.

On top of overseeing publicity and fundraising, the expedition organising committee invested time to plan for the 2018 summer expedition. The organising committee liaised with LEB to identify a suitable beneficiary for this summer's project. LEB also assisted in making logistical arrangements for the expedition. Time was also devoted to financial planning and to making improvements on several aspects of the summer expedition programme, based on past experiences and feedback collected from previous volunteers.

Thorough feasibility studies were also conducted on green technologies and other possible areas that can be incorporated into the summer expedition programme. This included studies on off-grid water filtration systems and solar panels.

Design improvements were made to further increase the constructability and efficiency of the building process. This included replacing methods which required welding to reduce the risk of arc-eye amongst onlookers. This was especially important as the site was located next to a kindergarten.

Method statements were prepared for all critical construction activities. Previous committees communicated construction methods verbally, which proved problematic as project managers were forced to innovate methods on-the-fly whilst they were on site.



This year, method statements were prepared beforehand and improved upon during the expedition. These documents would serve as vital supporting material for incoming committees who will be organising and coordinating future expeditions.

Prior to the expedition, a pre-departure briefing was held to communicate crucial information, and impart basic knowledge on construction and handling tools to the volunteers.

Summer project

This year, a total of twenty-one volunteers travelled to Sabah, Malaysia for five weeks to construct a kindergarten in Kampung Kuala Punteh. The village consists of a peaceful community of 400 people of the Lundayeh tribe. The majority of the villagers are farmers, oil palm estate workers and rubber tappers whose monthly household incomes are well below the regional mean (Department of Statistics Malaysia, 2014).

The Kampung (village) is located in the

sub-region of Sook, approximately 30 minutes drive through palm oil estates from the town centre, Keningau. According to the villagers, the main road leading to the Kampung from the town centre was built in 2013, which significantly improved the travel conditions; from 1 hour through cobble-mud roads to 30 minutes through asphalt roads. With the recent development of infrastructure, education became more accessible to the younger demographic of the village. Despite this opportunity, the school dropout rate in the village was high due to the lack of early childhood education and proper guidance.

Recognising the severity of the problem, the Head of Kampung Kuala Punteh appointed a committee of local leaders to improve the education standards within the community. In July 2015, the committee set up a community kindergarten to provide early childhood education to their preschool children, before entering Primary school at another village in Kampung Membulu. Kindergarten classes were conducted in the community church



Phase 1 volunteers



Phase 2 volunteers

FEATURES



View of the initial site, during the reconnaissance and walkover survey

building and an expansion was now needed to meet the growing number of students in the village. With the help of LEB, RED stepped in to construct an education centre which provides a conducive learning environment for the children in the community.

The Structure

The education centre is a 6 m x 9 m single-storey building. It is a steel structure supported by concrete footings. The walls are framed partitions, constructed from stainless steel frames, clad with cement fibre boards externally and gypsum boards internally. A standard steel roof truss system, with corrugated zinc roofing sheets and fibreglass insulation, sits on the steel tie beams which are supported by the steel columns.

The education centre consists of three rooms: a classroom, an office for the teachers, and a kitchen. The design of this structure has been replicated from previous projects with a few minor adjustments. It was designed by Imperial College students with the help of a local contractor.

Solar Panels for Electricity Supply

Last year's effort to promote the use of solar panels for electricity supply proved successful in Kampung Palipikan. After conducting further research with the help of a local contractor, improvements were made to the original design.

Firstly, a full sine-wave inverter has been incorporated into the design to convert direct current (DC) electricity into alternating current (AC). This ensures that the electrical system installed is more feasible as conventional AC appliances can be used in this system.

A distribution board (DB) equipped with circuit breakers which comply with the local safety standards has also been introduced into the design.

Rainwater Harvesting Tank

Throughout term-time, the RED committee looked into incorporating a drinking water filtration system to the current design. This is because rural villages in Sabah are typically not connected to a water distribution network. Villagers usually boil unfiltered rainwater for drinking. However, due to lack of resources and lack of contacts with the appropriate suppliers, a water filtration system could not

be incorporated into the design.

Site Reconnaissance & Walkover

A few days before the project commenced, a site recce was conducted by Sher Lynn, Xinjin and Yan Kai to survey the ground conditions and to decide on the building orientation. This was a crucial step in identifying the required design and construction adaptations specific to this project. An unforeseen circumstance was encountered as the site sits on an existing concrete slab of unknown thickness and condition. To overcome the problem, a thorough visual inspection was carried out to ensure that there were no visible cracks or signs of settlement within the boundaries of the site.

A discussion was also held with the builders in the village to understand the make up of the existing concrete slab and to decide on the ideal building orientation. According to the local builders, the existing concrete slab is approximately 30 mm thick with BRC reinforcement.

Amendments to Design & Construction Planning

Following the site reconnaissance and walkover survey, a local contractor from LEB was consulted to make several adaptations to the design to suit the site conditions.

As the existing concrete slab was not exceedingly thick, extensive plant was not required for footing excavation. Reinforcement was placed at the bottom of the newly cast slab to account for the uncertainty surrounding the position of the reinforcement in the existing slab. Additionally, the thickness of the new slab was reduced. The building orientation was also decided based on the potential for building expansion and for the teachers to conduct outdoor activities as part of the kindergarten curriculum. The location of the office and kitchen within the building was also finalised based on the available space for the rainwater harvesting tank.

Setting Out & Foundation Excavation

Prior to the volunteers' arrival, the local builders marked the site boundaries with wooden planks and excavated the foundations accordingly. The wooden planks were recycled planks used from past builds in the village. This eliminated the need to purchase wooden formwork.

Setting out was carried out by marking the

positions of the columns and footings on the boundary planks using nails. A grid was then formed by tying strings to the nails.

Erection of Columns & Casting of Footings

Drawing on their vast experience, the local foremen suggested an innovative temporary works design for the steel column erection. This involved using recycled wooden planks to form supporting props for the columns before concreting the footings. The columns were positioned according to the grid formed during the setting out phase. The tops of the columns were aligned by adjusting the amount of gravel in the footing holes.

Once the columns were positioned, the footing holes were concreted to fix the columns in place. Each footing was only filled up to three quarters of the footing volume to ensure that shear keys would form when the main slab was cast.

Casting of Concrete & Floor Slab

From the footing excavations, the condition of the existing floor slab was examined. Through inspection, it was concluded that additional reinforcement would be required to cast a new floor slab as the BRC in the existing slab was not positioned within the thickness of the slab.

