



Imperial ENGINEER

IMPERIAL GOES WEST
RED PLANET FOCUS
NEW CGCA PRESIDENT
OLYMPIC HERITAGE
FUTURE FOR VENICE?

ISSUE SEVENTEEN *AUTUMN 2012*

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

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COVER: This is a map showing the large-scale topography of part of the Northern Hemisphere of Mars. The colours represent different elevations with cool colours showing low topography and hot colours elevated regions.

The data come from the MOLA experiment - the Mars Orbiter Laser Altimetry experiment - to build a precise topographic map of Mars.

Imperial ENGINEER

EDITORIAL BOARD

Bill McAuley (Managing Editor)
Bill Bradford
Paul Holmes
Chris Lumb
Colleen Shilstone Richardson
Teresa Sergot

PRODUCTION EDITOR

Lynn Penfold

PRINTING

Bishops Printers, Portsmouth

CORRESPONDENCE and ENQUIRIES

Teresa Sergot
Engineering Chapter
Level 2, Faculty Building
Imperial College, London SW7 2AZ
Tel: +44 (0) 20 7594 1184
Email: t.sergot@imperial.ac.uk
Website:
www.imperial.ac.uk/engineering/alumni/
CGCA website: www.cgca.org.uk
RSMA website: www2.union.ic.uk/rsm/rsma/

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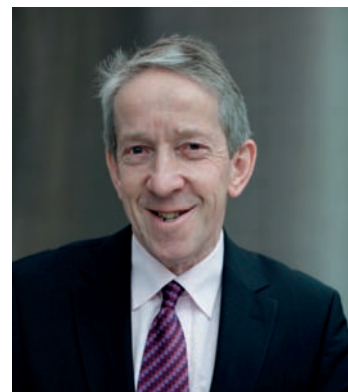
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THIS IS my first opportunity to contribute an editorial since my election as CGCA president at the June AGM. However, this does not mean that I have been unoccupied with CGCA matters during the summer – far from it. I took the opportunity provided to a new president to arrange for a ‘message’ to go to all members for whom we hold an email address. I wish that this represented 100% of you, since it is, by far, the most direct means of conveying news and information to members. For those of you unable to see the message, important news included dates for the Christmas lunch and our 100th annual dinner. This will take place at the Mansion House. Full details for both events are on page 24 of this issue or as an insert.

We have also been seeking ways to improve our engagement with current Imperial engineering students since these are our future Association members, as well as looking at how best to use the combined opportunities provided by this magazine, our website and various social media facilities in a coherent way so as to best keep in touch. The Association exists for its members, so ensuring prompt, regular and appropriate contact has to be a priority for us. Our hardworking hon sec, Nigel Cresswell, who is looking after this initiative, would welcome thoughts and suggestions from readers.

For some time now our editorial team of Bill McAuley and Lynn Penfold has been indicating that, having established *Imperial Engineer* as a thriving venture for our two associations, it is time for them to pass responsibility across to a new team and to enjoy some well-deserved relaxation. I believe that we have identified that team and would expect to be able to announce the new arrangements shortly. We are all very proud of *Imperial Engineer*, regarding it as just the sort of publication that those of us who are pleased to have benefited from our association with Imperial would wish to see representing us.



David
Nethercot



Mark
Burridge

PRESIDENTS REPORT

THE MOST recent formal RSMA events were the AGM and final year student barbecue, held on June 28. A good cross-section of alumni and students attended and, as usual, Eddie Gadd of the Ramsgate brewery, donated a keg of its finest ale.

It was interesting to note a number of graduates were actively planning a move abroad (especially Australia) to further their careers. I would ask all international alumni to assist in these ambitions and let the Association know about any job opportunities that they come across so that graduates can be alerted.

Thanks to the good progress being made by the new treasurer, Danny Hill, we were also pleased to report that both the Association and Trust finished the year in good financial health. However, Danny’s analysis has revealed some significant gaps in membership subscriptions. As a result of this a targeted, new membership drive is currently underway. In the meantime, I would like to ask you to check your subscription fees and update them to £15 per annum.

The RSMA and RSMA Trust have actively sponsored several students and supported social events this year and will continue to do so. The increased proceeds from the membership drive will be used to further enhance these opportunities directly, as well as being used to seed the 1851 initiative. This initiative will be all about providing vocational education and practical experience opportunities for students. We are at the last stage before launching this, with only the membership drive and final student/ Fwwaculty feedback required.

At the AGM, we also welcomed two new committee members, John O’Reilly and Hannah Bungey. I am also pleased to report that Emma Warris and Ben Bell have volunteered to assist Teresa and the committee with the database analysis, membership drive and 1851 initiatives. It is gratifying to see so many people wishing to get actively involved, either through direct support or through maintaining their own informal social and industry networks.

I am providing a further update at the annual dinner which will be publicised afterwards.

Passing the torch

IN 2003, the formation of the Faculty of Engineering sparked the birth of CG-CA's and RSMA's first joint venture, Imperial Engineer, with Lynn Penfold and me in the editorial hot seat.

Lynn had completed nine years of successful production of the RSMA newsletter, Update, and whilst not an alumna, has done a splendid job of capturing the ethos of the two organisations within the pages of the magazine.

We both originally signed up for a five year term in the belief that a job like this needs systematic refreshment to remain current and dynamic. In fact, we have been doing this for close to nine!

Happily, a superbly qualified team has finally been found to replace us. Peter Buck (Comp 76) and his wife Alison run a small publishing company in addition to Peter's IT consultancy. They will be able to take over seamlessly, with transition planned to be during production of the spring 2013 edition. They take over with the warmest best wishes from Lynn and me and only one piece of advice – start looking for your replacements NOW! Bill McAuley, managing (and soon to be emeritus) editor, Imperial Engineer

More to follow? FOLLOW the tiny URL links at the end of articles throughout this issue to read more. Or go to www.imperial.ac.uk/engineering/ to read more of articles marked at the end with an asterisk*.

Change at the top

PLANS are underway to separate the current responsibilities of the rector, and create a new role of provost. Sir Keith O'Nions has assumed the title of president and rector.

He now oversees all functions at Imperial and is placing greater emphasis on its external affairs in the UK and overseas, focusing on building relationships with alumni, supporters, governments and industry.

The provost will be responsible for advancing and delivering the College's core academic mission - education, research and translation.

Speaking about the change at the top of Imperial, Council chair, Baroness Manningham-Buller, said: 'Higher education is facing tough challenges. Chang-

ing the leadership structure will allow Imperial to maintain its position as one of the world's top universities.'

Sir Keith O'Nions will be retiring at the end of 2013, so his replacement is being sought, ready for putting the new leadership model in place.

Other appointments over the summer have been that of Simon Harding-Root and Prof Debra Humphris.

Mr Harding-Root is now involved in supporting the College by delivering outstanding facilities and outstanding capital development projects.

As pro rector (education) Prof Humphris is focusing on the quality of teaching and its assessment and the most effective methods to enhance learning.

Indian alumni help succession

A NEW scholarship programme has been launched to encourage academically outstanding Indian nationals to study in the UK, via three-year PhD studentships. It was a collective decision of the College and Indian alumni.

Singapore ground breaking

IN JULY, Singapore's ministers of Health and Education presided over the ground-breaking ceremony for the Lee Kong Chian School of Medicine. Imperial and collaborators Nanyang Technological University (NTU) in Singapore, celebrated the start of work on the School's new Novena Campus at Mandalay Road. <http://bit.ly/LCaBLI>

Imperial provides festival fun

THOUSANDS of visitors including members of the public, alumni, staff and students were in party mood this summer on Imperial's South Kensington campus, as they explored the first Imperial Festival. It was a two-day insight into the wonderful and surprising world of Imperial life and research.

One of the organisers, Natasha Martineau, head of research communications, said: 'Imperial's first festival went better than many of us dared to imagine, with hundreds of staff welcoming thousands of visitors to the event.

'Around each corner there was yet another opportunity

to discover something new about the work of the College. We're very grateful to everyone who made it all possible, and of course to the sunshine, which made a big contribution to the festival atmosphere on campus.'

Festival slideshow and story: <http://bit.ly/KXjr50>



Students enjoy taste of university

SCHOOLS Minister Nick Gibb visited Imperial recently, to mark the College hosting the first visit in the Department for Education's Dux Scheme. Twenty school students had a hands-on science lesson in the

College's Reach Out Lab. They were elected by their schools to take part in the scheme which allows high-achieving year nine students to visit a Russell Group university for the day.

Dux, being Latin for leader

or champion, aims to widen horizons and raise the ambitions of pupils. They can experience a taste of university life and see firsthand the opportunities available in some of the country's top universities.

College leads regeneration

IMPERIAL WEST, which will create 3,200 new jobs and lead the regeneration of White City, has been given the go-ahead by Hammersmith and Fulham Council.

The seven acre campus, on Wood Lane, will become Imperial's new technology campus, delivering research, commercial application, translation and collaboration with industry, side by side with postgraduate education. Included will be open spaces, health and leisure facilities available to the public, housing, a nursery and other education facilities, restaurants, cafés and shops.

Project director John Anderson says: 'Imperial West will build on and further develop the College's existing strengths in engineering, physical sciences and biomedicine.' bit.ly/LUgNLb



STOP PRESS: THE HIGHER Education Funding Council for England (HEFCE), through the UK Research Partnership Investment Fund (UK RPIF), is contributing £35 million to support this development. With space for 50 spin-out companies, the vision is for it to become a magnet for businesses and universities in the UK and beyond.

£73m leads clinical breakthroughs

THE £73 million Imperial Centre for Translational and Experimental Medicine (ICTEM) opened at the end of May alongside Hammersmith Hospital.

The six-storey building with room for 450 scientists houses a dedicated facility for evaluating and developing new medical treatments through clinical trials.

On the upper floors is one of the largest cardiovascular research facilities in Europe, including the headquarters of the British Heart Foundation

Centre of Research Excellence at Imperial. Developing stem cells to help the heart repair itself after a heart attack is part of its work.

On the second floor, teams from the Medical Research Council Clinical Sciences Centre are using next-generation gene sequencing machines. These are helping them to develop improved methods for preventing, diagnosing and treating common health problems such as heart disease and raised cholesterol.

The building is also home to the Imperial Cancer Research UK Centre, which brings together chemists, biologists and engineers who are working on new ways of tackling cancer, such as molecular imaging techniques that help doctors match treatments to patients and methods to reduce the toxicity of radiotherapy.

The Wellcome Trust McMichael Clinical Research has two wards on the ground floor to evaluate new treatments.

<http://bit.ly/KEaDk3>

Students increase satisfaction

AN OVERALL satisfaction rating of 86% has been given to Imperial by final year undergraduates in the National Student Survey (NSS). Across all the categories, the College achieved a higher or equal percentage satisfaction compared with previous years, with the largest climb being in assessment and feedback. This saw an improvement of 8% on last year.

The College scored most highly in the learning resources category, with students' satisfaction increasing on 2011. Access to library services, IT support and specialised equipment, achieved an overall rate of 92%.

Still at the top

IMPERIAL has maintained its position of eighth in the world and third in Europe, behind Oxford and Cambridge, in the Times Higher Education World ranking of top universities.

Stars in their eyes

RECENTLY, 300 schoolchildren heard real-life astronaut and head of NASA Charles Bolden tell them that the sky may not be the limit if they follow a career in science, technology, engineering or medicine (STEM). Speaking at Imperial, he told how he questioned his own career path shortly after his first trip to space in 1986, when the space shuttle Challenger exploded 73 seconds into its flight. <http://bit.ly/LhO33D>

CGCA president points way forward

FOLLOWING the conclusion of the formal business of the CGCA's June AGM, newly-elected president, David Nethercot, delivered a short talk – 'Steeling the Mind'. He promised to find a genuine 'guest speaker' for the next year but this year he had decided to speak, since it provided an excellent opportunity for members to learn a little more about him, his views and his thoughts on the Association.

David began by explaining that there was no spelling mistake in the title: as someone whose specialist subject was steel construction, the phrase was deliberate. He illustrated its relevance to the three key activities of an engineering academic's life of research, teaching and professional activity. Drawing on experiences from his 40 year career, he used the Milford Haven Bridge

collapse, the Constructionarium and Wembley Stadium roof to show how intellectual rigour needed to be linked to practical relevance if research were to provide genuine benefits, students were to receive an appropriate education and academics were to be seen as valued members of the engineering community.

During the formal meeting, among the appointments made were those of senior vice president and junior vice president. The first is Eur Ing Roger Venables FICE, MCIM, FCGI (Civil 66), a former hon sec, treasurer and membership secretary. The second is Air Chief Marshal Sir John Romney Day KCB, OBE, ADC, FCGI (Aero '65). He retired as commander-in-chief, Strike Command before being senior military adviser to BAE Systems.

For further CGCA AGM business, see story over the page.

Associations ask to be remembered

CGCA and RSMA are always looking for support for current students – here they appeal to be remembered in your will.

FROM THE RSMA TRUST

'IT IS always sad to lose an alumnus, but we are extremely grateful to John Reddick (Geol 50) who died last December, leaving a generous donation to the RSMA Trust,' writes Trust chairman Prof Rees Rawlings.

It is quite simple to remember the RSMA Trust in your will and we have a brief note about this, available on request, but, of course, you should consult a solicitor.

Additional funds will always be required to support the students of the RSM, if only because of the high cost of living in London. Such a legacy may be for the work of the Trust generally, or for some more specific purpose such as a bursary in someone's memory.

