





Imperial ENGINEER



**A PRACTICAL
RESPONSE TO POVERTY
THE RHYTHM OF LIFE
LONG-TERM CAREER CHANGE**

ISSUE THREE AUTUMN 2005

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

ISSUE THREE *AUTUMN 2005*

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BACK COVER: Reed-covered banks near The Dome. Story Jean Venables on pages 14 & 15

Imperial ENGINEER

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The editorial board of *Imperial Engineer* reserves the right to edit copy for style and length.

WELCOME to this third issue of *Imperial Engineer*, which I am very pleased to see is receiving more plaudits than we have room to publish. However, may I correct one misunderstanding? CGCA and RSM remain as autonomous associations that have chosen to work more closely together to provide better services to our members. *Imperial Engineer* is a good example of this collaboration, allowing us to communicate with C&GC and RSM alumni and with students and staff of today's Faculty of Engineering, which now has engineers of all specialisms.

May I take this opportunity to congratulate Past-President Sir Colin Terry on being awarded a Fellowship of Imperial College? He has been at the heart of what we have been doing to take CGCA, and the Chapter, into the 21st century.

As we continue to evolve, one change that seems sensible is to support the development of the departmental societies by nominating CGCA 'departmental' alumni representatives to provide advice and links between them and industry. For those who'd like to play a role here, please contact Teresa.

Our programme for this year includes two prestige events. The first, on 8 November, is a specially-arranged visit to the Courtauld Institute of Art for a reception and private view of an exhibition of André Derain paintings from around the world. They are in addition to the permanent exhibition which is, in fact, owned by London University. Although sponsored by CGCA, and organised by another Past-President, Morton Neal, we have opened this event to all staff, students and alumni of Imperial to provide a unique opportunity to

socialise with other supporters of the Faculty and College.

Our next prestige event is the Annual Dinner on Thursday 16 March, at the Ironmongers' Hall. Lord Ramsbotham (late Chief Inspector of Prisons and, through City & Guilds, a strong advocate of vocational training) will speak. As this year's dinner was a sell-out, keep an eye open for an application form.

Before you turn the page, may I leave you with a question?

Imperial is celebrating its centenary in 2007 (yes, I know this is 10 years after CGCA's), and we have been asked to generate ideas to mark the occasion. On the one hand, the College, and the Faculty, are looking for significant building projects, such as a modern Aero and Mech Eng building on Exhibition Road, and/or improved student common rooms or a new Faculty students' union office. But could we in CGCA fund something such as a CGCA scholarship, taking the work of the OC's Trust one or two orders of magnitude further?

Such a scheme would show how our 110-year old Association can support engineering students of the 21st century in the most useful way. What do you think? Could you help - with funds and fundraising?



**Barry
Brooks**



**Roger
Clegg**

PRESIDENTS REPORT

AS I HAVE recently taken over as president, I'd like to share some of my thoughts about challenges faced by of the RSMA and my ambitions for it.

The last couple of years have seen a tremendous evolution at Imperial in the form of the Faculty and the Chapter. Initially some viewed the Chapter as a means to replace the existing associations. I don't believe this was ever the case. I view the Chapter as a vessel through which the old and the new can exist harmoniously and learn from each other. We must move with the times but not lose sight of what the Associations and their alumni stand for. The pride a person feels for their college is not just in the qualification one receives but is much more based on the principles and experiences garnered during their studentship and taken into the world.

One of the successes of the Chapter has been how successfully those principles, as expressed through the Associations, have been integrated without losing a sense of identity for the constituents. The Chapter will soon develop its own set of traditions and principles. Let's not forget that this year will see the first graduates of the Faculty. It is important for them to know where they

have come from as well as what they are part of.

However, this is not the first time that RSM has been part of such an evolution in the 154 years since it was the Government School of Mines and of Science applied to the Arts. As long as we hand down the traditions and principles through the students and alumni, the spirit of the original colleges will live on. I believe that this will make the Chapter and the associations stronger. If anything, our history shows that we embrace change.

In terms of ambitions for the RSMA over my term, I'd like to increase our official links with the overseas members and allow them greater representation in the RSMA decision-making. It should not be forgotten that the committee of the RSMA represents over 1,575 members in 73 countries. Without your contributions we could not continue to provide the valuable service to students in the form of grants, hardships funds and sponsoring of social and sporting events.

OCTs helps fund a summer sabbatical...

CGCA'S charitable arm, The Old Centralians' Trust, spread its available funds widely last year. It committed £8,000 towards support for the Imperial College Undergraduate Research Opportunities Programme (UROP). Most of this funded 15 half-bursaries for projects between six and 10 weeks over the summer. The rest is earmarked to fund a social gathering for the students.

One of the greatest current needs of the City & Guilds College Union is to be able to fund a sabbatical year for the Union President. Whilst this objective appears to be out of reach at the present time, it has proved possible to find £400 to help fund a two-month summer sab-

batical for the incoming president, allowing him to spend the time necessary in August and September to lay down the foundations of a successful presidency.

In a significant move, the Trust has committed funding for a further five years' support to the Imperial Boat Club, at the rate of £1,000 a year. These regular annual sums will help to defray the heavy cost of maintaining Imperial's impressive record in university and national/international competition.

The Jessel Rosen Travel Award, valued at £500, has been awarded to Hugh Carr of the Electrical and Electronic Engineering department, on his being offered an eight-week intern-

ship with Omron in Japan.

A general award of £350 was agreed in support of a proposal to produce a 'year-book' for final year students of Civil and Environmental Engineering.

Travel grants of £250 each

were made to assist two post-graduate students in the Aeronautics Department; both students having been accepted to present papers at a prestigious bioengineering conference in Vail, Colorado, USA.

...and affordable accommodation

THE OLD Centralians' Trust Fund has granted 12 accommodation bursaries during 2005-06. These £700 awards, aimed at engineering undergraduates active in society, union or sporting affairs, help them find term-time accommodation closer to the South Kensington campus than they might otherwise be able to afford.

Those being supported were recommended by depart-

ment heads of Aeronautics, Bio-engineering, Chemical Engineering and Technology, Civil & Environmental Engineering, Computing and Electrical and Electronic Engineering.

Trust Chairman Chris Lumb, speaking at the board meeting, expressed pleasure at the quality of the nominations received. However, he regretted that not all eligible departments had been able to offer nominations.

Introducing Roger Clegg...

SINCE graduating in Mining Geology in 1993, Roger Clegg's career has taken him from mining and exploration overseas to London.

Having taken his master's in mining finance, he currently works for Ambrian Partners Ltd, a small investment bank dedicated to the natural resources sector.

Roger is engaged to be married next year 'to a wonderful accountant and her cat'. (They come as a package, as it was explained to him). He says he was 'an unremarkable student, probably best remembered for being captain of RSM's Football team'.

If I can do it, so can you!

THIS WAS Kurt Budge's reaction after completing this year's London Marathon. He writes:

'It was a strange kind of day. On the one hand I was excited to have the chance of accomplishing a long-held goal, while on the other I was proud, but sad to be running in the memory of my daughter, whom I obviously wished was alive.

'The motivation I got from thinking about Colette for the 26 plus miles, got me through the aching knees at 10 miles and tightening leg muscles at 20 miles. She was really all I thought about. When it finally came to running up Bird Cage Walk, seeing Buckingham Palace, turning the final corner into the Mall and seeing my wife Cécile jumping up and down from the grandstands, it was a very emotional moment – one I will never forget.

'SANDS (Stillbirth & Neo-



natal Death Society) is overjoyed with the sponsorship: I have been overwhelmed by the generosity of friends, family, colleagues and relative strangers. The final amount was £7,000 including GiftAid, with a substantial sum raised from generations of RSMA friends, some I hadn't heard from since graduation. It reaffirmed my unshakeable belief in the RSM family.

'Losing Colette is an experience that we wouldn't wish on anybody, yet for over 4,000 fami-

lies a year losing a baby is a reality. Its members gallows' humour replaces 'SANDS' with 'Dead Babies Society', but they cry and celebrate the lives of their children. SANDS gives them support to do just that.

'Will I run again? Most likely. They have a marathon in the Falkland Islands in March 2006, as it's less windy at that time of year. If not the Falklands, then London April 2006, but this time I need to break four hours.'

Tynwarnhale may be preserved

IT'S PRESERVED in the memories of thousands of mining students who surveyed it, but now Imperial's Tynwarnhale mine could be preserved for everyone. The Cornwall and West

Devon mining landscape, with Tynwarnhale, has been chosen as the UK's 2005 nomination to become a world heritage site. The outcome of the bid will be made known later this year.

C&G historic shields in new display

LIKE MANY other old and prestigious organisations the City and Guilds College Union upholds a long tradition of displaying the names of its past leading figures on honour boards. But ours is perhaps a little more unusual than most

At the end of each academic year, we make or purchase a wooden shield and inscribe on it the names and position of each member of the Union's executive, with the holders of a handful of traditional positions such as the Boanerges driver and Lord Mayor's Show organiser.

Since 1898, and until recently, we displayed the majority of these shields next to the Guilds clock in the foyer of the Mechanical Engineering Building.

Staff, students and alumni have been able to watch the C&GCU evolve and grow over the years as a new shield has been added each autumn.

In the summer of 2004, however, the foyer was refurbished and all the shields were temporarily removed. Around that time 20 older shields that had previously been feared lost were discovered by a member of staff. With the addition of these shields to our collection, and with more being inscribed each year, it soon became clear that it would be impossible to physically fit all the shields back after the refurbishment.

Following a few months' discussion, consultation and research, the Union executive de-

ecided that the best way forward would be to photograph and archive each of the 104 shields, store some of them in the College archives and create a photographic display of all of them for the foyer.

As many modern wooden shields as possible will also be displayed and space has been allocated for the next 20 years, so that the tradition of adding one each year may continue for years to come.

For visitors interested in seeing this display, it will be in the foyer of the Mechanical Engineering Building, hopefully from early September onwards.

Or see our digital archive at www.cgcu.net/about/shields/

John Collins



WALKS with a Past President is soon to celebrate its fifth birthday. It was an idea that developed from David Hattersley's wish to show Guildsmen the halls of the 16 livery companies whose coats of arms are displayed in the lobby off Imperial's main entrance.

The next walk, with a city guide, is on 5 November. For details see Diary Dates on the next page.

Pictured, David Hattersley and Jean Venables look through the gates of Trinity Hospital on this summer's walk by the Thames.

New blood will safeguard RSMA future

WITH students once again outnumbering alumni two to one (students were funded by alumni members), RSM's final year dinner in June was the largest ever, according to John Sykes.

John, President of the RSM Clubs and Societies (RSMCS), jointly hosted the event with outgoing RSMA President Giles Baynham.

It followed RSMA's AGM and EGM. The latter was called to alter the membership of

RSMA Trust's board now that there is no longer a dean of RSM.

'Apart from the usual suspects present, a strong representation of members from the early 90s made it look as if the continued traditions of the RSMA are safe-guarded', reports Hon Sec Paul Holmes.

Giles spoke briefly advising leaving students how to build a career in the mining industry and emphasising the benefits to be gained from RSMA membership.

He also presented colour ties to RSM students for sporting successes and involvement within clubs and society committee.

Prof John Monhemius presented the Chaps' Silver Medal to Dawn Houlston for the most outstanding student of the year.

Giles handed over to new President Roger Clegg. The dinner ended with the Mines' Song before celebrations continued long into the night.

RSMA Trust continues help

RSMA TRUST's essay competition attracted five entries in 2005. The winner was Saskia van Manen, Geophysics 3, for *The Arctic National Wildlife Refuge: drilling or not?*

During 2004, four loans amounting to £3,250 were approved, reports Trust Chairman Professor Rees Rawlings. Three loans for a total of £2,250 were drawn down. Repayments of £1,250 were received leaving a balance of £1,500 outstanding on 31 December.

The Dean's discretionary fund again proved valuable and grants of £600 were awarded in 2004.