To ensure the new slab bonded well, the existing slab was roughened before reinforcement was laid. The BRC was tied to concrete nails hammered to the existing slab.

Recycled timber and wooden planks were used to assemble the temporary works required for the casting of the slab. Polythene sheets were used at the edges of the new slab for water-proofing. After the concrete was poured and left to cure, a layer of mortar was added to ensure a smooth and level finish.

Fastening of Tie Beams & Roof Construction

The process of fastening the tie beams to the columns and the process of roof construction were severely hindered as welding was required.

Following a risk assessment, welding the tie beams to the columns was deemed unsuitable because of the danger associated with welding at height, without appropriate Personal Protective Equipment (PPE) and next to a children's facility. Drill bits, bolts and nuts of the appropriate sizes were then purchased to fasten the tie beams to the columns, in place of welding.

Subsequently, the roof trusses, which were assembled as the columns were erected, were installed onto the tie beams. Purlins were then fastened onto the roof trusses. Following that, corrugated zinc roofing sheets were installed with fibre-glass insulation and aluminium reflectors. The fascia and gutters were then put in place, completing the roof.

This entire process was originally scheduled to be completed within three weeks. However, severe delays were caused by unprecedented power cuts, which often lasted between an hour and a full day, during which the corded electric drill, which was critical for all activities, could not be used.

This posed a significant challenge. However,

with hard work and efficient planning, the roof construction was completed by the end of Week 4.

Casting of Outer Slab

As the building was built on an existing concrete slab, casting an outer skirting slab was not necessary. However, a 500 mm wide outer slab was added to the front of the building to add an aesthetic finish. This was cast shortly after the main floor slab was cast.

Installation of Wall Frames & Wall Panels

Once the finishing mortar layer hardened, wall frames were assembled and installed using concrete nails and rivets. Cement fibre boards were secured externally and in the kitchen. Gypsum boards were then fastened using screws.

Once again, this process was delayed due to the power cuts. To ensure the wall panels were completed according to schedule, additional work hours were added on days with stable electricity supply.

Finishings

Upon securing the wall panels, the walls were plastered to ensure a smooth and seamless finish. The joints between wall panels, as well as imperfections, were covered. A layer of paint primer was then applied followed by two layers of paint. Mural pieces were also painted onto the external walls.

Installation of Ceiling Panels

The ceiling panels were installed as the plastering and painting processes were ongoing. Metal frames which house the ceiling panels were suspended from the battens using tie wires and also secured to the walls.

Electricity Supply

Once the ceiling panels were in place, wiring and electrical appliances were installed. In light of the unreliable power supply, all electrical appliances and sockets in the building will be powered by the solar energy system.

Water Supply

A rainwater harvesting system – fed by rainwater channelled from the roof – was installed. The standard rainwater harvesting tank, available locally, was placed on a

concrete slab which was cast at the corner of the building according to the diameter of the tank.

Working with Local Workers

Two skilled workers from the village were hired to assist with the construction of the education centre. Rores, who is the head of the education committee, also assisted in planning and managing logistics as well as tools and material procurement.

Throughout the construction process, the foremen and RED members engaged in a continuous and open exchange of knowledge. The foremen, having worked in a village setting with limited access to power tools and plant, have traditional construction techniques suited for small scale construction. Their insight into these techniques have, in particular, facilitated the smooth progress of setting out, column erection and concreting. The unexpected presence of an existing slab on site required the project coordinators to adjust methods used during previous RED expeditions – input from the foremen was vital in ensuring that the proposed solutions were viable.

From this experience, the foremen have picked up knowledge on simple Eurocode compliant designs. They have also learnt new construction techniques which are safer and more efficient using lightweight and modular construction materials.

Tutoring sessions

Tutoring sessions for children and teenagers were held twice a week in the village church. A trial session was run during the second week of the expedition to assess the English language competency of the students. In the weeks following, classes were conducted by grouping the students according to their ages. RED volunteers were assigned, in pairs or threes, to conduct lessons for each group.

Pre-schoolers and kindergarteners were taught basic spelling and common words using games and flashcards. Younger students were taught based on existing school material using interactive quizzes, games and Q&A sessions. Older students preparing for public examinations were given extra guidance on chosen subjects by the Malaysian volunteers.

The main goal from these tutoring lessons

was to cultivate the interest of the local children and teenagers in the English language.

Student experience

Engineering Development

The nature of the works undertaken in this project enabled students to apply their engineering knowledge gained from university. It was also the perfect opportunity for them to learn various local construction methods to carry out precise work with traditional equipment. Student volunteers have also learnt construction management for small-scale projects from this experience.

Soft Skills

Volunteers were also able to enhance various soft skills such as team work, communication and problem-solving skills. On top of that, volunteers experienced working and making decisions under pressure. From the opportunity to lead tutoring sessions to construction sub-groups, volunteers also developed their leadership skills.

Cultural Exchange

Throughout the weekdays, volunteers lived in a traditional wooden house in the village. This allowed students to be immersed in the community's way of life. This also greatly encouraged interactions between the villagers and the student volunteers. Although the villagers only spoke Malay or the local 'Lundayeh' dialect, the non-Malaysian students were still able to communicate with both the children and adults through games or with the help of the Malaysian student volunteers. Interactions with the local villagers were also hugely encouraged by the tutoring sessions run twice a week by the RED volunteers.

The villagers were very happy to show us the surroundings of Kampung Kuala Punteh. They organised afternoon trips to the river to experience the natural beauty of the Interior Division of Sabah.

Weekend travels to Kota Kinabalu (the State Capital of Sabah), Kudasang and Keningau were also organised, to give volunteers the opportunity to discover and learn about the wonders of Northern Borneo.



Side view of finished building



Front view of finished building

BBOXX gains \$50M investment from Mitsubishi

In Imperial ENGINEER, we have previously featured BBOXX, the company founded in 2010 by three alumni from the Electrical and Electronic Engineering department, as a result of a student charity they set up while at Imperial which identified the need for off-grid solar power solutions in the developing world.

Their solution is to provide a battery box which connects to a mini solar panel, providing power to an ultra-efficient lighting strip and power socket. Users pay a small fee over two years, to cover the cost of the equipment, after which it is theirs to keep, providing them with electricity for free. Almost 300,000

systems have been installed, mostly in Nigeria, Rwanda and Togo.

