



Imperial ENGINEER



AGMs

SPACE EDUCATION

FLYING 3D PRINTERS

NEW CGCA PRESIDENT

NEW IMPERIAL PRESIDENT

DEATH OF QUEEN ELIZABETH II

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

ISSUE 37 AUTUMN 2022

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Cover image
Flying 3D Printer drones
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Based on photo courtesy of
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EDITORIAL BOARD

Peter Buck (Editor)
David Bishop, Tim Cotton,
Kristin Gembiak, Paul Holmes,
Bill McAuley (Emeritus Editor)

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Alison Buck

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CORRESPONDENCE and ENQUIRIES

Kristin Gembiak

Alumni Relations Office, Advancement Division,
Level 1 Faculty Building, Imperial College London,
South Kensington Campus, Exhibition Road
London SW7 2AZ

Tel: +44 (0)20 7594 9238

Email: rsma@imperial.ac.uk for RSMA queries

Email: cgca@imperial.ac.uk for CGCA queries

Website: www.imperial.ac.uk/engineering/alumni/

CGCA website: www.cgca.org.uk

RSMA website: www.rsm-association.org

URLs at the end of items indicate more details online.

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As I was putting the final touches on this message, the sad news emerged of the passing of Her Royal Highness Queen Elizabeth II. The changing of the guard, in a very different sense, is upon us: in the same week, we have both a new PM and a new monarch.

But the end of this summer, to me, marks what I hope is also the end of a sustained period of extraordinary events that have created local and global hardships, punctuated by a death toll of 6.5M, due to Covid. During a very difficult time, the community that is Imperial College put forward huge efforts to maintain, and even strengthen, all of its teaching and learning activities, leading to The Times and Sunday Times University Guide naming Imperial College “University of the Year” for 2022.

Imperial College has also reached new heights on the national – indeed, international – research stage. The Faculty of Engineering has been ranked top for research in the UK in the categories of both Engineering and Computer Science in the United Kingdom’s 2021 Research Excellence Framework review, a very significant accolade.

I am very honoured to be taking over the reins of the Association and would like to thank its members for their implicit vote of trust. Our outgoing President, Atula Abeysekera, will be a hard act to follow; I admired the very congenial atmosphere that Atula imparted to the running of CGCA meetings and events.

There are several people who continue to be pillars of the Association, the Trust and their long-standing activities; I would first like to extend well-deserved thanks to Nigel Creswell and Chris Lumb for all of their hard work. I’d also like to recognise the great efforts of Peter Chase, Tim Munday, Michael Hoffman and Andrew Hill who have offered their enthusiasm, energy (and, occasionally, a dining room!). Colin Kerr has been the mastermind of so many annual dinners, with sustained help from Karine Madoian and Clare Lupton. Other Trust stalwarts, Don Lehmann and John Collins also deserve recognition, and Milia Hasbani has always been ready with advice and contacts.

I would also like to mention some people behind the scenes: Bob Schroter continues to give selflessly of his time, and to provide wisdom and advice, and Dick Kitney is always at hand as a source of wisdom. I plan to continue drawing on the experience of these stalwarts, whilst also seeking the input of more recent members in shaping CGCA as we move forward.

As we draw near to what we all should hope is the end of an extraordinary time in our lives, I very much look forward to meeting both new and seasoned alumni in person at one of the many events of the CGCA.



**Anil
Bharath**

PRESIDENTS REPORT



**Tim
Cotton**

We are deeply saddened by the death of Her Majesty the Queen. She faithfully served the nation as our Sovereign during her long, happy and glorious reign. We extend our heartfelt sympathy to the Royal Family and the Association sent messages of condolences on behalf of the Association via official channels.

So why is the ROYAL in the Royal School of Mines? Anne Barret IC Archivist explains. “In 1851, the Government School of Mines and of Science Applied to the Arts was established as the first college of advanced technical education in Britain. Initially governed by the Board of Trade in 1856 it was transferred to the Education Department. After many discussions between the Department of Education and the School, and in order to boost the status of the school, in 1860 the ultimate accolade in name change was awarded with the title the Royal School of Mines via an Order of Council from the Privy Council. With a new title the award of the Associate of the Royal School of Mines was instituted, as an incentive to study there.”

The rest, they say is history, God Bless HIS Royal Miners!

In the spirit of Groundhog Day squared, I find myself once again writing to you all in the capacity of RSMA President embarrassingly entering a seventh year in office. We have been able to recruit new Committee members and are now getting those new members up to speed. Therefore, the Committee and I felt that for consistency I should say another year. This motion was taken to the AGM in June this year and approved by the members present. Whilst the Committee has a growing 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. Fiona Cassidy as Chair of the RSMA Trust is also looking for new Trustees and if you are interested please do get in touch.

As a volunteer organisation, 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 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 2021, the RSMA once again launched the RSMA Final Year Student Bursary Prize in June 2022. This award is open to students who are beginning their final year in September 2022. Currently, the Committee is planning to award a minimum of three prizes across ESE and Materials and, depending on applicants, may consider more. As we go to press, there are nine applicants being considered with a good mix across the disciplines in the RSM. 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,

Continues overleaf...

NEWS & REVIEWS

Continued from page 3

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 will be short-listing 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 are continuing to pay yearly. Your support is truly appreciated! Read on for a more detailed review of the 100 Club in the AGM report.

I am also very happy to report that the 2022 Annual General Meeting of the Association was held in person and virtually on 30th June 2022. This also meant the final year Bar-B-Q was also held in person in the Union Bar. See the AGM report inside this issue for a full update.

The Committee continues to maintain a very active relationship with the RSMU and for the 2022/22 academic year, the new RSMU representatives are Josephine Onerhime and Rhea Chandresh, respectively President and Honorary Secretary. Already they are an active part of the Committee with great ideas and support. Rhea even virtually joined a Committee meeting from the back of taxi in Bangalore!

Finally, the Committee has approved the 137th annual dinner to be held on Friday 25th November 2022 at the Rembrandt Hotel in Knightsbridge. This year we are excited to welcome Dame Sue Ion as our guest speaker. See below for more details on the event and a brief biography of Dame Sue.

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 at some point soon.

137th RSMA Annual Dinner, Friday 25th November 2022

Book your place for the 137th RSMA Annual Dinner, Friday 25th November 2022

Booking via Eventbrite is now opening at the following link:

<https://www.eventbrite.co.uk/e/rsma-annual-dinner-2022-tickets-427129334337>

Once again the RSMA Committee will be hosting the 2022 Annual Dinner at the Rembrandt Hotel in Knightsbridge at 11 Thurloe Place. The event will start at 6:30pm with welcome drinks, followed by a three course dinner with wine and tea/coffee.

This year the RSMA is especially delighted to say that we have arranged for Dame Sue Ion to speak to our assembled members and guests.

Dame Sue received the prestigious Dame Grand Cross award in the Platinum Jubilee Honours for services to engineering.

Sue's background is in materials science/metallurgy. She gained a first class honours from Imperial College in 1976 and a PhD in 1979 before joining BNFL where she was Group Director of Technology 1992-2006. She holds Visiting or Honorary Professorships at a number of universities including Imperial College and the University of Manchester. She has represented the UK internationally on key committees overseeing the nuclear sector for over 3 decades.

She is a Fellow of both the Royal Academy of Engineering and the Royal Society where she chairs or is a member of a number of subcommittees.

She was Chair of the Nuclear Innovation Advisory Board for the Government from 2015-2018 and is currently Hon-President of the National Skills Academy for Nuclear.

So grab your formal evening attire and book a ticket now!



2022 RSMA AGM Report and Final Year BBQ

Fourteen RSMA members and Committee members were present in the IC Union Bar and online via a video conference link on June 30th 2022 for the Annual AGM of the RSMA and the first Final Year BBQ in two years.

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 once again due to limited success in recruiting new Committee members, the succession planning for the Association Executive was behind schedule. Accordingly, it was proposed that Tim should stay in the role for another year, all members present concurred. At the meeting, two new Committee members were elected and the existing members and officers as listed below were voted in.

John Monhemius and Ben Moorhouse are standing down from the RSMA Committee, and the Association thanks them for their contribution over the years. In addition, Daisy Jennings-Grey attended the meeting and has expressed an interest in joining the Committee which will happen later in the year.

With new Committee members joining, it is hoped that more work



Photo: Tim Cotton

can be done in specific areas such as mentoring, member engagement and recruitment. Finally, it is hoped that a more formal succession plan can be put in place for key Committee roles.

RSMA Trust Board

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. Those shown on the right offer themselves for election as trustees.

Treasurer's report

The Treasurer reported that the RSMA and Trust are in good financial health and have the necessary funds available to continue to support the RSM. The year was marked by the receipt of a substantial Gift Aid payment on qualifying donations in the last few years. The Committee and Trust were extremely grateful to the Treasurer, David Bishop, in his efforts to get the money out of

RSMA Trust Board

Trustees:

Fiona Cassidy (Chair)
Prof. Rees Rawlings
Peter Waugh
John O'Reilly
Hannah Baker
Prof. John Monhemius

Trustees ex-officio

Tim Cotton
David Bishop (Treasurer)
Chris Webborn (Hon Sec)
Josephine Onerhime (Pres RSMU)

100 Club	2020	2019	2018	2017	2016	2015
Donations	£6805	£6383	£4550	£7170	£4552	£0
TOTAL	£6805	£6383	£4550	£7170	£4552	£0

HMRC. With a solid financial footing, the Trust was able to give more bursaries in 2021, some £5,000 in total. Furthermore, the funds allow the Committee to continue to award bursaries in the Autumn 2022 Term to final year students who show the true RSM spirit and act as an RSM ambassador. There have been 4 applicants and names are currently being shortlisted. With Covid restrictions easing, the Trust also supported students in expedition and conference attendance to the tune of £460.

100 Club

Since the Club was started in 2016 there have been 44 members, as of today only 41 remain active. The original idea was sound but unfortunately, the take up has not been what was originally envisaged but through the generosity of the 100 Club members almost £36,000 has been raised since 2016. See table above.

- The drop in members is due from;
- 1 member thought it was a one off £200 payment and not a yearly £200 payment.
 - 2 members have been unresponsive to further communications and have only made one payment.

To try and reinvigorate the 100 Club

the Committee has sent emails and letters to all members reminding them of the goals of the Club and allowing members to join at a lower rate and/or pay in instalments. So far, this has added two new members and receive some one-off donations but has not seen a material increase in members.

Bursaries

2018 saw the first three £1000 Bursaries awarded and a further three £1000 Bursaries awarded in 2019. 2020 and 2021 saw a great many quality applications and in both years 5 £1000 bursaries were awarded. 2022 will see the Bursary programme run again and 3 awards are being targeted but there is potential for this to increase if there is a suitable candidate pool.

Other matters

In other Trust matters, the following awards received no nominations that were considered appropriate:

- Peter Harding Memorial Award
- Rees Rawlings Young Member Award.
- RSMA Trust Essay Prize.

Efforts will be redoubled to see if this can change in 2023.

Once again, the Trust and Association are indebted to The Old Centralians Trust for their generosity in continuing to extend their Student Activity Awards to all Faculty departments thus including the ESE and Materials departments.

After the meeting ended, the draw for the 100 Club £250 raffle prize was won by Martin Levy for the third time! Martin has since very graciously donated the prize back to the 100 Club.

After the meeting the Committee and Members were joined by 32 students and guests for the final year BBQ which was held and catered in the Union Bar.

Election of officers and committee for 2021/22

President: **Tim Cotton**
Senior Vice-President: **Position unfilled**
Junior Vice-President: **Position unfilled**
Past-President: **John O'Reilly**
Hon. Secretary: **Chris Webborn**
Hon. Treasurer: **Dave Bishop**
VP International: **Position unfilled**
Membership Secretary: **Position unfilled**

Members:

Lorraine Craig, Rees Rawlings, Daniel Hill, Sam Casement, Eleanor Jay, Arka Sarkar, Dawn Houlston *new, Seb Turner, Richard Griffiths, Paul Holmes, Hannah Baker (nee Bungey), Jasmine Crocker *new
Overseas: **Celia Hayes, Harry Fisher**

President RSM Union: **Josephine Onerhime**
Hon Secretary RSM Union: **Rhea Chandresh**
President Geology Society: **Antoinette Mallon**
President GeoPhysics Society: **Angela Knowlson**
President Materials Society: **Yash Dwivedi**



Photo: Chris Webborn

L to R: Rees Rawlings, RSMA Committee Member and Trustee; Neville Cowan, RSMA Member; David Bishop, RSMA Treasurer; Coen Louwars, RSMA Member; Danny Hill, RSMA Committee Member; Tim Cotton, RSMA President; Nicola Pogson, IC Director of Alumni Relations; Chris Webborn, RSMA Hon Secretary; Kristin Gembiak, Alumni Relations Officer; Richard Griffiths, RSMA Committee Member; Tiegian Collins, RSMA Member; Jasmine Hedra Crocker, RSMA Committee Member; John (Angus) Moore, RSMA Member.

2022 CGCA Annual General Meeting

“The best laid plans...”

With the Annual General Meetings (AGM) of 2020 and 2021 forced into Virtualand by COVID, there were high hopes for the 2022 AGM, a meeting that would bring in our new President, Professor Anil Bharath. The date was set, 6th June, venue booked, The President's Evening arranged including a BBQ. All was well, until...

As the day approached, the talk of a transport strike in London firmed up, and Transport for London issued a warning not to travel by public transport in London on 6th June, forcing a late cancellation! Although COVID's shadow was lifted, another issue had thwarted us.

It was not possible to rearrange venue and catering at short notice, so the 2022 AGM joined its predecessors in Virtualand and was held on 28th June.

The meeting ran smoothly over ZOOM, except for one major issue. Our new President was unable to connect during the meeting, so our outgoing President, Professor Atula Abeysekera had to step into the breach and run the entire meeting.

Atula ran through CGCA's past year, one still challenged by COVID restrictions, and made more

complicated by war in Ukraine, and a deepening economic crisis. However, CGCA thrived.

Through the mentoring scheme, and via the OC Trust, students were supported financially and in managing their careers. Two great editions of Imperial ENGINEER were produced, and the best attended Annual Dinner for many years was held in February.

And this is the 125th Anniversary of CGCA (previously Old Centralians).

The Engineering Faculty became the highest ranked in the UK.

Atula thanked all those that helped and supported him during his two-year Presidency, in particular:

- Andrew Hill, Hon Treasurer and Peter Chase who stepped down as Treasurer to Chair the OC Trust.
- Nigel Cresswell as Hon Secretary.
- The younger members that have joined the Committee and created a new dynamic – and will be our future leaders.
- Colin Kerr for arranging the splendid Annual Dinner.
- Peter and Alison Buck for producing Imperial ENGINEER.
- Previous Presidents, Dick, Judith and David for their guidance and

help in the succession plan for the President.

- Nigel Brandon for his help in liaising with the Faculty.
- Nicola, Kristin and the Alumni team for their help and support.

Atula concluded by saying it was a honour and privilege to have been President for two years.

Andrew presented the 2021 Accounts in draft form as our new accountants were performing a thorough audit while taking us on as a client. One minor item was needed before the accounts were signed off, and no changes were anticipated. During the year our investments had done well, and a surplus was generated mainly due to lack of spending as few events took place. In response to a question, Andrew confirmed the Association will be moving part of the management of our investments in the near future.

Following a final attempt to connect with Professor Bharath, Atula moved onto the Election of Officers. Professor Kelvin Higgins was proposed and elected as Senior Vice President. All proposed Committee members were elected unopposed.

A change to the Articles of

Association for CGCA Limited was proposed. The changes included: removing 'man' and using 'person' in role titles, replacing Advisory Council and Operations Committee with a single Joint Committee, and establishing the role of Membership Secretary as a Director of CGCAL. The changes were approved.

As Professor Bharath had still not been able to connect, Atula declared him elected as President. (Note that President is a succession planned post and by electing a senior Vice President they will take the Presidency when the present President steps down.)

Past President, Roger Venables thanked Atula for his two years as President.

In a final twist to the saga, attendance in the ZOOM session did not reach the quorum set in our Articles of Association. To gain approval, the Minutes and other attachments were sent to members by email and they were given two week to raise any issues. No issues were received and the AGM was confirmed on 15th September 2022.

Nigel Cresswell
CGCA Hon. Sec.

Introducing the new CGCA President

Anil Anthony Bharath is Professor of Biologically-Inspired Computation & Inference in the Department of Bioengineering. He received a B.Eng. (Hons.) from the Department of Electronic and Electrical Engineering, University College London, in 1988, and a Ph.D. from the Department of Electrical and Electronic Engineering at Imperial in 1993. Since 1991, he has been a Lecturer and then a Senior Lecturer in medical imaging, in what is now the Department of Bioengineering. In 2005, he was appointed as the Reader in image analysis. In 2019 he became Professor of Biologically-Inspired Computation & Inference. In 2006, he was also an Academic Visitor with the Signal Processing Group, Department of Engineering, University of Cambridge.

He has worked on convolution-based architectures for visual processing since the mid 1990s. He has worked and published in the areas of medical image analysis, computer vision, and signal processing, and has worked as a consultant to the imaging sciences industry, primarily in the fields of medical imaging and medical informatics. His current

research is focussed on the use of deep networks for inference, and his group has recently published reviews on deep reinforcement learning and generative adversarial networks, as well as original research in these two fields.

Anil has published in the fields of pattern recognition, machine learning and signal processing, and has extensive experience in computer vision. In 1998, he demonstrated the first application of steerable filters (convolution-based architectures, with feedback) to shape detection. Later contributions included the use of Bayesian marginalisation in very early-stage computer vision, focus-of-attention methods, and custom-designed wavelet transforms to analyse images in a scalable manner.

In 2002, he initiated the Basic Technology Project “Reverse Engineering Human Visual Processes”, which created a blueprint for a scalable subset of processes in the human visual system, particularly of visual area V1. In 2008, he spun out the company Cortexica Vision Systems, which commercialised real-time focus of attention and descriptor

technology, applying it to video rate logo recognition and mobile-phone based product recognition, allowing it to provide visual search to service image queries submitted from mobile phones at commercial scales.

Cortexica was acquired by Zebra Technologies in 2019.

Anil jointly presented the 2003 Rosen Lecture at the Royal Institution, on *Art and Imaging*, with the visual artist D. Fern.



Photo courtesy of Imperial College London

Return of the Great Exhibition Road Festival



After a few years of disruption due to the pandemic, June saw a full-scale return of the Festival. The theme this year was 'Trailblazers', with groundbreaking theory and practice across science and the arts forming the backdrop for the weekend. Over 38,000 visitors came to South Kensington for the Festival.

Imperial partnered with the Science Museum, Natural History Museum, V&A and Royal College of Music, as well as the Goethe-Institut, Royal College of Art, Royal Parks and the Royal Geographical Society to co-ordinate and deliver a unique programme of events. Olympian Sir Mo Farah even dropped by the Festival to encourage visitors to 'exercise their mind'.

Talks, workshops, performances and activities saw audiences inspired by innovation in medicine, art, technology, design, chemistry and more, from cutting-edge virtual reality experiences to insight into forgotten histories, untold stories and scientific breakthroughs. As in previous years, the full programme drew on the vast wealth of expertise

from the College, museums and cultural institutions who collaborated to deliver it.

This year's Festival was bigger than ever, spilling out into the great outdoors, with visitors invited to explore areas themed by interest. Princes Gardens hosted the Hands-On Families Zone, packed with games, storytelling, crafts and experiments for budding scientists, engineers and even mini suffragettes. Children could build a bug, try paper marbling, or discover the world of badgers.

The Curiosity Zone provided a 'scientific selection box' of activities for all ages on Imperial College Road, exploring fascinating research from Imperial, including light that diagnoses diseases and 3D printed bones. Visitors were invited to make DNA printed bracelets, origami boats and microchip keyrings.

Indoors, the Medical Marvels Zone explored advances in the fight against malaria and cancer, while the Adults Zone at the Royal Geographical Society served up fashion upcycling, cloud demos and



controlled corrosion alongside drinks on the terrace.

The Smart Machines Zone offered insights into advances in artificial intelligence and the digital realm, while the Future Design Zone invited visitors to explore cutting-edge innovation across the four floors of the Dyson Building.

Visitors could explore the world in nano in the Magnificent Molecules Zone, and on Sunday, the Neurodiversity Zone celebrated the positive impact of different thinking in science and the arts, with unique talks, activities and calming environments on offer.

Neuroscientists Ani Kulkarni and Mathilde le Gal de Kerangal from the Department of Bioengineering joined forces with science artist Nick Sayers to celebrate tricks of the mind with 'Make Your Own Brain Illusions.' Showcasing a work adapting the technology of old record players running at different speeds to create illusions, Nick said: "I enjoyed enthusing the public about science and its creative applications, and the connection between art and

science." Children were invited to create their own brain illusions by drawing around bicycle parts and giving their picture a spin on the adapted record players.

Alongside a vast array of activities, audiences were offered a range of fascinating talks from inspiring public figures. Panellists and speakers explored topics ranging from climate change to ageing, the search for life on Mars and the untold stories of LGBTQ+ lives in our museums. Britain's first astronaut Helen Sharman explored how science and technology might help overcome environmental and geopolitical challenges at the poles. Curator Annemarie Bilclough discussed the life and legacy of Beatrix Potter as an artist and natural scientist, while author, filmmaker and lecturer Juliet Jacques discussed her latest work exploring the lives of trans and non-binary people.

The festival will be back in 2023, and the theme will be the power of awe and wonder to move and motivate us.