Rare view open to all

THE CGCA'S prestige event for 2005 is a private view of a new exhibition – André Derain: the London paintings. It brings together for the first time 12 large-scale works from 1906 and 1907. Also on view will be the impressive collection of European painting spanning seven centuries. It includes Impres-

sionist and post-Impressionist works not seen before.

The viewing will be held from 6.30 on 8 November in the Courtauld Institute Gallery, Somerset House. Tickets are £30 to include drinks and canapés.

Teresa Sergot has tickets and information. See page two.

Fitness first opens soon

WITH the opening next January of the new sports centre in Prince's Gardens, Imperial becomes the only UK university offering free use of a gym and swimming pool to staff and students. This is likely to be at-

tractive to prospective students.

External use is being limited and other facilities – sports hall, climbing wall, exercise classes, squash courts, sports injury unit, aquamassage and café bar – will be competitively priced.

CGCA second year agreed

IN HIS review of the year at May's AGM, CGCA President Barry Brooks spoke of its many successes during the year, including the Decade Luncheon, the Christmas lunchtime seminar and a packed Annual Dinner.

Before an address by Rear-Admiral Bawtree (see page 9), other business included a comprehensive and healthy report of CGCA's finances. It was agreed the president should be asked to stand for a second year.

Thunderous applause greeted the reading of the 36 names of students awarded their CGCU half colours and 14 full colours.

Simulator in Aeronautics

A MOTUS flight simulator has replaced computer modelling to help Imperial's aeronautical engineers test their project designs. It is one of only two of its kind in the world

Any aircraft design can be fed into a computer and then tested as it would perform in conditions that a real aircraft might face, including turbulence and extreme weather.

Students have previously tested their project designs using computer models. However, many of the handling characteristics of an aircraft are so subtle that they can only be established through flying a model, actual or virtual.

The simulator's cockpit seats a pilot and co-pilot and has all the controls of a real aircraft. Windows are replaced by screens in the virtual model giving a full view of the surroundings. Screens also recreate airports and terrain all over the world based on satellite pictures.

A screen outside the cockpit enables observers to watch the flight and alter the conditions in which the plane is flying. All data on the aircraft's performance are stored by the computer, meaning that flights can be replayed and analysed.

FOLLOWING extensive workshop activity between academics, students and the estates division, Imperial is implementing an updated energy policy.

Adoption of the policy is timely as the College continues to develop academic priorities in the fields of energy and environment. This is exemplified by the establishment of the National Energy Research Centre.

Since 2001, when the policy was first put in place, energy demand has risen following large-scale capital investment and sharply rising utility prices. There has also been new legislation to help the UK achieve targets

DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Energy on agenda

for control of carbon emissions.

The new energy policy will serve as a cornerstone of an environmental policy which is to be brought forward for approval later in the year.

The new policy will address issues of building sustainability, waste management and recycling. It will promote adoption

of a College-wide environmental management system to bring measurable benefit from new and existing initiatives.

There has also been the first seminar under the College-wide initiative Energy Futures. This debated how global energy demand could be satisfied in a sustainable way.



Engineers take IBM business prize

FIVE engineering students celebrate winning the IBM Universities' Business Challenge 2005 – a trophy and £1,000 – beating more than 130 teams from UK universities. For four months they acted as management consultants for a fictional brewery, a wine bar and a games company, demonstrating their skills at making marketing decisions to purchasing factory space. Pictured are team captain Saurabh Pandya, Yi Zhang, Wei Cher Feng, Zhi Streng Lim and Chao Yu with IBM's Tara Gill.

He's a jolly good fellow

ENGINEERING Faculty's Professor Richard Kitney, who is also professor of biomedical systems engineering, has been elected a fellow of the College of Fellows of the American Institute for Medical and Biological Engineering (AIMBE). He joins others elected to the institute on the basis of their international successes.

Credit due

The source of these articles and some of the words come from Reporter, the newspaper of Imperial College.

The role of fellows is to advise on research and development, help define policy for the US government and offer direction for industry and education.

Professor Kitney said: 'Very few non-Americans are elected, so this is a particular honour for me. Being in a position like this means we have the chance to make real and lasting changes with our knowledge'.

Professor Kitney founded the successful Imperial spin-out company ComMedica in 2000, which won the *Wall Street Journal* award for best new software company a year later. More on www.commedica.com.

PROFESSORS Yanghua Wang and Michael Warner of Earth Science and Engineering (ESE) have received the 2005 Guido Bonarelli Award from the European Association of Geoscientists & Engineers (EAGE). It was for their breakthrough presentation entitled 'Fully data-driven and robust techniques for seismic multiple attenuation'.

PROF ALAIN Gringarten and Dr Thomas von Schroeter were awarded the Cedric K Ferguson medal by the Society of Petroleum Engineers.

ESE'S PROF John Hudson has been elected as President of the International Society for Rock Mechanics from 2007-2011. As

AWARDS

12th president, he's the second from the UK.

PROF JOHN Woods has been elected an honorary member of the Meteorology Club which comprises 50 leading members of the UK profession. Just five are honorary members

PROF JOHN Kilner (Materials) has received the 2005 Royal Society Armourers and Brasiers' Award.

DR DAVID Dye and Prof Roger Reed (Materials) have received the 2005 Marcus A Grossman Young Author Award of ASM International for a paper on quenching Ni-based superalloys.

BEING new to Imperial is pretty daunting. It reminds me of joining Rolls-Royce: all the members of my team seemed to have worked for the company for 20 years. They enjoyed a common history of events and experiences that it was clearly going to take me many years to feel part of.

Fortunately, I joined Rolls-Royce in 1994, at a time of rapid change, and as growth, new engine projects, airline industry peaks and troughs, reorganisations moved on apace, I found that I was soon part of the corporate memory and culture.

'...good people seem to stay...'

The engineering departments at Imperial are places where good people seem to stay and come back to – I take both to be very positive signs. And there are a lot of changes happening (too many, as I keep being told).

So my first impression is of the commitment and loyalty of Imperial engineers to the College. It's something very important to retain. Another very early impression is of just how good people here are – the staff and the students. Even though expected, it is still very powerful.

Outside Imperial, I meet a perception that we are arrogant. My observations suggest this isn't because we are forever telling people how good we are – but rather the very opposite. People are so engaged in and focused on their research, that we probably don't spend enough time 'facing outwards' towards the research councils and other influencers.

I have been surprised on several occasions by how modest people's assumptions are about the influence we do (and could) have. I hear of real concern about quality assessments and accreditation – and yet, without being arrogant – with the quality I see across the Faculty, we should be setting the standards for these reviews, and in

'It's a great team to be part of'

many cases, I think we are.

Excellent? – yes, arrogant? – no. Too inwardly focused? – probably. So one of my challenges is to help raise the external profile of the outstanding work and people in Engineering at Imperial, and ensure that we are increasingly setting the engineering research and teaching agenda in the UK, rather than worrying about how we will measure up against it.

We have ambitious plans in the Faculty for research, teaching and improving infrastructure.

On the teaching front, our undergraduate numbers have continued to grow over the past few years, accompanied by an increase in entry standards – an enviable situation. Given the constraints of the South Kensington site, we have now decided to fix our numbers, so we can expect to see standards rise further in the future.

'...we can expect to see standards rise further...'

We are committed to providing a world-class experience for students. An exciting new project – the Vision Project – has just been launched to examine the future shape of engineering teaching at Imperial. The Project Leader, Dr Ruth Graham, is collecting data from recent graduates, employers, current students,

international universities, about issues such as the relevance of our teaching, the teaching environment, how employers and world-class 'competitors' view us and our graduates, etc. Over the next few months Ruth is working with teams across the Faculty,

including both new staff and Heads of Department, to develop a vision of engineering education at Imperial in five to 10 years' time. Our goal is to be one of

the top three universities in the world for high quality, innovative teaching and graduates with the right understanding and skills. We are in the early stages of an exciting project – with good support from a number of alumni.

Major infrastructural changes lie ahead. The new home for the Institute of Biomedical Engineering, in the Bessemer Building behind a new glass façade, will be opened next summer. College is also investing over £20M of the next tranche of strategic research infrastructure funding (SRIF3) on completing the upgrading of the Bessemer/RSM/Aston Webb complex for engineering activities. This will enable us to co-locate the growing Bioengineering department (currently spread over six buildings) with the Institute. We will finally have high quality space for the Imperial half of the London Centre for Nanotechnology – a collaboration with UCL. The Imperial LCN facility will house a

One year in,
Dr Julia King,
Principal of the
Engineering Faculty,
writes
about her job...



multidisciplinary team from Chemistry, Physics, Materials, Chemical and Mechanical Engineering, and will incorporate the new centre for materials modelling.

Looking further ahead, we are planning a new building on Exhibition Road, with the support of the Centenary Appeal, for the Aeronautics Department, completing College's dramatic new façade.

Our engineering research goes from strength to strength. There is an increasingly interdisciplinary nature to our activities. But there is plenty of evidence for excellence in the core as well – Hugh Spikes and his team in Mechanical Engineering won

'... part of Imperial's corporate memory.'

both the Gold and Silver Medals of the Tribology Society in 2005 – the first time the Gold Medal has been given to a UK researcher for 16 years and the first time ever that the same group has won both medals; the successful launch of Ceres Power on the AIM; the award of the Royal Society Armourers and Brasiers' Medal to John Kilner in Materials; and a record number of EPSRC, Royal Academy of Engineering and Royal Society research fellowships in all departments. A quick summary might just mention the 15% increase in research income over 2003/4!

I wish I could claim credit for all this. It is a great team to be part of, and with all this going on I should soon feel part of Imperial's corporate memory.

DIARY

Wednesday 19 October
Careers Fair and
Networking Reception. Starts
College entrance, 11am

Saturday 5 November
CGCA Walk with a past
president – My Lord Mayor.
Meet Temple station

Saturday 11 March 2006
Roaming in Roman London

Saturday 6 May 2006
Nuts about Notting Hill
If you are interested in these
walks, look at the website
cgca.org.uk to register interest
or email David Hattersley at
davidhattersley@aol.com

Tuesday 8 November
CGCA Reception & André
Derain exhibition, Somerset
House Courtauld Institute
Gallery, 6.30-9pm

Friday 18 November
RSMA Annual Dinner
Polish Club, 55 Exhibition
Road, 7 for 7.30pm

Saturday 26 November
2005 Decade Reunion
Luncheon, Senior Common
Room, Sheffield Building.
See booking forms on the
reverse of address flyer for
the two preceeding dates

Thursday 15 December
CGCA Christmas Lunchtime
Seminar, 170 Queen's Gate.
Contact David Hattersley at
davidhattersley@aol.com

Thursday 16 March 2006
CGCA Annual Dinner.
Speaker Lord David
Ramsbotham

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

Enterprise at home and abroad

AFTER failing to gain permission from the Burmese Embassy to take part in an Engineers Without Borders (EWB) project in Myanmar (Burma) immediately after graduation, Anna Thomsett has now left for a

one-year placement in Nigeria.

Backed by CGCA's Jessel Rosen Graduate Overseas Experience award worth £1,200, Anna is working in the Dadiya region of Gombe State for EWB and two local NGOs.



Amina Kewa, Anna, Hashimu Ibrahim and fellow Imperial graduate Joe Mulligan working on a rough survey and inventory of roads in Nigeria.

The work includes projects on rural road development (to provide year-round transportation over remote and difficult terrain), formulating an environmental water management strategy, and studying development opportunities including surveying a trail to support ecotourism.

Since graduation with first class honours in civil and environmental engineering, Anna has fulfilled short-term assignments with Arup Water in Leeds, Buro Happold in Bristol and with the South Bristol Community Construction Company. Her voluntary experience in Uganda, Nicaragua and El Salvador should be useful background for her work in Nigeria.

Fashion icon

Enterprise of a different kind was also recognised when Henri-Charles Ozarovsky, a mechanical engineering PhD student, was awarded the OC Trust's £350 Centenary Enterprise award.