They recently announced a \$50M investment from Mitsubishi which will help BBOXX to reach more people lacking reliable access to modern utilities and expand its global footprint. Chief executive and co-founder Mansoor Hamayun said: "The funding is further evidence of Japanese interest in Africa and in pay-as-you-go solar energy globally. We look forward to this next phase of growth that will help us to transform more lives, unlock potential and grow our already global footprint by opening up new markets, and develop our product range."

**Engineering and a second language
... the economic argument.**

Another snippet of advice wrapped up in a story from his career, by the RSMA's very own correspondent under the pseudonym John Simpson,

Engineers are rarely linguists. Language is outside the specification of most university engineering and science courses, but this must change, for economic reasons. English is the *lingua franca* of international engineering and science but a working competence in a major second language looks good on a CV.

I am a native English speaker. At school I learned French to O level; later in life I gained a working knowledge of Spanish (Catalan/Latin American style). My first Spanish teacher was a Catalan, from whom I rented a flat for several months on the Costa Brava. I was employed in South America by the UNDP in the late 1960s and worked in and around Central and Latin America for a decade in between 1976 and 1986. For a few years after this I kept my Spanish alive by teaching adults. French I have barely used except on occasional trips to Belgium and France.

The number of primary Spanish speakers in the world far outnumbers the native speakers of French, German or Italian. It is the second language of the USA and so makes a strong argument for a good second language. For historical reasons, there is a large oversupply in the UK of teachers of the three main European languages as mentioned above. This distorts the national language capability. Mandarin is currently being heavily promoted in view of the growing importance of the Chinese

economy, but it is very difficult to learn for those of us from Europe. Will there be many jobs or contract opportunities for those who learn Mandarin? We shall see!

The BBC published a paperback book in 1991 on languages called "Lingo: How to Learn a Language" by Terry Doyle and Paul Meara. For anybody who is considering learning a foreign language it is a 'must read'. It is out of print but can be bought second-hand via Amazon and all the usual places. It lists all the main foreign languages and rates them via a number of criteria, including ease of learning. Spanish is rated one of the easiest; there is a theme here...

There are very strong career arguments for promoting another language, since our medium/long term economic (and engineering/science) interests are drifting away from traditional, English-speaking countries. Our future clients and employers are more likely to be global in nature and a combination of English and a second language becomes a very real asset.

For those of us in the UK the teaching of languages has been a bit hit and miss; and all too often we start the learning of a new language far too late in a child's education. This means we need to get on with it when we are older which also has its own pitfalls. None the less, there is a strong case to do it, so give it a go. It has worked for me.

John Simpson

Alumni
We want your news
(see page 2 for contact details)

Alumni Weekend 2019



Photos: Peter Buck

This year's Alumni Weekend was held at the end of June alongside the Imperial Festival, which was itself part of a wider event *The Great Exhibition Road Festival* involving many of the institutions based in Exhibition Road.

As usual, Alumni were welcomed in the SCR with refreshments and space to relax, meet up and chat. Alumni were able to sign-up for alumni-specific events (such as tunnel tours and a guided walk up the Queen's Tower). We also had the opportunity to preview the various research projects from

around Imperial that were being demonstrated in the Festival, before the public were allowed in. Many departments were hosting their own events to welcome back alumni to visit and meet their professors to reminisce.

There were various information stands in the SCR, including an Engineering Alumni stand manned throughout Saturday by students and alumni from CGCU and CGCA including the guest appearance of Spanner. We had many interesting conversations with alumni of all ages.



Volunteers such as Alumni Charles Parry and Peter Lynch manned the Engineering Alumni stand on the Saturday



We were even entrusted with Spanner (modelled here by current CGCU President Thomas Cross and Past President Milia Hasbani)

DIARY

Fri, 25 Oct, 12:00**RSMA Toronto, Canada**

Informal RSM meeting, noon, Last Friday of every month.
Jason George Pub, 100 Front Street East, Toronto

Tue, 29 Oct, 19:00**Friends of Imperial**

Drugs, booze and politics: finding a balance
A talk by Professor David Nutt

Sir Alexander Fleming building, South Ken. Campus
Tickets from <http://bit.ly/IE31-FOI-Drugs>

Wed, 30 Oct, 17:30-20:00**Energy Futures Lab SGI Annual Lecture**

Practical Action for a lower carbon footprint
Dr Pratima Rangarajan, CEO of Oil and Gas Climate Initiative Climate Investments
Clare Lecture Theatre, South Ken. Campus
Register at <http://bit.ly/IE31-SGI-Rangarajan>

Wed, 30 Oct, 17:30-18:30**Data Science Institute Distinguished Lecture**

Socially Responsible AI
Dame Wendy Hall DBE, FRSE, FREng
G34 Sir Alexander Fleming building, South Ken. Campus
Register at <http://bit.ly/IE31-DSI-Hall>

Thu, 31 Oct, 18:00-20:30**Alumni social in Rotterdam**

Pillars Bar & Kitchen, Marriott Rotterdam Weena 686,
3012 Rotterdam, Netherlands
Tickets from <http://bit.ly/IE31-Rotterdam>

Fri, 1 Nov, 17:30 – 21:30**RSMA Perth, Australia***Monthly Sundowner*

The Celtic Club, 48 Ord St, West Perth, WA, 6005
Alan Dickson – alan@dickson.com.au
John Sykes – johnpsykes@gmail.com

Mon, 4 Nov, 18:00-19:00**Consort Club lecture**

What can we learn from fake news?: Existential Imperatives for Engaging the Differently Informed
Mark Kennedy, Associate Professor, Strategy & Organisations, Business School
Read Lecture Theatre, Level 5 Sherfield Building, South Ken. Campus
Register at <http://bit.ly/IE31-FakeNews>

Wed, 6 Nov, 18:00-20:30**Imperial Enterprise Lab***WE Innovate Future Forecast*

Discover the latest tech trends with leading tech journalist Gemma Milne, and hear from Imperial women at the forefront of innovation:
Letizia Gionfrida, Founder of Arthronica, and Zainab Ahmed and Pashiini Supramaniam, Co-Founders of QuickCount.
Great Hall, Sherfield Building, South Ken. Campus
Register at <http://bit.ly/IE31-VVE-Future>

Wed, 6 Nov, 18:30 - 21:30**Imperial College Business School***Marketing Professional Interest Network*