It would be helpful if you could let the Trust know if you are contemplating leaving any bequest in your will. Please write to me, honorary secretary of the RSMA Trust, c/o Dr Teresa Sergot, (address, page 2).

Glynn Lloyd-Davies

FROM THE OLD CENTRALIANS' TRUST

MOST CGCA readers will be aware of the Old Centralians' (OC) Trust, which is mentioned regularly as a provider of financial support to student expeditions, projects and extra-curricular activities. The Trust also provides help in cases of genuine student hardship. Fortunately such cases are rare, but when they do occur the Trust can make a real difference and avoid much of the need for the student concerned to take part-time work when he or she needs to be studying.

The Trust does not overtly canvas for subscriptions, but to give a little to the Trust is one way we alumni can give a little back for the good times we had whilst at college.

Over the years, a number of members have opted to make donations, either on an occasional or regular basis. At present there is a group of alumni who are donating regularly - specifically to support the upkeep and maintenance of Boanerges - but the Trust would equally welcome similar donations towards its work amongst the student body. A regular donation does not need to be large in order to build up to a very useful sum over the longer term. Donations can be gift-aided as the Trust is a fully registered charity.

One or two members in the past have made substantial donations in their will. Bequeathing his house in 1997 meant that when Professor Peter Lindsay died in 2006, the funds of the Trust were enlarged by a very significant sum. The annual Peter Lindsay Memorial Lecture, open to all students in the Faculty, absorbs only part of its income, allowing many additional awards and grants to be made each year.

Sadly, despite his having made it known that he wished to make a similar legacy, the late Dr Philip Oldroyd failed to leave any will to this effect, and we have been saddened to see the proceeds from his home go to the Crown. The message to be drawn from this is that any alumnus considering such a legacy should aim to include something in their will at the earliest opportunity – the Trust would be more than pleased to assist in this process if desired.

You may obtain details of how to donate to the Trust, by a small regular sum or single amount, from me, chairman, **Chris Lumb** (chris19@clgml.plus.com), hon treasurer Dan Lehman (dan@lehman.me.uk), or the CGCA office.

CGCA agrees new mission statement

THREE key motions were passed at the CGCA AGM before new president David Nethercot stood up to speak (see previous page). First to be agreed was free membership for undergraduate and post graduate students attending a full-time course within Engineering, starting in this academic year. Free membership will continue until the January after a student's graduation.

The second item was the withdrawal of life membership for new members. This is due to the very low returns on investment being experienced currently. Existing life members continue unchanged.

The third item was a new mission statement for CGCA. It was proposed and accepted by the meeting:

CGCA is our member-led network for current and former students and staff of the Imperial College Faculty of Engineering (departments that award the AGCI Diploma). Operating worldwide, we promote interaction through publications, web presence and social events, whilst retaining ties with Imperial and with current students through the City & Guilds College Union and the Old Centralians' Trust.

In his review of the year, outgoing president Chris Hankin noted the relationship between CGCA, the Faculty and Imperial's Communications and Development had greatly improved. In addition, CGCA had opened up new channels of communication with members such as a LinkedIn group and a stand at the Imperial Festival.



AMONG the many expeditions sponsored recently by the OC Trust was one in autumn 2011 to the remote Reru Valley, Ladakh, in the Indian Himalayas. The seven mountaineers were Jonathan Moodie, Dominic Southgate and Joe Prinold (Bioengineering); Robin Jones, Kunal Masania and Hal Watts (Mechanical Engineering), and Jonathan Bull (Earth Sciences and Engineering). The expedition was a success, with four summits reached and seven new routes established. The prime objective, Lama Jimsa Kangri (6276m), was climbed simultaneously by two parties on the West and South faces. Three virgin summits were reached – Moel Kangri (5930m), Bhaio Aur Bheno Ki Khushi (5985m) and Basecamp Big Wall (5385m). On Moel Kangri summit are Dominic and Robin.

David Nethercot, CGCA's energetic new president

a profile by Colleen Shilstone Richards

DAVID is the very energetic new president of the City and Guilds College Association (CGCA). This makes me very pleased that we voted a few years ago to ask the president to serve for two years instead of the former one year!

Recognised by peers

David Nethercot OBE etc, etc is a former head of the Department of Civil and Environmental Engineering at Imperial College and former deputy principal (teaching) of the Engineering Faculty. His area of expertise is in steel, aluminium and composite construction.

Elected to the Royal Academy of Engineering in 1993, he was awarded the gold medal from the Institution of Structural Engineers in 2009. Very recently, David has been elected to become the president of the International Association for Bridge Structural Engineering, when it holds its conference next September, in Kolkata.

David Nethercot is now concentrating his attention on making the CGCA into an influential body of men and women who can carry forward the influence of all the previous members – dead or still alive and serving – into the next decade.

David has also become closely involved with the future of the magazine of the CGCA and RSMA – *Imperial Engineer* – having meetings



with the two volunteers who will be taking over its production next year. He is aiming to make sure actions of the Association's committee continue to be featured within its pages.

David is energetic and determined. These two coming years seem to be dedicated to changing and encouraging the general committee to take charge of the next 10 years and mould the Association into a viable and useful body of men and women members.

Suddenly he looks grave. 'I think we've got quite a

lot to do over the next couple of years – but I do have faith in the Association. It adds a lot of good for the current students and offers as a good opportunity for alumni to get involved. I think, though, that we have to move forward because the College has changed dramatically over the last two years.

Need to entice

'It's important that we entice fresh graduates to join the Association as they leave the College, even if they don't join straightaway.

They at least know that we are here and that they can come back and join us when they are ready to do so.

'I am afraid that the CGCA suffers from a low profile with College academics. I, for instance, wasn't aware of the CGCA until I became dean in 2000.

'I believe we won't get far with student recruitment unless we get some interest from the academics.

'The admissions tutors and the senior tutors in the departments, though, are well aware of the existence of the CGCA. This is because of the receptions we hold and the fact that we are supporting their students through The Old Centralians' Trust.'

Feelings have changed

'Do you think the feeling of "oneness" has changed?' I asked.

'Yes, because graduate engineers don't end up being practising engineers these days – they go into finance or some sort of managing consultancy.

Surveys have shown that at the point of graduation those who continue with engineering has dropped to as low as 25%.'

David Nethercot went on to say that many of the present members of the Association are 'London Centric'. Perhaps we need to do more social networking to attract a wider cross-section of members.

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Biological wire has endless potential

RESEARCHERS from Imperial's Centre for Synthetic Biology and Innovation and Bioengineering have demonstrated a way of creating a new type of biological 'wire', using proteins that interact with DNA and behave like wires in electronic circuitry.

Dr Benjamin Blount, first author, and Dr Tom Ellis, senior author of the paper, say the advantage of their new biological wire is that it can be re-engineered

over and over again to create potentially billions of connections between DNA components, without causing a short-circuit in the device.

The team has also developed more of the fundamental DNA components, called 'promoters', which are needed for re-programming yeast. By enlarging the component pool and making it freely available to the scientific community, the team aims to

spur on development in the field of synthetic biology.

In the study, the researchers modified a protein-based technology called TAL effectors, which produce TALOR proteins, with similar qualities to wires in electronic devices. These TALORS can be easily re-engineered, which means that they can connect with many DNA-based components.

The team says their research

now provides biological engineers working in yeast with a valuable new toolbox.

Centre co-director Prof Richard Kitney, adds: 'The work by the team really takes us closer to developing much more complex biological machines with yeast, which may help to usher in a new age where biological machines could help to improve our health, the way we work, play and live.'

Easy-going microwaves produced

SCIENTISTS from Imperial and the National Physical Laboratory have become the first to produce masers (microwave amplification by stimulated emission of radiation) that do not require very low temperatures, pressures or powerful magnets to operate.

'This could lead to their widespread use in a range of applications from radio telescopes to quantum computers,' says Prof Neil Alford (Materials).

Missing link

A FOSSIL called Kulindroplax – the only one of its kind in the world and found in the Welsh borderland – is providing the evolutionary missing link between two groups of molluscs and shedding more light on their early origins.

Dr Mark Sutton (Earth Science & Engineering) said: 'Most people don't realise that molluscs, which have been around for hundreds of millions of years, are an extremely rich and diverse branch of life on Earth.'

Just as tracing a long lost uncle is important for developing a more complete family tree, unearthing this extremely rare and ancient Kulindroplax fossil is helping us to understand the relationship between two mollusc groups, which is also helping us to understand how molluscs have evolved on Earth.' <http://bit.ly/QKRGjV>



FOLLOWING his speech about his vision for British industry, the Business, Innovation and Skills Secretary, Dr Vince Cable MP took a tour of the College's £2 million pilot carbon capture plant in Chemical Engineering. He visited the control room where PhD students Amelia Foo and Giulia Ferretti were on hand to give a demonstration. 'Dr Cable was really interested to know more about how we used the plant,' said Amelia. 'We had a mock emergency situation to demonstrate one of our training scenarios for him.' <http://bit.ly/NrLTzt>

Eye-tracking device offers improved living

THE LIVES of people with conditions limiting their mobility, such as multiple sclerosis, Parkinson's or spinal cord injuries, could be enhanced thanks to a new eye-tracking device, invented by Imperial and costing less than £40 to produce.

This cost-effective device could enable people to interact with computers by tracking their eye movements, allowing them to control a cursor on a screen. Dr Aldo Faisal (Bioengineering) said: 'Crucially, we have achieved two things. We have built a 3D eye tracking system

hundreds of times cheaper than commercial systems. We've used it to build a real-time brain machine interface that allows patients to interact more smoothly and more quickly than existing invasive technologies that are tens of thousands of times more expensive.

'This is frugal innovation; developing smarter software and piggy-backing existing hardware to create devices that can help people worldwide independent of their healthcare circumstances.' <http://bit.ly/LOAev2>

INTERESTING!

AN 11th century Buddhist carving from Mongolia has been shown to have been made from a meteorite fragment. Dr Matthew Genge (ESE) says that meteoritic metal has associations with a number of ancient cultures. 'There are reports of Egyptian necklaces including meteoritic metal.' <http://bit.ly/THLFBG>

Most of these items come from the College's press releases. For more on these stories use the links with the articles or trace them through Google.

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Focus on the Red Planet

FOLLOWING the successful summer Mars landing, two areas of research at Imperial have received funding from the UK Space Agency. Professors Sanjeev Gupta and Mark Sephton (Earth Science and Engineering – ESE) have received combined funding of more than £400,000 to help them carry out vital research for future missions to Mars.

This includes investigation into the history of Mar-

tian rocks and soil and looking for signs of past or present life in rocks from the Red Planet.

Professor Jan Cilliers, head of ESE, said: Imperial has been at the frontier of space research for many decades, with leading research on meteorites, asteroids and comet dust. It is great to see Mark and Sanjeev involved in these two significant missions to Mars, which will teach us more about its climate and its potential for harbouring life.' <http://bit.ly/LAsLkV>

EEE supplying seismometers

DR TOM PIKE and a team from Electrical and Electronic Engineering (EEE) are developing miniaturised seismometers for detecting 'Mars-quakes'. As part of NASA's next unmanned mission to the Red Planet, they are due to be launched on board the Insight mission in March 2016.

Scientists will use them to understand the formation and evolution of rocky planets when they touch down on

Mars' equator that September. Tom, who also worked on the 2008 Phoenix Mars mission, said: 'I'm thrilled that we're going back to Mars. After having taken the highest resolution pictures of Mars, with Phoenix, in 2008, we now have a second chance to look at the planet as a whole with our microseismometers. It's exciting to know that Imperial technology will be used again to explore our neighbour.' <http://bit.ly/Rw5W0b>

Lessons from rolling stones

CURIOSITY rover has captured photographs of rounded pebbles which suggest the past existence of an ancient riverbed on the surface of Mars.

Since landing in Gale Crater on August 5, the mobile laboratory has sent high-resolution images of the Martian surface back to the control team in Pasadena, California. Professor Sanjeev Gupta has just returned from working with them.

He said in a Nasa video: 'The surprising thing is that when we looked closely at the pebbles many of them were quite well rounded – very different from very angular ones we usually see littering the Martian surface. On Earth, rounded pebbles are a tell-tale sign of rocks that have been transported by water, for example in a river or stream. For more information see page 21. <http://bit.ly/QOHsfo>

CORE strength

IMPERIAL and Cambridge University have created a high-performance computing (HPC) service to give businesses access to some of the most powerful IT systems in the UK. The service, named CORE, includes the largest Intel high-performance cluster; the UK's largest single shared memory pool, and one of the UK's largest high-performance graphics chip clusters. <http://bit.ly/LI3DbA>

We have lift-off

AT THE end of the summer, Imperial celebrated the launch of a shoebox-sized satellite which it took part building. The CubeSat for Ions, Neutrons, Electrons and Magnetic fields, or CINEMA, will help scientists study how the Earth's magnetic field is affected by the solar wind. <http://bit.ly/OuvGEH>

New biosensors help diagnosis

RESEARCHERS have created a test to detect particular molecules that indicate the presence of disease, even when these are in very low concentrations. This is unlike existing biosensors. They become less sensitive and predictable at detecting biomarkers in very low concentrations found in early stages of disease

'It is vital to detect diseases at an early stage if we want people to have the best possible outcomes - diseases are usually easier to treat at this stage, and early diagnosis can give us the chance to halt a disease before symptoms worsen,' said Professor Molly Stevens (Materials). <http://bit.ly/K9GnAN>

Imperial collaborates for urban care

IMPERIAL is partnering computer chip maker Intel and UCL to create a new institute for research into intelligent systems in cities. The collaboration aims to develop computer technology that will enhance the sustainability of cities and their inhabitants' quality of life. For example, networks of sensors that provide data on pollution, water supply or traffic.