It recognised his impressive record of participation in and organisation of student extracurricular activities during his seven years at Imperial.

Most notably was Henri's role in elevating the annual RAG fashion show to a new level of sophistication. He moved it from South Kensington to a leading Mayfair club and canvassed for support and sponsorship from leading companies, key fashion industry figures and several well-known musicians.

A very substantial sum was raised in support of the Macmillan Cancer Relief Fund.

Are alumni ready to bully up?

CAPTAIN of RSM's hockey club, Sam Phillips is calling all alumni, male or female, in trying to assemble a team to face his current squad.

The winners would take the trophy for the 'Old Boys Match', currently in the RSM office.

'Interest indicates we can get recent former players and more experienced alumni involved, so we should have a good match on our hands as well as a great social occasion', says Sam.

Contact 07818036257 or samuel.phillips@imperial.ac.uk.

Imperial racing into lead?

THE TEAM producing and driving Imperial's current racing car in the formula student competition achieved its aim of beating last year's attempt.

'With only our second running car, we beat many teams from around the world who have much more experience and funding and came in 17 out of 57', reports team leader Chris Foster. It was the fourth fastest in the UK and the first to finish the endurance test.. For the full story see www.cgcu.net/icracing

Networking to involve more alumni

FOLLOWING last year's highly successful Internship Fair, this year's event on 19 October is being expanded into an Engineering Careers Fair, with about 30 stands. It will be held in the College main entrance and Mechanical Engineering foyer from 11am until 3pm.

Imperial's Careers Advisory Service has taken the lead in attracting employers to the

event, concentrating on engineering companies and covering a broad spread of engineering disciplines. Companies have also been invited to bring along, where possible, any alumni to man their stands.

A networking reception will follow the end of the Fair when CGCA or RSMA alumni are welcome to participate. It will target final year students and

start at 6pm in the Ante Room, Sheffield Building. Contact Teresa Sergot for how to participate.

'We're also looking at other ways of engaging alumni with students', says Teresa. 'Schemes such as mentoring or occupational networking, inviting alumni via departmental societies to give talks are all currently being considered.'

Modern education before the mast

THE FUTURE Ship Project for the 21st century has dominated my life since 1991 when I was told Royal Yacht Britannia's days were numbered. To restore her would cost too much so I decided to push for a new Britannia, based on the idea of a royal sail training ship. The idea would be to promote everything best in British maritime design and technology and one that would also continue in Britannia's role for monarch and state.

Magnificent

The Royal Yacht Britannia, built in 1952 as a gift from the nation, was a magnificent sight wherever she went and was never upstaged by any other vessel. She was the 66th royal yacht in an unbroken line since 1660.

Shortly after arriving as Flag Officer Portsmouth in 1990, I realised that Britannia's days were numbered. She was then an old lady and restoration cost was always in excess of £40 million. It looked as if she would have to go.

When my commander-in-chief was not very encouraging about my plans for a new Britannia, based on a royal sail training ship, I told Maldwin Drummond, Commodore of the Royal Yacht Squadron about it. He was very supportive and the *Cadland* project was born.

We invited Colin Mudie, a great yacht designer and Malcolm Vincent, then Managing Director of P&O's ship design and project management company, to join us. We added a wide range of advisors from banking, national and international sail training, ship architects, youth training, legal services and business people.

Dick Evans, at the time Chief Executive of British Aerospace, felt the use for 1,000 graduates a year was invaluable.

We launched the royal sail training ship formally to the Conservative government but

our ideas were generally rejected.

Later, after Labour cancelled the idea of a replacement for Britannia, David Blunkett, then Education Secretary, spoke about raising educational aspirations in the 21st century. He said: 'We need to provide a much more extensive programme of structured and challenging activity. This will develop confidence, self-assured

elsewhere. People can learn a lot more about themselves on board, being pushed to levels higher than they might have thought possible. Any time spent in the rigging can be classed as quality time for character building.

They learn that no matter how difficult the problem, no matter how severe the storm, you continue to struggle because the alternative is unthinkable. Sail training is a

lowest pollution discharging ship of her size in the world. The FSP21 will be a showcase for all that is best of British design and technology, from materials and coatings to engineering and electronic systems. Her design will be for a ship life of over one hundred years.

Zero emission

The FSP21 will be built in sections in a similar way to that of the Chinese junks centuries ago and then joined together at the shipyard. Ease of maintenance and modular replacement will be an inherent feature of the design and all forms of waste will be treated to achieve 'zero emission'. This means all bilge and oil waste will be collected and treated by means of high-performance separation and coalescing equipment for clean water discharges.

To enhance sailing efficiency there will be a UK developed computer system for monitoring wind, weather, masts, sail and spar settings.

It is planned to fit solar panels to reduce the dependence on diesel power. The preliminary assessment is that this could drive the ship at 10 knots as well as covering her domestic power needs.

Improved

As a university of the sea, the FSP21 will provide a flexible new initiative to reinforce our system of education and training. Our young people's prospects for employment will be significantly improved. The number of souls on board the ship will be 287 of which 200 will be accommodated as trainees with 66 crew.

That's the story of what I hope will be our great national flagship, though FSP21 will not be her final name. I've no doubt it will happen. It's just a question of when?

Colleen Richardson summarises the talk by Rear Admiral David Bawtree following the CGCA's AGM



The FSP21 as she will be.

leadership skills, the teamworking of young men and women and also support an educational experience'.

FSP21

So we put together our proposals, calling it the Future Ship Project for the 21st Century – FSP21. Blunkett responded with enthusiasm.

Why do we feel so strongly about a sailing ship? We know that a vast percentage of the earth is covered by water and yet, over the past 50 years, we have become less of a maritime nation.

Our vision has turned inward, creating pressures on our land areas for recreation and youth training. Perhaps because of this, sail training is now the fastest growing, non-confrontational, challenging activity in the world.

A sail training ship offers a character-building experience not possible to duplicate

vital link between the past and future for a young person.

FSP21 will provide an outstanding facility to reinforce the UK's system of education and training, providing a resource and stimulus for able and disabled young people, particularly for those leaving full time education at 16.

Their prospect for employment will be significantly improved with a period of academic, challenging and life-changing activity in a new environment away from teenage distractions.

The FSP21 will be the largest and most gracious education and training sailing ship in the world – 515ft long with a mainmast height of 305ft and a displacement of 4,000 tonnes. She will do 18 knots under full sail and 20 knots if driven by her engines.

This ship will be as environmentally friendly as possible and she will be the

Focusing on strengthening links

John Collins, retiring CGCU President reports

MY LAST article in Imperial Engineer was written in February when everyone in the C&GCU was recovering from a particularly traumatic RAG Week, during which nearly £5000 was raised for charity. Since then we have organised barbecues, dinners, a new quiz night and most importantly of all, our annual general elections. Our new committee will have taken over from the old committee by the time this article is published and by and large all our positions are filled and are looking promising. All, that is, except for the president.

Sadly, our elected President has announced, for a variety of understandable reasons, that she is unable to take up the role next year. Consequently, we have appointed one of our Vice Presidents, Christopher McIver, as Acting President to

lead the Union over the summer. This is an exciting time for the Union as Chris will be the first full time paid President in the C&GCU's history, albeit for just two months. Chris's salary will come from the Summer Sabbatical fund which was raised recently from generous donations from alumni, the Faculty of Engineering, the Mercers Company and the Carpenters Company.

It will be a busy summer

ahead for Chris and his team. The final phase of our office refurbishment is well underway, as is preparation for the Lord Mayor's Show and our new engineering careers fair, which is coming up this October. No doubt there will also be a plethora of events awaiting our freshers this autumn, and these will require excellent planning and preparation.

There are also new initiatives that we will want to

prepare for during the summer and implement this autumn. We have recently been focusing on strengthening links between our departmental societies, the CGCA and industry which we hope to achieve by appointing or electing alumni student representatives in each department this autumn. We hope that this initiative will increase student recruitment to our associations and encourage greater student participation at a departmental level in their networks, activities and events.

It's been a privilege to serve as President and I'd like to take this opportunity to thank the Faculty, the CGCA, the RSMA and alumni in general for your support this year. I must confess that I am looking forward to a quieter life next year, but I hope to maintain a degree of involvement in both of my alumni associations' social calendars!

Now at last I can relax, and hand this valuable, heavy baton over to Chris...



I TOOK the role of president of RSM because it looked after me and opened up opportunities for me as a fresher. I also had a definite idea of what I thought needed changing about the RSM and what needed preserving in this time of change.

From the outset I believed there were four main areas of concern – finance, image, organisation and external relationships. I couldn't solve them all myself but by encouraging friends to run for office and getting to know others I hoped between us we could tackle these issues.

Finance is probably one of the best success stories. At the beginning of the year the RSM Clubs and Societies Committee was £2,600 in debt with around £1,000 of outstanding invoices and many clubs were also in debt. With the solid Junior Treasurer (Ed Poulding) and stricter event budgeting, this debt has been reduced to around £1400.

Despite an inflation-busting increase to our

RSMCSC heading in right direction

by John Sykes

subvention this year, the cost of our events is still far too high for maximum participation. Hopefully future sponsorship will help mitigate this. Along with finance comes organisation. This I found a much more difficult problem but I hope I've started the mend by at least recognising what needs to be done and making a few recommendations to the incoming President Leah Glass.

I believe our image is now slowly changing in the right way, partly due to renewed links with a variety of external organisations. With the C&GCU thriving we agreed we should remain separate but with the two of us supporting each other in a spirit of 'positive rivalry'.

In my years at the RSM, the RSMA has become more involved with its students, and is now financing both the RSMCSC events and some students. This is an important

relationship which I hope to see blossom with ever greater numbers of students at the RSMA's events.

On the alumni note it was also important that RSM students had good links with the CGCA which RSM students can now also join.

The other important relationship I focused on was with the Union and becoming involved in its council, executive, the building masterplan, the strategic review, the QAA analysis and the Union Summer Ball. I hope I've built a relationship, proving the RSM to be capable and vital to the union.

Much is still to be done in the RSMCSC but at least it's heading in the right direction. With long-term planning hopefully the issue is no longer surviving but thriving!

This year's changes

haven't always been obvious but, over the years, I hope these foundations will set the way for real benefits – from good social welfare and cheap events to vital industry and careers contacts and advice. In the meantime, I hope students and alumni have the patience to wait for fruition.

Memories of events and people will last a lifetime – the biggest Fresher's Dinner in memory, our first self-organised careers event (with Deloitte), a multitude of alumni events and dinners and, of course, another Bottle Match victory.

My best wishes to Leah, Stef, Rach and Ed. Thank you to the RSMCSC, CGCU, CGCA and RSMA committees; college staff and Teresa Sergot for attending and supporting our events. Finally, thanks to the great mass of people who are the RSM and always will be!

Very deep borehole disposal of high-level nuclear waste

Continuing the series of articles on the theme of energy

RESOLVING the nuclear waste problem, particularly for high-level wastes (HLW) like spent nuclear fuel (SNF) and reprocessing waste, is the key to the future of nuclear power.

Currently, the UK has no plan or even a policy on how to deal with SNF or other forms of HLW apart from maintaining it in surface storage. The Committee on Radioactive Waste Management (CoRWM) was established in 2003 by the government to consider the technical options and make a recommendation as to how the UK should manage its HLW. They have produced a 'short list' which includes geological disposal.

In discussing nuclear waste management, we need to be very clear about the distinction between storage and disposal – the former is temporary, the latter is intended to be permanent. A *repository* is, by definition, a store from which the contents will be retrieved some time in the future.

Possibly the only thing about HLWs on which there is widespread agreement is that they should ultimately be dealt with by some form of geological disposal. Excluding sub-sea bed disposal (internationally banned) and some of the more fanciful 'options', schemes for the geological disposal of HLW can be classed as 'wet', 'dry' or 'deep'.