A conversation about the importance of Marketing Personalisation, its challenges and applications
Andreas Eisingerich will chair the panel and he will be joined by Silje Opstrup - Head of Digital, Connections and Content, Pernod Ricard UK, Carlo Frem, Marketing Lead, Prime Video (Amazon)
Imperial College Business School, South Ken. Campus
Tickets from <http://bit.ly/IE31-ICBS-Marketing>

Wed, 13 Nov, 17:30-18:30**ISST, 10th Vincent Briscoe Security Lecture***Computers and spies: the rise of technology and death of secrets*

Gordon Corera, BBC Security Correspondent
G16, Sir Alexander Fleming Building, South Ken. Campus
Register at <http://bit.ly/IE31-Spies>

Thu, 14 Nov**Ring of the Alexandra Peal of bells in Queen's Tower**

Alexandra Peal of bells in Queen's Tower rung to celebrate the birthday of HRH The Prince of Wales

Tue, 19 Nov, 19:00**Friends of Imperial***Chirality and the future of electronics*

Dr Jess Wade BEM, Imperial physicist
Sir Alexander Fleming building, South Ken. Campus
Tickets from <http://bit.ly/IE31-FOI-Chirality>

Wed, 20 Nov, 12:30 – 14:30**Imperial Engineering Alumni***Quarterly Johannesburg Lunch*

Baron & Quail, Woodmead, Johannesburg, South Africa
Contact Richard Gundersen – Gundersen@yabo.co.za

Wed, 20 Nov**Ring of the Alexandra Peal of bells in Queen's Tower**

Alexandra Peal of bells in Queen's Tower rung to celebrate the wedding anniversary of HM Queen Elizabeth II and HRH The Duke of Edinburgh

Wed, 20 Nov, 17:30-18:30**Department of Computing***Can knowledge-based AI aid human-machine collaboration?*

Professor Alessandra Russo Inaugural Lecture
G16, Sir Alexander Fleming Building, South Ken. Campus
Register at <http://bit.ly/IE31-Russo>

Fri, 22 Nov, 12:00**RSMA Toronto, Canada**

Informal RSM meeting, noon, Last Friday of every month.
Jason George Pub, 100 Front Street East, Toronto

Fri, 22 Nov**RSMA 135th Annual Dinner**

Rembrandt Hotel, Knightsbridge
See booking form included with this issue, for details.

Sat, 30 Nov, 12:30 for 13:00**CGCA '5&10' Reunion Luncheon**

Polish Hearth Club, 55 Princes Gate, Exhibition Road,
South Kensington SW7 2PN
Tickets from <https://www.cgca.org.uk/reunion>

Thu, 5 Dec, 19:00**Friends of Imperial***Plastic fantastic: solving plastic waste*

Adrian Griffiths, CEO of Recycling Technologies
Sir Alexander Fleming building, South Ken. Campus
Tickets from <http://bit.ly/IE31-FOI-Plastic>

Fri, 6 Dec, 17:30 – 21:30**RSMA Perth, Australia***Monthly Sundowner*

The Celtic Club, 48 Ord St, West Perth, WA, 6005
Alan Dickson – alan@dickson.com.au
John Sykes – johnpsykes@gmail.com

Fri, 27 Dec, 12:00**RSMA Toronto, Canada**

Informal RSM meeting, noon, Last Friday of every month.
Jason George Pub, 100 Front Street East, Toronto

Fri, 3 Jan, 17:30 – 21:30**RSMA Perth, Australia***Monthly Sundowner*

The Celtic Club, 48 Ord St, West Perth, WA, 6005
Alan Dickson – alan@dickson.com.au
John Sykes – johnpsykes@gmail.com

Fri, 24 Jan, 12:00**RSMA Toronto, Canada**

Informal RSM meeting, noon, Last Friday of every month.
Jason George Pub, 100 Front Street East, Toronto

Thu, 6 Feb**Ring of the Alexandra Peal of bells in Queen's Tower**

Alexandra Peal of bells in Queen's Tower rung to celebrate the accession of HM Queen Elizabeth II

Fri, 7 Feb, 17:30 – 21:30**RSMA Perth, Australia***Monthly Sundowner*

The Celtic Club, 48 Ord St, West Perth, WA, 6005
Alan Dickson – alan@dickson.com.au
John Sykes – johnpsykes@gmail.com

Wed, 19 Feb, 12:30 – 14:30**Imperial Engineering Alumni***Quarterly Johannesburg Lunch*

Baron & Quail, Woodmead, Johannesburg, South Africa
Contact Richard Gundersen – Gundersen@yabo.co.za

Fri, 28 Feb, 12:00**RSMA Toronto, Canada**

Informal RSM meeting, noon, Last Friday of every month.
Jason George Pub, 100 Front Street East, Toronto

Fri, 28 Feb, 18:30-23:00**CGCA Annual Dinner**

Stationers' Hall

See booking form included with this issue

Fri, 6 Mar, 17:30 – 21:30**RSMA Perth, Australia***Monthly Sundowner*

The Celtic Club, 48 Ord St, West Perth, WA, 6005
Alan Dickson – alan@dickson.com.au
John Sykes – johnpsykes@gmail.com

Fri, 27 Mar, 12:00**RSMA Toronto, Canada**

Informal RSM meeting, noon, Last Friday of every month.
Jason George Pub, 100 Front Street East, Toronto

Fri, 3 Apr, 17:30 – 21:30**RSMA Perth, Australia***Monthly Sundowner*

The Celtic Club, 48 Ord St, West Perth, WA, 6005
Alan Dickson – alan@dickson.com.au
John Sykes – johnpsykes@gmail.com

Tue, 21 Apr**Ring of the Alexandra Peal of bells in Queen's Tower**

Alexandra Peal of bells in Queen's Tower rung to celebrate the birthday of HM Queen Elizabeth II

Fri, 24 Apr, 12:00**RSMA Toronto, Canada**

Informal RSM meeting, noon, Last Friday of every month.
Jason George Pub, 100 Front Street East, Toronto

Fri, 1 May, 17:30 – 21:30**RSMA Perth, Australia***Monthly Sundowner*

The Celtic Club, 48 Ord St, West Perth, WA, 6005
Alan Dickson – alan@dickson.com.au
John Sykes – johnpsykes@gmail.com

Wed, 20 May, 12:30 – 14:30**Imperial Engineering Alumni***Quarterly Johannesburg Lunch*