One example of how research could work in practice is where a major leak from a water supply floods the roads. Sensors could detect the leak, divert the flow of water to prevent more damage and wirelessly transmit information to transport authorities so that traffic could be diverted, preventing congestion and general city-wide disruption. <http://bit.ly/KKeA5u>

Comment

Puff for wind?

SPEAKING about the government's report that says windfarm costs could be cut by a third by the end of this decade, Dr Robert Gross (Centre for Environmental Policy) told Channel 4 News: 'It's not hopelessly optimistic, but it is very optimistic.'

We're at a very early stage in offshore wind developments, and reducing costs at this very early stage will be a challenge.?'

Day of robots

IMPERIAL inventor of a surgical robot which, in 1991, became the first in the world to remove tissue from a living human, says these are exciting times.

Emeritus Professor Brian Davies (Mech Eng) continued: 'Robots work much more accurately than the human hand. This is fantastic now we are seeking minimally invasive surgery through a tiny incision and precision is key.' <http://bit.ly/NdvrDz>

Off the rails

WRITING on *The Guardian* website, transport expert Prof Stephen Glaister (Civil & Environmental) says: 'The west coast mainline decision was always going to be subject to fierce scrutiny. Officials knew the stakes were high and any weakness would expose the decision to judicial review. Equally, they must know we all make mistakes, so a rigorous system of internal scrutiny ought to have been in place.'

Imperial Olympics

Carrying the torch

ON SATURDAY July 21, Professor Alison McGregor (Surgery and Cancer), third year mathematics student Franca Hoffman and fifth year medical student Kaushali Trivedi carried the Olympic torch, on behalf of Imperial, along routes in east London.

Professor McGregor was nominated by the College for her work supporting students at Imperial's Boat Club - treating injuries and helping students organise and run conferences. Kaushali was nominated for her work running a charity called KEEN London, a playgroup for children with special needs. And Franca was nominated for organising a small team from Imperial to run a mathematics camp for high school students in Accra, Ghana, as well as contributing to a range of College societies.



Actor Will Smith tried his hand at Olympic sports when he met members from Team GB at Imperial's Ethos sports centre this week. You can watch him show off his unique style in several sports, including basketball and boxing. at the BBC News website: <http://bbc.in/KyxOye>

Levelling the playing field

A TEAM of statisticians from Imperial was recruited by *The Guardian* during the Olympics to see what the medal table would look like if the results took into account countries' population and economic strengths. As the Games progressed, for each medal type (bronze/silver/gold) won, the team redistribute the medals that had already been won. For a small country, one medal was worth more than for a larger country and it

could end up with two or three medals, whereas a larger country 'lost' some of its medals in order to correct for the advantage afforded to it by way of its larger population. The population-adjusted rankings and a similar table correcting for GDP can be viewed on the Guardian website.

The Guardian: <http://bit.ly/NekJt>

Alexandra wins bronze

WITH team-mate Niki Birrell, alumna Alexandra Rickham (Environmental Policy 2006) won a bronze medal for ParalympicsGB in a two-person keelboat. Alexandra, who became a tetraplegic following a diving accident in Jamaica in 1995, was cheered on by colleagues from the Imperial community. <http://bit.ly/PRVdfZ>

Imperial legacy from doping lab

THE OLYMPIC drug testing lab is continuing its life as a unique biomedical research facility led by Imperial with partners at King's College, London. The Prime Minister announced the new initiative in his speech at the Global Health Policy Summit, an event organised by Imperial and the Qatar Foundation in London

The £10 million Phenome Centre will analyse blood and urine samples collected in large clinical studies, capitalising on the investment in analytical technology made for London 2012. The possibilities offered by the Centre are ground-breaking, as it will provide new ways of understanding the complex interactions between people's genes and their environment that determine their disease risks.

<http://bit.ly/ONrSLW>

Sport exchange

'THIS IS what it's all about,' said Sport Imperial's Samantha Bell, as she watched young British and Japanese try each other's sports, during a day at Imperial during the summer.

'It's not just about watching elite athletes compete, but also inspiring a young generation and creating opportunities for them to compete in any form of physical activity or sport and educating them culturally,' she concluded.

Youngsters from Tokyo Sports Association tried their hand at cricket and yoga against teenagers from Westminster Council's Edutain summer activities' programme.

THREE and a half years ago we featured *Engineering the Olympics*, John Armitt's boldly optimistic projection of how UK plc would deliver this enormous infrastructure project to meet the world's expectations. In the event, the Olympic Development Authority (ODA) wildly exceeded them.

Recently your editors caught up with Sir John Armitt (FGCI), chairman of the ODA, at his Canary Wharf office to find out how it was done.

EDITORS: What was the ODA's scope of work?

SIR JOHN: The ODA was established in 2006 and has been responsible for building the main permanent venues of the Olympic Park and the Olympic Village. We also built the Lee Valley White Water Centre, a shooting venue at the Royal Artillery Barracks, Woolwich and enhanced the existing venues at Eton Dorney, Weymouth and Portland. Beyond this we invested widely in the improvement of the transport networks and infrastructure serving the Olympic Park.

The work started in 2007 and, after about a year of site preparation, we started the big build in summer 2008. By July 27 2011 we had completed the construction of our venues.

EDS: On time and below budget is a very rare accomplishment in major civil engineering! How are the numbers looking at present?

SIR JOHN: We have saved about £1 billion on the as-built facilities, or roughly 12.5% on the initial (*ie* as revised) £8.1 billion budget. The Government didn't take this to the bank as transport and security costs could eat up a lot of this, but it's a very good place to start! The ODA has been responsible for developing the Transport Plan from the outset, but not for its execution. We have also acted as a consultant on security matters.

EDS: What have been the major contributions to this?

SIR JOHN: The most important factor was the complete political consensus that we would make this a successful project. Having a fixed deadline helped, as did having a robust budget, incentivised for good performance. For example, our subcontractors participated 50:50 in cost under-runs and forfeited 4% of any over-runs.

Crucially, contractors and subcontractors really bought into what we were trying to achieve - not only in building the stage for the Games, but also setting new industry bench-

LONDON 2012 SHOWS WORLD THE WAY

marks in areas including sustainability, health and safety and project management.

EDS: Were you a beneficiary of the recession?

SIR JOHN: Less than you would think, since most of the major contracts were placed before the downturn really hit. For example, we only got two bidders

for the Stadium. However, the bids for the later phases (the Olympic Village for example) benefited from much greater competition.

EDS: What has been the impact on employment levels in East London?

SIR JOHN: 20% of our workforce has been local and 10% came out of unemployment – we hope permanently. Many of our staff have acquired skills which should stand them in excellent stead throughout their working lives. We also hit our target of ensuring 15% of our workforce on the Olympic Park were of black or ethnic minority backgrounds, and worked hard to get more than 450 apprentices working on the construction project.

EDS: What about the legacy?

SIR JOHN: Most of the physical assets are going into private ownership following the Games. The ODA is retrofitting the Olympic Village into a new community for London called East Village. Around 50% of the 2,818 homes have been purchased by a social housing organisation and the remaining half is going to a private sector consortium, mainly for rental. The London Legacy Development Corporation are responsible for transforming the Olympic Park in legacy and running it thereafter.

They have already found future tenants for the Aquatics Centre and Copper Box (the new name for the Handball Arena), while Lea Valley Regional Park Authority is managing the Velodrome, associated BMX track and road circuit, in addition to the Eton Manor venue. This will become a multi-use sports centre. Owners are yet to be found for the Stadium and the Broadcast Centre but we expect this to happen in due course.

EDS: And how about your future – what's next for Sir John Armitt?

SIR JOHN: Technically my contract here lasts until April 2014. After that, who knows? But retirement is definitely not in my plans!



ODA collaborators share the legacy

LEARNING LEGACY, the showcase for sustainable, safe and successful construction, aimed at raising the bar of UK building industry, now has its website under the auspices of the Major Projects Authority (MPA), a partnership of the Cabinet Office, HM Treasury and other departments (see www.learninglegacy.independent.gov.uk). This blueprint for the UK construction industry (and elsewhere) was launched before the Olympics. It is a collaboration between the ODA, contractors, professional institutes, government bodies and academia. It builds on the ODA's ethos of setting targets well above the industry benchmarks, meeting the majority of these and, in a number of cases, exceeding expectations. It marks the first time that a construction project in the UK has sought to capture intellectual capital on such a scale.

John Armitt says: 'The scale and speed of the coordinated UK effort to build the venues and infrastructure is unprecedented and the knowledge and lessons gained during construction will both benefit the industry and act as a catalyst for inward investment'.

The website outlines the programme and provides case studies and reports across 10 industry themes – design and engineering innovation; equality, inclusion, employment and skills; health and safety; master planning and town planning; procurement and supply chain management; programme organisation and project management; sustainability; systems and technology; transport; and archaeology. It has been created from over 250 papers put together by the ODA and its supply chain, in addition to including independent research by industry bodies and academics.

The website is also linked to the associated industry organisations which are supporting the active dissemination of the Learning Legacy framework, with details of relevant seminars, events and workshops they are running to advise and inform future construction projects. Over time, the website will also be able to be contributed to, becoming a comprehensive online library to which companies of all shapes and sizes can refer.

Not just plain sailing

Olympic sailing judge John Doerr (Mech Eng 72) reveals how much engineering and science now influences his favourite sport

SAILING is a sport that is enjoyed by over one million people in the UK alone. It is a lifetime sport and more diverse than any other sport I know. I started sailing in a 13-foot dinghy my Dad built for me when I was eight years old. I passed him the tools on demand and this was my first introduction to

and seen firsthand the influence and development of engineering in every aspect of our sport, some obvious and some which may be a little surprising at first sight.

Making the boat go fast

If I wanted to cross the Atlantic today

over 4 tons that will sail at over 40 knots (approaching 50mph) in just 20 knots of wind. That requires some spectacular engineering. All of these are beyond the Olympics, which are sailed in much smaller boats, but the engineering trickles down, just as it does from Formula 1 to street cars.

The most obvious bit of engineering is getting the sails to produce lift and drive the boat forwards. While aircraft have the benefit of flaps and other bits and pieces to change the aerofoil performance necessary for landing and take-off, they are generally designed to operate within a very limited air speed range, and hence, operate at fairly fixed Reynolds numbers. Racing sailing boats must perform in airspeeds ranging from 4 to 25 knots, giving a massive Reynolds number range for the rig to manage.

Unfortunately, as more and more forward drive is produced so the heeling (the one that capsizes the boat) force also increases. This has to be balanced either by hydro-dynamic appendages under the hull or by the ballast. In Olympic classes, the ballast is provided by the crew, often using trapezes to increase the righting moment as much as possible.

The boat also has to contend with the waves and rapid changes in wind speed. These contrive to make the boat pitch, roll and yaw, all changing the angle of incidence of the wind onto



construction and materials and so, I now realise, to engineering. I know sailors who make it single-handed around the world at the age of 80. They must be capable of carrying out all the necessary maintenance and repairs themselves, sometimes in horrific conditions and 2000 miles from civilisation.

I have been very fortunate to be involved in Olympic sailing since 1992

Ben Ainsley takes the lead during this summer's Olympics

as fast as possible in a boat, I would select a sailing boat! Engines need fuel, tons of it, and that weight restricts the speeds achievable. A sailing boat now holds the Trans-Atlantic record for any boat. The America's Cup teams are developing 72-foot catamarans weighing

Imperial in forefront of sports engineering

AS TECHNOLOGY has developed, so too have specific applications to enhance sports science and engineering. Naturally, Imperial has been playing a leading role in the forefront of the latest developments.

In particular, researchers have been working with Sport UK and a number of other bodies to ensure British athletes reach the start line knowing they are the best prepared and best equipped in the world.

Funded by EPSRC, the Elite Performance Research in Training with Pervasive Sensing (ESPRIT) is developing a range of miniaturised wearable and track-side sensors, computer modelling tools and smart training devices. They are replacing controlled lab experiments.

During 2012, Rio Tinto started its latest partnership

with Imperial to create a curriculum-based project challenging engineering students to design, build and put into use paralympic sporting equipment.

Among other research at Imperial, a PhD student in Surgery and Cancer is studying the GB rowing team's lower limbs to see how they load their joints and how this affects posture and performance. Prof Alison McGregor and Anthony Bull of Bioengineering are also working with the UK's women rowers.

A project lead by Mech Eng's Benedict Copping will soon teach tennis players to deliver the perfect serve every time using a vibrating armband. By programming in the service of someone like Nadal or Murray, people could train by copying the movements of an elite athlete.



the sail. Modern carbon fibre masts are designed to have the best possible dynamic response to these changes. As the mast bends in response, the shape of the sail it is supporting changes with it. As the sail changes shape, so do the forces and the crew must react to every single one for optimum performance.

Materials and construction

Sailing boats are at the forefront of the application of composite structures. The largest sailing boats are amongst the largest, single-unit, carbon-fibre structures in the world at over 50 metres length. A mast can beat that by 20 metres and have a large enough section to permit the crew to climb to the top, inside.