Wet disposal

Wet storage/disposal is the type of solution to which many nuclear nations are looking. It is the well known mined and engineered repository exemplified by the Swedish KBS-3 concept (Figure 1). In this the HLW/SNF is sealed into large metal containers (copper, titanium or steel) that are put into silos in the floors or walls of a system of tunnels, enclosed in bentonite (a swelling clay) and sand then backfilled with concrete. At depths of 300 to 800m such repositories are often referred to as 'deep' but they are geologically shallow. They are designed for retrievable storage but there is often a clear implication that if, after a suitable period, there are no

technical difficulties and the political climate permits, the system of tunnels and access shafts will be sealed up and the repository will become a disposal.

There are essentially two main variants depending on the nature of the host rock. This can be either 'hard-rock', such as granite or basement gneiss, or

by Professor Fergus Gibb

'soft-rock', such as shale or clay. The former option is currently being pursued in Sweden and Finland while the latter approach is favoured by Switzerland and Belgium and is being investigated in France.

There are three main problems with the wet repository concept for dealing with HLW:

- The waste contains high heat-generating radionuclides like ^{137}Cs and ^{90}Sr that necessitate dispersal in relatively small packages throughout a large volume of rock to avoid overheating and containment failure. This greatly increases the size, cost and environmental impact of the repository.

- The HLW also contains very long-lived radionuclides like ^{239}Pu and ^{99}Tc with such long half-lives that they require isolation from the biosphere for up to a million years.

- The repositories are below the water table so the rock is saturated, often with quite high rates of flow around the repository.

It is this siting of the repository within the near-surface groundwater circulation zone that creates the most serious problems. Although the hydrogeological conditions may be suitable, they cannot be predicted far

enough into the future in the light of potential climate changes, glaciations, erosion *etc.*

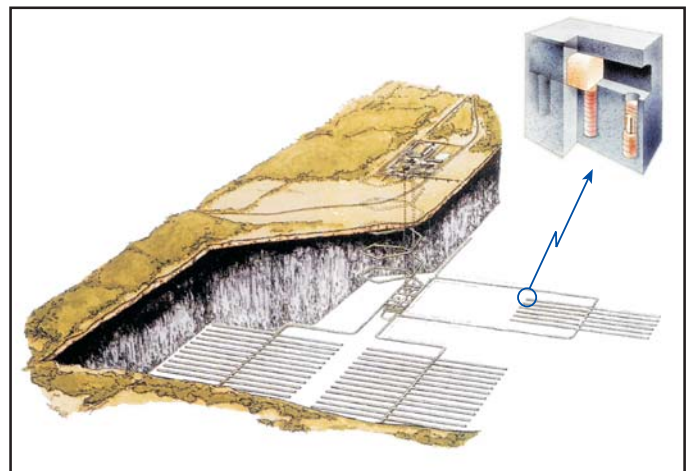
Dry disposal

To get around the problems presented by groundwater, the repository can be sited in a geologically 'dry' environment. There are two variants of this approach, both of which are presently in use in the USA.

The first is the 'high and dry' type where the repository is located above the present day water table, as exemplified by the Yucca Mountain (Nevada) project for the disposal of SNF. This is a mined repository situated up a mountain hundreds of metres above the contemporary water table in an essentially desert environment.

Unfortunately, quite apart from political difficulties serious technical

FIGURE 1: Schematic illustration of the SKB mined and engineered repository concept KBS-3.



problems have arisen. The environment has not proved as dry as hoped, necessitating construction of expensive titanium 'drip shields' above the waste containers. Recent concerns about climate change have raised questions about the site's long-term vulnerability.

Given some of the global warming models being predicted, it is plausible that Nevada might cease to have such a dry climate in the future and Yucca

FEATURES

Mountain could change from a dry disposal to a wet one – for which it is not designed – with disastrous consequences.

The second variant is the ‘deep and dry’ type where the repository is constructed a few 100m down (*ie* geologically shallow) in evaporites or salt domes, as at the Waste Isolation Pilot Plant in New Mexico for military HLW. Here the waste is disposed of in a system of horizontal excavations in the Salado salt formation some 700m below the surface. These salt deposits have been dry and stable for over 200 million years and would appear to offer an excellent chance of safe, long-term disposal, especially as the salt has good self-sealing properties.

The main threat to this again comes from possible climate change and the fact that erosion has left less than ~150m of relatively impermeable cap rocks on top of the salt. If the climate in New Mexico becomes significantly less arid the longevity and effectiveness of the cap rocks could decrease rapidly allowing groundwater access to the salt. Erosion rates of >150m in a million years are plausible.

Deep disposal

Geologically deep disposal involves sinking large diameter boreholes 3 to 5km down into the granitic basement of the continental crust, with containers of HLW in the bottom 1km or so, and sealing the hole above the deployment zone (Figure 2). This is *very* deep in engineering terms and is best described as very deep borehole disposal.

The great advantages of this type of disposal are that it avoids groundwater problems almost altogether and provides a far-field geological barrier of enormous strength. The geological

barrier is, of course, the only barrier to any escape of radionuclides that can demonstrably survive on the timescale of millions of years. In contrast to the very active groundwater flows at conventional repository depths (R in Figure 2), the migration of intra-rock aqueous fluids becomes increasingly sluggish with depth. This is mainly because of decreasing bulk hydraulic conductivities with what flow there is being largely confined to fracture zones, themselves usually of limited lateral extent. At depths of 4 to 5km in the

low (maximum ~ 350°C) and it is referred to as low-temperature, very deep disposal (LTVDD). The second variant uses radioactive decay heat of the waste to partially melt the enclosing rock and is known as high-temperature very deep disposal (HTVDD).

Low-temperature very deep disposal

Conceptually, this is a relatively straightforward option that relies almost entirely on the geological barrier for long-term containment. In it the HLW

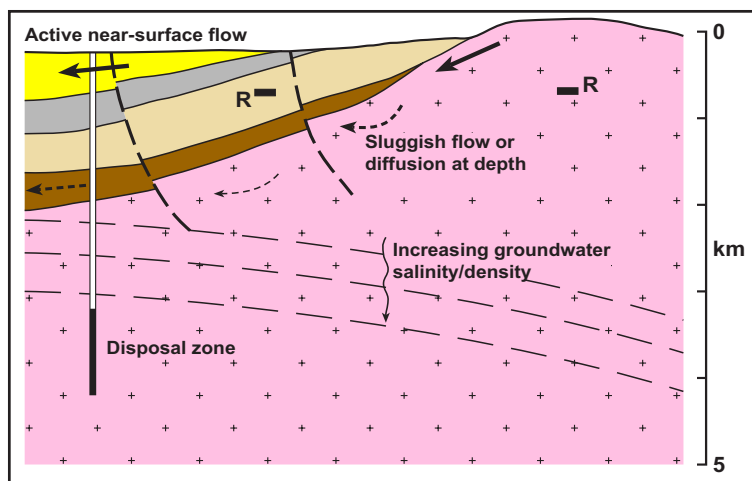


FIGURE 2: Conceptual model for very deep borehole disposal of nuclear waste (after Chapman & Gibb).

granitic basement, hydraulic conductivities tend to be less (and often much less) than 10^{-11} metres per second, *ie* fluids migrate at most a few hundreds of metres in a million years.

Furthermore, the intra-rock fluids are brines with a pronounced salinity gradient, resulting in a density stabilised stratification that has ensured these fluids have remained physically and chemically isolated from the near-surface groundwaters for millions of years. The density stratification also means that any flow that does occur will be lateral rather than vertical and it is so stable that it is unlikely to be significantly disrupted by even a major disturbance such as an earthquake.

Again, there are two main variants of very deep borehole disposal and both make full use of this powerful geological barrier. The first is suitable for low- and non-heat generating wastes, such as vitrified or otherwise diluted reprocessing waste or SNF that has undergone a significant period of post-reactor cooling. The key characteristic of this variant is that temperatures at and around the container surface remain

containers are stacked on top of each other, with or without spacers, and with bridge plugs at intervals to spread the load and prevent mechanical damage to the integrity of the containers. Above the deployment zone the hole is sealed at intervals to prevent upwards access of fluids. In detail, there are many options for packing geometry,

cased or uncased holes, backfilling, sealing methods *etc.* Sweden, while pursuing its hard-rock wet repository, is keeping this option open. The MIT (2003) report on *The Future of Nuclear Power* also recommended that the USA seriously pursue very deep borehole disposal.

High temperature very deep disposal

HTVDD combines the multi-barrier approach inherent in most repository concepts with the huge geological barrier offered by very deep borehole disposal to give potentially the safest of all HLW management options. This scheme was first proposed by the writer a few years ago and is summarised in Figure 3. Containers of heat-generating HLW are deployed in the lower reaches of a 4 – 5km deep borehole sunk into granitic continental crust. The heat from the waste generates temperatures above 800°C in the enclosing rock – sufficient to produce partial melting. As the heat output decays, the melt cools slowly and crystallises sealing the HLW into a sarcophagus of solid granite. This is surrounded by zones of thermal metamorphism and hydration reactions in which any pre-existing fractures are sealed. The near-field barrier therefore



Fergus Gibb is Professor of Petrology and Geochemistry in the Department of Engineering Materials at Sheffield University and a member of the Immobilisation Science Laboratory. As well as work on nuclear waste disposal, he's an acknowledged authority on igneous intrusions, especially mafic sills. He's a former external examiner for Geology and Mining Geology at Imperial.

consists of the wasteform, the container, the melted and recrystallised granite and the zone of metamorphism.

For HTVDD to work it is essential that sufficient melting of the granite occurs at low enough temperatures to preserve the integrity of the container and that the melt will recrystallise completely to holocrystalline granite on a time scale appropriate to the thermal decay of the HLW. Solidification rates calculated for natural granite bodies suggest cooling rates between 10 and 500°C per million years leading to a widely held view that granite can only form through extremely slow cooling. A series of melting and recrystallisation experiments on natural granite have demonstrated that, under H₂O saturated and undersaturated conditions at 150 MPa (corresponding to depths ~4.5km in continental crust), over 50% melting occurs below 850°C and the melt can be completely recrystallised when cooled to ~550°C at 0.1°C/hour or slower. We are currently developing a sophisticated heat flow model for HTVDD but a simple calculation for a disposal involving five year old PWR spent fuel suggests it would require ~70 days for the rock adjacent to the container to reach 850°C after which it would cool to 500°C in around 2.5 years. This equates to a cooling rate of 0.011°C/hour- *ie* well within the range necessary for complete recrystallisation of the granite. Consequently, HTVDD is perfectly viable as far as the melting and crystallisation of the host granite is concerned.

The other major issue relating to the feasibility of the scheme concerns a suitable container for the waste. Clearly, it must have sufficient mechanical strength to withstand transportation to, and deployment in, the borehole. At the same time it must be robust enough for its integrity to survive the high-temperature (granite melting and recrystallization) stage of the disposal. A programme of PhD research in its final stages at Sheffield University has

demonstrated that suitable containers could be made and that a number of possible options exist.

The technology for drilling boreholes up to 1m diameter to depths > 4km already exists and at ~£1m/km is surprisingly cost effective. The current UK inventory of HLW (~2,000 m³) could be disposed of in 10 to 20 boreholes, possibly all sunk from a single well-head and splayed.

The economic advantages of both variants of very deep borehole disposal are considerable, especially when compared with the costs of mined and engineered repositories. Yucca Mountain is estimated to have already cost several billion US\$ and has yet to receive its first SNF. A further advantage, especially of HTVDD, is that it is relatively insensitive to the composition and isotopic make-up of the HLW - it can even safely contain volatile species such as ¹²⁹I. Also, the environmental footprint of a very deep borehole disposal would be minimal in comparison with a mined and engineered repository.

The future

Several engineering challenges remain, mainly related to transport and deployment of the HLW containers, but the technology and expertise to resolve these already exist in the nuclear and hydrocarbon engineering industries. The science of very deep borehole disposal is sound and there are no insurmountable technical problems.