Baron & Quail, Woodmead, Johannesburg, South Africa
Contact Richard Gundersen@yabo.co.za

Fri, 22 May, 12:00**RSMA Toronto, Canada**

Informal RSM meeting, noon, Last Friday of every month.
Jason George Pub, 100 Front Street East, Toronto

Tue, 2 Jun**Ring of the Alexandra Peal of bells in Queen's Tower**

Alexandra Peal of bells in Queen's Tower rung to celebrate Coronation Day

Fri, 5 Jun, 17:30 – 21:30**RSMA Perth, Australia***Monthly Sundowner*

The Celtic Club, 48 Ord St, West Perth, WA, 6005
Alan Dickson – alan@dickson.com.au
John Sykes – johnpsykes@gmail.com

Mon, 8 Jun**CGCA AGM & President's Evening**

Details TBD

Wed, 10 Jun**Ring of the Alexandra Peal of bells in Queen's Tower**

Alexandra Peal of bells in Queen's Tower rung to celebrate the birthday of HRH The Duke of Edinburgh

Fri, 26 Jun, 12:00**RSMA Toronto, Canada**

Informal RSM meeting, noon, Last Friday of every month.
Jason George Pub, 100 Front Street East, Toronto

Fri, 3 Jul, 17:30 – 21:30**RSMA Perth, Australia***Monthly Sundowner*

The Celtic Club, 48 Ord St, West Perth, WA, 6005
Alan Dickson – alan@dickson.com.au
John Sykes – johnpsykes@gmail.com

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

Please note that while many of these events are open to all and often free, they usually require registration in advance. Please follow the links in the entry to get more information including if and how to register and whether there is any cost.

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

Proud alumnus, engineering entrepreneur and generous philanthropist

Sir JOHN MICHAEL LEAL UREN
(Mech Eng 1940-43)

John Michael Leal Uren, known as Michael, was born at Hendon, Middlesex, on 1 September, 1923, the son of Arthur Uren and his wife Doris, née Leal. His father had started his working life as a bank clerk in Cornwall, and rose to be a director of United Dominions Trust, a City hire-purchase business.

Michael attended Shebourn school, in Dorset, before reading engineering at Imperial College. In 1943, he took a first in engineering after three years rather than the normal four, while also serving in the Home Guard.

On graduation, he was conscripted into the RNVR, training at the Royal Navy Engineering College for combined Marine and Air Operations. He was commissioned as an Air Engineer Officer in the Fleet Air Arm, passing out top of his intake and serving in various squadrons until he was demobbed in 1946.

He then joined the civil engineering firm of Sir Alexander Gibb & Partners and spent five years based in Tehran, developing hydro power and projects in Iran, Iraq, Syria and Jordan.

Returning to Britain, he moved to the Cementation Company to work on the 12-mile Bowland Forest tunnel, carrying Lake District water to Manchester and, later, on a hydro scheme on Loch Tay. He changed firms again to work in New Zealand, building a dam on the Clutha river to provide power for the South Island.

Back in England in 1955, Michael partnered with John Hobbins, with whom he had worked in Iran, forming Civil and Marine Ltd, shipping sand and gravel in and out of North Sea ports, using a seagoing barge that had been built for the Gallipoli landings.

While Hobbins and his wife took the vessel to sea as master and mate, Michael took another job “to earn money to pay the wages on Friday” as a director of Dowsett Engineering, which worked on the construction of the M1 motorway.

The success of the barge business allowed Michael to leave Dowsett in 1964. He and Hobbins designed and built a self-loading dredger to suck sand and gravel from the bed of the North Sea and discharge it at a concrete works in the Thames Estuary.

Their fleet expanded to five dredgers servicing numerous concrete plants on both coasts of the North Sea – and, to Michael’s satisfaction, saving some 600 acres



Photo: Liz Swift, Imperial College, London

of agricultural land per year from being dug up for the extraction of onshore aggregates.

Meanwhile, in their own research laboratory, they discovered that high-quality cement could be manufactured from blast-furnace slag (a waste product of the steel industry) using only one-fifth of the energy required to make conventional Portland cement – and with much lower carbon emissions than traditional methods.

A first factory was opened at Purfleet in 1981; others followed adjacent to steelworks at Llanwern, Scunthorpe, Port Talbot and Redcar and later in Slovakia and Florida. It was a lucrative business model, since they were paid once by the steel industry, to take the waste material away, and again, by the construction industry, for the cement they produced from it. Civil and Marine became one of the UK’s foremost innovators in cement manufacture, and was enormously successful – eventually taking 17% of the UK cement market.

Michael was an engineer-entrepreneur whose irrepressible energy and curiosity were directed towards practical achievement rather than profit but, as he put it, “If those achievements are properly structured in the first place, then money will automatically follow”.

And follow, it did.

He first sold a majority interest in Civil & Marine in 1990, but remained involved and bought back most of the group in a management buy-out two years later. He continued to run the company until, in 2006, Hanson paid £245 million for the business.

The proceeds of the sale made little difference to Michael’s personal lifestyle. He continued to live in a modest Kent farmhouse and did not even buy a new car, though he did relocate and restore a fine medieval barn.

However, the sale enabled him, at the age of 84, to turn his attention to charitable causes. He described the situation: “A large pile landed on the table, for which Janis [his partner] and I had no need, so we started to use the money for major charitable projects”.

The catalogue of his donations during the last 13 years of his life amounts to a remarkable legacy. The biggest beneficiary was Imperial College; he gave £40 million for the foundation of a Bio-Medical Engineering Research Centre at the college’s western campus in White City.

The Sir Michael Uren Biomedical Engineering Research Hub, which is due to open in 2020, will bring together over 500 engineers, clinicians and scientists to develop new and affordable medical

technologies. They will combine the latest medical research and engineering to improve the treatment and diagnosis of diverse medical conditions, from finding ways to cure dementia to creating bionic limbs.

Speaking in 2014, he said: “It is an honour for me to be able to help this great university. Medical teaching and research didn’t exist at Imperial in my day, but it has evolved into an institution where the work between engineering and medicine is today one of its outstanding strengths. Imperial has always applied academic excellence for the greater good, and I am thrilled by the prospect of this Biomedical Engineering Hub doing exactly that.

“What I find so exciting about this project is that here is Imperial building one of the biggest research centres in the world within a few miles of the City of London, which itself has become the biggest financial centre in the world today. By putting the two together, what is quite clear is that the investment world will be watching for, and waiting for, the research and inventions which will create tomorrow’s great companies.