Sails are typically carbon fibre strands aligned to the stress forces, sandwiched between layers of Mylar (biaxially-oriented polyethylene terephthalate), all held together with adhesives that allow the optimum elasticity. They are supported on a mast of carbon-fibre, reinforced, epoxy resins, all held up in the air by aramid-fibre ropes that are typically three times the strength of high-tensile steel. They must also be salt-water resistant and have great fatigue resistance.

A boat at the Games encountered a wave every second, so in 20 hours of racing and 10 hours of sailing to and from the course, the rig is subject to at least 100,000 cycles. And that is with-

out the hours and hours of practice time.

The shape of the hull and the size of the sails are controlled by rules, but there remains plenty of opportunity for speed. Back when I tried an Olympic campaign we could not build boats stiff enough with the available materials without increasing the weight. Then, in the late 1970s, there were huge developments in materials like epoxy resins and high-tensile glass filaments became available. Suddenly we could, and did without realising it, build boats that were too stiff. Whether by luck or design, our competitors from the USA arrived for a world championship with boats that were still longitudinally stiff but more flexible in torsion. They were, quite simply, easier to sail fast and they wiped the floor with us, taking nine out of the top 10 places.

As you can see from the photos, there is plenty going on in an Olympic boat. Every part of the sail and rig can be controlled by pulling bits of string (sorry, I mean ropes) of very sophisticated construction that have the strength, durability, fatigue resistance, UV-resistance and abrasion resistance to operate through mechanical systems providing the correct purchase and range of movement, without increasing the weight of the boat. Oh yes, they are also arranged and designed after ergonomic studies of athletes performing at the highest level, hour after hour.

Playing the media game

The Olympics is often called 'The Greatest Show on Earth'. It is a show, and in order to fund the sport, the money that comes in from the Olympic media rights is essential. To achieve that, you must be 'media friendly'.

For sailing, this is a particular challenge. It is hard to televise when boats are scattered over 10 square miles of ocean. Working out who is winning a sailboat race is not easy, even for those who have been involved for years – we just do not sail round a track.

For London 2012, sailing did bring some of its courses closer to the land and a big effort was put into the visual appearance of the boats, but the engineering is even more impressive. Each boat carried a camera and tracking unit. There is nothing particularly special about that individually, but when there are over 200 boats transmitting positioning data every 10th of a second and that data has to be transformed into a 'live' visual image that makes sense to the public, the challenge becomes clearer.

There is plenty more 'science' in sailing, ranging from meteorology to all the personal fitness and clothing areas, but without the engineering, sailing just would not be the same. I hope that those of you who are not into sailing, will look at our boats a little differently in the future.

JOHN DOERR graduated from Mech Eng in 1972. After a few years in textiles and steel he moved to Esso Petroleum at the Fawley Refinery focusing on maintenance and project management. John left Esso in 1990 to change his life balance in favour of his passion for sailing. He was a World Dinghy Champion in 1978 and became an International Judge in 1988. After leaving Esso, John coached Team GBR at the Olympic Games in 1992 and has been a member of the International Jury for Sailing at the past five Olympics, including London 2012. He is currently a member of the Jury for the America's Cup to be decided in San Francisco 2013 and is also Senior Faculty Member for the European Institute of Industrial Leadership (<http://www.EIIL.net>) where he focuses on transferring the skills of leadership and teamwork between sport and business.



Science and engineering

In this article, which won the annual RSMA essay prize, MSc Environmental Geoscience student Edoardo Borgomeo reviews environmental problems facing Venice and its lagoon. He evaluates the proposed flood barrier project and draws conclusions about the integration of science, engineering and the environment in the context of La Serenissima.

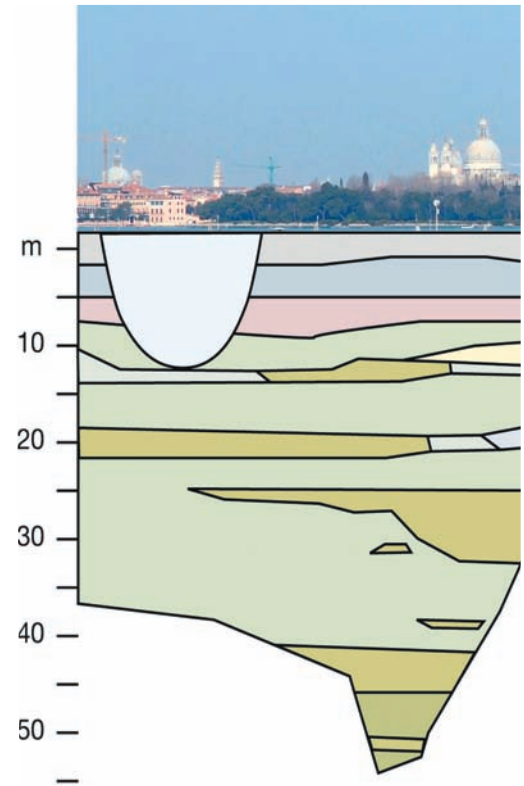
THE IMAGES of the 1966 flooding of Venice prompted the interest of not only Venetians in the measures aimed at safeguarding the city against flooding. The city of Venice has lived for centuries in a symbiotic relationship with the sea, but it seems that now the sea is finally overtaking the city. Flooding is just one of the problems affecting Venice. It is also threatened by subsidence, wave motion, erosion and environmental degradation.

The task of solving the 'Venice Problem' is an extremely difficult one because

Venice's lagoon is a place of transition between a marine and a terrestrial environment, where human activity and natural processes are occurring at the same time with great, dynamic intensity. The lagoon is one of the most studied environments of the Mediterranean, yet there is still a lot to be understood.

Geomorphological profile

The Venice lagoon is an arcuate basin oriented along a SW-NE direction, with a total length of around 55km and a width

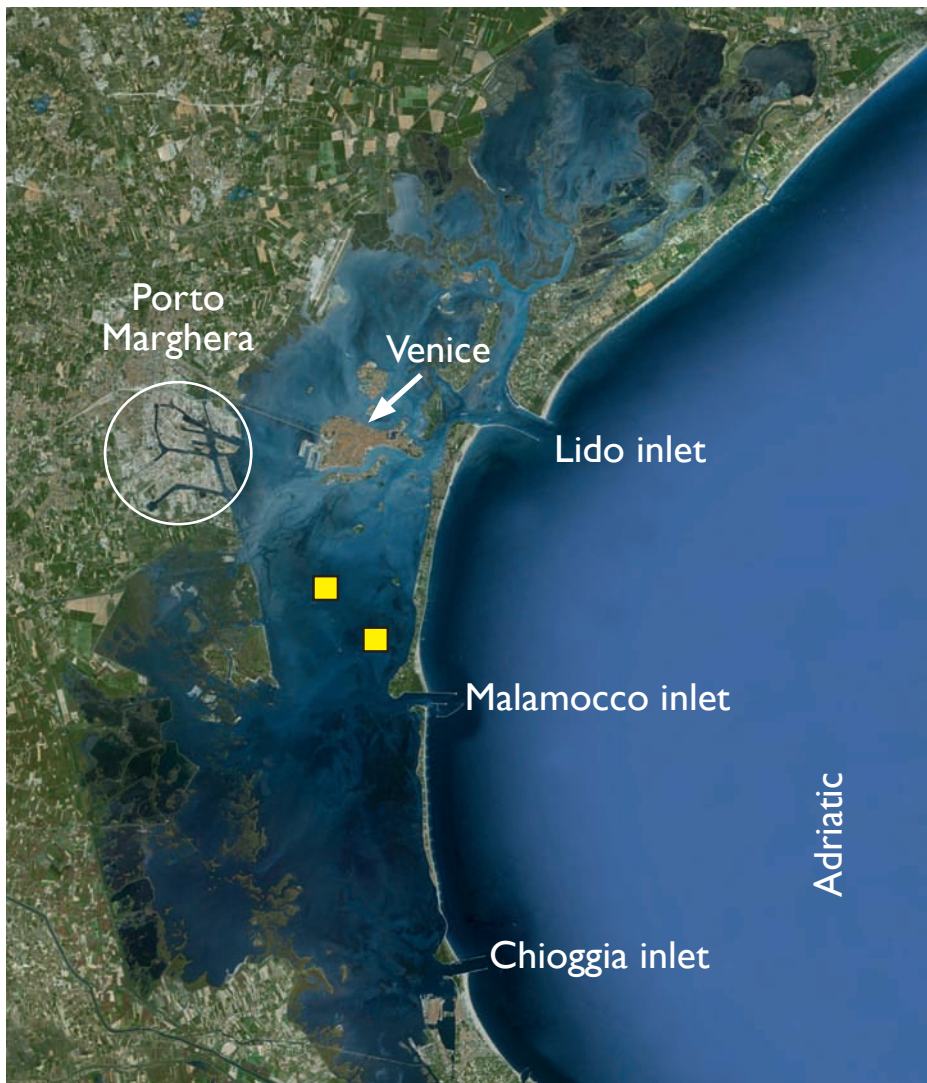


of 13km. The strip of land separating the lagoon from the Adriatic Sea is cut by three inlets (see left) which allow for the flow of tidal currents in and out of the lagoon. The tidal range in the lagoon is the highest in the Mediterranean, creating a unique coastal ecosystem that supports a large diversity of plant and animal species. The lagoon interior is characterised by a variety of different geomorphological features.

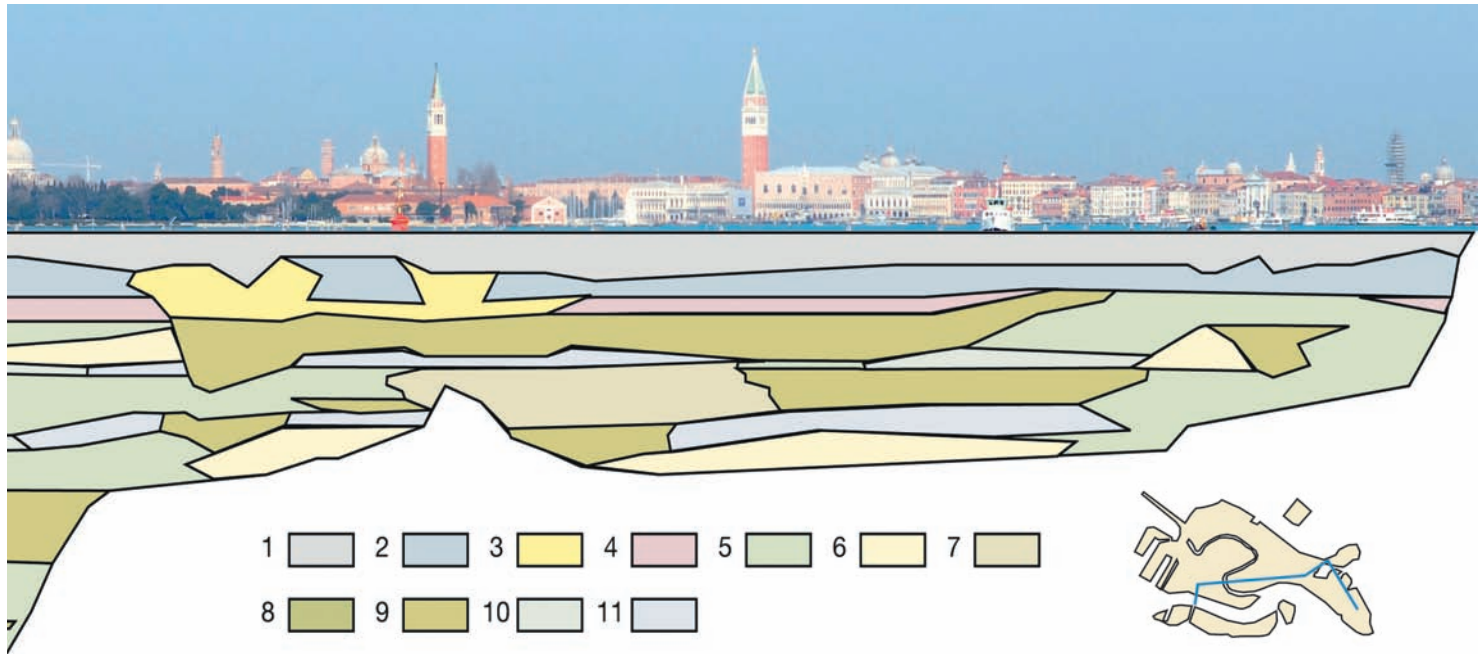
Underwater, tidal channels and creeks transport sediments in and out of the lagoon during ebb and flood tides, producing bedforms typical of tidally influenced wetlands. These structures include tidal flats, exposed only at low tide, and salt marshes, exposed under normal conditions and partially covered with seawater only during exceptionally high tides.

In normal environmental conditions, 60% of the lagoon lies completely underwater and 25% is below the high-tide mark and, thus, it is periodically exposed during low tides. The remaining 15% consists of islands and marshes, always above seawater, but susceptible to extraordinary high tides.

The three diagrams in this article were taken from Dehyen & Shaffer, Zezza and www.salve.it respectively. For Edoardo's full text, including bibliography, go to the website listed on page 2. Edoardo's email is edoardo.borgomeo@ouce.ox.ac.uk



g in the future of Venice



Stratigraphic profile of the Upper Pleistocene-Holocene deposits beneath the city centre. Units have been numbered. 1 anthropogenic deposits; 2 lime muds; 3 sands deposited in a lagoon; 4 caranto; 5/6 clays; 7/8 overbank floodplain deposits; 9 channel fill sandstone; 10/11= silts.