The only *perceived* obstacle is that the waste cannot be retrieved, or at least only with great difficulty and at enormous expense. However, *there is no scientific or technical justification for retrievability*. It is simply a marketing ploy aimed at persuading a sceptical public that in the event of a disposal 'going wrong' the waste could be retrieved. In reality any attempt to do so would probably do more harm than good and the waste would best be left undisturbed to let the geological barrier do its job. Also, there are circumstances where retrievability would be highly undesirable on security grounds, such as for the disposal of plutonium along with

HLW. Retrievability is at best a worthless safeguard and at worst a dangerous illusion.

It is predictable that, in the near future, the industrialised world will see a major resurgence in nuclear fission for a substantial proportion of its energy requirements. Although the new generation of nuclear reactors, such as the pebble-bed modular reactor (PBMR), are more efficient than their predecessors and generate much less waste, this will inevitably lead to substantial quantities of SNF and other HLWs that will require disposal. It is unlikely that the technical, hydrogeological, economic and siting difficulties surrounding 'wet' and 'dry' repositories will be resolved rapidly and in such a way as to expedite disposal of all existing and future arisings of HLW. Very deep

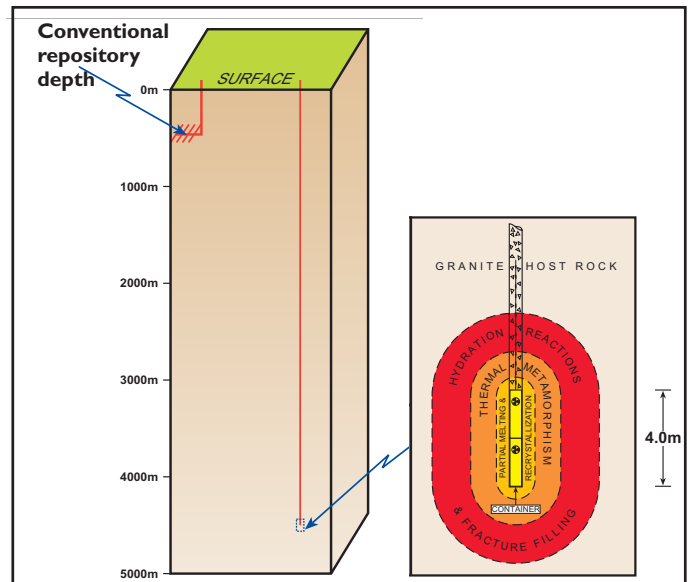


FIGURE 3: Schematic diagram illustrating the principle of high-temperature very deep disposal.

borehole disposal could provide an alternative, if not the main, route to solving the problem. Indeed, the enormous safety and economic benefits potentially available from HTVDD, together with no lack of remote, geologically suitable sites, could lead to this as the preferred option for some forms of HLW and the co-disposal of high-risk fissionable materials such as plutonium.

Environmentally, putting SNF and other forms of HLW back where it came from deep in the earth's crust could be almost as good as never having dug it up in the first place!

(A full text of this article will be on www.imperial.ac.uk/engineering/aboutthefaculty/alumniengineeringchapter/)

Comments and inputs from readers, including articles, on the theme of energy, are most welcome.

Contact Bill McAuley on 01276 23020 or at william.mcauley@dial.pipex.com

FEATURES

FLOOD RISK IN THE THAMES was one of the many topics of conversation on the recent CGCA summer event in the series 'Walks with a Past President', organised by David Hattersley. I led the 20 keen walkers from the Thames Barrier to Greenwich, ending up as guests of civil engineering contractor, Dean and Dyball, at their construction site at the confluence of the Thames and Deptford Creek.

They are building new river walls for a development site that may, one day, become an international cruise terminal and make a significant addition to the regeneration of the area.

The walk was five miles of the 180 mile long Thames Path which runs from the Barrier to the source in Gloucestershire. We passed through sections of extreme contrasts: historic buildings, industrial activity, dereliction, new development, ecological wetland and the Quantum Cloud sculpture by Anthony Gormley, viewed whilst going from east to west across the Meridian.

Contrasting

The group commented in particular on the contrast between the Trinity Hospital built in 1614, for 'Twenty One Retired Gentlemen of Greenwich' and run by the Mercers' Company, with the new flats and houses on the Greenwich Peninsular near the Dome.

The Dome is an excellent example of use of grey water, as it was designed to capture and store rainwater for flushing toilets to reduce the demand for potable water. The flood defences here are also of sound environmental design, being set back from the river's edge to provide inter-tidal habitat.

It was high tide and the established reed bed gave a soothing, and welcoming rustling sound as it moved in the currents in the water. Further ecological habitat is provided by some of the redundant jetties being grassed and planted for invertebrates and as safe roosts for birds.

Another topic about which I was asked many questions was water quality, as the natural silt content of the estuary



Jean Venables OBE
Civ Eng 66-69 & 73-74. Chair Crane Environmental, Chair of the Expert Panel, Thames Estuary 2100 Project, Chair Thames Estuary Partner-

ship, Vice President of the Institution of Civil Engineers, Chief Executive (designate) of the Association of Drainage Authorities and Court member of Imperial College.

belies the increasing water quality evidenced by a total of 121 species of fish, including salmon, having been identified in the river. Some say there are 121.5 as a roach/bream hybrid has been caught! The estuary acts as an important nursery for commercial fisheries in the North Sea with sea bass, in particular, being of economic significance to both commercial and recreational fishing.

However, we cannot afford to be complacent over water quality whilst there are many combined storm overflows (CSOs) that operate when the runoff from rain exceeds the capacity of the system, because they cause pollution and reduce the dissolved oxygen. Thames Water mitigates these incidents by injecting air, or hydrogen peroxide, from barges, but severe storms frequently give rise to a fish kill.

Disappointed

A proposal to build a tunnel under the Thames to avoid these incidents has been put forward by Thames Water. Many were disappointed that this item was not included by OFWAT in the recently agreed capital programme.

Investment to renew and upgrade the drainage network - to meet both current and future requirements - is required, even if it is a subject 'out of sight and out of mind' until it does not work. It is a truism to say that there are no votes in sewers.

Another area where the country has benefited from the investment of previous generations is in the drainage networks now operated by the Internal Drainage Boards. Low-lying, waterlogged



Ramblings

Flood defence and water

Jean Venables comes

conclusions for the future during

but very fertile land was drained and the water levels in the ditches managed by appropriate use of the pumping stations to maintain good growing conditions for the crops.

The need for agricultural efficiency is as strong now as it was in wartime as we have come to recognise that by reducing food imports, 'food miles' are reduced, with the consequential benefit of reducing greenhouse gases.

We all know that water is vital for life - but so many people have too little of the *right kind* of water, and are frequently at increasing risk of getting too much of the *wrong kind* of water. This does not only apply to developing countries but also to the developed.

For example, in densely populated areas, we consume so much water in comparison to the rainfall that 'semi-arid' is a description that can be applied to parts of South East England - often

PS The recent Katrina and Rita hurricanes and their aftermath remind us vividly that major cities on or near coasts and estuaries are at risk of inundation, and that there is always a risk of even the best-planned defences being over-topped by an extreme event. There is thus a clear need to keep our plans for how we would cope in such circumstances fully up to date.



LEFT: An old jetty on the Meridian line, grassed and planted to provide wildlife habitat.

BELOW: Reeds alongside the Thames-side path on the Greenwich peninsula with Anthony Gormley's sculpture.

BOTTOM: A diverse view upstream from the Thames Barrier.



of a Rambler

er sustainability expert
 es to some valuable
 g a summer walk by the Thames

much to people's amazement. At the same time climate change is predicting increasing sea levels and storminess and an increasing risk of inundation from the sea - too much of the wrong kind!

So, what do I mean by *right* and *wrong* kinds of water, right and wrong in terms of quality or quantity?

Appropriate

We need water of the appropriate quality for its use whether that is potable or for irrigation, rivers and canals. We also need to consider the spatial distribution of water. How much of the rainfall soaks into the ground and how much flows into the drainage and river systems?

Changes in land management processes and an increasing use of hard landscaping have increased the rate of runoff and reduced the natural recharge of the ground water system. In many areas rivers rely on the flow from ground water, replenished in the winter, to maintain the flow in the drier summers. In England, the winter of 2004/2005 was particularly dry, resulting in pressure on maintaining water supplies in the summer of 2005.

So what is being done to manage these risks? For the longer term, the Environment Agency has set up the TE2100 Project to investigate strategies for managing flood risk in the Thames Estuary over the next hundred years.

This very exciting, broad-based study is currently collecting data and will soon be reviewing strategies. As Chair of the Expert Panel for the

Project, I appreciate the efforts of the multidisciplinary team examining an extremely complex set of issues. In addition, the recent DEFRA document 'Making Space for Water' is causing new methodology to be developed to meet the current philosophy.

On our walk, we benefited from the creation of the far-sighted concept of the Thames Path. The City to Sea Project, being promoted by the Thames Estuary Partnership, seeks to extend the Thames path, on both north and south banks all the way along the estuary from the Barrier to the sea.

Most of us take the provision of essential services for granted. Few, I'm

sure, stop to think about energy or realise that reducing water use reduces the energy needed for pumping, which in turn reduces emissions of the greenhouse gases. Using less water can, at certain times of the year, also mean conserving a scarce resource. We Londoners have few hose pipe bans; we have been spoiled, thanks largely to the foresight of our Victorian forefathers. Much of this infrastructure may be out of sight - and therefore out of many people's minds - but we need to keep investing in its upkeep and updating.

By the way, weren't those Victorian forefathers the chaps who founded the City & Guilds?





DEVELOPING TECHNOLOGIES - a practical response to poverty

DEVELOPING Technology (DT) was established in the Department of Mechanical Engineering in 2001 with the aim of using student project work, from undergraduate to PhD, to provide technical support at little or no cost to organisations working in developing countries. In the longer term it was hoped that, by carefully selecting partners and projects, this work would help improve the livelihoods of poor people in developing countries.

Initially, few projects could be run but in late 2003 a two-year set-up grant was gained from the Hadley Trust, allowing employment of a full-time co-ordinator, Roy Dennis. This greatly increased capacity for project supervision and for working more closely with partners to transfer the students' work.

In 2004/5, 16 year 3, 10 year 4 (including two from Civil Engineering and Electrical) and two MSc students carried out DT projects. In 2005/6, it is anticipated that these numbers will increase. A PhD student also started a project on renewable energy this January. This shows DT's considerable activity and potential to make a real impact.

Early success

DT was greatly encouraged when its students won one of the coveted Mondialogo Awards against stiff international competition. The award is given to support outstanding projects in the developing world and encourage collaboration with local students, in this case from Nepal, sponsored by UNESCO and Dailmer Chrysler.

The project was to develop a water pasteuriser for making safe drinking water using waste heat from a cookstove. The award of \$15,000 will allow the work to expand and the stove to be tested in more homes. The device can greatly reduce the likelihood of disease and of death from contaminated water.

How DT works

- **FINDING THE PROJECTS** Real projects are found from direct contact with NGOs such as Intermediate Technology Development Group (ITDG); through the DT website; by working with EWB, or by identifying need. As far as possible projects are set up with clients/partners who provide info, answer queries and provide outlets for disseminating a project.
- **SETTING UP PROJECTS** Most staff are prepared to supervise one or two projects with support of DT's co-ordinator. Projects attract good quality students and are heavily oversubscribed. Students are encouraged to liaise with partner/client to establish a project's specifications and background.
- **FOLLOWING-UP PROJECTS** Student work is reviewed by a professional engineer, co-ordinator or other DT advisor, before passing to a client. Output may be a report to clients or a visit of students and co-ordinator to introduce and test the project.

Sustainable farming

Mongolia has a large horse population which needs a copious stock of hay for the winter months. The Russians introduced tractors for hay-making but when they left the Mongolians were not able to keep them running and returned to hand scything and a few horse-drawn mowers, resulting in starvation of horses in the winter from lack of hay.