“It seems to me that, in effect, what we are creating here is a new Silicon Valley London, which is bound to succeed. Imperial was inspirational when I first joined it as a young engineering student in 1940,

A gentleman of the highest integrity and discipline

when London was under attack every night, and it is inspirational today. May it continue to be so forever." [See IE 29]

The "thrilling thing" about philanthropy on such a scale, he recorded, was that it made possible entire projects which could not have happened without his help: "one can't ask for a bigger reward."

His previous support for Imperial had included the College's MSk Lab under the leadership of Professor Justin Cobb, whose focus is joint disease and the surgery needed to restore function.

A second strand of Michael's philanthropy favoured ex-services charities and the Gurkha Welfare Trust in Nepal, for which he funded the construction of residential care homes for former soldiers, which he liked to compare to the Royal Hospital, Chelsea.

A long personal commitment to charity work for blind children led him to Moorfields Eye Hospital, where he gave more than £3 million for research into treatments for macular degeneration. The private King Edward VII's Hospital Sister Agnes in Marylebone received more than £15 million to maintain its independence and modernise its facilities.

Michael was a long-serving trustee, chairman and benefactor of the Royal London Society for the Blind (now the Royal Society for Blind Children), and was instrumental in the development of new education facilities, and a working farm, at its Dorton House estate in Sevenoaks. He was also a past Master of the Cordwainers Company.

Michael loved animals and was a benefactor of International Animal Rescue for the preservation of orang-utans and other endangered species. Closer to his Kent home, he was a regular benefactor of his local church, St Mary's Kenardington; and his last gift, in June of this year, was £1 million to his old school, Sherborne, in Dorset.

He was appointed OBE for his work for the blind in 1999 and was knighted in 2016, for philanthropic services.

Well into his nineties, he was still vigorously engaged with the causes he supported and exploring new projects of his own – including the idea (thwarted by the wrong kind of soil) of turning his farmland into a vineyard.

In 1955, he had married Serena Anne ("Jane") Peal. They separated in 1996, but remained good friends.

Michael died on 9 August, at the age of 95. He is survived by his partner of later years, Janis, by Jane and their two sons, David and Mark.



MARK WELLESLEY-WOOD
(Mining 1969-72)

Mark Wellesley-Wood, who passed away at the age of 67, was the quintessential minesman. He was born in England on 2 November, 1951 and spent 10 years moving around the world with his father, who was in the Royal Air Force, before attending St George's College in Weybridge.

Mark was President of RSMU in 1971-72 and a formidable prop forward. He continued playing rugby and finished his rugby career with Guildford 'heavies'. After college, he was awarded an Anglo American bursary and spent time in Zambia before returning to London to do an MBA, "to know the financial side of mining".

His main claim to fame was that he subsequently brought about the downfall of two of South Africa's (SA) most notorious corporate crooks, Brett Keble and his father, Roger.

This big, straight-talking former prop forward with an 'RSM cauliflower ear' to show for it, was sent to South Africa (SA) in 2000 by London-listed majority shareholder Mercury Asset Management (MAM) to sort out the Durban Roodepoort Deep (DRD) gold mine in Johannesburg, which had become a mess under executive chairman Roger Keble's leadership.

DRD was part of Brett Keble's mining 'empire', and Keble called the shots. MAM told him they wanted Wellesley-Wood on the board and they met in London to discuss it.

Keble seemed surprisingly amenable. Mark suspected Keble thought he'd be able to manipulate him, like he did everyone else. He told Keble: "Brett, I don't blink, you know". If Keble thought he

was going to be his "patsy, somebody you can push aside, or bribe, or whatever, you've got the wrong man". Keble said afterwards, "The organ grinder had appointed its monkey."

It didn't take Mark long to uncover a "truly malodorous" situation at DRD. With no more than a 5% shareholding and a 'crony' board, the Kebbles had been running it like 'a family company' for their own enrichment. Mark reported that DRD was technically insolvent.

He then forced Roger Keble to step down as chair, but agreed to keep him on as deputy.

Mark became non-executive chairman and CEO after suspending the incumbent while he investigated "certain financial irregularities".

When he went home to England to sort out his papers, Keble retaliated by getting his contacts in the home affairs department to withdraw his work permit, declare him a prohibited immigrant and deny him re-entry. The director-general announced that Mark was "the kind of executive SA can do without".

While he fought to return, the Kebbles used their considerable influence to spread malicious rumours about him. Brett referred to him as "the pin-striped bandit from London".

The Kebbles tried to call a board meeting to expel Mark from the company. He promptly issued an order from London, prohibiting Roger Keble from carrying out any executive functions on behalf of DRD, banning him from the premises and from contacting any employees or contractors.

After five days working round the clock, he got home affairs minister, Mangosuthu Buthelezi, to overturn the banning order. He said it was the worst time in his life.

"If I'd lost, I would have just been a nonentity, some silly little Pommy director who came in and tried to **** around in SA. That would probably have finished my integrity, my reputation, and my career in one stroke."

When Mark got back to SA, he laid charges against Roger Keble, who in 2002 was arrested at OR Tambo International Airport, charged with 62 counts of fraud, and jailed for the night.

Mark's investigations into the Keble mining empire revealed that

it was a glorified pyramid scheme. He said their operations could be summed up in two words: asset stripping. He predicted there'd be a "tipping point" and, of course, there was.

The Kebbles tried to block the investigations with an army of lawyers and "ex-BOSS [the former Bureau for State Security] agents," according to Mark, who employed his own intelligence outfit to spy on them.

His house was bugged, his wife interviewed by "phony journalists", and his company books and bank records scrutinised. It emerged later that he was on a Keble hit list.

In 2005, Mark began proceedings to liquidate Brett Keble's mining house, JCI, for ignoring a court order to pay a R26m debt. This precipitated a plunge in JCI's share price.

Meanwhile, Mark was accused of pursuing a vendetta against the Kebbles, but he said he believed in good corporate governance — whatever it took.

"Corporate governance is not about having King codes and subcommittees," he said. "What you actually need is directors with balls who exercise their fiduciary duties."

Keble's friends in the ANC Youth League and National Union of Mineworkers accused Mark of being anti-South African for laying off 7,000 workers, and agitated for his licence to be revoked.

"I am here to run safe, profitable mines," he responded. "We run a business, not a charity."