Photos courtesy of Imperial College London

OLD CENTRALIANS' TRUST

REPORT OF THE TRUSTEES FOR THE YEAR 2020-21

This report covers the activities of the Old Centralians' Trust between 1st October 2020 and 30th September 2021.

TRUSTEES' REPORT

Objects

The Old Centralians' Trust is a registered charity founded for the purpose of providing financial support to the students and, in special circumstances, members of the academic staff of the Faculty of Engineering of Imperial College, London (formerly known as the City & Guilds College).

The charity's overriding priority, as laid down in its founding deed, is to provide grants to students who face exceptional financial difficulties through no fault of their own.

In addition to this, grants are provided to assist individual students or groups of students who wish to travel to industry conferences, undertake sport or leisure activities, or broaden their minds through adventurous or challenging activities or projects. Such activities were valued by alumni when they attended College, and many bequests gave guidance on the type of activity their money should support.

Source of Funds

Fund-raising is not carried out in any formal sense. The income of the Trust arises from legacies, donations given in memory of former members of the City & Guilds College Association (an independent alumni body for students and staff of the former City & Guilds College, which now forms the bulk of the Faculty of Engineering at Imperial College, London), regular Gift-Aided contributions from alumni, and from the income and growth on investments accrued from these sources.

The Trust's investments are managed by a sub-committee of the Trust Board, who implement a strategy to meet the Trust's requirements of a target level of income whilst at the same time maintaining the underlying value of the investment portfolio. The strategy is reviewed from time to time by the sub-committee in consultation with their investment advisors, but in essence the approach taken is to take a long-term view, maintaining a sensible level of annual expenditure of around 3% of total reserves, leaving a balance to meet management costs and to provide for long-term growth to counter inflation. This approach allows cyclic fluctuations in the stock market to be viewed without undue concern.

During 2020-21, one legacy of £10,000 was received, this being from the estate of Peter Slann, an alumnus who studied Aeronautical Engineering at the college between

1951 and 1954, followed by postgraduate study. There was no specific intention attached to this sum, so it was added to the General Fund. The General Fund also received six further, more modest donations totalling £118 (£138 when Gift Aid is added). In addition to this, regular donations were received throughout the year for the benefit of the College mascot – a 1902 James and Browne motor car known as 'Boanerges'. These were allocated to the Trust's restricted 'Ford Fund' and totalled £1,383 for the year (£1,633 when Gift Aid is added).

Public Benefit

The trustees confirm that they have complied with their duty under Section 4 of the Charities Act 2011. They have considered the public benefit guidance published by the Charity Commission and believe that they have followed its guidance in this area. The trustees' report gives a description of the activities undertaken by the charity during the year in furtherance of its charitable purposes, and the trustees are satisfied that all such activities are in compliance with the stated objects of the Trust and that they provide a public benefit.

Results for the year

The Trust's finances have continued to be in a satisfactory state; the overall value of the investment portfolio rose during the year by 22.02%, reflecting the general rebound in asset values as the Covid-19 pandemic eased. Meanwhile, the income from investments, at £69,776, was £5,765 less than the previous year due to the pandemic's effect on global business' operations. The pandemic also had a significant effect on the number of applications for financial support towards expeditions, postgraduate travel, etc, such that the total amount distributed in awards – at £33,582 (£42,643 in 2019-20) – showed a reduction of £23,867, or 41%, on the amount distributed in 2018-19 (i.e. pre-pandemic).

At the conclusion of the financial year, the value of the Trust's investments stood at just over £4 million, an increase from £3.3 million a year earlier. It is the opinion of the trustees that the objectives of the trust can continue to be met for the foreseeable future.

OPERATIONS

Despite the ravages of the pandemic making it virtually impossible for students to engage in more than a very few activities involving overseas

travel, the Trust distributed £26,332 in support of a broad range of student activities.

Hardship

There were three applications for hardship assistance received during 2020-21, with £6,750 being awarded. This was sadly expected, given students suffered more from the effects of the pandemic, both directly and indirectly, during this academic year than the previous one.

Statutory Awards

Engraved tankards and/or monetary awards were provided for four students under the headings of: the Holbein Memorial Award; the Peter Moore Memorial Award; the John and Frances Jones Prize, and the 'Fellows of the City & Guilds of London Institute Centenary Award'. The last two of these named awards are funded by, respectively, the Imperial College Registry (which still maintains the original legacy fund given by John & Frances Jones in 1935) and the 'FCGI Witchell Fund' held within the Trust.

Student Activity Awards

These awards were once again offered, on the basis of nominations submitted by Senior Tutors, to two undergraduate students in each of the ten Departments of the Faculty of Engineering. The awards, valued at £750 each, are made in recognition of the recipients' strong level of 'extra-curricular' involvement in student society affairs and/or in sporting or cultural activities. Students in their first, second or third year are invited to submit details of their level of involvement in extra-curricular activity to their Departmental senior tutor, who will then, in consultation with the Head of Department, nominate to the Trust the two students whose involvement has been judged to be the most deserving. The awards are issued at the commencement of the next ensuing academic year. The intent of these awards is to encourage undergraduates to make the best of their time at university, and to help meet the inevitable extra costs of a more involved lifestyle, whether these costs be for accommodation, travel or to help with other associated expense.

John Elliott Bursaries

Under the John Elliott Bursary Scheme, named after a former Honorary Secretary and Chairman of the Trust, (Alfred) John Elliott, FREng, FCGI, FICE, FWeldI (who studied Civil Engineering between 1940 & 1942), awards totalling £3,450 in aggregate were made

to seven key officers of the City & Guilds College Union (CGCU), to assist with the personal costs involved in fulfilling their duties for the union.

It is also worth mentioning under this heading, although provided from a different fund, that the Trust supported the Vice President of the CGCU during the summer of 2020 with a bursary of £500. This allowed them to support the President in preparing for the academic year ahead.

Awards for Student Projects, Sporting activities, Adventure and Travel

As mentioned already, the normal level of student activities was severely curtailed during the academic year by the global Covid pandemic. Financial support was, however, provided for two student applications.

The first of these was of £1,000 towards two students who conducted a climbing expedition to the Dolomite Mountains in northern Italy. Their aim was to explore the sport-climbing present there and tackle a multi pitch climb with the help of a guide, including a guided ascent of the Marmolada, in order to be trained in glacier mountaineering. The Dolomites represented an opportunity to explore and improve the students' sport climbing and primed them for more ambitious mountaineering objectives. An excellent report was provided afterwards, which formed the basis for a full-colour article in the CGCA/RSMA alumni magazine *Imperial ENGINEER*.

The only other award, which was of £500, was made to a student who enterprisingly desired to enrol on a negotiating skills course at Harvard in the United States. As this was considered to be well outside the scope of his degree course (a stipulation of our Deed being that the Trust cannot support degree-course tuition costs), the Trust was pleased to support him.

Conference Travel for Postgraduates

Each year a certain proportion of budgeted funds is made available to support postgraduate students in travelling to overseas conferences to present their research, whether by way of a poster display or a podium presentation. During the year 2020-21 only three students received awards for this purpose – again a much-reduced number over normal years as a result of the pandemic. The overall total of these awards was £1,310 – an average travel grant of £437 per student.

The total number of applications and awards for next year already looks to be very much higher.

GENERAL

At the Annual Meeting of the City & Guilds College Association (CGCA) in July 2021, I took over the reins of chairing the Trust from Mr Chris Lumb, who had served in the role for fully 22 years since 1999. As I had previously been Honorary Treasurer of CGCA I had been, ex-officio, a Trustee of the OC Trust since 2003, and so am well acquainted with its operations. Chris has continued as a Trustee – indeed acts as Vice Chair – since stepping down and has provided me with invaluable support during my first year of tenure. As such, I would not only like to take the opportunity this report provides to thank him very sincerely, on behalf of everyone who has benefited from his commitment and achievements as chair, but also for his kind support of me as I “find my feet” in my new role.

ACKNOWLEDGEMENTS

The Old Centralians’ Trust could not function smoothly without the freely given time of its officers and Board members, none of whom takes any remuneration or expenses, and sincere gratitude must be expressed to them all. The Trust is also fortunate to have much valuable support from a large number of academic and administrative staff within the Faculty of Engineering, without which its work would be much less easy to fulfil. Grateful thanks are expressed to all of those staff members who have been so generous with their time and advice.

AUDIT

The Board is pleased to have the expert services of Messrs Haines Watts, of Berkhamsted, Hertfordshire, as advisers and as auditor of the Annual Accounts.

The Accounts and this report for the year 2020-21 were approved by the Board and Trustees on 12 July 2022, and duly signed on their behalf by me, as Chairman.

Peter Chase



Peter Chase, Chairman of the Board of Trustees

LEGAL AND ADMINISTRATIVE DETAILS

The Trust is governed by a Deed of Trust dated 24th September 1965, amended on 1st June 1995, and is registered as an Educational Trust at the Department of Education under file number U.1725 ZZ/46. The Charity Commission Registered Number for the Trust is 1048552. The financial year of the Trust runs from the 1st October each year.

The following were Trustees during the year:

- Peter Chase
(Chairman, except between 14th June and 7th September 2021)
- Christopher Lumb
(Vice Chairman)
- Professor Richard Jardine
(College Consul for Engineering until 31st August 2021)
- Professor Ann Muggeridge
(College Consul for Engineering from 1st Sept 2021 on)
- Dan Lehmann
(Treasurer from 6th July 2021 on)
- Nigel Cresswell
(Hon. Secretary, City & Guilds College Association)
- Andrew Hill
(Hon. Treasurer, City & Guilds College Association from 14th June 2021 on)

Secretary:

John Collins

Registered Office:

c/o City & Guilds College Association, Level 1, Faculty Building, Imperial College, London SW7 2AZ

Bankers:

National Westminster Bank Plc, 208 Piccadilly, London W1A 2DG

CAF Bank, 25 Kings Hill Avenue, Kings Hill, West Malling, Kent ME19 4TA

Asset Management:

Management of the Trust's investments is carried out by an Investment Sub-committee of the Trust Board comprising Christopher Lumb, Peter Chase, David Law, Prof. Robert Schroter, James Fok and Andrew Hill

Investment Advisers:

St James Place Partnership, York House, 23 Kingsway, London WC2B 6UJ,
and
Newton Investment Management, 160 Queen Victoria Street, London EC4V 4LA

Investment Custodians:

St James Place Partnership, York House, 23 Kingsway, London WC2B 6UJ
and
Newton Investment Management, 160 Queen Victoria Street, London EC4V 4LA

Statutory Auditor:

Haines Watts, 4 Claridge Court, Berkhamsted, Hertfordshire, HP4 2AF

DIARY

As a result of the still ongoing worldwide COVID-19 pandemic, events in many locations have been cancelled or converted to virtual events, others are hybrid. Local restrictions are varied, therefore, before considering attending any event, please contact the organisers to check whether the event is still taking place.

RSMA Toronto, Canada

Informal RSM meeting

Last Friday of every month, noon.
Jason George Pub, 100 Front Street East, Toronto
Contact: rsma.1851@gmail.com

RSMA Perth, Australia

Monthly Sundowner

First Friday of every month.
The Celtic Club, 48 Ord St, West Perth, WA, 6005
Contact:
Alan Dickson – alan@dickson.com.au
John Sykes – johnsykes@gmail.com

Imperial Alumni, Houston, US

Alumni social

Third Thursday of every month, 6pm
Capital Grille, 840 West Sam Houston Pkwy N, Houston, TX 77024
Contact: Matt Bell – matt@in2oilandgas.com

Imperial Engineering Alumni, Johannesburg, South Africa

Quarterly Johannesburg Lunch

(16th Nov, 15th Feb, 17th May, 17th Aug)
Baron & Quail, Woodmead, Johannesburg, South Africa
Contact: Richard Gundersen – Gundersen@yabo.co.za

Engineering Alumni

Traditional Reunion Luncheon

For engineers who graduated in a year ending in a '2' or a '7' – C&G and RSM graduates all welcome.
Saturday, 19th Nov 2022, 12:30 for 13:00
Polish Club, 55 Prince's Gate, Exhibition Road, South Kensington
Booking form enclosed with this issue

RSMA

137th Annual Dinner

Friday, 25th Nov 2022
Rembrandt Hotel, South Kensington SW7 2RS

CGCA

109th Annual Dinner

Friday, 24th Feb 2023, 18:45 for 19:30
Carpenters' Hall, Throgmorton Avenue, London EC2N 2JJ
For more details, see insert with this issue

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-WhatsOn and the Friends of Imperial College regularly organise events of interest to alumni (see bit.ly/IE-Fol)

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

Guildsmen retain Sparkes Cup

The Sparkes Cup made a welcome return to the Imperial Sporting Calendar after a 3-year pandemic-enforced absence, sponsored by CGCA, RSMA and RCSA. With a reinvented format, the competition saw City and Guilds play the Royal College of Science across the best of 3 games of 7s. A last minute injury for the Captain of the Royal School of Mines scuppered any chance for the smallest and pluckiest of the colleges to field a team, enforcing this change of format!

C&G won the toss for the first fixture and opted to kick off. Clearly no one had told the RCS side that they were playing 7s, as they kept the ball tight with one up runners for several phases in their own 22. Eventually, they remembered that summer rugby is meant to be expansive and ran the ball out to the halfway line. Unfortunately at this point, only seconds into the game, RCS lost their captain A.Brzosko to injury, having been cleared out of a ruck by his own player. With a man on the deck for RCS, C&G capitalised, turning the ball over, with B.Zhang running under the posts to dot down, and converting his own effort. Following this try, the game began to open up. With brilliant end to end rugby, both teams were still feeling fresh. Both sides scored again before the break with a halftime score of 14-5 in favour of the engineers. Halftime substitutions were made by each team to utilise fresher players. RCS struck first after the break, in order to bring the scores to 14-12, before the C&G team reasserted their dominance with three further tries without reply, to win the first game 33-12.

With such a strong end to the first game, C&G were confident heading into the second leg. But RCS got off to a strong start, scoring

first and converting. The engineers responded quickly but missed the conversion. The back and forth nature of the contest continued throughout the half, with direct carriers from RCS such as K.Joshua, H.Fox and F.Weller resulting in another score before the break to lead 14-5. The C&G captain M.Speechley motivated his team at the break by reminding the squad that if they won, they wouldn't need to play any more games! Clearly this was all the motivation required, as from a scrum the ball found W.Ridge on the wing who ran in from his own half to dot down under the posts and convert. C&G quickly followed this up with a second try to take the lead for the first time in the second leg – the Sparkes Cup was seemingly in their grasp with only a few minutes left to play. However the RCS were resurgent as the guildsmen tired, with E.Saw scampering through a broken defensive line to level the scores. After the conversion was missed, an extended break (to deal with a player who'd gone a bit too hard at Ascot the day before) gave both teams time to compose themselves for the final minute to try and win the game to seal the trophy, or take the event to a final deciding game. From the restart, the ball was hung up on the 10m line

for C&G to chase and compete for, but the scientists gathered the ball, broke a couple of tackles, and ended up scoring under the posts again.

The final game of the day began with two very tired sets of players. Very similar to the second game both sides traded scores and matched each other throughout, but C&G led narrowly at halftime 14-12. In the second half, RCS scored back-to-back decisively, to bring the score to 24-19 in favour of the scientists with just over a minute left on the clock. RCS attempted to close out the final few minutes by reverting to their 15-a-side tactics of kicking for territory and using their heavy forwards to take it into contact and run down the clock. However, a single loose pass was picked off by D.Bedford on his own 22 and was chased down until scoring underneath the scientists posts to level the scores at 24-24. W.Ridge kicked the winning conversion to ensure that C&G retained the Sparkes Cup for the fourth time in succession.

We're extremely grateful for the continued support of all the college associations' for the Sparkes Cup.

Players of the Tournament

C&G: D. Bedford

RCS: F.Weller



The City and Guilds team played the Royal College of Science team for the Sparkes Cup after a pandemic-enforced 3-year hiatus. Sadly, at the last minute, the Royal School of Mines were unable to field a team.

The death of Her Majesty Queen Elizabeth II

Following the news from Buckingham Palace that the Queen died peacefully at Balmoral Castle on 8 September, Imperial paid tribute to Her Majesty with an article on their website (available at <https://bit.ly/IE37-Queen>) looking back over the close and historic ties between the College and the Queen, who witnessed several important College milestones. This item is based on that article.

Longest reigning monarch

Elizabeth II had been Queen of the United Kingdom and the Commonwealth Realms for more than 70 years. Born on the 21st April 1926, she acceded to the throne aged 25 on 6th February 1952, following the death of her father, King George VI. On 9th September 2015 she became the longest reigning monarch in British history, surpassing Queen Victoria.

Professor Hugh Brady, President of Imperial College London, says: "It is with great sorrow that we have learned of the death of The Queen. Throughout her extraordinary reign, The Queen has been a symbol of stability during periods of enormous change. Her death is a great loss to the British public and the world. I offer my deepest condolences to the Royal Family."

Professor Ian Walmsley, Provost of Imperial, said: "The Queen has been present for some of the most significant moments in Imperial's history. She has been an important champion of our mission, understanding that education and research are some of the greatest tools we have to drive progress and benefit society. We join the world in mourning her loss."

Longstanding links

Prince Albert, The Queen's great-great-grandfather, envisioned a vibrant cultural quarter in South Kensington celebrating science, technology, design and the arts. This vision led ultimately to the founding of the area's great institutions including Imperial, and the area that is widely known as Albertopolis today.

In 1969, The Queen visited Imperial for the first time, to open the Sheffield Building – known at the time as 'the College Block'. The building's construction was part of Imperial's post-war expansion scheme, which aimed to help Imperial meet the scientific and technological challenges of the 20th century.

Lord Sheffield, Chairman of the Governing Body, welcomed Her Majesty as Visitor to the College for the first time, to mark "the completion of the College Block and the two fine libraries, the Lyon Playfair library and the Museum of Science library." He referred to her great-grandfather who laid the foundation stones of two of the principal buildings of the College in 1883 and 1899; and to her father and mother who participated in the centenary celebrations of 1945.

The Queen responded: "Lord Sheffield, thank you for your kind

words of welcome. Ever since the Prince Consort founded the Royal College of Chemistry in 1845, there have been many contacts between the members of my family and the colleges which now make up the Imperial College of Science and Technology. One of the more formal of these must have been when Queen Victoria in her Golden Jubilee year laid the foundation stone of the Queen's Tower. A few years after that, in 1893, a peal of bells was hung in it, each one named after a member of her family; and it is those bells which are being rung today.

"One of the least formal of these visits to this great scientific complex must have been the occasion before the last war when my grandmother Queen Mary brought me and my sister to see the science museum whose library I look forward to seeing this afternoon. I shall never forget the pleasure and interest of that visit.

"As Visitor to the College I am particularly glad to be here today because the object of these celebrations is, as you have told us, to mark a really important step forward in your history and in that of higher technological education in Britain. As a first phase in their post-war evolution, the universities were encouraged to expand in a general way, though the main aim was to increase the numbers of their students in the pure and engineering sciences. Then, this college was one of the few chosen as the spearhead of a selected attack on the problem of providing more university educated scientists and engineers. In this you have been outstandingly successful, for you have grown not only in size but also in distinction, as you have discharged the responsibility laid upon you. What is more you have done much, as you have grown, to bring the pure and the applied sciences together. My attention has been drawn to something Lyon Playfair who, with the Prince Consort, had long urged the need to found the first of the colleges which you now incorporate, said as far back as 1851, in the year of the great exhibition, 'In this country,' he declared, 'we have eminent practical men and eminent scientific men, but they are not united and generally walk in paths wholly distinct. From this absence of connection there is often a want of mutual esteem and a misapprehension of their relative importance to each other.' I am very happy to know that the growth that you have enjoyed in these past 15



Photo courtesy of Imperial College London

Her Majesty at Imperial for the 2007 centenary celebrations

years has helped develop the kind of esteem which in the time of the Prince Consort and of Lyon Playfair was so sadly lacking.

"I am looking forward to seeing something of the College Block but before doing so I know that all of you who are here will join me in congratulating the architects, the contractors, the builders, and all those who helped with brain and hand to complete these buildings. I now have pleasure in unveiling this plaque which commemorates today's celebrations and the completion of the College Block."

Great vision

In 1998, The Queen opened the Sir Alexander Fleming Building, created to be the new headquarters for the College's medical and biomedical research. The building also became the heart of Imperial's recently formed School of Medicine, the product of a series of mergers with leading London medical schools. She also presented the College with a new Royal Charter.

Speaking during her visit, The Queen said: "I have no doubt that the two people whose memory we honour today would warmly approve of this occasion. This new building which forms the heart of your magnificent new medical school, bears the name of Sir Alexander Fleming and I'm delighted that his son is here with us to witness the inauguration of a building of which his father would have been proud; and Prince Albert would certainly view this coming together of science, engineering, and medicine, with enthusiasm, knowing that is yet further proof that his great vision is still in the process of being realised. I now name this building the Alexander Fleming building and have much pleasure in presenting the College with its new Charter."

Landmark moments

The Queen visited Imperial again in 2004, to witness the opening of Imperial College Business School and the College's newly constructed Main Entrance on Exhibition Road. The landmark building, designed by Sir Norman Foster and Partners, created the iconic entrance to the College, complete with its imposing image of a multi-coloured scan of a brain, representing the brainpower of the institution.

During Imperial's centenary celebrations in 2007, The Queen once again presented the College with a new Royal Charter, marking its independence from the University of London. At the event, she awarded the very first Imperial College London degrees to several honorary graduates, including her husband, the Duke of Edinburgh.