To counter this, DT is working with a charity, CAMDA, to introduce mowers that are more suited to the horses in Mongolia which are small and struggle to pull the conventional wheel-driven mower. DT has developed a mower with an auxiliary engine to drive the cutter. This cuts grass more efficiently and is much easier for the horse to pull.

The mower has just been successfully tested in Mongolia.

The DT design is based on standard steel sections. Arc welding and primitive workshop tools are available locally. Interestingly, a near identical need exists in rural Romania, so DT was able to work with two NGOs.

The next step is to attempt local manufacture of the prototype and disseminate the technology for widespread use.

On a different project, Ian Robertson, a former Scottish potato inspector, needed a low cost laminar flow cabinet for his work in Zimbabwe. This is a box-type enclosure which



TOP: Sponsored students Marcus Rafla, Sushobhan Joshi and Dan Wilson collect the Mondialogo Award In Germany.
ABOVE: The DT mower in Mongolia.

delivers very clean air for tiny seedlings rather like an incubator. Ian has developed a technique which allows sweet potatoes and cassava to be rid of a virus transmitted by white fly so they grow several times the yield of infected plants. The barrier is the normal cost of a laminar flow cabinet which is around \$6-10k. DT has developed a machine which works adequately for \$300 and again can be made locally.

Renewable energy

Life without any electricity is very limiting and for most of the rural parts of the developing world there is no grid electricity. This maintains poverty,

‘Wouldn’t it be a good idea to divert the energy and potential of the country’s top engineering students to help reduce poverty in the developing world?’ Fiona Pullen asked her husband, Keith. Here Keith, Senior Lecturer in Mechanical Engineering at Imperial, writes about the charity set up by Fiona, Developing Technologies.

especially limiting educational development since all the things we take for granted such as lighting for reading, computers, TV and radio, are not possible. One excellent source of power is hydropower but installing a bladed turbine and generator in a river requires substantial engineering resource – mechanical, civil and electrical. To justify this resource, the installation has to be reasonably large and then there are organisational barriers to overcome in setting up a scheme to pay for capital cost, distribution and maintenance.

The solution could be in the form of a concrete or clay pipe of around 300mm diameter placed in a river under rocks to form a rough dam. Fish and debris can pass through the pipe. The pipe is shaped as a venturi and it draws in air at its throat. Place an air turbine at the other end of the pipe and you can generate 50-500W.

David Howey is tackling this problem in his PhD, based on the Rochester venturi principle. The research is supported by the Hadley Trust. The idea is to mass-produce the air turbine generator in a modern factory, mainly from plastic mouldings, but have the pipes made locally. The system will be used by individual families who will have more incentive to operate and own it. The idea is also being developed for large scale power generation by the Imperial College spin-out, Hydroventuri Ltd.

How we can help

The technical support we offer charities and NGOs working in the field falls into three main categories –

- **DEVELOPMENT OF NEW DESIGNS** to meet need of client as described previously.
- **DEVELOPMENT OF EXISTING DESIGNS** like wind turbines for ITDG and a motorcycle trailer ambulance.

- **EVALUATION OF CLIENTS’ DESIGNS** Using advanced analytical methods to help clients develop and verify designs eg a low-cost foot-bridge for Sri Lanka.

Value of DT’s work

Clients benefit by gaining access to a wide range of resources and expertise which otherwise they could only dream of. Of particular value are modelling techniques allowing evaluation of a number of design options. The combined effort of students and staff provides considerable input to a project. As this is at little or no cost, it’s affordable to even the smallest organisation.

Students benefit educationally from a very realistic engineering experience in which they work on a real problem with a real need and real constraints and in which they have to consider a range of both technical and non-technical issues. Students often liaise with clients to define specifications and constraints and to obtain additional information. They are encouraged to take a professional approach, applying powerful analytical techniques to

CAN YOU HELP?

Developing Technologies is eager to attract support particularly from engineers and alumni, practicing or retired. This can be in the form of student mentoring, contacts with industry or financial support. As a student of any department, you may be interested to undertake a project. For more information or to donate, please see www.developingtechnologies.org or call Roy Dennis on 020 7594 7180 or email devtech@imperial.ac.uk

evaluate the effects of changing parameters even though designs may be technically fairly simple, eg heat transfer analysis of a water pasteuriser.

The College and departments benefit from being involved in philanthropic work in which a mechanism now exists, for the expertise already here, to be harnessed in tackling one of the most difficult challenges in the world today.

Future plans

An aim in the coming year has been to increase the range of partners/clients. For instance two projects in Nepal run on behalf of EWB; project with US NGO Enterprise Helps on recycling of plastics;



Motorcycle trailer ambulance in Tanzania.

the extraction of oils of essence with a woman’s group in Kenya, and design of a low-cost percussion drilling rig for water wells with an NGO in Sierra Leone.

In the longer term we would like to develop links with a few Universities in Sub Saharan Africa to strengthen capacity in technological support to local SMEs and the sustainability of DT’s work. SSA is chosen as being the area that has the greatest need for the support provided by DT.

An overriding issue for the future to secure the sustainability of DT and to achieve its aims is to establish funding on an ongoing basis, possibly through sponsorship from the engineering industry. The need is fairly modest covering the salary for the co-ordinator, operational costs and some support funding for dissemination of promising projects. The role of the co-ordinator is considered crucial in making sure that the work of DT meets the needs of and reaches the target end-users in developing countries.

FEATURES

WEARE ruled by time and we need to know the time to tell us what to do. But the clocks that instruct us to wake, eat and go to bed are unnatural. Indeed, many groups within our society are expected to perform with equal efficiency throughout the 24-hour day. In these groups, sleep is regarded as an illness which needs to be cured.

In our modern world, we are being driven by the energy states of an electron in the caesium atom and use machines to hack our day into hours, minutes and seconds. Yet despite the atomic clock, our bodies answer to another more persistent beat which probably started to tick shortly after life evolved. Embedded within our genes, and almost all life on earth, are the instructions for a biological clock that marks the passage of approximately 24 hours.



Until we turned our nights into days and began to travel across multiple time zones, we were largely unaware of these internal clocks.

Yet the striking impairment of our abilities at 4am soon reminds us that we are slaves to our biology. Our ability to perform mathematical calculations or other intellectual tasks between 4 and 6am is worse than if we had consumed several shots of whisky and would be classified as legally drunk.

Welcome to the world of circadian rhythms, those near 24-hour rhythms which persist when we are isolated from all environmental time signals, such as change in light or temperature.

Human volunteers have gone deep underground and stayed in a constantly lit environment for weeks. With no way of knowing day from night, their body rhythms started to drift out of synchronisation with the outside world.

After about a fortnight, they were going to bed around midday and rising at around 8pm. After about a month they were back, more or less, in synchrony with the outside world, before drifting off again. Our circadian rhythms under such conditions are not exactly 24 hours, but a little longer, on average 24 hours and 11 minutes.

Biological clocks drive or alter our sleep patterns, alertness, mood, physical strength, blood pressure and every other aspect of our physiology and behaviour. Under normal conditions we experi-

'The 24-hour variation in our performance is increasingly at odds with the demands of a 24/7 life-style', says Professor Russell Foster. In a recent book he examined the biological clocks controlling the daily lives of every living thing.



ence a 24-hour pattern of light and dark and our clock uses this signal to align biological time to the day and night. The clock is then used to anticipate the differing demands of the 24-hour day and fine-tune physiology and behaviour in advance of changing conditions. Body temperature drops, blood pressure decreases, tiredness increases in anticipation of going to bed. Before dawn metabolism is geared-up, anticipating increased activity when we wake.

The past decade has witnessed remarkable progress in the understanding of circadian rhythms in many different organisms. Much of what we know of the molecules that make up our biological clockwork has been learnt from the fruit fly (*drosophila*) and mouse.

The understanding of the molecular basis of circadian rhythms is one of the first successes arising from the genome sequencing projects. It is currently one of the best examples we have of how genes and their protein products give rise to complex behaviours.

At the base of our brain, in the anterior hypothalamus, is a structure known as the suprachiasmatic nuclei (SCN). Its 20,000 nerve cells form our 'master' biological clock, and coordinate 24-hour rhythmicity in every cell of the body. If this region of the brain is damaged or destroyed by a tumour, then we lose our 24-hour patterns of sleep/wake, and all other 24-hour rhythms.



The finding that individual SCN neurones, isolated from all other cells, show near 24-hour rhythms in electrical activity demonstrated that the basic mechanisms that generate this internal clock must be due to the molecular interactions within a single cell. So far, approximately 12 genes have been linked to the generation of this 24-hour rhythm of life. At the heart of the mechanism is a

'negative feedback loop'. The so-called 'clock genes' located in the mass of DNA in the nucleus of the cell are transcribed and produce a message (mRNA). This mRNA is translated into its protein in the cytoplasm. Then the protein moves into the nucleus to turn-off the transcription of its own mRNA. The clock protein in the nucleus is then degraded, and the gene is once more free to make mRNA, more protein, and so the cycle continues. This negative feedback loop generates a near 24 hour rhythm of protein production and degradation which ultimately acts as a signal to regulate the whole body.



Tiny changes in these clock genes can have a profound effect upon our behaviour. One family studied by researchers at Utah University included a grandmother, daughter and grandchild all with the same sleep disturbance. Regardless of work or social pressures, they cannot stay up much later than 7.30pm and they tend to wake up around 3am. A small mutation was identified in one of the clock genes. One commentator said '...by their contribution to our genes our parents are still telling us what time to go to bed!'

This 'delayed sleep phase syndrome' is exceedingly rare, but there is growing evidence that circadian malfunctions may be involved in depressive illnesses, a condition that will affect a significant percentage of the population and costs the health care systems billions. Schizophrenics, and people with bipolar disorder have difficulties with timing activities and this may be a symptom related to a circadian defect rather than dysfunctional behaviour.

A clock is not a clock unless it can be set to local time, and the near 24-hour molecular rhythm in the SCN is normally adjusted by daily exposure to darkness and light. Studying these light

Born free but controlled by a biological clock

detecting mechanisms led to the discovery of a previously unrecognised light sensing mechanism within the eye. These sensory cells are independent of the rod and cone receptors that we use to see. Indeed, some people can lack any sense of conscious vision, due to genetic disease of the rod and cone photoreceptors, but are still able to use their eyes to regulate their circadian clock using novel receptors.



The strong effect of light on our biological clock presents a problem for night-shift workers.

Even after 20 years of night-shift work individuals will not normally shift their circadian rhythm in response to the demands of working at night. Metabolism, along with alertness and performance, are still high during the day when the night-shift worker is trying to sleep, and low at night when the individual is trying to work.

A misaligned physiology, along with poor sleep, in night-shift workers has been associated with increased cardiovascular mortality and an eight-fold higher incidence of peptic ulcers. Other physical problems include chronic fatigue, excessive sleepiness, difficulty sleeping, higher rates of substance abuse and depression. Finally, shift-workers are also vulnerable when driving home after a night shift, especially on quiet monotonous roads. There is a 50% increase in the risk of a single vehicle crash at 3am after four successive night shifts.

So why don't shift-workers shift their clocks? After all, if we travel across multiple time zones, we do recover from jet-lag and adjust to local time. If night shift-workers hide from bright natural light during the day, they can shift their body clock to the night.

It seems that the mechanism that adjusts our clock is fairly insensitive to light. The clock will always respond to

bright natural sunlight in preference to the dim artificial lights commonly found in the workplace. But in the absence of any natural light, the clock will eventually respond to man-made light.

It is not immediately obvious but, shortly after dawn, natural light is some 50 times brighter than normal office lighting. At noon, natural light can be 500 to a 1000 times brighter - even in Britain. Exposure to strong natural light to and from work, and perhaps during the day, normally prevents the night-shift worker from shifting.