Months after Mark began his liquidation action against JCI, Brett Keble was killed in an alleged assisted suicide.

Restructuring saw DRDGold enjoy a brief resurgence. During one lucrative quarter, Mark played the Pink Floyd song 'Money' in the auditorium as analysts and media took their seats. But the resurgence couldn't be sustained.

At the time of his sudden death he was chairman of UK-listed Kefi Minerals.

Kefi stated, "He was a gentleman of the highest integrity and discipline, a true mining professional who made a great contribution to the industry over decades and to our company in recent years."

Mark was a strong supporter of the RSMA and Chaps Club and regularly attended dinners when in London. He will be sadly missed by the RSM community.

He is survived by his wife, Shona, and four children.

A raconteur and stickler for doing things right



JOHN TREVOR CHASE
(Civil Eng 1951-54)

John was born on 18 October, 1932 and died, aged 86, on 18 April.

His son, CGCA Treasurer, Peter Chase (Computing, 1979-82), writes:

My dad was a traditional engineer, and having studied Civil Engineering at Imperial, he went on to do three years' national service with the RAF. There, of particular note, he helped with the challenge of constructing runways and run-up areas for the V-wing jet bombers of the fifties, using pre-stressed concrete in large slabs. Like so much of his work, some still survives today, at Robin Hood airport near Doncaster (or RAF Finningley, as it was then known).

After National Service, he worked in Mill Hill, for Oscar Faber, and then for Laing Construction in St Albans. Here, his management potential was spotted, and he was offered the position of opening a design office in Bristol, in 1966.

Married in 1961, with me and

my sister arriving in '63 and '64 respectively, the family moved to Clevedon in Somerset.

The Laing Bristol office was involved in several notable sixties projects during his tenure, including pioneering work to reduce ceiling thickness, enabling more floors in tower blocks for a given overall height.

The Bristol and West Building Society head office in Bristol still stands to this day as a testament to this innovation. Its architecture may not have been much loved, but it has now been made over with blue glass cladding and is the "Radisson Blu" hotel.

Nearby, at Avonmouth docks, is another notable (if ugly!) building my father was involved in. When travelling (eastwards particularly) on the M5 over the Avonmouth bridge, you can very clearly see a large, church-like structure which is, in fact, a grain silo. This was a very early example of the jacking method of concrete tower construction,

used for each silo tower, where successive segments are cast at ground level and the entire structure jacked up as it's built. Such was the novelty of this at the time, my father was asked to oversee time-lapse photography of the process, itself quite a novelty.

In 1972, my father left Bristol to join a consulting firm in Worcester called John Dossor and partners. Over the next twenty years, he helped build the practice and its reputation, with sister offices in York and Norwich. I remember the long trips he'd do to Pontefract, Manchester and Elstree, to name just a few – and it became apparent to me that quite a lot of his work was advising on the reasons for, and sometimes the rectification of, mistakes made by others.

The Elstree job related to an entire housing estate built on a previously wooded area of clay soil, which resulted in terrible 'heave' occurring to many homes, some of which were underpinned and others demolished.

He also famously worked out that a glancing blow from a crane on a low loader passing under an iron railway bridge in Wales had caused a massive brittle fracture in the bridge's structure. Key to this was the supposition that the temperature must have been at or around four degrees centigrade on the morning in question. My father went to the trouble of contacting the Met Office to find out the temperature on the date in question, and back came the answer: exactly four degrees centigrade.

I can only say that the one time our two disciplines (mine being computing) coincided was when he asked me to help monitor concrete cancer in a building in Worcester. Gaps were forming in concrete pillars, and from three measurements taken in the form of a triangle across a crack, I was asked to do some decent trigonometry on my Commodore VIC-20 (what a museum piece that now is!) to calculate a given crack's width. Obviously, the intention was to see if the cracks were widening – and they were.

The seventies were a time of continued innovation, and some fellows bravely toyed with building concrete domes by inflating them as they were built. Sceptical of this himself, John nevertheless helped advise on some aspects of those trying out this newfangled idea in Malvern, Worcestershire, where the "Edinburgh Dome" (named after the Duke of Edinburgh, who opened it) is the only UK example ever tried, and is now a listed building.

His network of contacts was extensive, and this gradually turned to more leisurely pursuits in the 1990s as he retired from business.

He spent many happy weeks walking with business fellows (they called themselves "Thwaites") in beautiful areas such as north Wales, the Derbyshire peaks and the Yorkshire Dales.

In his will, he asked that his ashes be scattered at the top of Ingleborough, an indication of the love he had of that peak.

He also designed and had built not one, but two, canal narrowboats, and used them to navigate most of England's waterways with his wife Rosemary.

Always a lover of driving, John bought a classic MG TF, and later a Jaguar XK150S, both of which saw the couple enjoy many leisurely tours of our green and pleasant land.

A life lived to the full, John leaves his wife, Rosemary, of 58 years, me and my sister, Catherine, four grandchildren and two great-grandchildren.

Ever a raconteur, and a stickler for doing things right, he will be sorely missed.

IN BRIEF

PETER R. SIMPSON

Peter, a friend of the Department of Earth Science and Engineering, passed away on 24 April 2019 at the age of 82. The following is from an obituary by Dennis Buchanan, the Department's Emeritus Professor of Mining Geology.

In the early 2000s, Peter contributed to both the undergraduate and postgraduate teaching of exploration and environmental geochemistry in the Department, a course which generated very favourable reviews from students. He subsequently became a Visiting Professor.

He was a vividly eccentric and entertaining man, welcomed at social gatherings and scientific conferences alike. He sadly lost his wife, Jane, a companion through so much of his personal and professional life, in 2016.

He died, following a short illness, and is survived by his daughter Emma, an advertising executive, his son Tom, an NHS doctor, and his grandchildren.

He is also survived by his infamous green and white Land Rover.

PAUL TREMAIN PEARCE
(Civil Eng 1952-55)

Paul, who was born in August, 1935, died on 7 April, at the age of 83.

A true gentleman and a world leader in his field



Prof HENRICUS (HANS) MICHELS (Chem Eng 1963-67)

Hans, who was an IChemE Fellow, was a world leader in the field of safety and detonations, and a great presence in the Department of Chemical Engineering at Imperial College for more than 50 years.

Born in Amsterdam, Netherlands, on 13 January, 1934, he was the third child of Antonius Michels and Christina Veraart. His parents were both physicists, who together founded several modern schools in Amsterdam. Hans was inspired by his father, a professor of experimental and technical physics, to join academia and pursue a subject which would connect him to the industrial world.