Speaking at the event, The Queen said: "Imperial was founded with the intention that it should support British technology and industry in the face of international competition. You have certainly fulfilled that aspiration.

"Today you renew your mission of applying your learning, discoveries and innovation to meet the changing needs of society, industry and healthcare. You will also, of course, continue to carry out the important task of educating the young people who will become the future inventors, discoverers and leaders of business and society.

"By discharging this academic mission, you play a vital role in supporting this country's position on the world stage."

The event also saw the opening of the new Institute of Biomedical Engineering, which went on to spur the future development of innovations, including Prof. Chris Toumazou's rapid lab-free PCR tests for COVID-19.

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Imperial's UK and World rankings

Imperial College London has been named *The Guardian's* University of the Year. Imperial, which has risen to fifth place in the newspaper's overall rankings, was commended for its strong performance with graduates' career prospects and for having the highest levels of student satisfaction for teaching in England.

More than 94% of students in recent years have found graduate-level positions within 15 months of earning their degrees – the highest level in the league table.

In addition to its strong reputation for encouraging entrepreneurship, through facilities such as the Enterprise Lab and Hackspace, the College has been praised for its multi-disciplinary approach to research and teaching.

President Hugh Brady said: "Innovation and enterprise are really part of the DNA, they're part of what attracts the students. The atmosphere is different: impact, innovation, entrepreneurship just ooze out of the institution."

Professor Brady also suggested that there was now a deeper appreciation in society of the value of science, engineering and medicine, adding: "You can really argue that Imperial has never been more important to the country."

The accolade comes after Imperial was named University of the Year for Graduate Employment in *The Times' Good University Guide 2023*.

Imperial has also been ranked 3rd in the UK and has risen to 10th in the world in the latest *Times Higher Education* World University Rankings. The College has risen two places from 12th in the world in last year's rankings and is again recognised as London's top university.

President Hugh Brady said: "Imperial now ranks third in the UK and in the top ten worldwide, underlining our global reputation for excellence and impact. The result follows a string of recent successes, which is a testament to the hard work and dedication of our phenomenal staff and students."

"As one of the world's greatest universities we push the frontiers of research and education and deliver benefits to society here in London, across the UK and across the globe. Our community made a critical impact during the pandemic and continues to make vital contributions to solving some of the world's greatest challenges. Our work has never mattered more, and these results show that."

In May, the College ranked top in the UK for research as part



of the UK's Research Excellence Framework (REF), with a greater proportion of "world-leading" research than any other UK university. Imperial ranked first in the UK for research outputs, first in the UK for research environment, and first for research impact among Russell Group universities.

In June, the league table published by the QS World University Rankings, showed Imperial ranked in sixth place for 2023 putting it third in the UK and top in London. It has been awarded an additional certificate of recognition for "internationalisation", acknowledging the College's global impact and connections.

In July, the College recorded student satisfaction of 82% in the National Student Survey (NSS), putting Imperial first among fellow London Russell Group universities and second place among all Russell Group institutions. The College also secured a ranking of 27 out of a total of 160 higher education providers covered by the survey.

Imperial's Vice-Provost (Education and Student Experience) Professor Emma McCoy said: "These results reflect our community's continued efforts to prioritise the quality of the student experience in this past year."

"As we emerge from an uncertain two years, we can be confident that we are making the right decisions in collaboration with our students. We have been delighted to be able to return to our campuses this academic year, meaning they have become vibrant, collaborative spaces once again. This has clearly brought benefits to all student cohorts and has allowed our final year students the opportunity to say a proper farewell to their student experience."

Last year, Imperial was named University of the Year and University of the Year for Student Experience for 2022 by *The Times* and *Sunday Times* Good University Guide, after recording an all-time high in student satisfaction following increased investment in learning and teaching, with the development of a world-class hybrid education experience.

Athena Swan Silver award

Imperial has successfully renewed its institutional Athena Swan Silver award, for commitment to the advancement of gender equality.

Imperial's award was first granted in 2012 and last renewed in 2016. Imperial is the first university to renew a Silver award under Advance HE's new transformed Charter, which is designed to be more flexible, transparent and supportive.

Imperial's Provost, Professor Ian Walmsley, said: "This process has provided a welcome opportunity to review our progress so far in advancing gender equality and consolidate our future efforts. The award is a recognition of the College's commitment to supporting women's careers, resulting in an increase of the number of female professors and targeted support for researchers after maternity leave or those with unusual career paths."

Professor Stephen Curry, Imperial's Assistant Provost for Equality, Diversity and Inclusion (EDI), led the College's renewal application, alongside Rob Bell, Athena SWAN Coordinator, and a self-assessment team made up of colleagues from across Imperial. "The Athena Swan Charter continues to provide a valuable framework for benchmarking progress and setting out our ambitions for the next five years," Professor Curry said.

"Increasingly it is embedded in a broader scheme of work at the College that aims to address not just equality, diversity, and inclusion, but the values and culture of the institution. As a result, we have endeavoured where possible to integrate Athena Swan actions with commitments that are part of other action plans. This is laying the foundation for a more intersectional approach to issues of equality, diversity, and inclusion that we hope to mainstream as business as usual."

Progress so far

Imperial has embedded gender equality work at the highest-level

of governance and leadership. The Equality, Diversity and Inclusion Strategy Group, chaired by the Assistant Provost (EDI), reports to Imperial's Provost's Board. All Provost's Board papers must consider EDI aspects before submission.

Specific achievements from the last few years that impact gender equality include:

- An increase in the percentage of female professors to 18.3%, and an increase in female undergraduates to 40.4%;
- Reduction in the gender pay gap from 9.4% to 6.3% (median) over the past four years;
- Reverse mentoring scheme for senior leadership;
- Introduction of the Report and Support tool – a single portal for staff and students to report bullying and harassment of any sort;
- Introduction of free period products on all our campuses.

What's next

The new, transformed Charter asks universities to identify a small number of priority areas in their applications. Imperial's action plan[†] sets out the following four priorities, with key targets for each to reach by 2027:

- Improve the way we value and support women's careers;
- Improve culture and day-to-day experiences, and learn the lessons of Covid-19;
- Improve organisational systems capacity;
- Boost the numbers and experiences of female students.

Specific commitments include:

- Appointing eight more female readers and professors in the next three years;
- Increasing the percentage of female PhD students – the student cohort which has seen the least change – with a focus on the Faculties of Engineering and Natural Sciences.

[†] Download the action plan from <https://bit.ly/IE37-Swan2022>

Imperial awarded Secured Environments security accreditation

Imperial has received the Secured Environments accreditation in recognition of its work in building safe and inclusive campuses for our community.

The award, which distinguishes organisations that demonstrate excellence across six key principles of security, was awarded to the College's Security team by Commander Helen Harper, Head of Profession, Crime Prevention, Inclusion and Engagement at the Metropolitan Police. The achievement reflects Imperial's

commitment to ensuring the safety of students, staff and visitors across all our campuses.

In order to be accredited, the Security team demonstrated that they had implemented the six key principles of Secured Environments, which focus on how organisations protect themselves against crime and risk.

Imperial's Security presence covers 9 campuses and hospitals from South Kensington to Silwood Park in Berkshire.

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Honours for academics and alumni

In June the Queen's Jubilee Birthday Honours List was announced, to mark the public service of individuals across the UK in celebration of the Queen's 70 years of service.

Mary Ryan, Professor of Materials Science and Nanotechnology and Vice-Dean for Research in the Faculty of Engineering, has been awarded a CBE for services to Education and to Materials Science and Engineering. She holds the Armourers and Brasiers' Chair in Materials Science.

Professor Ryan is also Interim Vice-Provost for Research and Enterprise. She is responsible for developing and providing leadership around the delivery of the College's research and enterprise strategy, and for enhancing the quality, impact, management and delivery of Imperial's research.

In addition, she leads several pioneering initiatives, including the College's sustainability programme Transition to Zero Pollution.

Her research spans diverse areas including energy materials (batteries, magnetocaloric cooling devices, photovoltaics, fuel cells and catalysis), nanomaterials for biosensors and therapies, the mechanisms associated with nanostructures that lead to human and environmental toxicity, and the potential of nanomaterials to remedy environmental damage - in particular for nuclear waste. She was elected Fellow of the Royal Academy of Engineering in 2015 and is also a Fellow of IoM3 and of the Institute of Corrosion.

Professor Ryan said: "This recognition is a huge honour and a testament to the amazing group of students and researchers I have worked with at Imperial and elsewhere."

Photo courtesy of Imperial College London



Professor Mary Ryan CBE

James Durrant, Professor of Photochemistry in the Department of Chemistry, has also been awarded a CBE, for services to photochemistry and solar energy research.

Kathryn Maitland, Professor of Tropical Paediatric Infectious Disease in the Department of Surgery & Cancer, has been awarded an OBE. She is a paediatrician and infectious disease researcher who has dedicated her career to improving the care of critically ill children, including studying the impacts of malaria, bacterial sepsis and severe malnutrition.

Honours for alumni include:

Susan Ion (Metallurgy and Material 1976, PhD Materials 1979), former Chair of the Nuclear Innovation Research Advisory Board, has been made a Dame Grand Cross of the Order of the British Empire for services to engineering.

Professor Rachel Gomes (PhD Environmental Science & Technology Research 2000) has been awarded MBE for services to research and to education.

Peter Kwok (BEng Materials Science and Engineering 2007) has received a Medal of the Order of the British Empire for services to the East and South East Asian Communities in the UK.

RAEng Research Fellowships

Dr Reshma Rao from the Department of Materials, and **Dr Jack Gartside** from the Department of Physics, have each received one of 17 Royal Academy of Engineering Research Fellowships for 2022. The programme supports outstanding early-career researchers to become future research leaders in engineering.

The fellowships are designed to advance excellence in engineering by providing funding for five years to allow awardees the freedom to concentrate on basic research in any field of engineering. This year the value of the awards has been increased to offer up to £625,000 over five years.



Dr Rao has been awarded for her project 'Seeing the invisible – probing hydrogen production from low-grade water'. Her work concerns developing catalytic materials for splitting water – a first crucial step in creating green hydrogen fuels.

Using spectroscopic techniques, she investigates the molecular details of the water-splitting reactions on various materials. Using this information to determine which steps limit the efficiency of such reactions in a range of conditions could lead to new ways to improve the activity, stability, and selectivity of materials for green hydrogen production from contaminated or low-grade water.

On receiving the Fellowship, she said: "I am delighted to have this unique opportunity to further my research vision for green hydrogen production. I am truly blessed to be working in this wonderful environment at Imperial College, which is so innovative, collaborative, and supportive."

Photos courtesy of Imperial College London



Dr Gartside has been awarded for his project 'Engineering magnonic metamaterials for low-energy neuromorphic computing'. His work uses miniature 'nano' magnets to process and store data, acting as computers that mimic brain networks.

Dr Gartside and colleagues recently demonstrated that it is possible to perform artificial intelligence using these nanomagnetic systems, which could slash the energy costs of AI. The team showed nanomagnets can be used for 'time-series prediction' tasks, such as predicting and regulating insulin levels in diabetic patients.

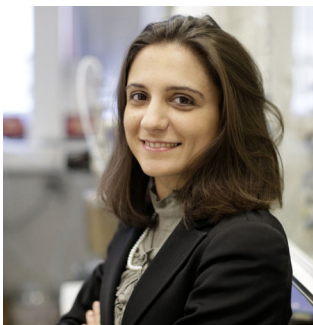
On receiving the Fellowship, he said: "It's great to have the support of the Royal Academy of Engineering and Imperial College London to work on this pressing global societal issue. Lowering the energy and carbon footprints of AI is a huge task and I'm excited to be working on it."

European Research Council Proof of Concept Grants

Dr Cecilia Mattevi, a Reader in the Department of Materials, and **Professor Cristian Cadar** from the Department of Computing have won ERC Proof of Concept Grants to accelerate their research ideas and concepts. The grants, worth €150,000 each, are to explore the commercial or societal potential of the results of their research projects. The funding is part of the EU's research and innovation programme, Horizon Europe.

The ERC has funded new research, led by Dr Mattevi, to investigate the fabrication of rechargeable Zn-ion batteries, based on aqueous electrolytes, manufactured using 3D printing to power wearable devices.

Photos courtesy of Imperial College London



The use of 3D printed batteries in wearable devices offers many advantages. A more sustainable alternative to traditional batteries, they are cost-effective to produce, and designs can easily be customised.

Dr Mattevi explains: "The idea behind the 3DZnBat proof-of-concept is to address pressing challenges in the field of battery for wearable electronics such as safety, availability of raw materials and conformal features. This project will allow me to develop the proof of concepts to explore the market potential of 3D printed rechargeable Zn-ion batteries based on aqueous electrolytes."

Professor Cristian Cadar's project PATCH is investigating ways to help software systems evolve safely and securely.

Professor Cadar said: "PATCH provides an exciting opportunity to explore the potential of our



ERC research in practice. Modern software systems evolve at an accelerated pace, and there is an acute need to comprehensively validate software changes, which is the main goal of our project."

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

New Royal Academy of Engineering Fellows

Imperial Professors Bassam Izzuddin, Kin Leung, and Roy Taylor have been formally elected to Royal Academy of Engineering Fellowship. The new elections take the number of Imperial Fellows of the RAEng – one of the highest UK honours an engineer can receive – to 104.

The new Fellows will be formally admitted to the Academy at a special ceremony in London on 8 November, when each Fellow will sign the roll book. In joining the Fellowship, they will add their unique capabilities to the Academy's mission to harness the power of engineering to create a sustainable society and an inclusive economy for all.

Sir Jim McDonald FEng FRSE, President of the Royal Academy of Engineering, said: "I am delighted to welcome such an array of enormously talented people to the Fellowship of the Royal Academy of Engineering. From industry and enterprise to education and government – both national and international – these are some of our most pioneering and distinguished engineers and technologists.

"In an uncertain world, one thing is certain – engineering skills, vision and leadership will play a crucial part in addressing the escalating domestic and global challenges that we face today. The combined connectivity, professionalism, experience and wisdom of the new Fellows who join us today will greatly enrich the expertise and support we can provide to the government and to society in general."

Professor Izzuddin's research focusses on modelling whole buildings and masonry arch bridges under service and extreme loading conditions, like those caused by earthquakes, fires and blasts. A key feature of his work has been extensive national and international collaboration with fellow academics and leading players in the structural engineering industry, leveraging ADAPTIC to set the international agenda on several fronts.

He has also made determined steps towards developing simplified design-oriented assessment techniques, including pioneering work on structural robustness, and proposing analogies which enhance the understanding by engineers of complex nonlinear structural phenomena.

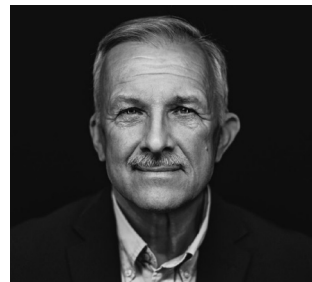
Of his election, Professor Izzuddin said: "I am delighted to receive this honour from the Academy, recognising the synergistic impact of my work in fundamental computational mechanics, structural engineering research and engineering practice.

"I am particularly excited about our ongoing work in computational mechanics on the conceptual and development fronts, applied research on masonry arch bridges and retrofitting of building structures, and practical assessment methods that are shaping the future of structural robustness design."

networking problems, establishes theoretical foundations, invents efficient architectures and algorithms for network control, and develops new network and service capabilities. These have been applied to nationwide infrastructures for civilian and defence applications.

Of his election, Professor Leung said: "I am honoured and humbled to be elected as a Fellow of the Royal Academy of Engineering. I also feel privileged to spend the second half of my career at Imperial – an intellectual powerhouse.

"I am very grateful to my research students at Imperial and collaborators in the UK and US for their stimulating and fruitful collaborations. My work in education is not finished and I'm excited about what the next chapter may bring."



Professor Roy Taylor

Roy Taylor is Professor of Ultrafast Physics and Technology in the Department of Physics. He is widely acknowledged for his influential basic research on and development of ultrafast laser systems and their application.

He has contributed extensively to advances in picosecond and femtosecond dye laser technology, compact diode-laser and fibre-laser-pumped vibronic lasers and their wide-ranging application to fundamental studies.

Professor Taylor is also particularly noted for his fundamental studies of ultrafast nonlinear optics in fibres, with emphasis on solitons, their amplification, the role of noise, and self-effects, such as Raman gain.

He is also a Fellow of the Optical Society of America and of the Royal Society, London. Of his election, Professor Taylor said: "Obviously, it is an honour to get elected to the Fellowship of the Royal Academy of Engineering and it is quite uplifting to get some recognition for the very diverse range of applied research and development that I have carried out, aside from my fundamental studies, over my now more than 50-year career. However, at this stage of my career, some may consider it as a good attendance award, and I suppose they may have a point!"

President's Medal

The President's Awards for Excellence have four streams: Culture and Community, Education, Research, and Societal Engagement. Those awardees judged to have made particularly exceptional contributions within each category are selected to receive the President's Medal.

Outgoing President Professor Alice Gast addressed the award-winners, saying: "It's heart-warming and inspiring to hear about all of your achievements, even more so when you have faced uncertainty and overcome challenges. You make Imperial an exciting place to study, a rewarding place to work, a source of solutions, a valued partner and a beacon of hope for the future. I am proud to be your colleague and I am sure I speak for everyone here today when I say, 'thank you!'."

Professor Nilay Shah, Professor of Process Systems Engineering in the Department of Chemical Engineering, won the President's Medal for Excellence in Culture and Community for his work chairing the Imperial History Group. The Group was commissioned to examine the history of the College through its links to the British Empire, and to report on the present understanding and reception of the College's legacy and heritage in the context of its present-day mission.

Sara West, who nominated Nilay for the award, said: "The impact on not just the current community but potential future generations of Imperial staff and students, particularly those from non-white backgrounds, cannot be understated. This project was ambitious and unique, and I'm pleased to see Nilay's role as Chair recognised in this way."

"I'm delighted to receive this award," Nilay said. "Chairing the History Group was one of the most challenging and rewarding things I've done for many years.

"It was particularly a great pleasure to work with a diverse set of colleagues who were all committed to exploring and understanding our history and to making the College a more inclusive institution for staff, students and stakeholders."



Professor Nilay Shah

Photo courtesy of Imperial College London



Professor Bassam Izzuddin

Bassam Izzuddin is Professor of Computational Structural Mechanics and Head of the Computational Structural Mechanics group in the Department of Civil and Environmental Engineering. He is also the founder and developer of ADAPTIC, an adaptive static and dynamic structural analysis program for high-fidelity modelling of steel, concrete, composite and masonry structures.



Professor Kin Leung

Kin Leung is Tanaka Chair in Internet Technology in the Departments of Electrical and Electronic Engineering (EEE), and Computing at Imperial. He also serves as Head of the Communications and Signal Processing (CSP) Group in the EEE Department.

Professor Leung's research focusses on optimisation and machine learning for the design and control of large-scale communications, computer, and sensor infrastructures. These include wireless technologies, Internet of Things, distributed and cloud computing, and vehicle communications, as well as neural networks and artificial intelligence.

His research solves major

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Royal Academy of Engineering Enterprise Fellows

Three Imperial researchers and a recent alumnus have been named as Fellows for the Royal Academy of Engineering's Enterprise Hub.

The Enterprise Fellowship is a 12-month programme for creative and entrepreneurial engineers to help with the acceleration of innovative ideas at an early stage of development. It offers equity-free funding, an extended programme of mentorship and coaching, and access to a community of engineering mentors and alumni.

Since its 2013 launch, the RAEng says that the Enterprise Hub has supported nearly 300 researchers, recent graduates and leaders of SMEs to start and scale up businesses.

Maxwell Munford, Research Assistant in the Department of Mechanical Engineering, has created the technology OSSTEC, which aims to improve partial knee replacement – a treatment designed to help younger patients where only the diseased part of a knee joint needs to be replaced.

His team has created 3D printed titanium structures which mimic how bone naturally grows and heals itself, which can be used to improve implants being fitted.

OSSTEC aims to produce the world's first partial knee replacement that, by mimicking the bone's properties, maintains the patient's bone health – allowing the joint to behave in a natural way and improving patients' quality of life.

GLOW Surgical, developed by **Maria Leiloglou**, Research Assistant in the Hamlyn Centre for Robotic Surgery, and her team, is an imaging system that can visualise a tumour and its boundaries accurately in real-time in an operating theatre.

The system uses a near infrared fluorescence and white light camera system, with accompanying software for control and image processing, to provide augmented images of

the surgical scene with diagnostic information.

The benefits of GLOW are that it is non-invasive, fits within the current surgical workflow, and has been tested in over 50 surgeries.

Will Dubin is a recent graduate from Imperial's Civil Engineering MEng course, winner of the 2021 FCGI Centenary Award, and the founder of ManholeMetrics – a low-cost technology designed to prevent wastewater flooding.

The technology uses ultra-low-cost, long-life sensors mounted in manholes to collect data from sewers and drains, giving real-time flood warnings and allowing for insights into the correlation between weather data and water levels to predict flooding and identify blockages.

The ManholeMetrics team is formed of Imperial students and recent graduates from departments in the Faculty of Engineering and Natural Sciences. The technology has received support from Yorkshire Water, Thames Water and National Highways, and will shortly be launching field trials with their partners.

About:Energy is a company that was co-founded by **Gavin White**, a PhD student in the Department of Mechanical Engineering, to produce affordable battery models that are tailored to the specific requirements of customers. It aims to dramatically reduce the reliance on experimental research and development processes by centralising the development of battery models across a wide spectrum of applications.