Space is the most extreme shift-working environment. Crews on space missions sleep poorly. On some missions up to half the crew take sleeping pills and, overall, nearly half all medication used in orbit is intended to help astronauts sleep. Even so, astronauts average about two hours less sleep each night in space than they do on the ground - a problem that will have to be solved before the manned flight to Mars. Many big accidents have happened at night. The nuclear accident at Three Mile Island began at 4am, Chernobyl at 1.23am and the explosion at the Union Carbide plant in Bhopal, at 12.15am.



The search is on to create the 'metabolically dominant soldier' - a generation of warriors who can fight 24 hours a day, seven days without rest. Eliminating the need for sleep, while maintaining a high level of mental and physical performance, is considered to be the way forward in modern warfare. Soldiers, sailors and aircrew have to make instant decisions based on incomplete information. Even a slight drop in cognitive performance makes all the difference between life and death.

British troops used stimulants to keep them awake during the Falklands conflict and USAF aircrews took amphetamines during the Libyan air

strikes. But a range of side effects from agitation, irritability and nausea to impotence are associated with amphetamine use.



By contrast, Modafinil is a so-called eugeroic ('good arousal') drug.

The French government admitted that its crack corps, the Foreign Legion, used Modafinil during covert operations inside Iraq during the first Gulf War.

There are great hopes for Modafinil among the US military which is allegedly spending \$100 million on research on the rationale that soldiers who sleep less will give the US a military edge.

Professor Michel Jouvett, an authority on sleep, claimed during an international defence meeting that 'Modafinil could keep an army on its feet and fighting for three days and nights with no major side effects'.

Police, hospital staff, pilots, people who work all night, and even students taking exams, are among the many millions in our 24-hour society who might also be tempted to take Modafinil.



Based upon our increasing understanding of the mechanisms that generate circadian rhythms and sleep, it is not too far-fetched to imagine that, in the next few years, we will develop a whole range of drugs that could be used to manipulate our rhythms. We could develop a world in which we sleep only two hours a night and perform at peak levels throughout the other 22 hours.

We have to make choices. We could manage the continued development of the 24-hour society and, if necessary, use pharmacological intervention to counteract the biological downside of working around the clock. Or we can reject the trend and use what we know about the clock to embrace biological time. The choice, as ever, is not completely free but it is one that we are going to have to make.

Russell Foster heads the Department of Integrative and Molecular Neuroscience at Imperial's School of Medicine. He's recently been awarded the Zoological Society's Scientific Medal. He's also the first European to receive the Cogan Award of the USA's Association for Research in Vision and Ophthalmology.

FEATURES

Imperial Engineer looks at two alumni and the way they've changed paths since Imperial

ALMOST 30 years ago Simon Wynn graduated from the RSM with a mining degree and, like many graduates at that time, headed for South Africa's gold mines. 'Some time after that my career began to follow a less conventional route', he writes. 'Today I jointly run a broadcast public relations company, On Line Broadcasting, working for clients all over the world generating TV and radio news coverage.'

'From mining I made a move into PR while working for Taylor Woodrow and spent a number of years working for a PR consultancy before setting up my own. I was able to use the technical grounding I received at RSM to help me spot and develop the opportunity to set up a business using the newly-introduced ISDN data lines and specialist audio codecs developed in the early 1990s to deliver broadcast quality interviews to radio stations.'

'While I was working on the BT-sponsored Swimathon I was able to convince BT that using their ISDN lines to provide links to radio stations would provide a valuable association with their business.'

'From the outset we talked to radio stations and discovered that, while there was a strong appetite for good interview material, there was also a need for a service to help the PR industry understand and meet the needs of broadcasters. So we offered our clients strategic advice on how best to develop stories for radio, with a service comprising preparation of background information, selection of suitable spokespeople, booking and scheduling interviews and the technical facilities to produce live interviews in broadcast quality.'

'We worked closely with leading charities and other high-profile clients on projects from Macmillan Cancer Relief's World's Biggest Coffee Morning to product launches for Duchy Originals and stockmarket-based stories from Barclays Stockbrokers.'

'We very quickly realised that it was possible to take our equipment to locations where stories were taking place and which would be popular with radio stations. With this concept we managed to win clients including Chelsea Flower Show and the UK Ideal

From mining to broadcasting...

Home Exhibition, as well as the International Red Cross (we arranged coverage from conferences in Geneva) and WWF (for whom we delivered a series of radio interviews with the Duke of Edinburgh in Cameroon to the UK). We even produced live interviews from a cowshed, enlivened by a cow giving birth, at the height of Britain's BSE crisis.'

'Our move into live television news

power. As long as our clients' stories have sufficient news value, we can potentially gain coverage on stations like CNN, BBC World, CNBC, Sky and Bloomberg. We can also reach virtually every significant broadcaster worldwide through broadcast news agencies.'

'The more memorable high-profile projects we've worked on have been the sale of the piano on which John



Simon sets up an interview with business partner Nicky Mayhew.

interviews came while we were working with rising young tennis player Tim Henman for HSBC's sponsorship of a UK inter-school tennis championship. ITN suggested we could hire their satellite trucks to deliver live-linked interviews for TV in addition to our radio coverage. From this initial success the new arm to our business enabled our clients to deliver live interviews to TV stations in the UK and overseas.'

'The sponsorship division of ad agency M & C Saatchi was an early adopter of our new service, asking us to help raise the broadcast profile of the Jordan Formula One Team. Since then we've worked with or for every team in F1, as well as for the new motor racing circuits in Bahrain and Shanghai. Our live interview service is also popular with companies announcing financial results.'

'Since our move into live TV interviews, we've become increasingly known for bringing our clients' stories to broadcasters from all over the world. This reflects the fact that there are many international stories TV stations would like to report, but for which they do not have the resources, budget or man-

Lennon composed *Imagine*; regrouping of the surviving members of rock band The Doors in Los Angeles; the launch of a new motor racing series, 'A1 Grand Prix' and a series of live interviews with President Musharraf from Pakistan.'

'Our business continually evolves as technology and clients' needs change and opportunities emerge. Our philosophy is that the people who run this business shouldn't become remote from practicalities of delivering projects for clients, so we take a very hands-on approach and have deliberately chosen to remain a small specialist company. With relatively low overheads, we can offer a high-quality bespoke service.'

'While my day-to-day professional life is far removed from the career for which the RSM prepared me, the skills I learned haven't been wasted. Applying them to different and sometimes unexpected challenges has taken me in interesting new directions on a journey that's never predictable.'

Contact Simon Wynn and On Line Broadcasting on 0044 208 342 7390 or simon@onlib.com

AFTER referring to his role as editor of Old Student Notes reporting some post-college antics admitted to by CGCA members over the last 31 years, John Gardiner told dinner guests, following a committee meeting in June, a little about his life since Imperial and his long-time interest in sustainability.

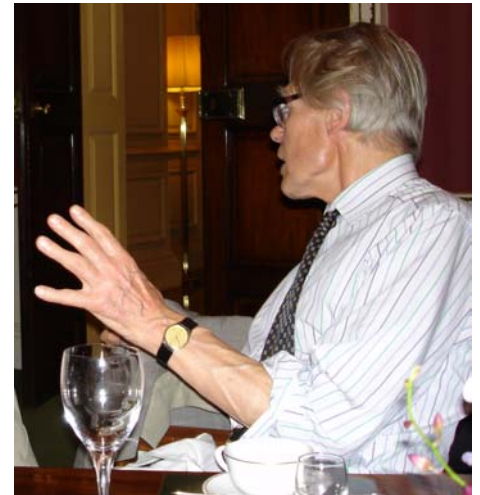
'So how did I come to the conclusion that the only route to a more sustainable future is understanding and respecting not only natural processes but also the views of stakeholders?' he asked. The answer lies in his diverse career.

Initially working on foundation engineering and major site investigations during a two-year indenture to Soil Mechanics Ltd, John was glad to find refuge in the Thames Conservancy, ironically built in the Thames floodplain in Reading.

A diverse 10 years in design, construction, site supervision and land drainage, prepared John for the challenge of managing the complex, four-year Lower Colne study (Rickmansworth to Staines) in 1983. His



John (left) listens to a question from Professor Peter Grootenhuis (below). BELOW LEFT: John with baby Amara.



...and water works to alpacas

holistic approach brought him the fellowship of his guests for the evening, with whom he worked on many major projects over the next decade. John introduced Edward Evans, then head of river modelling at Sir Wm. Halcrow and Partners, Mark Lintell, Chairman of Land Use Consultants and absent guest Professor Edmund Penning-Rowse, Director of the Flood Hazard Research Centre. Together they plotted a new project trajectory for more sustainable river management.

'Among other things, we dreamed of directly linking the (hydrodynamic) river model with an econometric model of flood risk, producing flood damage contours to show where non-structural measures could help minimise structural options. This is now a reality and became the national standard and much-copied overseas'.



Central to their multi-disciplinary assessment was Mark's environmental impact appraisal approach four years before it became a legal requirement. They believed in involving the public from the start.

John's inspired team also produced the UK's first floodplain management plan (from Datchet to Walton-on-Thames) and the three first catchment management plans, well ahead of EU directives. More breakthroughs followed, including complete revision of the authority's response to planning applications, and producing policies for inclusion in local authority land use plans. 'The significance of this achievement is underlined when it is realised that the quality and quantity of a catchment's water environment is determined by land use', says John.

In his 23 years with what by then was the National Rivers Authority, John also used the Land Drainage Act to convince developers not to culvert streams but enhance them to increase property values. Mark's team supported the NRA's efforts to reach central government planners with policy and strategy for water environment in its area of responsibility.

Edmund became John's boss at the Flood Hazard Research Centre, when in 1995 he took up the post of Professor of Sustainable Environmental Management at Middlesex University (MU). He also met Christine, a bio-geomorphologist. They married in 1996 and spent their honeymoon working for SERC, taking in

eight US states as part of their survey into the use of plants, especially willow, in riverbank restoration, combined with the use of river modelling.

Back in the UK, they team-taught courses at MU and formed Salix International Ltd, winning research projects for the university. The move to Portland, Oregon followed when they set up hydrology consultant Philip Williams and Associates' first branch office. But despite successful initial years, they found they were not working together as they'd hoped.

So they set up WaterCycle Inc and now grow their own food and breed alpacas on 20 acres near Portland. They teach watershed renaturalisation at the university and strive towards a more sustainable lifestyle, eg harvesting 83,000 gallons of rainwater to show the importance to flood defence, water quality and water resources of rainwater harvesting in stormwater management.

'Our farm distils much of our philosophy and technical understanding', says John. 'Alpacas are extraordinary animals: it's tempting to believe they're sent to save America from itself, to give youngsters a chance to learn about what really matters.' Next year will see him brewing compost tea and maybe biodiesel...

Contact on johnpgardiner@cs.com or ring 001 5038261839.

**TREASURE AND INTRIGUE –
THE LEGACY OF CAPTAIN
KIDD**

BY GRAHAM HARRIS (CIVL 58, 62)
Published by Dundum Press
ISBN 1-55002-409-6

GRAHAM HARRIS is already known to CGCA members for his fascinating article *Recovering the Oak Island treasure* in the Spring 2002 *Imperial College Engineer*. After a book on Oak Island, he turned his attention to piracy in the Indian Ocean during the late 17th century, focusing on the exploits of Captain William Kidd. His book is also a detective story which probes the enigma of Kidd's treasure.

Before his execution in 1701, Kidd asserted that he had 'lodged goods and treasure to the value of £100,000 in the Indies', which he pledged the government in exchange for his life. His gamble proved futile, despite the sum offered being so enormous that 300 years ago, it amounted to between six and seven percent of the state's revenue.

Many biographers have derided the notion that Kidd possessed much wealth, although between 1929 and 1934, some convincing-looking maps were found hidden in secret compartments within old furniture. This was bought at auction by Hubert Palmer, a noted collector of pirate relics. The maps depict an island where some people still consider the treasure to be buried. They have fuelled a frenzy of

Provocative and persuasive

treasure-hunting fever all over the globe. The debate continues regarding their authenticity, but the island remains as elusive as ever.