Sediment: from lagoon to bay

Venice's lagoon is fed by a large drainage basin with major rivers. However, in the last 50 years river diversions have almost completely eliminated fluvial sediment input. Dredging of navigation channels has caused an increase in erosion and a distortion of tidal currents, reducing the sediment input from the sea.

In particular, navigation channels have prevented the sediments from reaching intertidal areas, thus exposing the salt marshes to increasing rates of erosion. These changes in the hydrodynamic conditions have been worsened by the construction of breakwaters at the inlets. This has caused a reduction in the input of coarse marine sediments while lagoon sediments have been removed to construct artificial salt marshes.

The study of the lagoon sediment budget is based on the analysis of bathymetric maps which show an average sediment loss between 1950 and 2000 of about 1,106m³ per year. Some of these sediments were redeposited within the lagoon, but approximately one fifth was dumped into the sea outside the lagoon.

The consequences of these large-scale sedimentological changes, some of which are directly caused by human action, are a reduction in the salt marsh area (important in buffering the effects of high tides) and an overall increase in water depth throughout the lagoon.

The lagoon has been transformed from the highly-complex microtidal setting of the 1930s

to the sediment-starved and subsidence-dominated lagoon of the present day, with a flatter bottom surface that favours water exchange with the sea.

The geomorphological and sedimentological data indicate that the lagoon is progressively evolving towards a marine-dominated, bay-like environment.

Venetian subsoil profile

A stratigraphic profile of Venetian subsoil shows that the succession is heterogeneous and the sediments, although horizontal, exhibit lateral and spatial variabilities due to changes in depositional environments. The profile below 30m reveals an undifferentiated formation of sands, muds and clay deposits in fluvial environments. The uppermost 30m of

sediment contain Upper Pleistocene and Holocene deposits. The former are terrestrial fluvial facies and mainly consist of floodplain deposits. The absence of coarse-grained units suggests that the channels were in the lower part of the floodplain close to the river mouth.

Changes in fluvial regime (induced by climatic changes) and channel avulsion processes caused an alteration in the lateral distribution of the Pleistocene deposits causing interruptions and inhomogeneities in the vertical succession. Upper Pleistocene deposits are capped by a layer of siltstone and claystones to a mean thickness of 2m. The uppermost 3–4m of the profile contains anthropogenic deposits.

Continued over page



BORN and raised in Rome, 22 year old Edoardo Borgomeo moved to Imperial to study Earth Science as he is particularly interested in environmental issues and climate change.

Edoardo graduated this year and is now studying for a PhD at the Environmental Change Institute, Oxford University. His research explores water resources adaptation strategies in the south east of England, in the context of climate change. In the future, he would like to continue working on water-related issues.

FEATURES

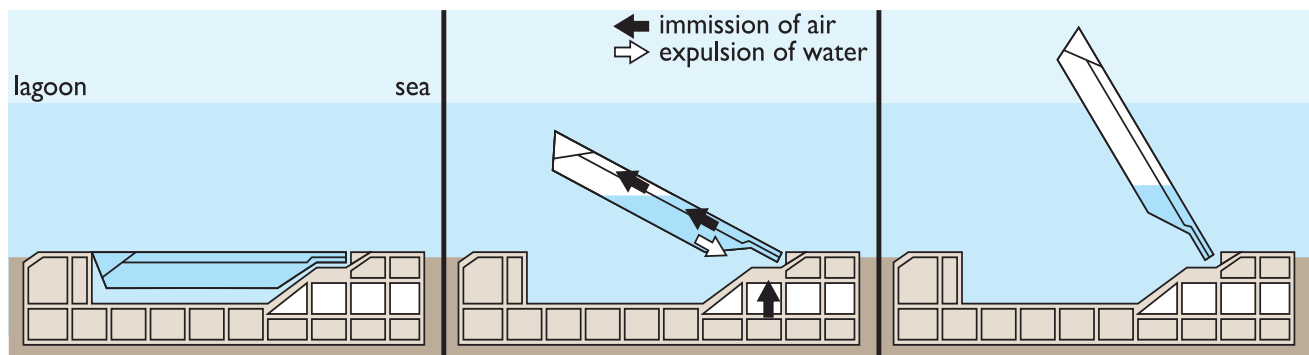


Diagram showing the functioning of the folding panels. The maintenance of the panels and of the pivots will present major technical challenges because it will have to be carried out underwater. www.salve.it

Sinking city: rising sea

Venice is a city effectively built on water and its inhabitants are accustomed, since its foundation in the 6th century, to periodic high tides and inundations. However, in the last 40 years the frequency of flood events has increased drastically.

The hydrodynamics of the lagoon are influenced by two wind systems: the Bora, from the east, and the Scirocco, from the south east. These two wind systems contribute to the generation of storm surges. The most disastrous inundation occurred in 1966, when high tides combined with strong winds and persistent rains to raise the waters 194cm above the mean level.

These extreme events cause widespread destruction and damage, but they are not as important, in terms of inconvenience caused to the population and need for urban maintenance, as the chronic flooding of the city, which occurs when water levels rise above 110 cm. In fact, when the water level rises above this datum, 40% of the city is flooded. However, high tides are not the only reason Venice floods.

Land subsidence and eustasy also play a major role. Experts have estimated that the interplay of these two phenomena has caused the city to subside by 23cm relative to mean sea level in the past 100 years. Of these 23cm, about 11cm resulted from sea level rise, and 12cm from land subsidence, both natural (3cm) and anthropogenic (9cm).

Subsidence is a local problem but it can be mitigated with restrictions and local policies. Eustasy, on the other hand, is a global problem related to climate change. Eustasy is without doubt the biggest long-term threat to Venice. In 2007, the IPCC predicted that, in the next 100 years, global sea level will rise by between 8 and 88cm,

with a mean possible value of 50cm, causing a tremendous increase in the frequency and intensity of high tides, probably making it impossible for many human activities in Venice to continue.

Engineering against flooding: the MoSE Project

Since the 1970s, local institutions and the national government have tried to develop a large-scale engineering solution to solve the problem of flooding. This scheme, known as MoSE project (*Modulo Sperimentale Elettromeccanico*, in English, *Experimental Electromechanical Module*), involves the construction of mobile barriers to temporarily close the inlets. They use folding hollow panels that are raised by injecting air within the individual panels when tides higher than 110cm are forecaste. At times of low tide, the panels will refill with water and sink down inside concrete caissons buried in the sediments. The barriers will then lie on the sea floor during normal sea and weather condition, allowing natural exchanges between the lagoon environment and the Adriatic Sea. The system consists of four barriers, placed at the three inlets of Chioggia, Malamocco and Lido, the last being divided into two parts.

The design and implementation of the MoSE poses a series of complex questions regarding the effectiveness of the barriers, their impact on the lagoon ecosystem and the sediment budget and their sustainability. The difficulty of predicting and modelling future conditions in the lagoon has made the impact assessment of this project very complicated and uncertain. The construction of the barriers has also triggered an intense political debate concerning the cost effectiveness and life span of the project. The barriers have an expected lifetime of 100 years,

implying that they are not the final solution to the problem but that they could buy time for Venice.

The future?

The situation of Venice and its lagoon is an example of the complicated challenges posed by sustainability.

These challenges are not limited to any particular geographic area, but coastal environments, such as the Venice lagoon, represent one of the scenarios where the interaction between humanity and natural ecosystems is most pronounced and intense. Local, national and international institutions are all developing strategies to 'save Venice'. This has certainly raised public interest in a problem that is emblematic of our times as it not only involves environmental management issues, but also political, economical and legislative challenges.

'Saving Venice' is an ongoing process that sees the interaction between science and engineering on one side and political decisions on the other. Science and engineering are essential as they provide a comprehensive understanding of all the aspects of the lagoon system (geological, biological, geomorphological *etc*) necessary to define strategies of intervention.

One certain conclusion that has been reached by scientific analyses and predictions is that there is no single engineering solution that will solve the Venice problem, and that continuous monitoring of environmental conditions, water circulation, sediment budget and human activities is essential. Therefore, after the completion of the MoSE project, decisions regarding lagoon management will still need to be made. The saving of Venice is then a continuous and gradual process, based on continuous monitoring of the city and its lagoon.

THE GREAT THING about an engineering degree is that it prepares you for potentially doing lots of different things. I think this is great, given that few of us have very little real idea of what we want to do after university.

I'm not sure, however, that my degree prepared me for what eventually happened in my case, but some 19 years after leaving Imperial College, I find myself running a financial markets software company with two of my best friends from my Electrical Engineering degree, and with another great friend from Physics (although we try not to hold that against him too much).

While financial markets is not as much of a glamorous area as it was before the recent crisis, it's still a big market and one where the right software and systems to deal with risk and regulation are much in demand.

In brief, Xenomorph (www.xenomorph.com), the software company we founded in 1995, is involved in the management of all the data and calculations that feed the risk management models used by banks, asset managers and hedge funds.

Put another way, no matter how sophisticated your trading and risk management models are, they are of very little use to anyone – and in particular to regulators – if the data and analytics you are feeding into them are of poor quality and consistency.

Xenomorph has recently expanded to a total of three offices, with our headquarters in London, an office in New York (where I am now based) and a

Brian Sentance shares some of the tips he discovered in setting up his company Xenomorph.

Startups, finance & electrical engineers

new office in Singapore. All this sounds very global and indeed it is, but it was a long slog to get here. We made many mistakes along the way, most of which I hope we have learned from.

If you have any desire to start your own company, there are a number of things I suggest you would do well to keep in mind:

- Get some experience first but don't be afraid to jump out of a good job – family, friends and acquaintances in the UK were not always that encouraging initially when you told them what job you had resigned from to form your own company. In other words, give it a try!
- Get started early before other responsibilities (spouse, mortgage, family) start to make your risk appetite more conservative.
- Do expect shareholder disputes during the first year or two of the company's life. Actively plan for this happening and you will survive and be stronger from the experience.
- Get yourself a good accountant early on and make sure that the initial

funding the company received from you is fully recognised.

- Don't expect help from banks unless you are in an industry where the bank can secure its money against some assets. We have met a few understanding bank managers who wanted to know our business, but even these are limited in the help they can offer due to bank policy.
 - The difference between a bank and a venture capitalist is primarily that banks want security against an asset, but venture capitalists effectively desire security against company control. Be careful what control you offer. Don't hand over too much before you know your worth and get the best deal you can.
 - When considering hiring others to help grow the company, wait until you can afford experienced people who can add value. Hiring inexperienced staff looks attractive on paper but becomes a big drain on resource until the company is large enough to handle appropriate training for them.
 - Do communicate regularly with staff and let them know where the company is going. People like to hear about a direction and, in the absence of it, human beings will typically assume the worst.
 - Find something that you are passionate about and stick at it. There is no substitute for hard work, and often hard work is what keeps you in business long enough to experience good luck.
- I hope the above is helpful to any of you considering starting a business. I wish I'd known many of the things above before Xenomorph came into being. That said, there's no substitute for learning from your own mistakes, and direct experience seems to greatly improve my memory of what is best to do next!
- www.xenomorph.com

Matt, Mark and Brian were in Elec Eng 79, becoming friends when grouped for lab projects. Chris studied physics and knew Mark as both were sponsored by GEC Avionics and played football at Imperial.

All four were in the old Linstead Hall and later shared digs in Finchley and then Fulham – Nine of them who shared digs, including this four, are meeting for an annual weekend reunion this December, a tradition which has lasted over 25 years.

After College, the four took up complementary roles – Chris in trading software design, Mark in database tech, Matt in trading and Brian in derivatives software.



From left: Brian Sentance, Chris Budgen, Matthew Skinner and Mark Woodgate.

At Bakers Trust in the mid 90s, Chris found that traders were struggling to do quick, statistical analysis on large amounts of data. With a background in database design and knowing there was a market for software to solve the problem, he persuaded Mark to leave Logica and Brian to leave JPMorgan. Matthew joined a year later from ING Barings, Hong Kong. The four know each other pretty much inside out which has been very helpful in navigating some of the many ups and downs since 1995. They socialise together too but with Matt in London, Brian in Connecticut, Mark in NYC and Chris in Melbourne, they don't get the chance too often.

FEATURES

This article, previously published by the Swedish Chamber of Commerce, follows the story of an idea born at Imperial which became a company and aims at helping absorb institutional capital from the west to help crack Africa's energy crisis.

Alumni develop charity initiative for brighter future

HAVING watched a YouTube video about the NGO Light Up the World, the future founders of BBOXX realised that their field of study, electrical engineering, could only benefit half the world's people. So, in 2009, whilst in the middle of their Electronic and Electrical Engineering degrees, they decided to try and change that by founding the charity e.quinox, as a student-run engineering project, to provide energy services to rural communities in Africa.

With approximately 90% of the population lacking basic electricity, Rwanda provided a good example of the electrification situation in Africa and this was where the founders of e.quinox decided to travel in 2008 to scout the market needs.

OC Trust support

Thanks to the generous support of the CGCA's Old Centralians Trust and Imperial College itself, they were able to travel to the country to meet local NGOs, representatives of the Rwandan government and private individuals.

By a stroke of luck and with a lot of persuasion, they successfully landed a contract to supply a village of 60 people with solar energy through the 'energy kiosk' concept.

Subsequently, \$300,000 in charitable funds was raised over the following two years. The e.quinox project continues to go from strength to strength under the guidance of students at Imperial, with continued support from the Old Centralians' Trust.