To achieve this goal, the team uses decades of experience in battery model development and patented processes. About:Energy will also create 'The Voltt', a database of battery models to mimic the operation of 100s of commercially available batteries, so subscribers can select a battery model to fit their needs.



L to R, back row: Maxwell Munford, Gavin White
L to R, front row: Maria Leiloglou, Will Dubin

Photo courtesy of Royal Academy of Engineering

Prestigious thermodynamics prize

The Christopher Wormald Award is offered in honour of Christopher J. Wormald, recognising his outstanding contribution to the Thermodynamics Conference Series. The prize is awarded on the basis of the quality and originality of the work entered and given only once every two years.

Dr Fabian Thiemann, from the Department of Chemical Engineering, received the award for his thesis titled 'Properties of Low-Dimensional Materials Explored with Machine Learning Potentials'. His PhD focused on the development and application of machine learning approaches to better understand carbon and boron-nitride materials and their interaction with water. He has had four papers published in the *Journal of Physical Chemistry, Proceedings of the National Academy of Sciences, Nano Letters*, and *ACS Nano*, all of which represent significant advances in the field.

Commenting on his award, Fabian said: "I feel very honoured to have been awarded this prestigious prize and proud that our work has been received in such a positive way by the community. I am convinced there is still much more to learn about low-dimensional materials and hope to contribute to the field further in the future. I am deeply grateful to my supervisors, collaborators, and all the mentors I had throughout my



Dr Fabian Thiemann receiving the award from Professor Tim Mays of the University of Bath

PhD without whose patience and help this would not have happened."

Professor Erich Muller, his PhD supervisor, said: "The Wormald prize is the premier award in the field of Thermodynamics and recognises outstanding rising stars. All of the previous winners have lived up to this expectation, becoming leading academics and/or holding key industrial positions.

"Fabian is a worthy recipient of the prize – one of the brightest and most capable researchers I have ever had the pleasure to work with. Fabian's work stands out in terms of rigour and deep physical insight he extracts from his simulations. One of the hallmarks of his research is his ability to digest enormous amounts of complex simulation data and arrive at simple and intuitive physical insights on the behaviour of complex materials systems."

UKRI Future Leaders Fellowship

An Imperial engineering researcher has been awarded a UKRI Future Leaders Fellowship (FLF). The FLF scheme aims to develop the next wave of world-class research and innovation leaders in academia and business.

Urbanisation-related flooding is a huge issue – it has a projected global cost of £500 billion a year by 2030 and is expected to cost the UK economy £27 billion annually by 2080, if no action is taken. Current permeable pavements which are designed to absorb rainfall, suffer from a number of challenges, including low strength and durability, as well as being prone to clogging by sediments.

Dr Alalea Kia, of the Department of Civil and Environmental Engineering, has developed a clogging-resistant permeable pavement called Kiacrete through her research and start-up company Permia. Kiacrete offers significant environmental benefits whilst contributing towards achieving net-zero, through flood mitigation, reduced emissions, water reuse and the decreased urban heat island effect. If you've been to Imperial's White City Campus, you might have walked on Kiacrete. The patented interlocking tile delivery system was deployed there two years ago and monitoring so far has shown excellent durability and drainage performance.



Photos courtesy of Imperial College London



Kiacrete is deployed in White City Campus

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Bee-inspired flying 3D printer drones

Researchers from Imperial and Empa (Swiss Federal Laboratories for Materials Science and Technology) have created a fleet of flying 3D printers for building and repairing structures while in flight.

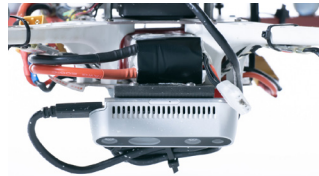
3D printing is becoming more widespread in the construction industry, both on-site and in factories. The researchers created flying drones that use collective building methods inspired by natural builders like bees and wasps. This could be used for manufacturing and building in inaccessible or dangerous locations, and in post-disaster relief construction.

The drones in the fleet, known collectively as Aerial Additive Manufacturing (Aerial-AM), work co-operatively from a single blueprint, adapting their techniques as they go. They are fully autonomous while flying but are monitored by a human controller who checks progress and intervenes if necessary, based on the information provided by the drones.

A research paper was published in *nature* in September (and featured on the cover, see below). Lead author Mirko Kovac, Professor at Imperial's Department of Aeronautics and Head of Empa's Materials and Technology Center of Robotics, said: "We've proved that drones can work autonomously and in tandem to construct and repair buildings, at least in the lab. Our solution is scalable and could help us to construct and repair buildings in

difficult-to-reach areas in the future."

Aerial-AM uses both a 3D printing and path-planning framework to help the drones adapt to variations in geometry of the structure as a build progresses. The fleet consists of BuilDrones, which deposit materials during flight, and quality-controlling ScanDrones that continually measure the BuilDrones' output and inform their next manufacturing steps.



The ScanDrone's camera

To test the concept, the researchers developed four bespoke cement-like mixtures for the drones to build with. Throughout the build, the drones assessed the printed geometry in real time and adapted their behaviour to ensure they met the build specifications, with manufacturing accuracy of five millimetres.

The proof-of-concept prints included a 2.05-metre high cylinder (72 layers) with a polyurethane-based foam material, and an 18-centimetre high cylinder (28 layers) with a custom-designed structural cementitious material.

Next, the researchers will work with construction companies to validate the solutions and provide repair and manufacturing capabilities. Professor Kovac said: "We believe our fleet of drones could help reduce the costs and risks of construction in the future, compared to traditional manual methods."

Co-investigators include teams at UCL, Univ. of Bath, Univ. of Pennsylvania, Queen Mary Univ. of London, and Tech. Univ. of Munich (TUM).

A video produced by *nature* showing the drones working can be seen at <https://bit.ly/IE37-3Ddrones>



ScanDrone (left) monitors the progress of BuilDrone (right)

Early adopters of heat pumps needed

According to a new Imperial College report, new measures are needed to build consumer confidence in low-carbon heating.

The Briefing Paper, published by Energy Futures Lab, Imperial's global energy institute, finds that giving consumers, installers and other stakeholders access to real-world heat pump performance data and customer satisfaction scores could help drive the transition to low-carbon heating in the UK.

The report investigates the potential of leveraging early adoption to drive a boom in installations and calls for new measures to give consumers confidence in low-carbon technologies – notably the creation of a publicly accessible database of heat pump case studies.

At present, householders and landlords considering installing a heat pump system are faced with complexity and uncertainty, relying on performance estimates, which do not accurately reflect real-world operation and running costs.

The report recommends the development and routine use of standardised procedures to measure building and heating system performance before and after the installation of a heat pump at minimal cost and inconvenience to householders and installers.

"The reality is we urgently need to move away from gas for heating but unless homeowners have the confidence to invest in alternative technologies, the transition will falter," says Dr Richard Carmichael,

a Research Associate at Imperial's Centre for Environmental Policy and author of the report.

"By requiring installers to measure the performance of buildings and their heating systems, householders will feel reassured that they are getting a high-quality installation and a heat pump that operates efficiently."

Combining these measurements with customer satisfaction ratings and running costs to create case studies, accessible through a public database, could unlock social influence effects, helping to trigger the next stage of heat pump adoption, according to Dr Carmichael.

"When it comes to making improvements to our homes, our neighbours and peers could become effective 'trusted messengers' if we enable peer-to-peer learning. Letting householders see for themselves how heat pumps actually perform in properties similar to theirs would give them the confidence to make the change. These case studies would also provide the heating industry with a rich resource for upskilling and training plus valuable transparency."

The report also highlights serious concerns over the reliability and suitability of widely used building energy performance certificates (EPCs), which are based on outdated assumptions and estimated performance and consistently deter households from adopting heat pumps.

Institute for Deep Tech Entrepreneurship

Imperial has announced the launch of a pioneering Institute for Deep Tech Entrepreneurship, that aims to drive the development of groundbreaking, ambitious technologies with world-changing potential, and help them find a pathway to market.

Many of the world's most pressing challenges – from climate change, developing sustainable food and water systems, and improving human health and wellbeing – depend on the successful commercialisation of fundamental, curiosity-driven science and engineering. These innovations are often referred to collectively as 'deep tech' and include the development of technologies like grid-scale energy storage, clean and renewable energy generation, vaccines and drug discovery, and new computing paradigms.

Developing deep tech products or services is time-consuming, requiring lengthy research and technical development before they

reach the market. This can deter investors and means that projects with great potential that don't get early-stage support go undeveloped.

Through its DT Prime Fund, the Institute aims to secure £50 million of philanthropic support over the next 10 years to support the commercialisation of fundamental science and engineering discoveries with the potential for transformative societal impact. The revolutionary approach to incubation will have a focus on de-risking technologies by helping Imperial scientists to achieve technical milestones that address key uncertainties in the eyes of investors.

The Institute is one of Imperial's Academic Strategy projects, aiming to deliver impact and benefit to society. It will work across College and the co-directors from each of Imperial's four faculties, as well as the Enterprise division.

Watch the launch event at <https://bit.ly/IE37-DeepTech>

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Monitoring wheelchair fencing



Photo courtesy of Christina Mastalia

The team, L-R: Wout David, Mateusz Chodkowski, Cassandra Do and Joanna Gryczka.

Students from Imperial have attended the Wheelchair Fencing World Cup in Italy to test a pressure monitoring system that detects rule-breaking in the sport.

The team from the College's Department of Bioengineering has developed a pressure monitoring sheet that can be placed under a fencer to signal when they have broken the rules by lifting from their seat. This offence is currently detected by eye, but this process is prone to errors.

After working with the International Wheelchair and Amputee Sports Federation (IWAS) and wheelchair fencing judges to evaluate the system, the students flew out to Pisa, Italy, to trial it with volunteer wheelchair fencers.

The team developed their prototype under the supervision of Dr Warren Macdonald for their 2nd year Design and Professional Practice 2 (DAPP2) module.

Hugo Stanbury, project manager for the student team, said: "Using piezoresistive technology, we were able to create a pad with a matrix of pressure sensors at 1% of comparable cost."

"Testing the system last week at the Wheelchair Fencing World Cup in Pisa not only confirmed the excellent performance of our device, but enabled us to gather valuable feedback from the world's top athletes and gave us insights in deploying technology in high performance sports."

Behavioural re-identification

A new study has revealed how someone's behaviour can be used by machine learning algorithms to re-identify them within seemingly anonymised datasets.

Over 22 billion connected devices, from smartphones and wearables to Internet of Things devices, passively collect fine-grained behavioural data about our lives. The location of a mobile phone is, for instance, collected up to 14,000 times a day, while a car generates up to 25 gigabytes of data every hour. These data are widely used. Location data, for example, are used by banks to detect fraudulent behavior and predict the likelihood of loan repayment. They are used by governments to monitor employment, and quickly respond to natural disasters, like the COVID-19 pandemic.

Researchers in the Department of Computing have found that 'anonymised' datasets are a lot more at risk of being re-identified than previously believed. Re-identification has until now required an attacker to have access to auxiliary

information – information about the target person – matching the one in the dataset.

The team developed a new entropy-based profiling model to learn time-persistent profiles of how an individual behaves rather than matching auxiliary information to the dataset. Using auxiliary data collected at a different period of time, the researchers used the algorithm to re-identify 79% of 500k individuals in an 'anonymised' location dataset. Their results further showed that accuracy only slowly decreases over time, while traditional de-identification methods like noise addition did not protect from profiling attacks.

Co-lead author Dr Yves-Alexandre de Montjoye said: "Anonymisation is how we, as a society, find balance between using data for good while preserving privacy. This research challenges de-identification practices, and emphasises the need for legislations such as the proposed US privacy law to embrace modern anonymisation techniques."

Test launch in space rocket programme

Imperial students celebrated a successful test rocket launch from rural Scotland in July.

The launch is a big step for the team, which includes students from eight departments and three faculties across the College, who are aiming to be the first university team to send a reusable rocket into space.

The student-led Karman Space Programme aims to design, build and launch a rocket to pass the Karman Line – the internationally recognised boundary to space, roughly 100km above sea level – and then successfully return it to Earth to be reused.

The first test launch, which tested the recovery and avionics systems of the rocket and verified that it was reusable, took place in Ayrshire, Scotland shortly before 7pm on Saturday 16 July 2022.

Aeronautical Engineering students Shapol M., Shakil Perera, Tian Fang and Mohammad Kapadia started the space programme last summer after first discussing the idea as part of an end-of-year project.

They have since recruited students from across the university, as well as a team of academic supervisors and advisors, including Computing alumnus Dr Ali Baghdadi.

Dr Baghdadi, who enjoyed building model rockets as a child, has mentored the student team, helped to raise sponsorship and was present at the test launch.

He said: "The founders reached out to me with their idea and we started collaboration. I guided them on how to get structure as an organisation and introduced various concepts such as design thinking, project management and budgeting."

"As a team, they are so enthusiastic and there is a tremendous amount of talent there. They are very mature."

After some technical challenges and delays, the 2.2metre Nebula rocket successfully took off from Fairlie Moor, North Ayrshire, accelerating very rapidly amid



Nebula test launch in Scotland

plumes of smoke and cheers from dozens of student, climbing to an altitude of some 16,000 feet.

Operations lead, Dyuti Chakraborty, said the team would now be able to gather important data about how the rocket functioned.

She said: "Everyone is ecstatic and just so relieved that we could do it. We have been working on this rocket for a very long time and, for many of us, it's our first rocket that we've ever designed or made. It's been quite a nerve-wracking couple of days."

Over the next two years, the team will work on building and launching a series of prototypes, aiming at different altitudes to refine their design and prepare for the launch of a 100km altitude rocket in 2024.

The final rocket, Aurora, and their early prototypes (Nebula, Orion and Vega) will be researched and designed by the team, with most elements being built at the College's White City Campus, including the Advanced Hackspace.

Some elements, including the rocket's liquid engine, will be manufactured by British aerospace manufacturing company GKN. One of the project's sponsors, Dassault Systèmes, has supported the team to simulate their designs.

Read more about the project and the Karman Space Programme team at <https://www.karmanspace.co.uk>



Some members of the team, present to witness the test launch

Imperial's new President, Prof. Hugh Brady

Professor Hugh Brady is the new President of Imperial College London. Prior to his appointment in August 2022, he served as Vice-Chancellor and President of the University of Bristol from 2015 to 2022, and President of University College Dublin (UCD) from 2004 to 2013. We present below a short biographical note, an apposite extract from an interview, and the full text of his Inaugural President's Address.



About Hugh Brady

A graduate of UCD, Professor Brady trained in general medicine and nephrology, and was awarded PhD and MD degrees for research in renal physiology and molecular medicine, respectively. His academic career as a physician-scientist included positions at Harvard Medical School, the University of Toronto and UCD. He is an international authority on the pathogenesis of renal inflammation and diabetic kidney disease.

Professor Brady is a recipient of an Honorary Doctorate of Science from the Queen's University Belfast, an Honorary Fellowship from the Royal College of Anaesthetists in Ireland and the Robert Menzies Medal from the University of Melbourne.

Professor Brady is a non-executive director of Kerry Group plc; a member of the League of European Research Universities (LERU); and chair of Ireland's Public Health Reform Expert Advisory Group. He has also served as a member of Ireland's Higher Education Authority; chair of the Irish Universities Association; chair of the Universitas 21 Network of global research universities; member of the Western Gateway Partnership Board, and was a non-executive director of ICON plc from 2014 to 2022.



On the Alumni community

When Hugh joined Imperial he was interviewed on camera by Dr Jess Wade from the Department of Physics – you can watch the whole interview at <https://youtu.be/tB5jTopllhk>



Among other topics that Jess asked about, were his thoughts on alumni.

JW: Imperial has an extraordinary community of about 240,000 alumni all over the world, working in different sectors, and pushing these new boundaries, and doing incredible things. And I wondered, as President, what your thoughts and visions were for that alumni community?

HB: So I think they're just a critically important community. I mean, first and foremost, they're wonderful ambassadors for Imperial. But, flipping it around, Imperial cannot, I think, realise its full potential without the support of those alumni. They're going to be critically important and I really look forward to engaging with them. What is so fantastic here, is the ingredients that we have to play with. I mean, what a fantastic set of kind of ingredients, whether it's our students engaging with alumni and donors, or our research, which undoubtedly has and will continue to inspire them. Not all universities have that fantastic set of ingredients, so I would hope the future's really bright on that front.

Inaugural President's Address

On October 11th, Hugh gave his inaugural President's Address to the Imperial community. We have a transcript below – or you can watch it online at

<https://youtu.be/iWZ1QoZP76I>



Thank you to Imperial for its world-leading Covid response

First, a very big Thank You to the entire Imperial community for the quality of the Covid response over the past two and a half years.

It has been an extraordinarily challenging and exhausting time and, of course, tragic for so many families.

Your efforts to keep Imperial's education and research activities going were truly heroic!

Imperial's research shed light on the biology and pathogenicity of the virus, its variants and behaviour, vaccine design and treatment approaches.

Our modellers influenced government responses across the world and likely saved hundreds of thousands, and perhaps millions of lives.

The Imperial community proved itself to be both creative and resilient academically and empathetic, collaborative and supportive!

We hope, of course, for a more normal 2022-23, but nothing is guaranteed.

A few words on my own journey

It is a great honour to serve as President of Imperial.

It is all-the-more special because it was a medical student elective in

1981 at the Hammersmith Hospital, one of our clinical partners, that inspired me to pursue a career in academic medicine.

I trained as a clinician-scientist, a nephrologist – kidney disease, dialysis and transplantation.

Before joining Imperial, my journey took me through University College Dublin where I graduated, the University of Toronto where I had my clinical training, Harvard Medical School where I spent most of my formative academic years, and the University of Bristol – four very different and successful universities, each with their own unique character and located in four great cities.

But I can say with the utmost confidence that I saved the very best wine until last!

I'm very grateful for the warm welcome I've received across the College during my meetings with staff and students, campus tours and departmental visits.

I'm learning so much about Imperial, what makes it tick, what staff, students and alumni love about the place, their ambition for the College and equally their anxieties, concerns and day-to-day pressures.

What attracted me to Imperial?

In short, it was a combination of its unique history, magnificent track record of achievements, distinctive profile and strengths, and, above all, its enormous potential!

Every time I walk along Exhibition Road, I marvel at the vision of Prince Albert and his fellow architects over a century and a half ago.

And my goodness didn't they create something really special!

Per square meter, Albertopolis must be one of the most impressive cultural and scientific quarters in the world.

It is such an important part of the Imperial Experience and it is great

that we are collaborating with our fantastic neighbours more and more.

I visited Imperial's Dyson School of Design Engineering over the past few weeks and heard about its Masters in Global Innovation Design – a really unique transnational programme delivered collaboratively with the Royal College of Art – that is already producing some remarkable young entrepreneurs.

Sitting in City and Guilds this evening is a reminder of how Imperial has evolved – its antecedent institutions – the Royal School of Mines, City and Guilds of London Institute and the Royal College of Science – coming together to form Imperial College London which received its Royal Charter in 1907.

25 years ago, Imperial welcomed its new School of Medicine. Many congratulations to the Medical School on its silver jubilee!

And in 2004, the late Queen Elizabeth II opened Imperial College Business School.

These bold and visionary moves over a century and a half, none I suspect without their challenges and detractors, paved the way for the creation of today's Imperial – a global powerhouse that is truly distinctive because of three powerful elements:

First its focus on business, engineering, medicine and science;

Second its commitment and passion for innovation, entrepreneurship, impact and societal benefit;

And third its location in, what I would argue, is the world's greatest city!

It was this alluring cocktail that attracted me to Imperial and that attracts the brightest minds – students and staff – from across the world.

It is the cocktail that makes Imperial unique among the world's leading universities!

Innovation and impact are in Imperial's DNA

I have been struck by how many staff and students tell me that they chose Imperial explicitly because they want to make the world a better place!

Imperial students talk excitedly about innovation and starting companies.

This was readily apparent when I welcomed first years in the Great Hall and chatted with students at the stalls during Welcome Week.

And it positively lit up the room when I met our impressive student entrepreneurs at the recent London Demo Day – Imperial now produces approximately 50 student start-ups per year!

Innovation and impact have also been central themes in my conversations with staff during departmental visits!

It is no exaggeration to say that our fantastic staff are generating

and harnessing new knowledge and technologies to make our world healthier, smarter, safer and more prosperous and more sustainable.

I'm always somewhat reluctant to give examples but even over the past fortnight, it was inspiring to learn more about truly groundbreaking initiatives such as:

Imperial's new Institute for Deep Tech Entrepreneurship;

Our Institute for Security Science and Technology;

Our new Brahma Vasudevan Institute for Sustainable Aviation;

The College's recently established Institute of Infection; and

I-X at White City.

And all against the backdrop of Imperial being ranked 1st for research quality in the recent Research Excellence Framework (REF).

And its abundantly clear that Imperial is not resting on its laurels.

If anything, the REF success has raised the College's ambition and my job over the coming years is to understand that ambition, and to work with you to further develop it and secure the resources to deliver it.

I can't think of a better job in the world!

Developing a vision and strategy for Imperial

It is customary at these events for the new President to enthral the audience with a vision for the future in an eloquent speech infused with literary quotes, humour and uncanny foresight.

I'm afraid I'm a much more practical individual!

Indeed, it would be inappropriate for me to be prescriptive after only two months in this great institution.

However, I will share my early thoughts and, in particular, propose why and how we carve out some time to refresh Imperial's Vision and Strategy over the year ahead.