Hans studied physics and chemistry at the University of Amsterdam. He was active in

sports and met his future wife Josée Nooij through the hockey club. They married in 1963 and spent 55 happy years together, raising four children: Hans Jr., Nicolette, Patricia and Bart. Josée sadly passed away in September.

Hans completed his Masters in his father's laboratory, where he worked as his assistant and accompanied him on regular consultancy visits to the Dutch State Mines. It was here that he first became involved in industrial problem-solving.

In 1963, Hans began his PhD studies in Chemical Engineering at Imperial under the supervision of Professor Ubbelohde, the Head of Department at the time. His thesis, 'Marginal detonation in hydrocarbon-oxygen mixtures', was completed in 1967 and won the prize for best in year. He was immediately hired as a Lecturer at the institution, becoming Senior Lecturer in 1985 and Professor of Safety Engineering in 1999. Hans taught the undergraduate safety course for many years, a subject about which he was truly passionate.

He will be remembered for his kindness and his dedication to his family, the department and his students. He was always full of

energy and enthusiasm for his work and generating ideas for ways to improve the department.

Stephen Richardson, Imperial's Emeritus Professor of Chemical Engineering, who worked closely with Hans, said: "The memory that many people have of Hans is a true gentleman with the best interests of Chem Eng, and the College more widely, at heart. This is absolutely the man I knew: he was scrupulously fair and generous. I will always remember him with great pleasure. I was privileged to know him."

Professor Nilay Shah, Head of Chemical Engineering at Imperial, said: "He was a great presence in the Department and a world leader in the field of safety and detonations. He was also a champion for new ideas in education and in improvements in the Department's infrastructure and operations. He will be greatly missed."

Professor Dame Julia Higgins, President of the Institute of Physics and Emeritus Professor of Chemical Engineering at Imperial, said: "When I arrived in the department in 1976, Hans was one of my neighbours on level 5 ACE. He has been a constant colleague and someone I have loved to meet and chat with ever since.

He was indeed someone totally committed to the department and particularly our students. He will be sadly missed."

Alongside teaching, Hans worked closely with industry, and in 1982 co-founded the UK Explosion Liaison Group (UKELG). He had roles as consultant and expert witness in combustion and post-industrial disaster cases. In 2017, he was recognised with the IChemE Franklin Medal for "significant contribution to safety and loss prevention over five decades of research at the heart of industrial applications".

Hans also engaged with the local community and spent 10 years as a governor at St Mary's University. Former Principal and Vice-Chancellor, Arthur Naylor, said of Hans: "His professional expertise, immense energy, positivity and personal charm made a huge contribution to the development of St Mary's and a lasting impression on all who worked with him".

Hans passed away peacefully on 8 March at the age of 85 and is survived by his four children, and ten grandchildren.

With thanks to Prof Nilay Shah, and Nicolette Michels

A globe-trotting life in the mining industry

H.E.K. (HUGH) ALLEN (Mining Eng 1957-59)

Hugh was born in 1934.

Prior to entering the Royal School of Mines in 1957, to study mining engineering, Hugh had already done two years' National Service with the Royal Engineers, which had included a year in Malaya with a Gurkha regiment, followed by three years at Cambridge University, where he took an MA degree in Natural Sciences at Corpus Christi College.

Thus he began his RSM career as a relatively mature student and gained his BSc(Eng) degree in mining engineering after only two years of study, graduating in 1959.

During his student days in London, he married, Ann, at Pinner in Middlesex. This was the beginning of a life-long partnership, which resulted in five children and, in due course, 13 grandchildren.

Like many RSM graduates, Hugh began his professional mining career in the South African gold industry; he was recruited in 1959 by the Anglo American Corporation and was posted as a shift boss to the newly-opened President Brand mine at Welkom in the Orange Free State. He rose rapidly through the management ranks at Anglo American, with assignments in Tanzania and the USA, culminating

in a posting to Australia in 1971, where Hugh and his family spent two years based in Melbourne, while Hugh toured that vast country assessing mining opportunities for his company.

In 1973, the Allen family returned to Africa, when Hugh was transferred to the De Beers subsidiary of Anglo American to become manager of the famous Orapa and Lethakane diamond mines in Botswana. One of his tasks as manager involved monthly trips to Johannesburg in light aircraft, accompanying a briefcase full of the mine's monthly output of diamonds, to deliver it securely to Anglo's head office for safe-keeping.

After 18 years of globe-trotting in the mining industry, with his long-suffering and ever-expanding family in tow, Hugh decided it was time to return to the UK to settle down. Doing this involved Hugh in a career change from industry to academia and, in 1979, he returned to his alma mater, the Royal School of Mines, to take up a Readership in Minerals Industry in the Department of



Minerals Resources Engineering, as the Course Director of the MSc programme in Mineral Production Management.

Hugh's wide experience of the mining industry on several continents was an ideal background for teaching this postgraduate course, which attracted students from all parts of the world. Students would often be invited to Hugh's home at Harrow on the Hill, to share a meal with Ann and his lively family.

Eventually, after nearly a decade of teaching and living in London, Hugh began to get itchy feet again and, in 1987, he left academic life to return to the mining industry as a mining advisor for RTZ.

Although the new job was based in London, at the company's head office in St James Square, it involved plenty of travel, visiting RTZ operations around the world.

After a couple of years of this, the company decided that Hugh's vast experience of the industry could be better employed elsewhere in the organisation by promoting him to

the role of Director of the Rio Tinto Technical Services in Bristol.

In 1991/2, Hugh was elected President of the Institution of Mining and Metallurgy, in the Institution's Centenary year and following in his father's footsteps, who had been President of the IMM some 40 years earlier.

On retirement from RTZ, Hugh set up his own mining consultancy, where he was involved in various mining projects around the world, including in Brazil, Australia and Liberia.

Hugh lived his life to the full. Despite being a strongly focussed professional engineer, he took every opportunity to further his many other interests, using his knowledge of geology, natural sciences and in particular, his love of birdlife, to explore and get to know the regions of the world to which his varied career took him. He had a large and loving family and he was a committed Christian; when he was at home, he was very involved in church affairs in his local parish church, St Mary's at Harrow on the Hill where, after his death this year, he was finally laid to rest.

Hugh will be much missed by his friends and colleagues and his many former students from the RSM.