Exams and start-up

On graduating in 2010, the three co-founders, Chris Baker-Brian, Laurent Van Houcke and Mansoor Hamayun, decided to take the non-profit concept of e.quinox to the next level and founded BBOXX in the spring of their final year.

Having run the charity, they knew from experience that one of the major obstacles was the lack of power infrastructure. Moreover, they were unable to find the proper equipment to cater to the power needs of the poorest.

As a result, they decided to design

and manufacture their own devices and, amidst the usual exam stress and the completion of final year engineering projects, the three somehow found



the time to design a concept product, raise first round financing and, in the summer of 2010, implement the projects on the ground in Rwanda.

Having tested the market demand for such products, the three then spent over a year establishing a joint venture factory in China and sorting out the logistics of their initial markets, Rwanda and the Democratic Republic of Congo.

With the logistic infrastructure in place and local partners sourced in a number of countries across Sub-Saharan Africa, BBOXX started shipping their solar-powered battery boxes and quickly expanded across the region. They eventually reached out into Asia whilst also developing new products that are produced at their manufacturing base in China.

Today, the solar energy company, which enters new markets by establishing a national level franchise through dedicated local partners, oper-



ABOVE: The wonder of electric light. Users can study after dark which shines the way to a better, educated future. ABOVE RIGHT: Goodbye to kerosene and candles!

ates in 14 African countries, including areas such as war-struck eastern Congo and politically-challenged Somalia.

'It's not difficult to imagine that the countries that are the most unstable, or have suffered from recent political/social problems, are often the ones with the lowest levels of reliable electricity access,' says Christopher Baker-Brian. 'The risks associated with these areas are the reason that people do not have access to basic electricity. At BBOXX, we've accepted the challenge of providing electricity to these areas because we believe electricity is absolutely fundamental to improving quality of life.'

Slow glimmer

The market for BBOXX's product range is constantly growing, due in no small part to the surge of mobile telephone usage in Africa during the last decade and the rising populations that are outpacing grid connections in the majority of BBOXX markets. The International Energy Agency predicts that even by 2030, 1.2 billion people (the majority in Africa) will still lack access to basic electricity supplies.

BBOXX's corporate customers include restaurant owners and barbers, without access to on-grid electricity, who want to attract customers by installing a TV and running their equipment for extended periods.

BBOXX has managed to achieve all this without taking on-board any insti-



ABOVE: The first energy kiosk in Rwanda.

tutional funding. The founders and their initial investors have grown the business into a company with eight full-time UK-based employees and multi-million dollar revenue in the past year.

Recently, the founders have launched a new initiative, BBOXX Capital. This aims to crack the last problem of electricity access in the developing world – ending consumer financing. The in-house bank will provide credit solutions and payment plans to customers and turn the high unit cost of the products into a life-cycle cost over 12 months or more. It also aims at facilitating the absorption of institutional capital from the west to help crack Africa's energy crisis.

Over the next 24 months, BBOXX aims to treble in size to support its franchisees on the ground in Africa and take advantage of new opportunities in Asia and the Pacific regions.

Six year plan

The team has already won several entrepreneurship prizes over the last two years. However, as Mansoor Hamayun say: 'We really haven't achieved anything yet. Our vision is to solve the problem of electrification. We are planning to electrify 1.6 million people in east Africa within the next six years. While the number might seem large, it only represents 2% of the market, so we have a long way to go.'

CHRIS Baker-Brian (centre), Laurent Van Houcke (right) and Mansoor Hamayun all gained their MEng in Electronic and Electrical Engineering in 2010. They were part of the team of students who founded e.quinox in 2008 and later co-founded BBOXX in 2010. Mansoor was the first chairman of e.quinox

Christopher is responsible for product development, supply chain and BBOXX's manufacturing partnerships. He brings to the partnership extensive technical experience in petro-chemicals (Shell) and aerospace (Rolls-Royce) industries. He is a full member of the IEEE and IET (Institute of Engineering and Technology) and



currently serves as a general member of the 2011-2014 IEEE Ad-Hoc Committee on Humanitarian Activities.

Laurent is responsible for macro-managing BBOXX's operations globally, from shipping to the point of sale, going through marketing and

long-term business development. Laurent also has professional experience in energy distribution with EDF in London and energy consultancy with Norman Disney & Young. Laurent supports BBOXX's local partners from a technical, market and business development point of view.

Mansoor looks after BBOXX's global strategy in HR, new markets and industrial partnerships. He has professional leadership experience in engineering and customer service with Rolls-Royce in the UK and Hong Kong. He spends considerable time creating the framework and partnerships necessary to fulfil the social aim of the business – mass electrification.

Refractories: an essential evil?

compatibility & longevity

by Michael C Walton

THE HIGH temperature processing industry depends almost entirely on refractories. For process vessel integrity and longevity, it is essential to choose the appropriate refractory lining or the opportunity costs in lost production and unproductive time can be immense.

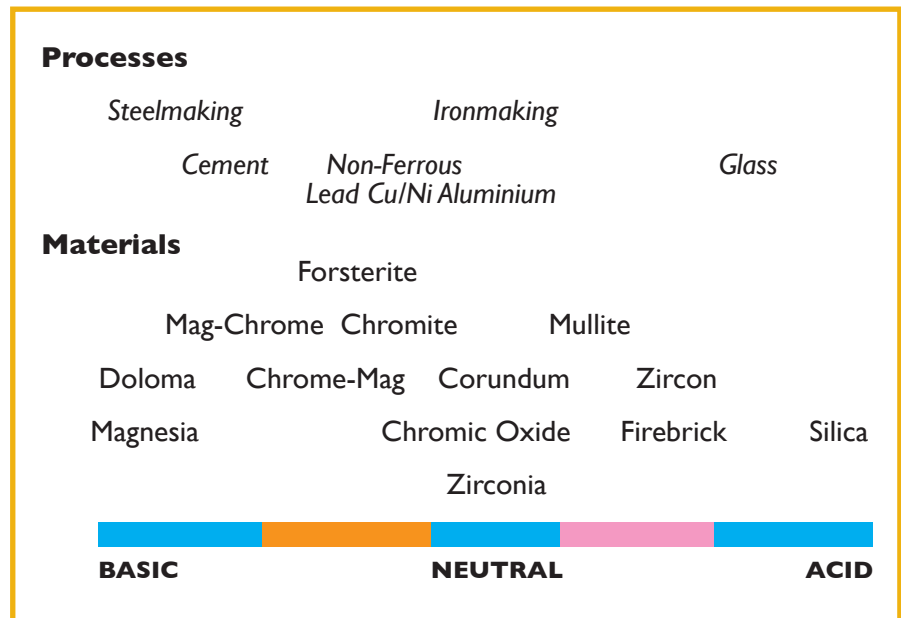
Any definition of 'refractories' would need to recognise that they contain the process at high temperatures and, thus, protect the process vessel and ancillaries.

Refractories have to maintain their critical properties under process conditions, whether that is for temperature, chemical or mechanical resistance to the environment. These materials are generally oxides, of either alumino-silicate, magnesia or doloma chemistry, with the important phases being mullite, corundum (neutral or semi-acid), spinel or periclase (basic). Some non-oxides – silicon carbide and carbon (as graphite or pitch) – are used in mildly oxidising to reducing conditions.

An obvious critical factor is operating temperature. The refractory must be chosen so it has not only the capability to operate at the required temperature, but also has 'head-room' to accommodate the inevitable process fluctuations. In processes where there is a separation of liquid phases (*ie* smelting), one of the most important factors is the compatibility of these phases with the vessel lining. As most liquid metals are not too reactive, this relates to the slag make. Chemical incompatibility is the major source of high temperature erosion/corrosion of refractories at high temperatures.

The preliminary analysis, shown in the figure, is a good starting point to assess compatibility of process slags to various types of refractories.

Light metals, such as aluminium and zinc, are very reactive, and often passivating additives have to be employed to protect the refractories in contact with them. Certain gaseous environments can also cause problems, especially where hydrocarbons or carbon monoxide are formed. In many



processes, volatile alkali oxides, chlorides or sulphates are evolved. These too require a focused approach

Refractories will fail when mechanically overstressed. They are strong only in compression and generally do not have a 'softening' zone, unlike steel, and can fail rapidly if slightly overheated.

Most mechanical issues can be accommodated with knowledge of the following material and process parameters:

- * thermal expansion;
- * abrasive component (dust-laden high velocity gases);
- * process variations;
- * bending moments;
- * auxiliary anchoring systems (stainless steels/alloys).

Refractories cannot last forever, but the design must attempt to give the operator a reasonable campaign life, to

optimise the unit costs and minimise downtime. A viable design is one where the refractory lining wears at a predictable rate over the campaign life within the process vessel environment.

Failures, where the campaign life is much shorter than expected, or where the lining breaks down unexpectedly, can generally be ascribed to one of the following causal factors:

- * Poor design, a critical factor missed or not recognised in the design process.
- * Poor operation, where operator pushes system outside of the design limits.
- * Poor installation, lack of quality control by installer.
- * Faulty material, lack of quality control by supplier and/or purchaser.
- * Inadequate material or process specification.

MICHAEL WALTON (right) is an independent refractories engineer, based in Melbourne, Australia, who qualified in metallurgy in 1970. He has over 40 years' industrial and consulting experience related to refractories. Further details can be found at www.refmet.net



FOR THE past three months, Prof Sanjeev Gupta (Earth Sciences and Engineering) has been working as a participating scientist on NASA's Mars Science Laboratory (MSL) Mission, the Curiosity rover. As a sedimentary geologist, Sanjeev's role is to investigate sedimentary rocks encountered by the rover. He uses images captured by its cameras to examine rock layers for clues to the processes that transported and deposited sediments, and to reconstruct the ancient environment in which the rocks were deposited.

The prime goal of the Curiosity mission is to search for signs of rocks that might record ancient habitable environments. In addition, the mission aims to reconstruct the geological and geochemical evolution of Gale Crater, where the mission landed, by examining successions of rocks exposed at the

LIFE? ON MARS

base of the 5 km high Mount Sharp, in the centre of the Crater.

Understanding the geology of sedimentary rocks encountered by Curiosity and their palaeoenvironmental context, using the rover's cameras, is the first step in analysing such rocks. The rover's formidable armoury of geochemistry analysis tools is then deployed to tease out the mineralogy and chemistry of the rocks and understand their mode of formation. Curiosity has

already had exciting new results. Close to the Bradbury landing site, the rover discovered rock outcrops containing rounded pebbles, a rock type geologists call a 'conglomerate'. On Earth, rounded pebbles are a classic indicator of transport and abrasion of pebbles in vigorous water flows in ancient streams. The pebbles are too large to have been moved by wind. This is the first time that sedimentary deposits likely to have been formed by vigorous water flow have been discovered on another planet.

Sanjeev is also a long term science planner (LTP) for the mission. With other LTPs, he works with the science and engineering teams to develop and implement strategic plans for the rover's activities. This is particularly exciting as it enables him to get a close glimpse of rover operations.

The team is now working remotely, and Sanjeev, back in London, interacts with team operations by telephone and the internet from the Royal School of Mines. 'Its amazing to see plans you help develop in close collaboration with rover engineers become reality on Mars!'

Rock layers at the base of Mount Sharp pictured by Curiosity's Mastcam camera. In this false colour image, the colours have been stretched to show a range of colours and emphasise differences in visual colour. Subtle colour variations in false colour images may represent differences in the geology and mineralogy of the layers.



THE CLIMATE FIX

(what scientists and politicians won't tell you about global warming)

by Roger Pielke Jr

ISBN 978-0-465-02052-2

Published by Basic Books (2010)

ROGER Pielke Jr is an American academic who treads the line between science and economics. His father was a climate scientist. In this book, Jr seeks to rationalise the confusion following the 2008 climate debate in Copenhagen and to suggest a way forward.

His essential thesis is quite simple; he describes it as the Iron Law of climate policy. Where there is a conflict between environment and economy, the economy always wins.

He starts his book with a story. Al Gore organised a congressional hearing on global warming in Washington in

BOOK REVIEW

the summer of 1988. He set the meeting up on what was expected to be the hottest day of the Washington summer. It was and, just to emphasise it, the air conditioning in the meeting room was ineffective. The media reports exceeded all expectations, and the meeting was later seen as the start of the global warming debate.

The debate took place during a period of general high confidence and good economic growth, which came to a grinding stop in the later noughties. Climate meetings in Rio in 1992, Kyoto in 1997 and in other locations developed a considerable momentum; it came to a halt in Copenhagen in 2008.

The author offers a way through this which might be considered complementary to the 'ecopragsmatism' of Stewart Brand, the lateral thinking of Bjorn Lomborg and the ideas of lesser known authors. In Chapter 9 - Obliquity, Innovation and a Pragmatic Future for Climate Policy, Pielke argues that to achieve climate stabilisation we need to be indirect. Multiple stimuli and acts can be more effective than a single initiative. The focus should be people, not the planet.

It is an interesting addition to the growing chorus of contrarians who are not change deniers, but who feel that well-focused technical/economic rapiers would be more effective than an anti-carbon political blunderbuss.

For more information visit rogerpielkejr.blogspot.com

Bill Bradford

FEATURES

NO DOUBT many readers will recall the two sporting events between Imperial's constituent Colleges, namely Morphy Day and the Sparkes Cup.