Imperial's performance has been remarkable – it is now ranked amongst the world's best universities – virtually all of which enjoy significantly greater levels of resource.

I detect a clear ambition to strengthen Imperial's position within this top tier and to maximise Imperial's potential as a force for good in our world.

The purpose of our refreshed strategy will be:

To capture our vision and ambition for Imperial over the decades ahead;

To establish a roadmap or gameplan to guide our decision-making and investments; and, very importantly,

To inspire others to join us, partner with us and invest in us.

To be relevant, our refreshed strategy must, of course, take cognisance of the context within

which we operate.

Indeed, it is precisely because of the recent tectonic shifts in our world that it is an opportune time to take a fresh look at Imperial's strategy.

I don't need to remind colleagues that we live in truly extraordinary times – a pandemic; Brexit; geopolitical instability and war; a cost-of-living and energy crisis, likely recession and the concerning consequences of climate change.

We also operate in a Higher Education sector that is challenged on multiple fronts:

Home tuition fees that don't cover the cost of educational delivery;

Research funding that doesn't cover the full costs of research;

Ongoing doubt over our association with the world's largest research programme Horizon Europe;

A national immigration narrative that the brightest and best across the world perceive as unwelcoming;

Culture wars which sometimes depict our world-class higher education sector as a problem rather than the huge international success story that it is!

And now a question mark over the long term sustainability of the government's finances.

A quite legitimate question is whether Imperial can continue to compete successfully in the top tier globally given this confluence of threats.

I wouldn't be here if I wasn't confident that Imperial can, but only if we play smart and:

Build on our strengths and differentiators;

Identify and grasp new opportunities early;

Diversify our income streams and deploy our resources wisely;

Partner strategically; and

Strengthen our global brand.

Our strategy needs to address all of these key issues. It will be the playbook that enables us to compete at the very top level, on a sustainable basis, in the face of the very challenging external environment.

It is definitely not going to be easy, but Imperial's fundamentals are very strong and it has a fantastic set of ingredients to play with and it has you, our fantastic, staff, students, alumni and friends.

Our new University Management Board kicked off the strategy discussions during a two-day residential in early September and we are forming a Steering Group to coordinate a College-wide conversation.

We will be seeking views from our entire community and, equally importantly, the views of external stakeholders.

I hope you will get involved.

We will try to keep it as light touch as possible – I appreciate how busy people are – but it will require some of your time if the process is to be engaging and meaningful.

Balancing day-to-day pressures with long-term vision

Before turning to some of our big strategic opportunities, let me reassure you that our strategy refresh will not diminish our efforts to address key day-to-day issues that I know are important to staff and students.

Staff have been very clear that we have further work to do together on our culture and values, the quality of our support systems and services, and, of course, workload. These will be a priority for my team.

On the topic of culture and values, I want to first acknowledge the important ongoing work coordinated by the Imperial Together Action Group and secondly to announce that we will establish a People and Culture Subcommittee of the University Management Board, which I will chair, to ensure that this agenda has the prominence it deserves at the very top table in the institution.

In my conversations with students, three topics have come up repeatedly that they would like addressed as a matter of urgency: student mental health; assessment and feedback; and student hardship.

There is already important ongoing work on assessment and feedback that is building on Imperial's excellent recent NSS results and we will redouble our efforts in this area.

I can also assure students that we will closely monitor the size and eligibility criteria for our student hardship fund over the coming year and make adjustments if necessary.

But, given that it was World Mental Health Day yesterday, I thought it appropriate to say a few words on this priority. The rising tide of mental health challenges among young people in the UK and across the globe is very concerning. It is not, of course, restricted to students, being at least as prevalent in non-students of the same age. Nor should universities be expected to replace the NHS – the primary provider of mental health services. Having said that, we are in a privileged position to identify students with mental health issues early, support them and help them access the NHS.

I'm delighted that Imperial has adopted the student opt-in policy that we pioneered in Bristol and many of the recommendations of the Suicide Safer Universities report that I chaired for Universities UK.

An absolute priority for me over the next year, will be to partner with our students and staff to develop a comprehensive 'whole institution'

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mental health strategy to ensure that our efforts across Imperial are joined-up and fit-for-purpose. At Imperial, mental health has got to be everyone's business.

Medium to long-term strategic opportunities

Let me return now, in the final section of my address, to our strategy.

Again, I appreciate just how busy everybody is and the pressures they are under, but it will be important that we carve out the time to take a medium-long-term view.

There have been many successful and even iconic organisations that have run aground because they were overly focused on the day-to-day and failed to recognise emerging trends or threats.

Key questions that I suggest we need to sink our teeth into are:

What is the optimal institutional size, shape and business model given our ambition?

How can we be more radical in our approach to EDI and widening participation?

How can we achieve a step change in the scale of our research in key strategic areas and, related to that, a step-change in our innovation capacity and industry partnerships?

How can we harness the full potential of our White City Campus and how do these developments dovetail with our plans for South Kensington, Silwood Park and our clinical sites?

How can we deliver on our commitment to transition to net zero by 2040?

And last but not least, how do we strengthen Imperial's international presence and brand?

Given time constraints, I'll say a few words on some, but not all of these topics.

First, a word of reassurance. Imperial is already a high-performing organisation and much of what we do today will continue without radical change over the decade ahead.

As a physician, I am acutely aware of the adage *primum no nocere* (first do no harm)!

But the reality is that:

Our world continues to change rapidly;

With that change comes both new opportunities and significant threats;

Our competitors are not standing still – in many areas they are moving faster and investing more and, at the very least, we need to match the opposition and ideally get ahead of them.

I'm aware that discussions on size and shape can cause anxiety in high performing institutions as it implies winners and losers but that's not the intention and I can reassure you, that I'm not contemplating closures or mergers!

But, if we are to compete on a sustainable basis in the very top tier internationally, we are competing in a deep-pockets game and will need to grow our non-regulated fee income to generate the resources to reinvest in our research and innovation activities.

This reality, in turn, raises a number of questions:

In what academic areas should we grow?

How do we incentivise, accommodate, and support growth?

How do we ensure that we are not over-dependent on a limited number of geographies (already a clear and present danger)?

Is our portfolio sufficiently flexible for a world where many students may not want the traditional residential experience; and fit for purpose when many employers are looking to upskill their workforces through different types of educational products and partnerships, mainly in areas of STEM where Imperial is best in class?

How do we capitalise on our new digital education capabilities and emerging immersive technologies to further strengthen our menu of educational opportunities?

Having generated additional resource, where do we invest for most impact?

What are the research areas we want to scale up?

These are challenging real-world questions that we need to grapple with sooner rather than later given the inherent weaknesses and risks in the UK's current HE funding model.

If I could turn then to EDI, I'm delighted that it has figured centrally in all of my department visits to date and huge progress is being made.

I'm also very encouraged by our efforts to widen participation and make an Imperial education accessible to a wider swathe of the population.

In this vein, I can't think of a more exciting and timely initiative than Imperial's new joint Medical School with the University of Cumbria.

This is real levelling-up and I hope it will inspire other parts of the College to be even more radical in their approach to WP and diversity.

Finally, I am tremendously excited by the potential of our White City Deep Tech Campus and how it complements, and indeed enhances, the wider Imperial experience. It's amazing what has been achieved so quickly, under quite challenging conditions. My congratulations to all who have been involved to date.

It is already, certainly coming from the outside, a rich cauldron of world-class research, innovation, start-ups and scale-up, and industry partnerships.

It is serving as a magnet attracting both SMEs and large corporates in the wider White City Innovation District.

And it is providing valuable educational, training and prototyping opportunities for communities in one of London's most disadvantaged areas.

It is a shining example of how a world-class research-intensive university can develop a new precinct that is transformational for its own educational, research and

innovation activities and a catalyst for levelling-up, urban regeneration and economic growth.

We have some exciting decisions to make:

What does the next phase of campus development look like – both its academic focus and innovation profile?

Who and how should we partner as we develop it?

How can we fund it and how fast can we deliver it?

How can we best support and influence the shape of the wider White City Innovation District?

And how can this world-class innovation asset contribute to the UK's wider innovation ecosystem?

As a relatively recent arrival to the UK, I find it somewhat puzzling that the strength of London, and indeed the so-called Golden Triangle of London, Oxford and Cambridge, is sometimes portrayed as a problem.

Most countries would be celebrating and promoting such a brand across the globe to attract talent and foreign direct investment, and looking to leverage this unique concentration of research and innovation to build innovation capacity, through partnership, in other regions of the UK.

The real competition is not national, but international – it is not London versus Manchester, Birmingham or Glasgow but London versus Kendall Square, Silicon Valley and Shenzhen.

Imperial is a phenomenal innovation asset, and I look forward to using our strategy process to engage with the UK government and other potential stakeholders on how we can maximise our contribution to the UK's growth ambitions.

Thank you for listening. It's a great privilege to serve as your President and I look forward to exploring these topics with our community in more depth over the months ahead.

Professor Hugh Brady
President,
Imperial College London



Breaking Out of Capitalist Realism

While engineers can invent, design and construct many of the elements of the future that will (hopefully) benefit society, author Juliet Kemp argues that the better and fairer society, which we would all like to see in the future (if not now!), can best be envisaged, and as a result (hopefully) hastened, by writers who examine and exercise alternative societies in the guise of science fiction.*

Science fiction and fantasy are uniquely positioned to give readers (whether deliberately or accidentally) a vision of possible alternative futures; an imagination of what could be, good, bad, or more complex. But, inevitably, those stories are also a reflection of the now: writers in conversation with what's around them, growing ideas in the substrate around our rooted feet. If we as writers want to envisage, to create, an anti-capitalist, socially just future, how do we get there from here, and just how limited are we by where we are now?

Reading recent SF/F, it has seemed to me that, while there are plenty of extrapolations from our present into future dystopias, and a fair few stories about mutual aid carve-outs within a current-or-future dystopia, there's less in the way of true alternatives, compared to the writings of people like Le Guin or Delany in the '70s and '80s. If SF/F is a reflection of the now, how do we imagine a different future? If SF/F is an imagination of the future, should we let it be constrained by the now? Is it even possible to escape where we are right now, and what does that mean for the futures we are able to imagine? ¹

The political philosopher Mark Fisher, in 2009, called this the impact of Capitalist Realism (https://en.wikipedia.org/wiki/Capitalist_Realism) – the way in which modern (post-Soviet Union) capitalism has created a narrative that there *is* no alternative, that capitalism is the only “reality”, the unchallengeable basis of our existence. Fisher referred to “a pervasive atmosphere” which makes its way into art and literature, then permeates our thoughts and imaginations, obliging us to operate within capitalist imperatives and structures.

Writers are, of course, free to choose what

they want to write – but is that choice (is any choice) wholly free? What's the distinction between the futures we *choose* to imagine, and the futures we are *able* to imagine? The choice to write extrapolations of what we see around us, or something wholly different, can be constrained in practice by the difficulty of stepping outside our conceptual boundaries.

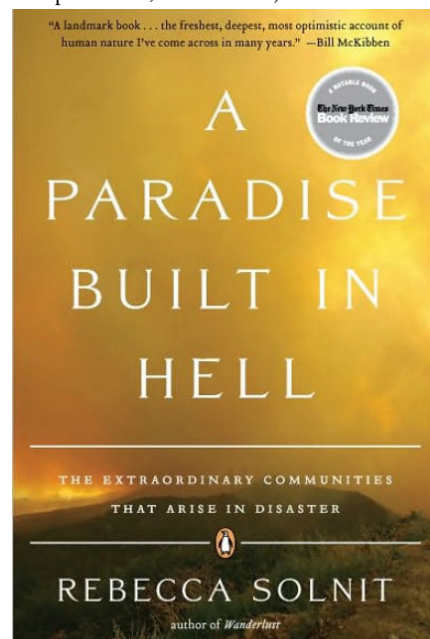
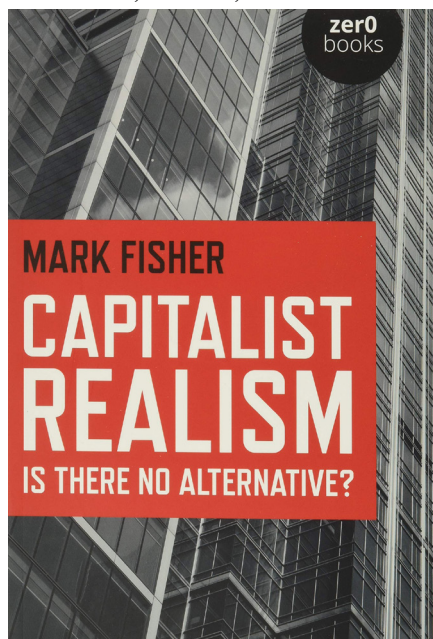
It seems we're better at envisaging (certain forms of) social change – societies in which you don't get grief for being queer, where people's gender is malleable and no one's business but their own, where disabilities are a normal part of human existence and acceptance is in-built, where racism isn't a source of prejudice and damage... It's just that a lot of those worlds are underpinned by a form of capitalism; and even, that trying to write our way into social change runs head-on into the capitalist challenge of “but, really... can we *afford* it?” (Perhaps we can't afford not to. Perhaps that's the wrong question to ask.)

Some writers take the option of writing their way around late-stage patriarchal capitalism, rather than writing it out altogether: imagining themselves into the edges, trying to find ways to escape within it. They create a world of small-scale mutual support networks existing within an oppressive larger system, rather than reimagining that larger system wholesale. It totally makes sense: it feels far more doable. It's easier to imagine the mini queer commune, or even a string of them, supporting us to make our way through the hellscape; it's easier to write our band of rag-tag misfits scrabbling on the edges of society. And it's wish-fulfilment: it feels good to write and it feels good to read, because many of us don't have that sort of support in person. For many queer folks, for example, our queer community – our wonderful, important, supportive queer community – lives in our phones. That's valuable, and it's a hell of a lot better than not having it at all, but the community in your phone can't share childcare or cooking or the general physical burden of living. For that, you need in person; and we've all had, right, the Queer Commune Millionaire Fantasy? Absent winning the lottery, we can write it, instead.

From this angle, it begins to feel like a reflection of desperation and learned helplessness; except that “learned helplessness” in the literature conjures up visions of dogs who don't know the floor's no longer electrified. Our floor's still electrified. We've tried to convince politicians to act against climate change, and – well, I won't say “nothing's changed”, but it's not changing *fast* enough, and it's bloody easy to fall into despair. If nothing works, why bother? If there's no escape from where we are now, how can you imagine one? Alternatives are a pipe dream.

Which is precisely Fisher's point: that's the lie capitalism tells us, that there is no alternative. It even co-opts anti-capitalism in its own support: no longer targeting the end of capitalism, but trying to mitigate it. (As above: rag-tag bands of misfits providing mutual aid and surviving around the edges of a dysfunctional system.) Food banks get people fed, which is straight up a Good Thing; but they don't solve structural poverty, and running them takes up time and energy during which people aren't trying to imagine a system where food banks aren't considered “just how things are”, in a Western country with more than enough money to feed its people.

If you've just stifled a groan at reading “just how things are”, I'm with you. It's a critique that most activists of a socialist, anarchist, or anti-capitalist bent are familiar with, in that or its other form, the claim that “human nature” prevents any realisation of an alternative future which doesn't revolve around endless growth, individualism, and the profit motive. This almost invariably translates as “this feels weird TO ME” – or to the assumption that “human nature” = “what humans in my current society are like”. People will claim with utter conviction that people just aren't *like that*, even when there is both historical and current evidence that at least some people have, in fact, been *like that*. Humans co-operate, humans are kind, the state of brute nature is a (racist) myth. Further, sometimes it's not even about how real humans behave, but about how people think, incorrectly, they behave – as Rebecca Solnit points out in her book about disasters, *A Paradise Built in Hell*. (Spoilers: Solnit found that most people in a disaster are kind and generous to one another. Except the rich, who are not.)



FEATURES

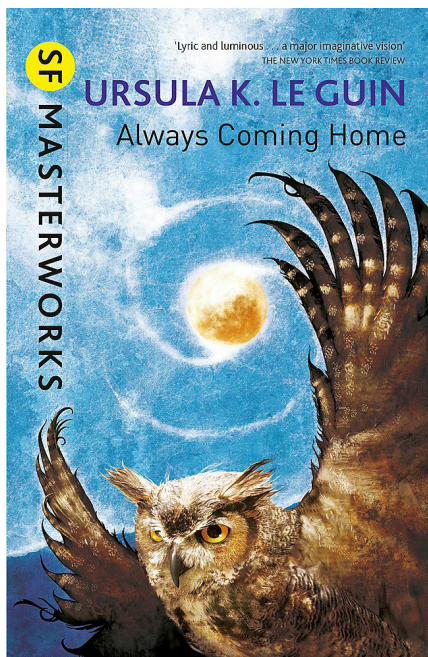
How, then, do writers get away from that? Can writers get away from that? At some point, obviously, I have to quote Le Guin: “We live in capitalism, its power seems inescapable – but then, so did the divine right of kings. Any human power can be resisted and changed by human beings. Resistance and change often begin in art. Very often in our art, the art of words.” So, whether or not we can entirely escape the sea we’re swimming in, we can sure as hell try.

Write what the hell you like, obviously. No one’s obliged to do anything in particular with their writing or their reading; it’s a big old genre and there’s room for all of us. But. If it feels too hard – too scary, too depressing – to propel ourselves into a truly alternative future, why is that? And *can* we resist that pressure to shrug and give up, accept that this is as good as it gets, if we want to?

The mini-commune on the edges of society, that feels like it might be within range, maybe, if you got really lucky. It’s a good dream: it’s a dream, but it’s imaginable. The bigger dreams are far more beautiful and thus far more dangerous. What happens if we step into that fear? How can we as writers escape our programming? Because I refuse to believe that we can’t. How do we balance the rejection of destructive capitalism with the reality of the structural factors making it very difficult to break out? Shouldn’t SF/F be showing the way here? Did we all convince ourselves too hard that utopia-means-no-place, that this can’t be done? I mean; it can’t, no, there’s no perfect world. But. There’s better.

Authors do manage, have managed this, to a more or less successful extent.²

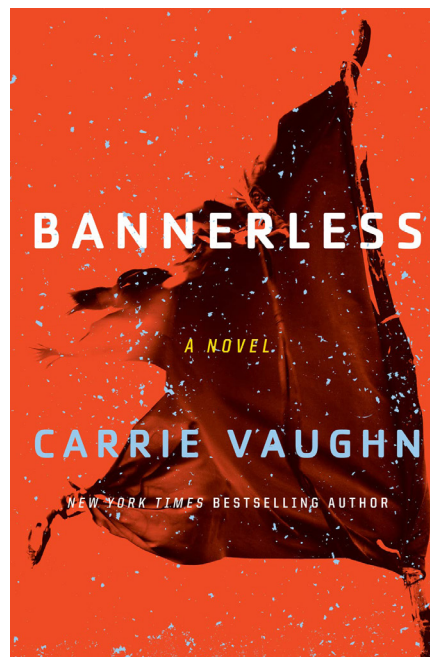
Le Guin in *The Dispossessed* carefully imagined what an alternative might look like and how it might interact with something more like present day society; the trade-offs are fully realised and highlighted. In a different vein, I love the patchwork nature of her far future *Always Coming Home*, the endeavour to reimagine everything, including myths and



stories and coming-of-age narratives. And that it’s *written* in a way that challenges traditional Western narratives (although we should remember that Indigenous critics challenged Le Guin’s co-opting of Indigenous narratives and beliefs).

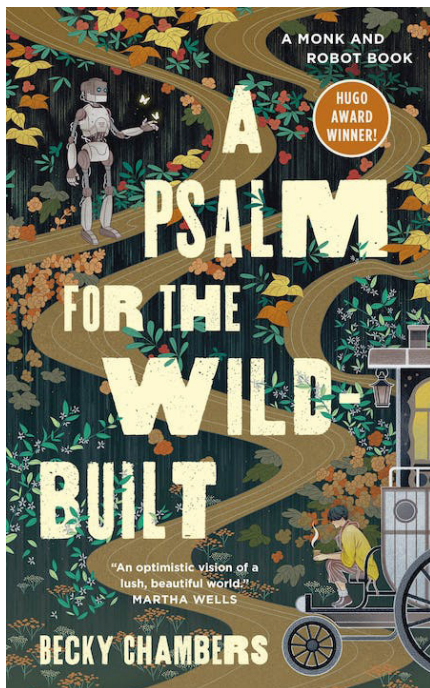
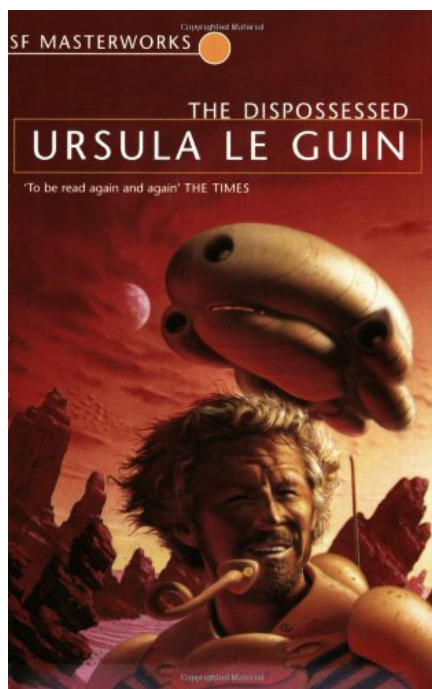
Becky Chambers, in the *Monk And Robot* series, is clearly trying to envisage an alternative society; one of the things I love about *Psalm For The Wild-Built* is how the differently realised society is the underlying fabric to a story that’s about finding one’s own way and what one wants; the society is set up for that to be available, and set up to be both sustainable and sustaining for individuals, but you still have to work at it.

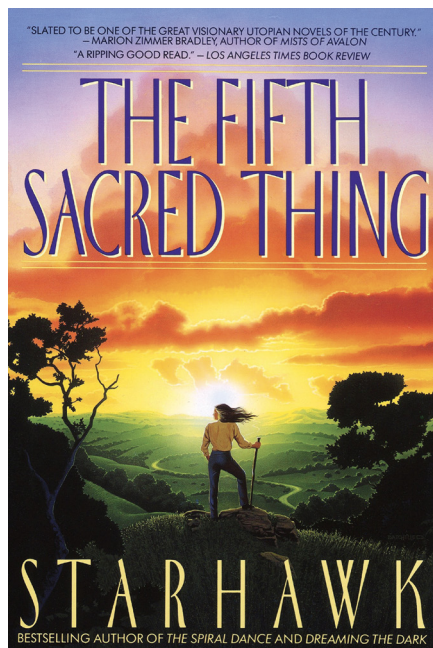
Carrie Vaughn’s *Bannerless* series is arguably dystopic in that it’s a post-crash society, making its way around the skeletal remnants of our former society, after some level of ecological collapse. The main driver of the society in *Bannerless* is the control over having children – you have to earn the right



to have and raise a child – and that strong focus on living sustainably with the land and deliberately limiting human numbers in order to do so. And, again, the trade-offs and costs are examined. Maybe that needs to be part of any successful alternative envisaging; the acknowledgement that we can’t have it all. Marge Piercy talks about similar trade-offs in the future society in *Woman on The Edge of Time*. In *Bannerless* it’s clear that this is not the only approach that exists; it’s just one fairly small society. (In a similar area to where it’s suggested the Kesh, in Le Guin’s *Always Coming Home*, live. Starhawk’s *The Fifth Sacred Thing* is also set in California, with a fairly small sustainable society in conflict with a dystopian one; it has a somewhat clunkier feel than *Bannerless* or *Always Coming Home*.)

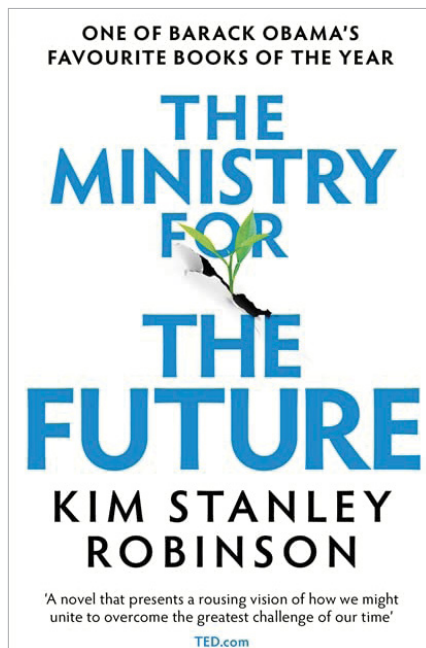
I like Cory Doctorow’s *Walkaway* for looking at how we might get there from here; and also thinking about the possibility of mainstream society (or those who run mainstream society) hitting back. It shares an approach with Kim





Stanley Robinson's *The Ministry for the Future* in that it doesn't skip over the interim; it shows us some ideas about how we might get *there* from *here*. Ruthanna Emrys' *A Half-Built Garden*, which uses some similar tech ideas to *Walkaway*, does jump past that process but does sketch in the backstory that established its more sustainable watersheds community. Humans have begun to be successful in rescuing the planet, but it's a provisional success and the watersheds exist in some tension (albeit not the open conflict of *The Fifth Sacred Thing*) with other systems and structures. Perhaps, again, those limitations are part of why it feels more achievable, more touchable from where we are right now, than some other alternative visions.

Writers, then, can do it. Can *readers* accept it? What about that acquired internal belief system that tells us that human nature just isn't like that? Reading *Always Coming Home*, or *Psalm for the Wild-Built*, even I have to do a certain amount of squashing my own inner cynic, and I'm way along the optimistic end of the scale. (Anarres, interestingly, had its



own cynics built-in; beautifully not-capitalist realism.) Kim Stanley Robinson tries to map from *here* to *there* in *The Ministry for the Future*, but that, whilst a sterling effort, is absolutely about manipulating capitalist structures into doing something that doesn't totally suck. Arguably, the fact that it is depressing and deeply pragmatic – albeit with gleams of hope showing through – may make it more convincing to cynics.

"But people aren't like that" – people react to their settings and to the expectations around them. The complaint of "but human nature" reveals a real misunderstanding about how actual humans behave. (Projection? I couldn't possibly comment.) Are some people shit-heads? Sure. But not as many as is fondly imagined.

So how do we as readers challenge/escape our programming? Here's a good starting rule: if you find yourself thinking "but surely..." about human beings, you're probably wrong. Back to that Le Guin quote: we are all limited by our surroundings, and we are all told what we should treat as the basis, the bedrock. Let's not. Let's move the ground. Let's believe six impossible things before breakfast. (Maybe choose your impossible things carefully.) And in any case, and this is not a new point: if you're willing to read about dragons, spaceships, magic, and FTL travel, then you should think hard before criticising the "realism" of imaginary communities based on how you imagine the world "must" be. Look around you. People *are* doing things

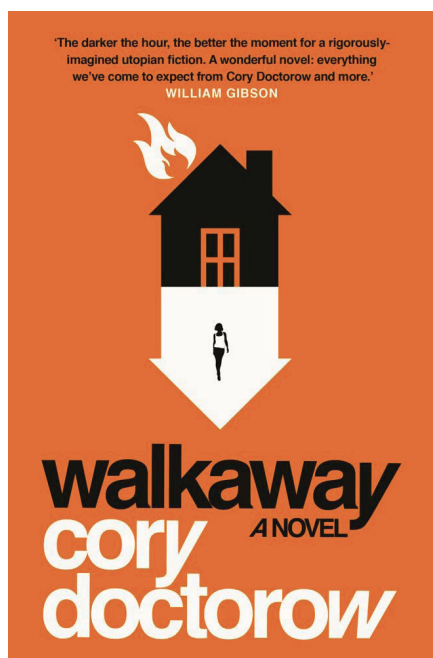


differently, in small ways; they are breaking out of capitalist structures, even if only for a little while. Individualism is not the only way, and indeed hasn't been the only way for many different human cultures.

Let's look at what Becky Chambers or Ruthanna Emrys are writing for something to aim at; at Kim Stanley Robinson's efforts to imagine the steps away from here that might begin to take us there; let's take the attitude-to-others of hopepunk and the structural changes implied by solarpunk. Let's consider the trade-offs that Carrie Vaughn's books look at, and if we don't like those, find another way to manage the sustainability and carrying-capacity problems that Vaughn's societies identify. Let's write a new *Always Coming Home*, taking Le Guin's work further into a future that's rooted here and now, and bridging the gap between now and then. Let's keep imagining what we could be, if we let go of those voices telling us *this is it, this is all we get*.

* This essay was originally published in *Uncanny Magazine* issue 48 in September 2022 (<https://www.uncannymagazine.com/issues/uncanny-magazine-issue-forty-eight/>), who have graciously agreed to its republication here.

- 1 A note about cultural specificity: what it is, exactly, that surrounds you, and what you're in conversation with, will vary between cultures, backgrounds, and sub-cultures; but the larger problem of awareness-of-the-sea-you're-swimming-in remains, even if those seas may differ between different people.
- 2 Obviously I've missed people. I do my best, but a couple of hundred books a year isn't enough to keep up with the conversation. I am extremely open to suggestions of things to read. I did ask some people for recommendations while writing this essay, and got fewer than I'd hoped for.



Juliet Kemp, who previously worked at Imperial in Astrophysics in The Blackett Building, is a queer, non-binary writer who lives in London. Juliet was also one of the Guests of Honour at the Imperial College SF society Picocon convention in 2020. Their fantasy *Marek* series is available from Elsewhen Press; the first book in the series, *The Deep And Shining Dark* was a Locus Recommended Read. Their short fiction has appeared in venues including *Uncanny*, *Analog*, and *Cast of Wonders*, and their story "Somewhere Else, Nowhere Else" in the anthology *Portals (Zombies Need Brains)* was shortlisted for the WSFA Small Press Award 2020. In their free time, they knit, go bouldering, and get over-enthusiastic about fountain pens. They can be found at <http://julietkemp.com>, or as @julietk on Twitter.

The 4th Symposium on Space Educational Activities

Barcelona, 27th-29th of April, 2022

Conference report by Filip Szczebak, 3rd year undergraduate, Department of Mechanical Engineering

1. Introduction and background

This report describes my travel to the SSEA 2022 conference which was made possible by the generous support from the Old Centralians' Trust.

The Symposium on Space Educational Activities (SSEA) is an event organised by European Space Agency's (ESA) Education Office, which provides a forum for students and professionals to come together and share their experiences in organising, running and participating in educational activities related to space. This is also the time when major CubeSat, rover and rocketry student teams come together to exchange knowledge and build new collaborations between universities.

This year's SSEA was the 4th edition of the event and was organised by Universitat Politècnica de Catalunya (UPC) · BarcelonaTech in Barcelona between the 27th and 29th of April 2022.

I have attended the symposium to present a co-written paper on findings from the ESA's "Fly a Rocket!" campaign which took place in October 2021. The programme entailed an online course held for a few weeks which then ended with a 5-day trip to the Andøya Space Center in northern Norway, where we as a team of 24 students from all over Europe could assemble and send a 2-meter sounding rocket 8km into the atmosphere. Despite the fact that the programme finished, we as the team really came together and continued working on group projects – the papers presented in this year's SSEA are one of them.



Universitat Politècnica de Catalunya (UPC) · BarcelonaTech – Main Campus

Photo courtesy of UPC



The main hall of the UPC where the major talks and presentations were held

Photos: 2020-2021 Fly a Rocket! Team



The 'Fly a Rocket!' team from the 2021 course – a group picture with our rocket just before it was sent to the launchpad

2. The Symposium

Day 1 – Beginning of the Symposium

The first day of the event began with an Opening Ceremony by the ESA's Education Office and the UPC. We were surprised by the scale of the event, with some participants coming over from as far as Brazil.

The ceremony was then followed by about 4 hours of oral presentations by student teams – the headliner of the event. The presentations were divided into subject blocks based on their topics. The Monday orals were divided into: 'Solar System Science', 'Solar System



UPC Terrassa campus



The Fly a Rocket team reunited in Barcelona after 6 months

Exploration', 'Small-Sat applications' and 'Space Education in Europe'.

Personally, I have taken part in the Solar System-related panels, where I was able to meet students designing martian and lunar bases for example.

In the evening, all participants were taken to the Terrassa campus, where we were able to attend workshops by SatelIot and Open Cosmos – both being 'new space' companies born in Catalunya.

In addition to that, we were able to meet and talk to the students of UPC at their project fair, where they were showcasing their creations from rockets, and rovers, to the formula student car. Many connections have been made on that day with students from all over the world.

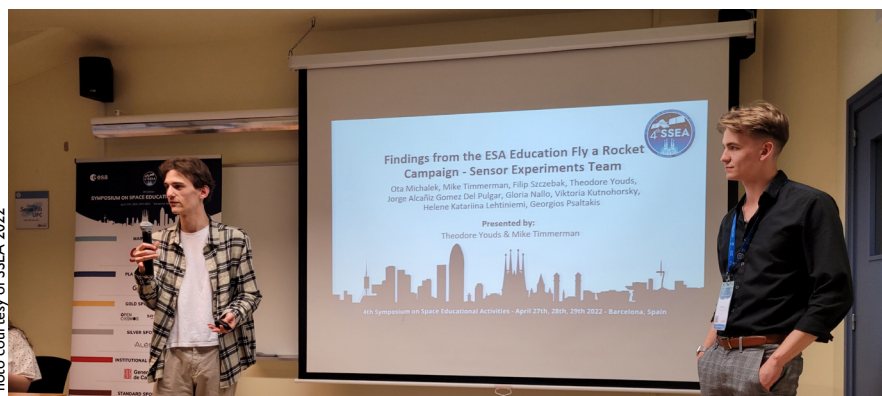
Day 2 – Presentations continue and Gala

The next day began with more oral presentations. Thursday's topics were: 'Small-Sats in Education', 'New Space Opportunities', 'Space and Health', 'Space for sustainability, equality and diversity' and 'Space Education at University'. Also, this was the day when poster flash talks took place for the teams which only had a poster. The topics varied widely here.

During these panels, we were able to see what experiences each team has and then approach them after the presentations. These proved particularly useful before the evening event on Thursday.

Before that, we were also able to tour the facilities of UPC, notably the NanoSat Lab, where we could see how CubeSats are being developed and tested. Despite being relatively small, it was impressive how many facilities and machines this small lab has.

In the evening of the 28th of April, an official gala was held at the Fabra Observatory, overlooking the whole city of Barcelona. Apart from being an amazing social event, it allowed us to network with the most active students in space-related projects from all over Europe. For example, I have established a really good contact with students from the UK, Italy, Spain, Poland and Switzerland just to name a few.



Our team presenting the results from our flight data analysis

Day 3 – the 'Fly a Rocket' presentations and finishing remarks

Friday 29th of April was the final day of the Symposium and the day when our team got to present our work during the 'Rocketry' panel. The presentation went very smoothly, and we got plenty of questions from the audience.

Apart from ours, three more presentations from our Fly a Rocket programme were shown, outlining the hardware and the course itself.

The last day ended with an Award Ceremony when awards were given to the best presentations and posters.

3. Next Steps

Personally, the Symposium allowed me to meet very inspiring people from all over Europe in the field of space exploration. The contacts I have made with the UPC Rover Team and Team Diana from Politecnico di Torino have helped me and my friends at Imperial start a new space-student initiative called the "Imperial Planetary Robotics Lab" which is aimed to be the team for Imperial students to collaborate on space-related robotics, such as rovers aimed at competing in international rover challenges like the "European Rover Challenge". We will aim to compete with other teams in the competition in September 2023.

I would like to again thank Old Centralians' Trust for making this possible – this has been a great opportunity which I hope will not only benefit me personally but the Imperial community as a whole with our upcoming student projects.



The Fabra observatory (left) with the evening view over the city (right)

The 37th International Electric Propulsion Conference

MIT, Boston, June 19th-23rd 2022

Conference presentation report by

Maria Abbi, MEng student – Aeronautics with Spacecraft Engineering, Department of Aeronautics

Presenting at the International Electric Propulsion Conference (IEPC) was the highlight of my time at Imperial. Held in MIT in Boston, the 37th IEPC gathers an international community of academics and industry experts to share the most recent developments in Electric Propulsion for spacecraft. The focus of our research was an investigation into the wall interactions of a Hall effect thruster using water vapor as propellant, by using an in-house simulation: PlasmaSim, developed by the Imperial Plasma Propulsion Laboratory. PlasmaSim can simulate the motion and behaviour of the plasma within a Hall effect thruster to high fidelity. The interest in this area of research comes from the need to find alternative propellants for Hall effect thrusters. Hall effect thrusters typically use noble gases but the scarcity and volatility in price of such resources demand that other propellants are considered. The effect of wall interactions, collisions between electrons and the walls of the thruster, is also of interest since they are phenomena not currently modelled by PlasmaSim. I presented within the numerical-simulation electric propulsion section of the conference, and had the opportunity to answer questions on the potential applications of our research and future work. It was fascinating to learn of the other approaches to tackling the implementation of wall interactions and the scope of other authors' research.

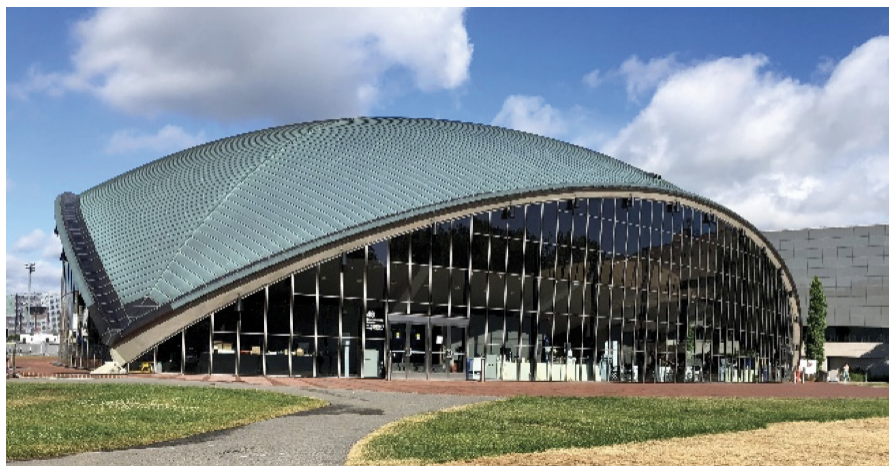
This research was conducted as part of my Masters' thesis and was in collaboration with Jesús Manuel Muñoz Tejeda, Maryam Reza, Aaron Knoll, Kieran Jones-Tett and Emmanuelle Rosati Azevedo.

I was fortunate to attend a panel session discussing "Delivering NASA's Gateway for Sustainable Lunar Missions", with panellists: Peter Peterson of NASA, Sarah Shark of Aerojet Rocketdyne, and Scott Tilley of Maxar. NASA's Gateway will be a manned space-station in orbit around the moon to facilitate lunar missions. Maxar will be providing the Power and Propulsion Element. This is a 60-kilowatt solar electric propulsion using Hall effect thrusters. These thrusters will be used for attitude control, and orbital transfer manoeuvres for the Gateway.

It was an honour to present at this conference and I would like to thank the Old Centralians' Trust and the City and Guilds' College Association for their support, which made this experience possible. It has been a privilege to represent the CGCA and Imperial at such an institution. I would also like to thank Dr Knoll, Jesús Manuel Muñoz Tejeda, Maryam Reza, Kieran Jones-Tett and Emmanuelle Rosati Azevedo for their expertise and guidance and their essential academic contributions.



Photos courtesy of Maria Abbi



Kresge Auditorium at MIT



The author presenting at the 37th IEPC

An Apology – First female CGCU President

We received the following letter from Professor David Barnes regarding the Alumni News item about Dr Cathy McClay OBE in the last issue of Imperial ENGINEER (IE36 p26).

To the Editor

Dear Peter

On reading the recently delivered new issue of Imperial Engineer (Issue 36 Spring 2022), I noted the article on Cathy McClay being awarded an OBE. Firstly, may I congratulate her on this great honour.

However, I am afraid that the article contains a factual inaccuracy in that it claims that Cathy was the “first female President of CGCU in 1990-91”. In fact, the first female President of CGCU was Jenny Jones (now Jenny Body) in 1974-75. Jenny went to have a distinguished career as an aerospace engineer, becoming the first female President of the Royal Aeronautical Society in 2013-14. She was awarded the CBE in 2020, having previously been awarded an OBE. I trust a correction will be published in due course.

You may be interested in the attached photo taken at that time, showing most (but not all) members of the CGCU Executive in 1974-75. Jenny is seated on the left. I am seated on the right. Seated in the centre is Judith Hackitt (now Dame Judith Hackitt), who went on to have a distinguished career as a chemical engineer, including being President of the Institution of Chemical Engineers in 2013-14. She is also a past President of CGCA.

Best wishes

David Barnes

Vice-President CGCU 1974-5
(now Professor of Operations Management – University of Westminster)

Photo courtesy David Barnes



Members of the CGCU Executive 1974-75.

**L-R – Standing: Tim Reeves, Mac Newton, Rob Jones
Sitting: Jenny Jones, Judith Hackitt, David Barnes**

Photo courtesy CGCA



Photo courtesy European Defence Agency



We were clearly misinformed and would love to take this opportunity to apologise directly to Jenny Body (née Jones) for accidentally ignoring you. Thank you to Professor David Barnes for bringing this to our attention. We have included here the photograph that David attached, along with a photo of the 1974-75 CGCU Honours shield.

As David mentioned in his letter, Jenny has had a distinguished career in the aeronautical industry. She joined Airbus as an undergraduate apprentice where she prepared flight software for 'fly by wire' aircraft. Since then, her career has involved her in research and technology management, wing design and development and the preparation and establishment of the Next Generation Composite Wing Programme – the biggest UK Aerospace Research and Technology programme to date. In 2002, she was made engineering lead of the Nimrod wing design team. In 2009, she established the Women in Aviation and Aerospace Committee. In 2010, she retired from Airbus, where she was the most senior female engineer.

In May 2013, she became the first woman to be President of the Royal Aeronautical Society since its creation in 1866. During her time as President, she focussed on the development of women's technical skills, trying to inspire and motivate young people to consider careers in aerospace engineering. In 2014, she announced that a memorandum of understanding had been signed between the International Aviation Women Association and the Royal Aeronautical Society to recruit and up-skill women within the aviation industry. She regularly represents the society to this day, awarding prizes and giving interviews to the press.

She is a Fellow of the Royal Aeronautical Society, a Fellow of City and Guilds of London Institute. She was a member of the Royal Society Diversity Committee between 2015 and 2017. She works on the Diversity Strategy of the Royal Academy of Engineering. She is a chair of the Royal Aeronautical Society Education and Skills Committee. She is part of the British Computer Society Women in STEM network. She is an ambassador of Aerospace Bristol. She was awarded an OBE in 2010, for services to engineering, and appointed CBE in the 2020 New Year Honours, for services to aerospace engineering.