Morphy Day, instituted in 1920, was a race between the eights from C&G, RSM and RCS for the Morphy Cup and from 1945, also for the Lowry Cup. The former was presented by Arthur Morphy, father of Donald W Morphy, an electrical engineering graduate who co-founded the firm Morphy Richards. The Lowry Cup was presented by G C Lowry, the College secretary. However, the day is probably better remembered by most alumni, not for the rowing, but for the lively battles, using rotten fruit from Covent Garden and flour as missiles, which took place on the towpath.

Rugby was the other major sport at Imperial College and the Sparkes Cup was competed for by the colleges' 1st XVs. The Sparkes Cup honoured Stanley Robert Sparkes, who was dean of the City and Guilds College (1967-70) and president of the Imperial College Rugby Club.

Major event

Both of these events have been superseded by the Varsity as the College's major sporting competition which was established in 2003.

It is a one-day event which caters for a range of sports and competitions between Imperial College and Imperial Medicals. This year nine sports were involved, namely hockey, football, lacrosse and rugby matches (other than 1st XVs), at Imperial's Harlington Sports Ground, and netball, basketball, squash, badminton and water-polo at the indoor venues of Ethos and Wilson House. Many of the competitions had

Historic rugby result during 2012 Varsity



men's and women's teams and three events were mixed.

Since its institution, the overall Varsity winner has been Imperial College and this year was no exception with the College winning 14 of the 26 matches/games with four draws.

The highlight of the day is the rugby game. This is played in the evening for the JPR Williams Cup, named after former Welsh rugby captain and St Mary's Hospital Medical School alumnus John Peter Rhys Williams (known as JPR). He always attends to present the trophy and choose the man of the match.

The match, played under floodlights at a top venue, has been at Harlequin's ground, the Stoop, for the last two years. In contrast to the overall competition, for nine years

Imperial Medicals has lifted the JPR Williams Cup. However, in recent years, the games had been very close and this year hopes were high for an Imperial College victory to crown a successful season. The team had just gained promotion after winning the British Universities and Colleges Sport South Eastern 1A League.

On the evening, the engineering and science students in a crowd of over a thousand at the Stoop were not disappointed. The opening quarter was tense and both teams failed to take the opportunity to open the scoring when awarded penalties.

Try-ing time!

However, deadlock was broken in the 23rd minute when Imperial College scored the first try of the game. It was converted. Shortly before half-time Imperial College had an unconverted try to lead 12 - 0.

The second half was dominated by the College's well-organised defence thwarting any chance the Medics had of getting back into the game. The mobile IC pack produced excellent quick ball for the backs who took every opportunity to show their handling and running skills. The XV man rugby resulted in five tries in the match and the final score of 31-0 for Imperial College is the widest victory margin in the history of the competition.

To round off an enjoyable evening for the engineers and scientists present, JPR awarded the man of the match to Imperial College player, Jack Flanagan.

Rees Rawlings, ICURFC president



Stephen recognised by Canadian mining



STEPHEN QUIN (left above, Geol 80), president and CEO of Midas Gold has received the Selwyn G Blaylock Medal, which is awarded by the Canadian Institute of Mining Metallurgy and Petroleum (CIM).

Stephen was awarded this prestigious medal in recogni-

ALUMNI

NEWS & VIEWS

Five pages of who's doing what and where

tion of a career dedicated to the responsible and sustainable advancement and development of national and international exploration.

Established in 1948, the medal honours Selwyn G Blaylock, one of the pioneers in the mining industry in western Canada.

Stephen continues to demonstrate exceptional leadership, management skills and industry knowledge.

Dick finds mine paved with gold!

'DICK' Whittington (PEng74) as CEO and president, has spent the last few months putting together a mine development business plan for Norther Vertex Mining's new Moss gold project in Arizona. 'The business plan has been specifically designed to take advantage of the natural attributes of the Moss deposit while minimising the capital re-

Leading light

WITH HIS CGCA tie shining like a beacon (writes David Hattersley), recently Jim Andrew gave the Institution of Civil Engineering's 2012 Smeaton Lecture.

Dr Andrew (MechEng 65) spoke about Thomas Newcomen's developments, how steam was exploited as a source of power and the improvements made by Smeaton.

quired to get into production and the lead time in doing so, thereby reducing project development and capital risk,' says Dick. 'This is the exact challenge I've been looking for.'

While not large by gold mine standards around the globe, Moss will target 50,000 ounces per year initially and 75,000 ounces per year when at full mine design capacity. 'It has all the hallmarks of a mine in waiting,' comments Dick.

Mobile: 604 805 8577
dickw@northernvertex.com

Notes on web

'I WAS very impressed to see that one of our alumni, Dr Philip Pells (Civils 68), thought so highly of his post-graduate study at IC that he has reproduced all his lecture notes on his website,' wrote Ron Butler recently from Australia, 'They are all beautifully hand-written.'

The lecture notes can be seen at www.pellsconsulting.com.au/imperialCollegeLectureNotes/

Extra honour

IN RECOGNITION of his services to technology and his outstanding contribution to engineering and society, Professor Paul Jowitt (Civils 72) added a CBE to his FEng FRSE CEng CEnv FICE FCGI FRSA this year.

He has also been made Fellow of the Royal Academy of Engineering following his year as president of the Institute of Civil Engineering.

Canadian award

NIGEL Fitzpatrick has been made Honourary Life Member Electric Mobility Canada for his role in starting Azure Dynamics which launched one of the first hybrid cars. +16(0)94-318-6489, npfitz@telus.net

WHAT A SWELL PARTY!

BY LAND, sea and air we came! Of the 61 who graduated with BSc Honors in ChemEng in 1972, 37 of us made it to the reunion. We were unable to contact 11 of our year and the remainder had other pressing engagements.

We came from Australia, Malaysia, Hong Kong, California, New York, Turkey, Belgium, Switzerland, the Isle of Man and even the UK! At the last minute one was prevented from coming from Qatar.

Our programme was sim-

ple, involving land (walking and climbing), sea (a cruise down the Thames) and air (the new cable car across the Thames).

Friday was very informal with departmental and College tours, the Union Bar and informal dinner groups). Saturday we climbed Queen's Tower, went on more department and College tours, spent an afternoon, on a four-hour charter bus ride with a Blue Badge Guide, with stops at the Thames Barrier and near the Olympic sites.

Saturday evening offered a buffet dinner at 170 Prince's Gate (the 'Rector's Pad'). Many had never been inside this Victorian listed property. On Sunday, a group of us caught the ferry down the Thames, then rode the new cable car between Greenwich and the Docklands Railway.

Gordon Jackson

* For details of how to organise such a successful reunion, see Gordon's complete story on the web (see p2).



DIARY

Monday December 10

CGCA Christmas Lunch, 170 Queen's Gate, 12:00 for 12:30

2013

May 8-11 Imperial College/Chapter Imperial Festival – Annual Alumni Reunion. Details to be confirmed

Friday May 17

CGCA 100th Annual Dinner, Mansion House, 18:45 to 22:45

Advanced booking form inserted in this magazine

Thursday June 27

RSMA AGM/Final Year Barbecue. Details to be decided.

LONDON WALKS

Saturday March 2
City walk to include Dr Johnson's House and Cheshire Cheese pub. All welcome. Please email johnsheilabackhurst@tiscali.co.uk for further details

Saturday April 13

Cannons Park and Chandos Church, Edgware walk
All welcome. Details above

Saturday June 8

London Walks – St Johns Wood, homes for the rich, cricket lovers, The Beatles crossing.
All welcome. Details above

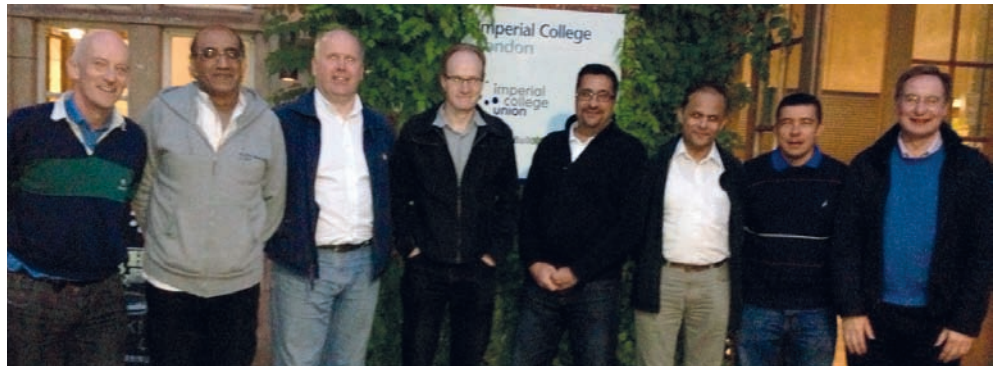
TBA

The Olympic Site – visit to be arranged when the site is completely open.

All welcome. Details above

If we do manage to have an Olympic site visit, we would find an extra date or replace one of the walks above with the Olympic Walk.

More information and booking for any events, contact Teresa Sergot t.sergot@imperial.ac.uk or phone 020 7594 1184



ON SEPTEMBER 22, nine former classmates of Electrical Engineering 81 held their latest annual reunion, starting in the Union Bar. They went on to enjoy a meal in a nearby Thai restaurant. From left they are Ian Tyes, Krishna Thakrar, Mike Casey, Roger Edwards, Sunil Morzaria, Yogesh Joshi, Arthur Jordan and Alan Higginson. Also enjoying the reunion with them was Shahid Raja. alan.r.higginson@btinternet.com

More alumni lead professional bodies

FOLLOWING last issue's article about Barry Brooks' (EEE 71) appointment as deputy president of the Institution of Engineering and Technology, news has come in that *Reporter* magazine has featured three females in key roles. The three met again early this summer after 40 years.

Next May, Jenny Body (Aero 75) will become the first female president of the Royal Aeronautical Society. She retired in 2010 after a long career with Airbus, finally becoming head of research and technology.

Isobel Pollock (MechE 75) is president of the Institution of Mechanical Engineering, while

Judith Hackitt (ChemEng 75) will become president of the Institution of Chemical Engineers next May.

Judith has been chair of the Health and Safety Executive since 2007. Isobel is a visiting professor at Leeds University, having worked for ICI, DuPont and other manufacturers.

New Elizabethan turned round Rolls Royce

MANY alumni were pleased to hear James Naughtie's profile of Sir Ralph Robins on Radio Four's recent series *The New Elizabethans*.

On graduation from Aero Engineering in 1955, Sir Ralph joined Rolls Royce as a graduate apprentice. During his 48

year career with the company, he is credited with turning round its fortunes. He was also CEO and retired in 2003 after 10 years as chairman.

Under Sir Ralph's patient guidance, Rolls Royce invested heavily in aero engine technology and became known as one

of Britain's last bastions of engineering excellence. Today it is one of world's great manufacturing businesses.

The programme, dated August 16 is available by going to the BBC4 and searching for *The New Elizabethans*.

Sydney reunion

THE ANNUAL informal reunion in Sydney attracted 18 alumni, with perhaps the most illustrious being Prof Tony Bradshaw (Metal 43) who has regularly attended our reunions and still manages to lead a very active life.

Whilst Tony was our oldest participant, our youngest was Alison Howe's 16 month old daughter who delighted us all. It was also a pleasure to welcome four newcomers, two with MBAs and two with health management degrees.

As always, it was a bit disappointing to receive 33 apologies



from old friends who had hoped to attend but were otherwise engaged. Many pleaded pressing work commitments which is a good sign of the health of the Australian economy.

Ron Butler

Brian Haywood (MechEng 60), Michael Hards (Aero 60), Mrs Haywood, Jim Kehoe (MechEng 62), Lei Wang (Health Mgmt 05), Ray Dudgeon (MinProc 68) and Jolyon Nove (Civil 60).

Alan wins prestige RSMA medal

Alan Dickson, winner of the 2011 Peter Harding Medal for services to the RSM, was unable to attend last November's RSMA Dinner. So when John Sykes (senior vice president) caught up with him in Perth, Australia, he made the presentation. John writes –

ALAN has been deeply involved in both Imperial and RSM alumni activities since the 1970s. While he missed Malcolm Baron's first Western Australian event in 1978, he did make the second, and has been to most since and has organised 61 functions.

Alan has been attending and organising the Perth event since 1979. As a 'First Friday' Sundowner for RSM alumni,

it morphed out of an Institute of Mining & Metallurgy event. Generally about a dozen from a cohort of about 100 semi-regulars now attend each month.

Alan attended the RSM from 1965-68, studying Mining Engineering, and still plies his trade in Perth as a consultant mining engineer. At college Alan was a keen swimmer and water polo player. He captained the RSM swim team and played in the Imperial water

polo team, gaining full RSM and Imperial colours.

If you live in Perth and would like to come to the events, or if you were passing through (he might even organise an event in your honour), feel free to email Alan at alan@dickson.com.au. The sundowners are on the first Friday of every month, at the Celtic Club, starting 5pm. They usually end in a curry house!*

ANOTHER international reunion of RSM mining engineers from 68 and spouses was held in Buenos Aires in March, arranged by Frank O'Kelly and his wife Marcela who are based in Chile and Argentina.

A little jet-lagged, we were treated to a champagne break-

Malbec marks BA reunion

fast at their apartment in Buenos Aires and were introduced to our local guide for our stay in BA. The group included Frank and Marcela, Julian and Mary Bennett, Mike and Carol Dixon,

Lionel and Pat Sainsbury and Dave Thomas whose wife had family commitments.