There is an interesting interview with Jenny from 2014 available at <https://bit.ly/IE37-JennyBody>

Imperial startup developing 3D face-capture for consumers

Imperial startup, Lumirithmic, aims to bring realistic 3D face appearance capture to consumers, using affordable and readily available hardware combined with proprietary algorithms developed by the company and based on Imperial research. The company has revealed details of its technology for the first time following its launch two years ago in 'stealth mode'.

The technology required to capture a realistic 3D model of a human face has until now been the preserve of the entertainment industries, which use it to create computer-generated avatars of actors for computer games and digitally animated films.

Lumirithmic's co-founder and Chief Technology Officer, Professor Abhijeet Ghosh from Imperial's

Department of Computing, was inspired by academic work he and his team carried out using a complex and expensive camera and lighting rig similar to those used in Hollywood. He said: "While some existing technologies offer great results, I've seen first-hand through my earlier work just how cost and inaccessibility can significantly limit its application."

Dr Ghosh and Lumirithmic's co-founder and CEO Gaurav Chawla say that their solution, which uses portable and relatively low-cost off-the-shelf hardware, can produce a realistic 3D scan in minutes with rich detail that matches the quality of the systems used in film production.

By bringing realistic 3D face capture to the mass market, Lumirithmic could help greatly



Photos courtesy of Lumirithmic

expand its commercial applications. In addition to film and gaming, the company hopes that it could eventually be a key technology behind the metaverse, a mooted next-generation of the internet that substitutes 2D images and text for immersive virtual reality environments.

Another application is in beauty, where the company's skin simulation algorithms enable consumers to try out simulated facial beauty products without needing to put them on. This and other applications could provide retailers and consumer goods companies with new opportunities to provide value.

"As companies look for ways to make consumer experiences more engaging, Lumirithmic offers an adaptive solution that will ultimately enable more customer touch points and increase brand loyalty without

the significant capital investment that current technologies require," said CEO Gaurav Chawla. "Our world-class 3D facial appearance capture technology will have a significant impact on entertainment, beauty-tech, video games, the metaverse and more – the possibilities are endless."

London-based Lumirithmic currently has customer pilot programmes with some of the largest gaming, beauty-tech, and ad-tech companies in the world. The Company has closed two seed rounds from a variety of notable financial and tech investors including Michael Bronstein, Steven Mail, Munish Gupta and others. The company will start a new equity round in Autumn 2022.

See the technology in action at <https://www.lumirithmic.com>



Imperial alumni win James Dyson Award prize for breast monitoring device

Alumni from Imperial College's Dyson School of Design Engineering have won the national round of the James Dyson Award, an award for up-and-coming problem-solving inventors.

Debra Babalola and Shefali Bohra are recent graduates of the Master's in Innovation Design Engineering, offered jointly by the Dyson School of Design Engineering and Royal College of Art.

Their device, Dotplot, is an at-home breast monitoring tool which gives clear guidance while women check their breasts for abnormalities. Dotplot was invented when one of the founders was advised to monitor a knot in their breast by their doctor and found a lack of at-home solutions to guide their examinations.



The device was created in consultation with breast cancer surgeons, radiologists, GPs, and other scientific professionals and gives users an active, autonomous solution for monitoring their own health. Research by Dotplot found that current methods relying on demonstrations and tutorials left women feeling uncertain they were performing them correctly.

Dotplot uses a handheld device that connects to an app to provide accurate monitoring of breast tissue composition. Once a personal profile is set up, taking into account the user's menstrual cycle and a personalised map of the torso, the app guides users through the physical exam each month, comparing the current results to the baseline. The results can be sent directly to a GP, and a reminder will be sent to the user to consult with their doctor if abnormalities persist for three months.

On winning the prize, co-founder Debra Babalola said: "It's been unreal, we were really surprised to win it. We're thankful that Dotplot has been recognised and receiving the award has enabled us to share it with a wider audience which is amazing.



Photos courtesy of Dotplot

It's especially exciting as previous winners have gone on to realise their products and solutions which is exactly what we are aiming to do."

The Dotplot team previously won the Health and Wellbeing track of Imperial's Venture Capital Challenge and received £30,000 in the grand final of the competition, the culmination of seven weeks of masterclasses and coaching.

The national James Dyson Award prize is £5000. The international prize pot is £30,000 and Dotplot is shortlisted, with the winner to be

announced on 16 November.

Debra said: "The cash prize will help us to continue refining and testing our technology. We want to get to the point where the product is robust enough to be used for clinical trials and the award helps us reach this goal."

"Our next step is to grow our team which will help us bring together all the aspects of the technology. We'd like to recruit specialists in electronic engineering, data science, data engineering and app development to make this happen."

Imperial alumni win European Patent Office Young Inventors award

Two former Imperial students have been honoured by the European Patent Office (EPO) for an AI-recycling technology first conceived at the College.

Environmental engineer Victor Dewulf and computer scientist Peter Hedley were awarded first place in the inaugural Young Inventors prize for developing a recognition and sorting system that can help waste management facilities quickly and accurately separate rubbish to ensure that valuable materials can be recycled.

The system has been rolled out to recycling facilities in the UK and Europe through their London-based start-up Recycleye.

António Campinos, President of the European Patent Office, said: "Victor Dewulf and Peter Hedley are using cutting-edge AI technology to tackle a substantial problem –

how to drastically reduce our waste.

"By increasing the likelihood that waste will be recycled, their innovation contributes to a cleaner world for us all and this is exactly the type of sustainable venture that the Young Inventors prize was set up to recognise."

The invention was conceived when Victor and Peter were at Imperial, studying master's degrees in Environmental Engineering with Business Management and Computer Science respectively.

Victor visited a recycling facility as part of his course, where he was struck by how labour-intensive waste sorting was, making the process prohibitively expensive for companies.

This inspired him to write a thesis on waste sorting automation using computer vision, which was developed into a prototype for a



computer-vision-powered waste recognition system in 2019.

Victor said: "Applying computer vision and new technologies like robotics means that we can start accelerating the automation of [the waste] industry.

"Ultimately, that means accelerating our economy's transition to a circular economy, to the point where our removal chains can be merged back into our supply chains."

The Young Inventors award was created by the EPO to honour innovators aged 30 and under, offering a cash prize to inventors who have developed solutions that contribute to the United Nations Sustainable Development Goals and positively impact society.

Victor and Peter will receive €20,000 as one of two first-prize

winners, alongside Erin Smith, a US-based researcher who developed an AI-powered app that uses video footage to enable early detection of Parkinson's disease.

The Recycleye system consists of two parts – a waste recognition system that takes photos of passing waste and sends them to an algorithm, which then ranks them in terms of picking priority, and a robotic arm that picks up and places the waste for sorting.

The Imperial alumni developed the system in a garage at Peter's parents' home using a camera, a treadmill and a pile of rubbish, before founding their company in 2019.

Recycleye has so far deployed 17 vision systems and five robot arms and raised millions of pounds in funding for its work.



Photos courtesy of European Patent Office.

More than £55M support raised by philanthropists and alumni in 2021/22

More than £55 million was donated to Imperial during 2021/22 according to new figures released in September by the College's Advancement Division.

More than 3,600 individuals and organisations donated during the 2021/22 financial year, raising a total of £55.5 million for academic posts, student support and campus facilities.

The total, which includes donations from alumni and private philanthropists, alongside grants from charitable foundations and other funders of research, is nearly double that raised in the previous year and the second highest total in the College's history.

Philanthropy supported a number of major research initiatives this year. A founding donation of £25 million from Aeronautical Engineering alumnus Brahmal Vasudevan and his wife Shanthi Kandiah established the Brahmal Vasudevan Institute for Sustainable Aviation, which will drive the transition to zero pollution air travel. Other gifts will support a low-cost air pollution monitoring system, enable a new study looking at how

vaccines work in cells, and establish a new lab focusing on the role of distributed ledger technology in the circular economy.

Around £16 million was donated for scholarships and student assistance, including a gift of £3.5 million from the Michael Uren Foundation that will create two PhD scholarships in engineering and in medicine, and also establish a student prize – one of the most generous in the UK – for research that has real-world impact. A new Sanctuary Scholarship was established with support from many members of staff and Council to provide financial assistance to students from displaced communities, such as those affected by the war in Ukraine.

The majority of those who made a donation during 2021/22 were alumni donors, many of them responding to postal or telephone fundraising campaigns, which together raised nearly £600,000 for student support and other College priorities this year.

Engineering alumnus Theodosios Michalopoulos, who donated to celebrate the twentieth anniversary

of his graduation in 2021, said: "Being a member of the Imperial donor community makes me feel good and connected with the place that helped me progress in my life – it feels I am giving back with gratitude in return for all that I received during my studies."

Michael Murphy, Vice President (Advancement) said: "This year's support reflects the generosity of our community and the collective efforts of many Advancement colleagues who I would like to thank for their hard work and ability to adapt to the challenges that the pandemic has thrown our way. We are grateful also to the many academic colleagues and staff who have contributed by meeting with donors to introduce the College and explain their work.

Imperial's Advancement Division focuses on building relationships with donors, alumni, and other supporters, to advance the College's mission of excellence in research and education. Fundraising is an important aspect of this, and Advancement has specialist teams focusing on raising funds from

alumni, individual philanthropists, families, and charitable foundations. Other Advancement work focuses on alumni relations, events and other operational support services. RSMA and CGCA are supported in the Advancement Division by Kristin Gembiak, the Alumni Engagement Officer for Groups and International. Kristin also represents the College on the Imperial ENGINEER Editorial Board.



Kristin Gembiak, Imperial's Alumni Engagement Officer (Groups and International)

Photo courtesy of Imperial College London

Imperial startup helps pharma develop nanoparticle medicine

Imperial startup SPARTA Biodiscovery is offering technology to accelerate the development and production of nanoparticles used in advanced medicines.

Nanoparticles are tiny polymer or lipid capsules around 1,000 times smaller in diameter than a hair. Known in medicine as nanoformulations, they are used to deliver medicines such as cancer drugs and therapeutic genetic information into the body.

Unlike traditional formulations, nanoformulations are engineered to release active agents only where they are needed, for example at tumour sites, preventing harmful side-effects or loss of potency as they move through the body.

In many cases it is not the development of new active agents but the development of nanoparticles used to package and deliver them that is driving the development of transformative new medicines.

"It's easy to kill cancer cells using drugs. The problem is you only want to kill the cancer and not the healthy cells around it," explains Dr Jelle Penders, CEO and co-founder of SPARTA Biodiscovery. "You can do that by putting the drug inside a carrier that protects the healthy cells and signals it to only target the cancer cells."

Cancer medicine is just one of the fields moving towards nanoformulations, others include small-molecule drugs, gene therapies and vaccines.

The company's new technology, SPARTA® – Single Particle Automated Raman Trapping Analysis – could help further accelerate their development. "There's still a major un-met need, namely an efficient way to verify the composition of nanoparticles for R&D and

quality control purposes," says Dr Penders, who began developing the technology as a researcher in Imperial's Department of Materials.

Nanoparticle analysis is currently carried out using technologies that typically look at average characteristics of these particles and can take days to return results.

SPARTA Biodiscovery's new spectroscopy platform, by contrast, is designed to quickly and automatically analyse populations of individual nanoparticles and provide chemical fingerprints to verify each particle's size, composition and functionality. It achieves this by focusing a laser beam onto each nanoparticle and detecting in detail how the laser light interacts with it.

Building on prototypes developed at Imperial, and subsequently validated in published research, the company's SPARTA platform uses new hardware and proprietary algorithms to perform the required analyses at high throughput and deliver results via an easy to read interface.

The company expects the SPARTA platform to help accelerate the design of nanoparticles before they progress to clinical trials. "One use is for R&D," says Dr Penders. "It will help scientists to really optimise their designs because they can try one way to package their drug, analyse it with the machine, then tweak some parameters and do it again. It will make R&D cycles a lot more rapid and efficient, and save pharmaceutical developers a lot of money and risk down the line."

Another use is quality control. "You could measure the particles coming out of the production process and make sure that they're all within the parameters they should be. And the benefit there is that, because SPARTA looks at these



Photo © SPARTA Biodiscovery



Photo courtesy of Imperial College London

Professor Molly Stevens

particles individually, you have much, much higher resolution to detect abnormalities and contaminations."

The startup will benefit from continued links with the research group that originated the technology, led by SPARTA co-founder Professor Molly Stevens FRS FREng in the Department of Materials, and from Imperial's position at the centre of London's White City Innovation District, an emerging hotspot for research and

innovation in biotechnology.

"SPARTA really is such an exciting innovation," said Professor Stevens. "It has transformed the way that we can analyse nanoparticles across our extensive research portfolio into novel diagnostics and therapeutics. The amount of interest we are seeing from other partners in the field is also testament to the unique proposition that it can offer."

Dr Alastair Smith, SPARTA Biodiscovery Chair and CEO of the AIM-listed biotechnology company Avacta, said: "As far as we're aware, SPARTA is the only technology that can deliver chemical information on nanoparticles at this level of detail. This makes it an exciting proposition for customers – who can use it to develop drugs more quickly and at lower risk – and for investors. Ultimately what excites us and gets us going is the prospect of helping bring next-generation drugs to market and the positive impact this will have on patients."

SPARTA Biodiscovery plans to build and sell its devices and software to pharmaceutical companies, research institutions, and materials companies producing nanoparticles for both medical and non-medical applications. It will also provide nanoformulation-testing as a service for clients that wish to outsource this work and partners interested in co-development.



The SPARTA Biodiscovery team

Photo © SPARTA Biodiscovery

A life lived to the full

BARRY LANZ
(Mining 1955-58)

Barry Lanz, mining engineer, golfer, humourist and family man passed away on March 2, 2022, aged 86.

Barry followed older brother Terry to the Royal School of Mines and graduated in 1958. His greatest achievement while at Imperial College, in his own judgement, was being captain of the IC Rugby Fifteen.

His first job was at the Mufilira Copper mine in what is now Zambia. After a graduate training programme, Barry became personal assistant to the General Manager, then shift boss and mine captain. In 1959, he proposed marriage to Jane by sending her an engagement ring wrapped in the paper cover used for mining explosives.

In 1966, with their first born (of three daughters) the family returned to the UK. Barry now turned to civil engineering with the Cementation Group and participated in the successful development of pipe jacking systems. In 1974, he became responsible for promoting the Group's engineering techniques and established a marketing data management system which made communication between the engineering and the marketing personnel more functional.

Friends of Barry and Jane remember well their acquisition in 1976 of a near derelict 250-year old Buckinghamshire farmhouse with 12 acres of land. The renovation of the property, largely a DIY operation, occupied the next 20 years. In the village Barry became known as the 'fiddler on the roof' so long did it take him to replace the tiling. The hard work on the house was compensated, he was insistent in

pointing out to visitors, by the close proximity of the pub.

In 1981, the Lanzas returned to mining. This time to the Middle East for six years; during part of the time they were resident in Jeddah. Back in the UK in 1996, Barry and Jane moved to a town house in Bedford. Golf had always been an important part of his life and playing at Bedford and County Golf Club brought him great pleasure; he was captain of the seniors. Back in their time at Mufilira, Barry and Terry had initiated dinghy sailing on the newly constructed slimes dam at the mine, and after the move to Bedford Barry took up sailing again but, this time, on a different scale – including a challenging voyage across the Baltic to St Petersburg. Serious walking was another activity which Barry greatly enjoyed; highlights being the Coast-to-Coast and Offa's Dyke Path and, most recently, in 2019, the circumnavigation of the Isle of Wight with Brian Wallace and Roger Fisher, fellow 1958 graduates [As reported in *Imperial ENGINEER* issue 32 – Editor]. Barry was also made an honorary member of Rotary.

Barry's life was characterised by his wonderful sense of humour and great sense of fun. His interest and curiosity about the world led him to seize every opportunity to learn and to do. Barry never sought the simplest solution or the easiest route. Undertaking a task usually involved every implement, gadget, tool and extension lead available.

He lived a life to the full. His profession was his pride. His family was his devotion.

Obituary kindly provided by Brian Wallace (Mining 1955-58).



A very good eye for detail

MYRTLE PAGE

(CGCA Honorary Member – Editor of 'The Central' Issue 172 and 'Imperial College Engineer' Issues 1 to 12, 1987-92)

CGCA has only recently become aware of the death in 2017 of Myrtle Page, who edited the CGCA magazines over a span of five years between 1987 and 1992. The circumstances of Myrtle's recruitment to this position are not recorded, but when she stepped down in 1992 she was made an Honorary Member of CGCA.

Some details of Myrtle's life were provided by Angela Singer in the 'Dunmow Broadcast' newspaper in December 2017, as follows:

Myrtle Page, who worked as a reporter for a number of newspapers including the *Dunmow Broadcast* and *Saffron Walden Reporter*, has died aged 85. She had been resident in Felsted since 1975, and sadly died suddenly on holiday in Yorkshire on 24 October 2017, having suffered from lung and heart problems over recent years. A service to celebrate her life was held at the Three Counties Crematorium, Braintree on November 20.

Myrtle was born in Walthamstow on June 12, 1932 and went to Walthamstow Girls High School. She trained as a secretary and became a public relations officer before becoming a journalist. In the 1950s she worked for the public relations company Pritchard Wood – the agency in London's Charlotte Street who memorably coined the phrases: "If you want to get ahead get a hat" and "Have a break, have a Kit Kat". Having trained as a secretary, and therefore being proficient in Pitman shorthand, Myrtle was unusual in starting as a press officer and becoming a journalist – it is more usual for careers to go the other way round.

Myrtle met her husband Eric, an optician, at Walthamstow Tennis Club. They married in 1959 and had two sons. The boys were born in Wales in the 1960s where Myrtle, having by then become a journalist, worked as a sub-editor for the *Abergavenny Chronicle*.

After they moved to Essex in 1975, she became a reporter for various titles, including the *Broadcast*, the *East Anglian Daily Times*, the *Essex Chronicle* and the *Braintree and Witham Times*. She was also invited to a Buckingham Palace Garden Party in appreciation of her work for the 'The Oyster', a journal of the Rural Communities Council of Essex, which was working to promote fellowship and activities in rural communities, including an annual 'Village of the Year' competition, for which she and Eric were judges, though not for their own village, of course.

In Felsted, Myrtle was a member of the bowls club and also a piano teacher. She was also a member of the Samaritans. Her husband, Eric said: "She had a great sense of humour, there was always banter and repartee. She had a very good eye for detail and was always interested in everything that was going on."

Myrtle left two sons and three grandsons.

When Myrtle stood down as editor of the *Imperial College Engineer* in 1992, she was succeeded by Joe Fernley for Issues 13-20, and then by Colleen Richardson for Issues 21 to 33.

After Issue 33 of the *Imperial College Engineer*, the first Issue of our joint CGCA & RSMA magazine, *Imperial ENGINEER*, was published in Autumn 2004.



Competent & conscientious, he would help anyone

PETER JOHN TAYLOR

(Electrical Eng 1952-55)

Peter Taylor was born in Willesden London in 1930, his father was a businessman, and Peter was the eldest of three boys. He was often taken to watch the trains at Willesden junction by his family even before he could walk, sparking a keen interest in railways which would remain with him all his life.

His family remained in London at the beginning of the second world war but, with the continuous night bombing, his father moved the family down to Somerset whilst he remained in London running his business, Wenlock & Taylor, whilst also working as a Duty Controller for the Willesden ARP Control Centre and as an Assessor for the War Damage Commission.

In Somerset, the family stayed in a working water mill for a short time, before the family re-united in Berkhamsted, which would eventually become the family's hometown. They initially rented a house, which was miraculously only several doors from his future wife's family, but Peter and Marnie would only meet some years later.

Peter's resilience and abilities were no doubt developed during these war years.

He was educated at Berkhamsted School, he was a high achiever and also a good marksman – precision and accuracy were part of his character. As a schoolboy, he built a very large O gauge electric railway layout in his parent's house.

Postwar National Service followed – in the Royal Signals – but due to the Korean War this was increased to two years. When referring to the Korean war period, he commented that "I have never experienced a worse time of collective gloom".

After leaving the Army, he spent a year with his father working for the family business, but his interests still lay in engineering and particularly electric railways so he chose to undertake a 3 year degree course in Electrical Engineering at Imperial College. This course was, in his words "in the unfashionable heavy electrical engineering".

On completion of his degree he undertook a graduate apprenticeship with English Electric spending time in Bradford, Preston and Stafford for instruction on traction theory, train timing, workshop practice, manufacture of machines and control gear, rectifiers and transformers, together with commissioning, trouble-shooting and maintenance.

Peter joined British Railways in 1959, a career move that lasted 31



years until retirement. He worked on many varied projects, including the Deltic diesel locomotive, his final position being as a Project Manager for a new class of Multiple Units.

He initially worked as a member of BR's Headquarters team – specifically in detailed charge of English Electric and GEC Multiple Unit traction equipment contracts and for liaison with building works (York and Doncaster), dealing with rolling stock planned for the Fenchurch St and Liverpool St suburban lines.

Subsequently, he moved to new works on the Eastern Region, working on new AC systems and DC stock conversion, before moving back to British Rail HQ to work on fault investigation and devising solutions to engineering problems. He then joined the Southern Region, at Southern House in Croydon, where he worked on many projects and rolling stock including the Gatwick Express.

His last position was at Network

SouthEast, where he worked as project manager for the design of a new generation of express stock – the class 471 Electric Multiple Units, intended for long-distance services from London to Kent and Sussex. But it became clear this project would not be developed into service, and early retirement followed in 1990.