A trip to the Pampas was a highlight of the visit culminating in a day with the horses and gauchos. There were convivial dinners in BA where we enjoyed the local beef, Malbec wine and a spectacular tango evening.

Heartiest thanks to Frank and Marcela for sharing with us some of the delights of impressive Buenos Aires and rural Argentina and in particular for enabling us to get together at such a successful reunion.

The next reunion is planned for 2014. Details to be announced. * **Lionel Sainsbury**



OUTSIDE of academia or public service, few of us make the headlines or the Queen's Honours list, but *Imperial Engineer (IE)* is one of the few publications where a lifetime of personal engineering effort and achievement can be properly recognised and appreciated.

On the editorial board, we think it's important to record what, in many cases, have been the illustrious, productive and interesting careers of Imperial engineers. *IE* does what it can, but we are aware that many graduates and postgraduates are not properly honoured and their deaths are only reported in a few brief words, if at all.

Bank your obituary?

You might like to follow the example of 'Howard' Goldsmith. He was a good friend of mine and one of the immediately postwar RSM mining graduates. As well as serving in the Pioneer Corps in WWII, he had a very full mining career in South and Central America as well as North and West Africa. He finished his career with a spell at the United Nations HQ in New York. He had the forethought to write his own obituary.

Why not do a 'Howard' and write your own and send

it to us? We will keep it on file for you.

In the meantime, if you hear of the death of an Imperial engineering former staff member, graduate or postgraduate, please advise us even if you do not know enough about them to produce an obituary – an announcement in *IE* however brief may jog other valuable memories.

As an example, a few years ago I wrote a supplementary 'obituary' for Kim Ash (Guilds) and Herman Ramstad (Mines), two out-

IN BRIEF

Perth event welcomes spring

AN EARLY summer lunch is planned for December 9, for any Imperial alumni in the Perth area of Australia. Hosts are Gaynore and Graeme Ashford. Contact Alan Dickson – +61 (0)414 815 483, home: +61 (0)9246 3295 alan@dickson.com.au

Bridging the gap

ROBIN SHAM of AECOM Long Span and Specialty Bridge Group, Hong Kong gave Civil Engineering's Denise Yeung an insight into bridge building this summer. It was the start of Robin's plans to give work experience to good students.

Jolly good fellow!

AFTER his inauguration as a Fellow of the City and Guilds in June, Robin Sham (Civils 89) delivered the lecture, Reflections on Memorable Bridges, to the Department of Civil Engineering.

Congratulations...

...to Roger Hedge (Chem Eng 61) and his wife Wendy who celebrated their Golden Wedding on May 3.

...to John Sykes (ESE 06) who married Imperial medic Serena Menashe on May 5. They have moved to Perth, Australia where Serena will be a doctor and John is taking a PhD.

standing ICBC oarsmen of the 1950s.

We all have a great deal to be proud of. However many of our career achievements have been obscured by the antics of accountants, bankers, economists, lawyers and politicians. Time to restore the balance?

Why not spend a few minutes to write and send us your obit, however brief?

Bill Bradford

OBITUARIES

An artistic engineer

ERNEST KAYE (Elect Eng 42) enjoyed a long life and was one of a team of four people who developed the world's first business computer – the LEO – for Joe Lyons & Company.

Ernest was an accomplished musician, gaining his LRAM at the Royal Academy of Music, and writing music for jingles and children's programmes on ITV! Latterly he ran his family's props hire business for over 30 years until 2004.

For more about Ernest, there is a recording of him talking about the early days of computers, in a TV programme in March this year, on you-tube (<http://www.youtube.com/watch?v=GE6TX70A3Rc>) and a fascinating documentary about LEO, in which he speaks, at <http://www.youtube.com/watch?v=johDLwL65tE>

There is a recording of Ernest leading an intimate first performance of his string quartet on Youtube at <http://www.youtube.com/watch?v=6VklQQOzNLg>

More complete versions of obituaries, marked with an asterisk *, can be found on the website address published on page two.

Son remembers Scouting father

DOUGLAS HAIGH was a veteran of WWII, landing on Juno Beach with the Canadians on D-Day. He had already travelled considerably before that and completing his degree in chemical engineering in 1941. He died on May 5, aged 93.

After Imperial and three years in the ranks, Douglas trained with the Royal Engineers as an officer and joined the 79th Armoured Tank Regiment.

On his return to England he was a chemical engineer. He met Anne Sager and they married in 1947. Douglas was the Scoutmaster of First Davy-

Dr Peter Jost, president of the International Tribology Council and chair of the Tribology Trust Awards Committee, writes about Michael Neale (Mech Eng 45) whom he knew well.

'MICHAEL Neale, who died on August 4, was in the forefront of tribology in the UK for over 40 years. His first major contributions were made as research manager of the Glacier Metal Company. However, he gained national and international reputation as a consultant, leading his own company, working primarily in the synthesis of tribological principles.

'Using his very comprehensive theoretical understanding of tribology, he was able to translate the theoretical works of others and integrate these with his practical experience, to produce design guides and data that could be ap-

He made tribology available to all

plied easily by designers who were not experts.

'His work in developing novel ways of presenting established information in an easily used manner was outstanding. An example of this thinking was his presentation of data for bearing type selection, based on load and speed factors.

'As editor of *Tribology Handbook*, Michael was responsible for the a unique presentation of design data used later in every corner of the world.

'He carried out a number of surveys, under government contract, into tribological problems. An outstanding example was his

studies on 'scuffing' which highlighted areas of the problem on which investigations were most likely to be rewarding. It led to new advances in an area of engine technology in which the incidence of scuffing had been a restriction on the advancement of design.

'Michael was a past chairman of the Tribology Group, a vice-president of the International Tribology Council and a past president of the Whitworth Society. An outstanding engineer, he had the ability to apply scientific tribology to many and diverse practical applications. He will be much missed.*

MAC – a subject of countless anecdotes

MALCOLM Arthur Charles Newton (Civil 75), known throughout his life as 'MAC', died on July 21 after facing cancer with typical disdain.

MAC spent his working life firstly with British Rail Western Region and then until retirement with Brown & Root Energy Services, Wimbledon. But his life revolved around music, which took up most of his free time whilst at college and continued to do so.

Mac was scarily talented; regarded by his contemporaries

as easily capable of achieving a top first if he did any work at all. But he tended to avoid projects until the last moment, and then work like a maniac for the final 48 hours.

For an essentially private person, Mac certainly attracted more than his fair share of stories including falling down Scafell Pike in a dinner suit.

While all this was going on, Mac had discovered Imperial College Choir and then the Operatic Society. Whether on stage, in the orchestra playing

violin or helping paint the scenery, Mac was one of those people you wanted to have around, doing what was necessary to bring order to chaos

'Nothing sums up MAC like the past few months. His strength, and that of his family has been just inspiring to see,' says Andy Tomlinson. When he saw Mac just before he died, and they'd said their goodbyes his last words were, 'I'll pop back from the other side and let you know, one way or the other' - classic, vintage, Mac.*

Bernard benefited many students

BERNARD HENRY BAINES (Mech 54) who died on August 25 aged 80, achieved first class honours and stayed on at Imperial to study for a PhD.

Classmate John Radford writes: 'He joined the staff of Manchester University, because it had been working on the development of the first really big computers - Atlas and Mercury – a lot of his work at Imperial had involved writing stress analysis programs for computers. He enjoyed the variety and challenge of his stress analysis consultancy work, and stayed at Manchester until retirement, no doubt to the great benefit of many, many engineering students.

'Within a few years Bernard, Sandy Sandercott and I had ended up in the North West, living and working a few miles apart, but it was to be more than 40 years before we met up again with our other close undergraduate friend from Mech Eng, Tony Maxworthy.

'We all had the great pleasure of meeting several times after that first meeting.'



Meeting recently – Bernard, Tony, John and Sandy.

hulme Troop and Anne was very active in Guiding.

By 1952, Douglas found work at a pulp and paper mill in Tasmania, built his home there and continued his involvement in Scouts, Rovers and the church choir. In 1963 the family moved on to Canada where he joined a consulting engineering practice which sent him to work in Ceylon. After two years, they were back in Canada. Douglas retired in 1982.

Douglas received both the 35 year Service Medal and Long Service & Good Conduct Medal in Scouting. He enjoyed photography, bookbinding, woodwork, wine making and singing in the choir. He read widely, particularly on history and the classics, and kept up to date on world politics.

From Peter Haigh's obituary*

FATHER won an exhibition to Imperial but the War reduced his studies to two years. Nevertheless, he graduated with first class honours before joining the Royal Engineers. He later became a parachutist.

After demob and a DIC at Imperial, he embarked on a trip to Sweden, where he worked on the construction of a dam. Returning to England, he took up a position with ICI in Middlesbrough. It was here that he met one of his friends, Mike Robinson. He enjoyed playing rugby, and this became his favourite sport to enjoy on television in later life.

Most importantly it was here that he met his wife to be, Marjorie. The wedding took

*Jonathan (Civil 76) remembers his father,
Robert Holland Walpole, BSc ACGI DIC CEng FICE (Civil 42 & 47)*

Work now part of local landscape

place in Bedale church in October 1952 and they went to live in Runcorn, Cheshire, where Julia and Jonathan were born.

In 1959, Dad joined Taylor Woodrow and moved south to Gerrards Cross, moving into a brand new house in Howards Wood Drive. Andrew was born in this house in 1963 and it was while living here that Dad first started his own consulting engineers business - Robert Walpole and Partners - which continues as a thriving business.

At work, he became an ex-

pert in the design of container handling facilities and concrete pavements, when freight was transferring to containers. He travelled around the country designing and supervising projects in many major cities.

Nearing retirement, he became a parish councillor and enjoyed using his professional skills on local projects. He organised the works to protect Gerrards Cross common from Gypsy encampments. His pre-cast concrete

posts and embankments are now part of the landscape!

Dad made new friends on the parish council and also when he and Mum took up playing bridge.

He continued working into his late 70s but it was then that he started walking with a stick.



He suffered with heart disease that brought seemingly innumerable trips to hospital and, in the last years of his life, he became severely disabled with MS.

'University' just one of his successes

A R (TONY) BARRINGER will be remembered as a unique individual whose prodigious efforts in scientific discovery and invention spanned 50 years, during which time he generated an enormous body of ideas and technologies from mineral and oil exploration to health and security.

Tony must rank as a genius if not for his achieved contributions then for the sheer breadth of his imagination regarding the measurement of physical aspects of the Earth that few had conceived of before or since.

After gaining his mining degree and a PhD in economic geology at the RSM, he followed the lead of his father who had been a mining engineer in Canada, and joined Selco Exploration, the Canadian exploration branch of British company Selection Trust. The mid-50s were very exciting times in minerals exploration in Canada and airborne geophysics was seen as the way forward.

After four years as an exploration geologist, Tony ap-

proached Selection Trust chairman to back his idea for a new airborne electromagnetic (EM) system. The first commercial INPUT (**I**nduced **P**ulse **T**ransient) EM system, Mark V was introduced in 1964.

INPUT was Tony's best known and most commercially successful legacy, attributed with being used in the discovery of more than 25 ore bodies worth over 100 billion dollars. The majority of current airborne systems owe all or at least part of their inheritance to its design.

Over the next almost 30 years, a steady stream of ideas and technologies emerged from the Barringer organisation. In geochemical measurement, the AIRTRACE and SURTRACE systems were two of his major achievements.

Tony developed the E-Phase and Radio-Phase airborne EM instruments used for shallow mapping. This work appeared to shape his later thinking about how natural EM fields could be used for mapping

deep structures remotely.

Tony could not have achieved his dreams single-handed. He related very well to people at all levels and was an exciting and motivational person to work for. One of his greatest legacies is what has become termed 'the alumni of the Barringer University.' Many members went on to become industry leaders.

Tony was a visiting scientist to NASA and visiting professor at Imperial. Various geoscience and industry groups bestowed their highest honours on him.

Tony officially retired in 1989 but remained professionally active until the last few months of his life. In late 2004, he wrote the following about his 'current project' using natural EM fields to find oil and gas deposits from an airborne platform; he remained engaged in this project until his death.

'The underlying physics is sound and we can penetrate to 20,000 feet. We also detect the definitive plume "signatures". All that is now needed is one success and we can move forward. I hope that my final biography will record this success.'

Tony died in August 2009.

Laurie Reed, Ken Witherly and Peter Bradshaw with ideas and remembrances from many Barringer alumni. (lreed@aztec-net.com) *

Knowledge used as expert witness

JACK WALLER (Civil 47) died on June 25, aged 85 after a short illness

After service in the Royal Engineers, Jack joined Sandford Fawcett & Partners, before returning to Guilds to obtain a DIC in concrete technology.

For the following 14 years he was with Ove Arup, later becoming an associate. He managed the office for the design of the Barbican Development Scheme. In 1969 he joined the Oscar Faber Partnership where he continued till his retirement often working overseas and as an expert witness.

In 1974 he became a Fellow of the Institution of Structural Engineers and in 1992 was elected president. He was a Freeman of the City of London, a Fellow of both the City & Guilds of London Institution and the Institution of Civil Engineers.

Nancy Waller (his wife)

NOTICES IN BRIEF

DR EDGAR BENDOR died in March 2009. He completed his qualifications in aeronautical engineering in 1955.

ROBIN CROUCH, who studied physics and mechanical engineering at Imperial in the late 50s, died on September 12, aged 77.