As an Engineer, Peter was technically highly competent, he had the ability to adapt to many different situations and throughout his life had embraced many technological changes – having been familiar with steam lorries in his childhood and computers in his later years. This ability and conscientious attitude, no doubt picked up during the war years, allowed him to repair, maintain and complete endless systems, items and projects.

Peter spent a lot of his private life in the service of others, including the Crusaders and the Church, he would readily but discreetly come forward to help others. He was a member of the Berkhamsted Crusaders where he met many lifelong friends including – notably – his future wife, Marnie, to whom he was married for 66 years.

Peter and Marnie eventually set up home in Berkhamsted in 1962, in a house that was to become the family home for their three children. Peter was a very practical man, and much time was spent initially renovating the house, including a full rewire, and then its decorating and maintenance. Similarly, he undertook much car maintenance up until his retirement and, despite not being a mechanic, was very capable and able to undertake varied interventions – from engine changes to bodywork welding, with all work carried out on the drive and in the open. A comprehensive kit of spares and tools were kept in his various vehicles to allow any necessary

repairs to be made 'en route'.

Peter was a devoted family man, and many holidays were spent in Cornwall, Wales, Ireland, Scandinavia and France, often in the family's green Dormobile campervan. In later years, many holidays and visits were made to France and Switzerland – not unsurprisingly combining travel by rail which was always meticulously planned. He even had some cab rides over the mountains in Switzerland in his 80s (see the picture below of him in a BLS Lotschberger EMU).

Always discreet, dependable and thorough, Peter became a trusted member of the Methodist Church taking on the responsibilities of church and circuit steward.

Peter was also actively involved with the maintenance and running of the Methodist church buildings including the installation of the first hearing loop system and its set up each Sunday, and a new oil tank and boiler installation.

Following retirement, Peter continued with the church maintenance but was also deeply involved with the 'Way Inn' Community Post Office project in Berkhamsted, and not only took on the building maintenance and operational issues, but even became the official Postmaster for a while. For many years, he programmed the weekly church heating schedule and carried on with this programming until the end of 2016 when he was diagnosed with a carcinoma in his upper jaw and underwent surgery in 2017 which, sadly, along with his aphasia, left him with very little voice and much hardship eating and drinking. Peter fought hard to recover from this affliction, always remaining calm and patient, but above all he never once complained about the hardship he endured.

In summary, Peter could turn his hand to many things and would help anyone he could.

He was an excellent planner and map reader/navigator, a reflection on his ability to direct his life, he always knew where he was going and the way forward. He was always available to help and spent as much time as possible with his family and in his beloved garden, where he spent much time growing a range of fruit and vegetables, with many surplus Bramleys and runner beans appreciated by friends and family.

Peter died peacefully at home in December 2021, at the age of 91, surrounded by his family.

He is mourned by his wife Marnie, and by their three children John, Alan and Sue.

(Obituary provided by Alan Taylor)



Embodied the spirit of a genuine Minesman and Chap

BILL HOOLEY

(Mining 1965-68)

Bill, who died suddenly on June 7, 2022, aged 75, was the epitome of a true Minesman.

He attended Northampton School, and was incredibly talented at Maths but chose not to attend Oxford as he felt that IC and the Royal School of Mines was more his thing. Such sense for a young school leaver!

He quickly integrated into college life, establishing himself in the Rugby and Cricket Clubs as well as becoming an active member of the student union and especially social activities.

He graduated with his mining degree in 1968. His first posting was to Queenstown in Tasmania whence he started a long career as a talented mining engineer. Queenstown, whilst a relatively tiny place, was incredibly busy, with a large ex-patriate community, and he was involved in many social activities, such as the theatrical society, and of course Rugby. He went on to play internationally for Tasmania in a game against France, for which he was very proud, and one of his most treasured possessions was his French team shirt.

It was during his stay in Tasmania, that he met his beloved Sheila, who was working as a midwife. They married and, a couple of years later, were blessed with their daughter, Tracey-Ann.

Tracey-Ann relates that they were incredibly generous and supportive parents, and whilst they moved around a great deal with Bill's work, he made it a priority that, for Tracey-Ann, there was always access to books, music lessons and the very best in education. This was borne



out, as Tracey-Ann subsequently went to IC, graduating in Biology!

A big part of their family life was moving around the world with Bill's work. The family developed specialist and proficient packing and adaptability skills and together got involved in a renovation project of whichever property they would be living in for a while.

During these years, Bill and Sheila were surrounded by the great sadness of losing four children, and the whole family were deeply impacted by the losses. However, Bill also possessed great resilience and directed his energies into positive moves to the future and, in testament to his incredible character, Bill's effervescence and gregarious nature was never very far away.

When Sheila became unwell, Bill supported her through her illness with great devotion, and after their long and happy 44 year marriage, when she died, he was devastated. However, his resilient and stoic nature came to the fore once again.

Bill had a passionate love of mountains. Tracey-Ann says he loved to tell people that he taught her to walk when she was nearly 17 years old, which meant he desperately wanted to share his love of mountains with her, and when living near Snowdonia he decided that they should attempt all 15 of the 3000 Ft summits. Bill saw the mountains as great places of camaraderie and unsurprisingly his favourite part of any mountain day was when they stopped for a pint on the way home (rehydration of course). One regret in his life was that he never made it to the Himalaya.

There are many stories that can

be told, and some best left unsaid.

Bill, at one stage worked for Micon which was managed by another RSM character, Harry Burgess. In an earlier year on a rugby trip to France, Bill and Harry got arrested in Montmartre but when taken to le poste de police, the Gendarme turned out to be a rugby fan (France had beaten England that day). Apparently the likely lads had inadvertently apprehended a pickpocket so the gendarme put them in his squad car and dropped them back at the bar in which they had been arrested, to continue their frivolities.

Following his return from Australia in 1985, Bill was a very active contributor to all things RSM and remained a strong supporter of the RSMA throughout his life as well as a strong supporter of the Chaps Club.

In later life, he was lucky to meet his new partner, Marie. Both widowed, they discovered a shared interest in natural, social and political history and loved to hunt around museums and into their ancestral past. During a visit to the romantic city of Paris, they got engaged over a candlelit dinner and their commute between Rhos-on-Sea and Hove came to an end when they married at Brighton Pavilion.

They shared a love of gardening, and seeing the garden birds; they fed a one legged seagull whom they named Hoppy, and Bill enjoyed seeing him on a regular basis. They took great pleasure in the garden, creating beautiful flower borders and an orchard with apples, pears and plum trees and after their hard work, Bill loved nothing more than

to retire to the hot tub, soothe the aches and pains, and have a beer.

Bill had a great interest in researching his family history and was thrilled to find and visit Risley Hall and the grave of an ancestor, Ernest Hooley, a famous and roguish financier, who died the year Bill was born. Bill and Marie made many trips together, and had more planned. Always, when travelling, Bill was adventurous in his food tastes and would try anything. At home, when he cooked, he applied his engineering brain to being so meticulous in the kitchen: he used every utensil available.

At the time of his death, Bill was still on the board, as Deputy Chairman, of Anglesea Mining for whom he had worked as Chief Executive until 2021. Bill and Marie were regular attendees at the RSMA annual dinner and other functions.

Bill had a very successful career with over 50 years of experience as a mining engineer and company executive, as well as being a great family man. He was a great asset to any team in which he participated and he made a contribution to many projects worldwide, with extensive experience in Australia, Canada and the UK. He embodied the spirit of a genuine minesman and Chap.

On news of his passing, tributes poured in from all over the mining world. Whether it was on or off the field, in the boardroom or the workplace or just in the bar, Bill Hooley was regarded by everyone (even the Aussies) as a thoroughly good bloke and a great mate.



Awarded Medal of the Order of Australia

ROBERT DOUGLAS HUMPHRIS
(Mining 1960-63)

Bob was born in 1942 in Kings Lynn Norfolk, his father was the town doctor and Bob was one of four children. He was educated at a local boarding school and then Wellington College. As a school boy he enjoyed sailing and shooting, and he represented Wellington College at the Bisley Shooting Competition. In 1960, Bob went to the Royal School of Mines to study mining and, for reasons unclear, his father stopped supporting his education. In order to stay, Bob found himself a scholarship with the National Coal Board and so started a 50 year career in the mining industry.

Whilst at RSM, Bob found two additional passions, rowing and his wife Ann, and for a while Bob enjoyed rowing in the Imperial College 1st Team of 8 however, as his relationship with Ann grew, Bob

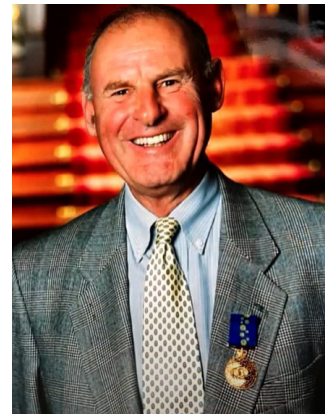


had to settle for rowing in the 2nd 8s as he had begun to miss practice. Bob graduated in 1963 and joined the National Coal Board in the Warwickshire Pits as a graduate mining engineer. Bob was a great believer in team work and finding and keeping good people. This was instilled in him early in his career as he recounted tales of "shovelling 7 tonnes of muck a day on his knees" and "at the end of the shift cleaning his nose out with snuff". At one point the miners on his crew actually shared their bonus with Bob because as a graduate he was on an extremely low wage.

In 1964, Bob and Ann were married in what would be 58 years of global adventure in the mining industry. The first taste of this was in 1965 when Bob and Ann moved to Guyana in South America to mine bauxite. Ann remarked that it was actually she who got Bob the job as she had the experience of living in remote jungle conditions as she grew up in Kenya. They spent 5 years in Guyana and here is where Bob's two sons, Ian and Brian, were born. 1970 saw the young Humphris family return to the UK and move to Kinross in Scotland to mine coal with Costain. Bob would stay with Costain, in all its various guises, and coal mining for the next 30 years. Through Costain, Bob and the family moved to Australia and the New South Wales coal fields

around Musswellbrook. Bob's career developed and he went from Mine Manager to Managing Director of Peabody, before Peabody was bought by Coal and Allied in 2000.

During this time and in the years following the Coal and Allied take-over, Bob held numerous industry and State appointments which included Chair of the New South Wales Mineral Council, Chair of the Australian Coal Association and Newcastle Coal Shippers Limited. Bob was also Director of Australian Coal Research Limited and Port Waratah Coal Services Limited. All of this work in support of the Australian coal mining did not go unnoticed and on January 26, 2003, Bob was awarded the Medal of the Order of Australia for service to the mining industry, particularly the coal industry. Bob was also Chairman of a number of companies including Ampcontrol Pty Limited and Eroc Holdings Pty. Mind you, it wasn't all coal and in 2003 Bob joined Aurion Gold, an ASX listed company, as a director. In addition, he was also a Director of the Australian Infrastructure Fund Limited and finally an Independent Non-Executive Director of Leighton Holdings Limited. Bob spent over a decade in all of these roles, travelling the world in support of the company projects and in March 2013 he was appointed as Chair of Leighton Holdings. This was to be



his last mining role and in May 2014, Bob retired at 71.

Bob had many hobbies and shared many with his wife Ann. These included sailing, off-shore racing, travelling extensively, and photography. One of his favourite places was Antarctica and it was here that he was especially fond of photographing Albatross and Penguins. Back home, his passion was vintage cars and he had a fleet of 11. If there was a common theme it was that they were all considered fast at the time of their original launch.

Bob passed in April this year and is survived by his wife Ann, his elder son Ian and his wife Gabrielle, his youngest son Brian and his partner Sarah, and six grand children Jessica, Rebecca, Angus, William, Robert and Edward.

A true gentleman

DOUGLAS CHARLES BENFIELD
(Civil Eng 1958-61)

Douglas Benfield was born on March 14, 1937. The youngest of four boys, Douglas was brought up in Laleham, a village on the River Thames, located between Staines and Chertsey. He attended Strodes Grammar School at Egham, from whence he went on to fulfil two years of National Service, as a sapper in the Royal Engineers, mainly in Hamelin, Germany.

In 1958, he entered Imperial to study Civil Engineering, following his eldest brother Ian, who had studied Electrical Engineering from 1944. Doug duly graduated in 1961 and, in his final year, he was awarded the Duncan Prize, which Professor Sparkes said had been awarded for 'ability and personality which made him smile'. At Imperial, Doug greatly enjoyed rowing and, in his final year, he was a member of the College's First VIII, whose year culminated in competing at Henley regatta in July 1961.

After gaining his degree, Doug took up employment with Sir

Alexander Gibb & Partners, designing London bridges and spending 3 years on the Roseires Dam in Sudan. He then transferred to Shellabear Price, contractors specialising in water treatment, whose projects took him all over the world. In the 1970s, Shellabear became part of Biwater and, in 1989, Doug was made a corporate member of the main board of the company. After retirement in 1995, he spent the next three years working as a volunteer for the Citizens Advice Bureau.

Doug had met his future wife Sue in 1954, at the Laleham Regatta Hop – held in the village hall – but they were not destined to get married until he had rowed at Henley in 1961.

After living at Horsley in Surrey, Doug and Sue were able to return in 1985 to his childhood family's home, the Red House in Laleham, where he lived for the rest of his life. Sadly, Doug's death came only months before they would have celebrated their diamond wedding anniversary.

Doug was very much a family man

and accompanied his eldest daughter Jane on the piano whilst she learnt the flute, until she became too good for him. The family connection with Imperial grew when his youngest daughter, Bridget, enrolled in 1983 to study Metallurgy and Materials Science at The Royal School of Mines, and this was where she met her future husband, Michael Naylor, who had just begun his postgraduate studies in the same department. And at Bridget and Michael's engagement party, her elder sister Jane met – and subsequently married – an RSM graduate, Michael Osborne (Mining Engineering 1982-85). So, including Doug's eldest brother Ian (who sadly died less than a month before Doug), the family can be seen to have had no fewer than five connections with Imperial!

Doug kept in life-long contact with his close friends from Imperial – Vlad Feltzman (Civil Eng 1958-61), who also rowed, and Louis Cattani (Civil Eng 1958-62). His hobbies embraced music, amateur theatre, bridge, and spending every day doing the Times Crossword.

Doug greatly enjoyed living by the river at the Red House, where all the First VIII had come to dinner so many years earlier whilst practising for their many races. In 2001, a reunion was organised for the first and second eights from 1960-61, and although only four members of the second eight were able to attend, the entire first eight, including Doug, were present. An appropriate celebration lunch was held in the Rowing Museum at Henley, and as this took place during regatta week, the participants were able to cap their celebration lunch by moving on in the afternoon to watch the racing.

Doug died suddenly and unexpectedly on April 16, 2021. He was the kind of person about whom friends and acquaintances would say 'Doug was a true gentleman'. Doug is sadly missed by his wife Sue and by all his family.

(Much of the detail given above has been provided through the generous assistance of Doug's daughter Bridget Naylor, with additional detail from his wife Sue.)

A much loved pillar of the bioengineering community

PROFESSOR COLIN CARO

(1960-2022)

Colin Caro was born in Durban, South Africa in 1925. He was awarded a Doctorate in Medicine (MD) from the University of Witwatersrand in 1961, for a thesis entitled "Pulmonary Function in Patients with Kyphoscoliosis" in which he demonstrated that lung elastic recoil strongly determines airway resistance. After working in different hospitals in South Africa, New York, Pennsylvania and the UK, Colin settled in London in 1960 after being appointed as Lecturer at St Thomas's Hospital Medical School.

Professor Caro's research interests were ground-breaking and interdisciplinary. He carried out work in the fields of respiratory mechanics, atherosclerosis and arterial wall shear, non-planar vascular geometry, and flow. He also worked on new ways to image blood flow, and this led to the development of a small helical stent which was produced by spinout company, Veyan Medical.

In 1966, Professor Caro co-founded and became Director of the Physiological Flow Studies Unit (PFSU) at Imperial College London. He employed a group of gifted mathematicians, physicists, engineers, biomedical researchers, and clinicians who shared his vision of an innovative, multidisciplinary research approach. PFSU became one of the first interdisciplinary biomechanics groups in the world. The group quickly earned an international reputation in the areas of arterial and respiratory fluid mechanics,



particularly for its pioneering work relating blood flow and vascular mass transport to atherosclerosis.

To fund undergraduate teaching in the unit, Professor Caro obtained grants from sources such as BP and the Worshipful Company of Clothworkers. His fundraising and team-building abilities would go on to be a cornerstone of his career and eventual legacy. For example, three of the applied mathematicians in PFSU went on to become heads of departments: Cambridge (Tim Pedley), Imperial College London (Phil Hall) and University College London (Frank Smith).

In 1989, PFSU went on to merge with the Engineering in Medicine Laboratory which was founded as a research group in the Department of Electrical and Electronic Engineering. The amalgamated groups became The Centre for Biological and Medical Systems and then the Department of Bioengineering in 2001.

Professor Caro remained an

integral part of Bioengineering, even after his retirement in 1991. He was appointed as Emeritus Professor, ran an active research group, and came to the College almost every day until the start of the Coronavirus pandemic in 2020.

The list of Professor Caro's professional achievements is vast. He received several honours including honorary degrees from London (2003), Paris (2005) and Witwatersrand (2010); an Invited Professorship at Tokyo Women's Medical College (First Awardee, 1981); Inaugural Member, World Council for Biomechanics (1990); Foreign Fellowship of the American Institute of Medical and Biological Engineering (Initial Awardee, 1994); Founding Fellowship of the International Academy of Medical and Biological Engineering (2000); the Arthur Guyton Award from the International Society of Cardiovascular Medicine and Science (2003); Outstanding Engineer at the

Engineer Technology and Innovation Awards (2007); and Annual Harveian Lecturer at the Harveian Society of London (2011).

Professor Caro's influence was not limited to his scientific achievements and publications. His expert opinions and intuition were of great value to his colleagues. Despite being a soft-spoken man by nature, he was still an incredibly engaging speaker due to his gravitas and presence. Above all else, his constant enthusiasm was undeniable. His drive to understand more about the human body was unrelenting, as evidenced by the fact he was still working on new ideas only weeks before his passing.

Colin will be missed by his many collaborators, students and colleagues in the Department of Bioengineering; his bioengineering influence and legacy lives on in his significant body of work and in our ongoing research and teaching endeavours.

Professor Caro was married to Rachel Alice Caro, an architect, for 57 years until her passing in 2013. He later married Marilyn Evans, who also worked at PFSU.

Professor Colin Caro died in February, 2022. He is survived by a son and daughter from his marriage to Rachel, and their children and grandchildren.

This is based on the tribute to Professor Caro by Miss Kemi Aofolaju from the Department of Bioengineering where he is remembered as an integral and much loved pillar of the bioengineering community.

A man of integrity

JACK DESMOND SANDY

(Mining 1947-9)

Jack Sandy died on March 27, 2022, at the age of 98. He was born in Gillingham, Kent on March 21, 1924. He helped to defend the Medway towns by serving in the 101st Kent Home Guard rocket battery and was awarded a certificate of merit for this in July 1943.

In February 1945, he joined the army and was commissioned into the Royal Engineers in Bangalore India. He served in North West India with Queen Victoria's Own Madras Sappers and Miners; took part in the last large scale military expedition under British Crown rule in the winter of 1946 and was in Rawalpindi when religious conflicts broke out in the Punjab. He was demobilised late in 1947. He married Barbara in that year and subsequently gained a first-class mining engineering degree at the Royal School of Mines.

His practical mining career began at

the Roan Antelope mine in Northern Rhodesia in 1949 where he was to remain for 17 years. It was in the mining town of Luanshya that Barbara and Jack's four children (David, Jonathan, Caroline, and Michael) were born. He spent most of the time working underground in a variety of supervisory roles. In the early 1960s, he was instrumental in introducing changes of major economic significance in the underground mining system.

Early in 1967, he became the Mine Superintendent of three smaller mines in Kalulushi. Here he also took over the management of the exploration and research section before becoming manager of the Mufulira mine in 1970. The mine suffered a disastrous tailings inrush soon afterwards, in which 89 underground workers were killed. After three years of complex mine rehabilitation Jack was promoted to general manager.

In 1975, he joined Johannesburg Consolidated Investments to

bring the Otjihasse mine in South West Africa into production. He believed the basic parameters to be unsound, said so and was fired. Longstanding connections with Selection Trust, London enabled him to be appointed a consulting mining engineer in London and for several years he was connected with mining developments in Canada, Australia and the USA. Later, he was appointed technical director, and subsequently Chief Consulting Engineer to BP minerals. His boss was now the man who had fired him in Johannesburg, which was interesting!

He retired early in 1984 and with Barbara he moved to their home in Pembrokeshire which they had improved over the years. Tragically Barbara died in 1986. He continued to worship at Capel Colman Boncath where Barbara is buried. For 12 years he guided the financial affairs of the church.

In 1988 Jack married Meriel James

and moved to Fishguard. Jack and Meriel travelled widely and he was assiduous in maintaining contact with his relatives and friends worldwide.

He had maintained mining links since his retirement, mainly to the extractive industries by an association with the consulting firm of Knight Piesold which continued until mid-1996. In 1991, he spent a month in Poland advising a mine contracting company on behalf of the British Executives Service Overseas organisation.

Early in 1993, Jack underwent surgery for cancer; his recovery and the succeeding 29 years he enjoyed are a great tribute to the skilled medical attention arranged by his son, Professor Jonathan Sandy, in Bristol. He is survived by his children David, Jonathan, Caroline, and Michael; his daughters in law: Helen, Jackie and Alison and six grandchildren: Emma, Barnaby, Katie, Jack, Laura and Christopher.