This book examines Kidd's life and the voyage of his famous ship the Adventure Galley, concluding there is evidence to support his claim. The maps are shown to be bogus, but are considered to represent an island in the Indian Ocean where Kidd did actually cache his treasure. They appear to have been drawn two centuries after the treasure was recovered.

BOOKS

So why should someone go to the trouble of fabricating them? It seems that the intention was to create a false trail for Palmer, thereby creating the impression that Kidd's treasure was still 'out there'. It is an old maxim that if one wants to hide the 'real truth' then another 'truth' must be invented. The maps have since disappeared as mysteriously as they first appeared.

Much of the information on Kidd's life is contained in official papers which previous biographers believed to be completely reliable. Most indisputably are, but Graham Harris suspects that the records have been subject to a launder-

ing process. There are too many inconsistencies, as well as a five month gap in Kidd's activities in the Indian Ocean after capturing his greatest prize, the *Queddab Merchant*. He could have been anywhere during this period.

Harris concludes that Kidd was hanged because the authorities made a deal with his crew. They knew where the island lay and the treasure was recovered shortly after Kidd's death. But as none of the stolen goods were returned to their former owner, the Mogul of India, the maps were produced in order to avoid political embarrassment during a period when Anglo-Indian relationships were becoming increasingly strained.

Navigation during the 17th century was a highly-skilled art and an explanatory chapter is therefore provided. Other chapters include the history of piracy in the Indian Ocean and the riches of the Orient that attracted the European adventurism that descended into piracy.

Graham Harris has clearly researched his subject very well and his conclusions are persuasive, albeit provocative. I can highly recommend the book to anyone interested in treasure, intrigue or both. To order a copy, see www.dundum.com/bookid/0150. **Adrian Winchester**

Preplanning key to emergency fuel

IMPERIAL academic Dr Bob Noland has published *Saving Oil in a Hurry*, which is an emergency 'toolbox' to help countries cope in an oil crisis.

Dr Noland, from the Centre for Transport Studies in the department of Civil and Environmental Engineering, analyses various road transport measures for the best quick fixes if there were a major disruption to the oil supply today.

Helping consumption to fall just a few percent would have 'a significant dampening effect' on world oil prices if supplies were constrained, says Dr Noland, in addition to minimising the impact of any supply disruption.

Over one million barrels of oil would be saved a day, he calculates, if an odd/even licence plate scheme were

SAVING OIL IN A HURRY

BY BOB NOLAND
Published by IEA
ISBN 92-64-10941-2 (2005)

introduced across all IEA countries, including the UK, Japan, Australia and the United States. Under the scheme, only drivers with odd licence plate numbers would be allowed to drive one day and only those with even the next.

Ruling that motorways only allow carpooling would generate a similar level of savings, estimates Dr Noland.

And over 500,000 barrels of oil would be saved a day if all public transport were free during the crisis.

If drivers became 'eco-drivers', adopting efficient driving styles and maintaining their vehicles in an eco-

friendly way, the same amount of oil would be saved, he calculates.

For these measures to work, governments need to mount intensive public information campaigns, suggests Dr Noland.

He says: 'Pre-planning is essential to ensure that measures to reduce the oil consumption of transport succeed in an emergency. Governments must be ready to implement measures on very short notice. It is very important that the public have clear information and are aware of how any plans will work'.

Dr Noland wrote the report that formed the book for the International Energy Agency (IEA). Energy ministers from 26 IEA countries discussed the book's recommendations when they met recently in Paris.

Work still fundamental source reference

ALWAYS known as Jack, Dr J H Burgoyne, who has died aged 90, was an internationally renowned consultant, specialising in safety engineering and emphasising fire and explosion. At Imperial he gained a first-class honours degree in chemistry in 1933, later undertaking research on the combustion and ignition behaviour of aromatic and alicyclic hydrocarbons. This work sparked in him a permanent interest.

In 1946 Burgoyne was appointed a lecturer (and subsequently Senior Lecturer and Reader) in what had become the Chemical Engineering and Chemical Technology Department at Imperial College. He helped his students whenever they needed assistance but always allowed them to develop their own ideas. Work with his students resulted in the publication of further papers, many of which remain fundamental sources of reference to-day.

During Burgoyne's time at

university his work received widespread recognition outside academia. Research contracts came from industry and government to investigate problems like crankcase explosions in marine engines, explosions in flour mills and the spontaneous heating and ignition of palm kernels.

JACK BURGOYNE

He demonstrated a flair for unravelling the most complex cases by his meticulous attention to detail and his application of lateral thinking, supported by his enormous wealth of knowledge of combustion science.

It was not long before the insurance industry routinely commissioned reports from Burgoyne on fire and explosion incidents. These often resulted in litigation requiring him to appear in court as an expert witness. His ability to explain complex technical issues clearly and succinctly earned him an unrivalled reputation in the High Court.

Burgoyne left Imperial College in 1964 to undertake full-time consulting, mostly for insurance loss adjusters. This provided a regular source of fire and explosion scenes to examine. Whenever there was dispute over the cause of an incident, he often found himself in opposition to Bob Maisey. In 1968 he and Maisey merged their practices to form Dr J.H.Burgoyne and Partners. In the early 1970s, Burgoyne was appointed as a visiting professor in industrial safety at City University and later also as visiting professor at the University of Sheffield. For several years he was Chairman of the Safety in Mines Research Advisory Board, a member of the Advisory Committee on Major Hazards and President of the Association of Consulting Scientists.

In 1978 Burgoyne retired from the firm which he had formed but remained in close contact with his former partners as it expanded. At about the same time he was

appointed by the Department of Energy to chair a Committee of Inquiry into Offshore Safety. In recognition of this he was awarded a CBE.

Burgoyne was a rather reserved and private person, a little difficult to get to know at first but ultimately a very loyal and staunch friend. His legacy of justices and to the truth ensured that he always did right by those whom he encountered.

DAVID LOVESEY

Electric lifetime

DAVID LOVESEY (EE 58-61) died in July, aged 69. He was one of the older students in his year, having first completed national service in the RAF. David's entire career was spent in the electricity supply industry, and at the time of his retirement he was Managing Director of SEEBOARD. He is survived by his wife Jackie and a son and daughter.

Andrew St Johnson, who died last April, is remembered by his fellow student Alun Williams

Ahead of computer game at every step

ANDREW and I were both in Electrical Engineering and after graduation, in 1943, many of us were commissioned in the Navy, our call-ups having been deferred.

In fact, my recollection of the last time I met Andrew was in Murmansk in 1944. He had come up on an aircraft carrier whilst I was in a Frigate Escort Group.

While Peter Stokes went into the engineering branch (I last met him in the wardroom of HMS Howe) and Harold Hair to the Instructor Branch (ending as captain and Dean of RNEC Manadon), George Morris and I went into the Electrical Branch.

My time ended as lieutenant in 1946. Andrew joined the Special Branch and ended as lieutenant com-

ANDREW ST JOHNSON

mander. Regrettably most of the above are no longer with us but their memory is still very real to me.

Andrew was a keen radio fan in College and he tinkered with bits of circuitry and thermionic valves in those days. He did the communication course whilst I did power.

He was obviously destined for a distinguished career in the light current field. His obituary in the *IEE Review* for June 2005 recalls his long history in developing computers and control systems with Elliot Brothers and then Vaughan Systems.

I quote the final section of

the *IEE* obituary on Andrew:

'During his working life, he had been an active player in a remarkable progression that saw digital computers start as a gleam in the Admiralty's eye and ended up

as a tool in the hands of every schoolchild'. Thermionic valves to digital chips – and to be ahead of the game at every step! What a record. For me, what a memory!

Alun Williams

JOHN HARRIS

A WINNER of the Bessemer and Glorney prizes when he graduated in 1935, John Harris gained an ARSM and BSc in mining and metallurgy.

His career started as a metallurgist in Tanganyika, the land he later returned to just before retirement, aged 70. By then he was working from UN HQ in New York, having travelled the world on its behalf assessing countries'

mineral wealth or carrying out mineral research. Even then he didn't slow down, but carried out work for a Canadian company in the Sahara.

His most remarkable invention in his early days was an x-ray process for sorting diamonds. Although now the standard sorting process, it was filed away at the time and failed to make his fortune!

John, who lived in The Boltons, London, died in July 2004 aged 92.

ALUMNI NEWS

RSMA AUSTRALIA

Has Ron got you on his list?

RON BUTLER'S New Year resolution has seen him doing something about his 'horribly out-of-date address list' of RSMA members in south Australia.

He 'was a little embarrassed to only have a couple of contacts for John Bramley to call on during his visit in January (see last issue).

He emailed all the addresses he had and half came back 'not known' but asked for help in locating others. It's rather snowballed.

'I now have a list of 128 with more coming in. To make it easier to keep, I'm only recording names, email address, location, and best contact phone number (usually a mobile)' he reports.

If you're an Australian resident Minesman and you haven't heard from Ron, do get in touch. Anyone interested in a copy of the list should also contact him at rbutler@acenet.com.au

CGCA SYDNEY

Where are you?

ANOTHER SOS to help revive the virtually defunct CGCA alumni group in Sydney has been received from Bill Macmillan (macmillanw@bigpond.com or on macmillanw@bigpond.com).

'Please let us know of your plans to visit Sydney. We would like to entertain you and hear about your work', says Bill.

'THE NEXT Governor of Western Australia will be Dr Ken Michael, who studied at Imperial for a doctor of philosophy in engineering', writes Peter Rowe.

'Ken worked for the Department of Main Roads in WA, becoming Commissioner of Main Roads in 1991. He retired in 1997 to establish his own consulting business and became chairman of the trustees of the WA Museum in 1998. He was also Chancellor of Western Australia University where he had completed his engineering degree.

'In 2002 he was appointed chairman of the East Perth Redevelopment Authority.

Ken breaks mould



Between 1999 and 2003 he was the Independent Gas Pipelines Regulator, and ruled on gas tariffs, not an easy job.

'Ken was awarded the

General Division of the Order of Australia in 1996 and was named 'WA citizen of the year' in 2001.

'Ken succeeds Lt Gen John Sanderson, breaking the tradition here of having governors with a military background.

'Ken and his wife Julie have always been keen members of our group in Perth and his appointment is universally popular. We look forward to having a dinner meeting in the future at Government House!'

Peter Rowe (Mech 53)

Peter_Rowe@ghd.com.au

WITH apologies to anyone if we offend, but this piece, emailed to us by Jack Sandy (Minerals 50 – jack.sandy@tiscali.co.uk) had the Editorial Committee in stitches. Jack says: 'It has a particular resonance for any one who has Rutley's Elements of Mineralogy in his library.'

HAZARDOUS MATERIALS' INFORMATION –WOMAN

CHEMICAL ANALYSIS

Element Woman

Symbol ♀

Discoverer Adam

Atomic Mass Accepted as 53.6kg but known to vary from 40kg to 200kg

Occurrence

Copious quantities in all urban areas

Physical Properties

- * Surface usually covered with a painted film
- * Boils at nothing, freezes without any known reason
- * Melts if given special treatment
- * Bitter if incorrectly used
- * Found in various states ranging from virgin metal to common ore
- * Yields to pressure applied to correct points

Chemical Properties

- * Has great affinity for gold, silver and a range of precious stones
- * Absorbs great quantities of expensive substances

- * May explode spontaneously without prior warning and for no reason
- * Insoluble in liquids, but activity greatly increases by saturation in alcohol
- * Most powerful money reducing agent known to man

Common Uses

- * Highly ornamental especially in sports cars
- * Can be a great aid to relaxation
- * Very effective cleaning agent

Tests

- * Pure specimen turns rosy pink when discovered in a natural state
- * Turns green when placed beside a better specimen

Hazards

- * Highly dangerous except in experienced hands
- * Illegal to possess more than one, although several can be maintained at different locations if specimens do not come into direct contact with each other

WE NEED YOUR NEWS

Let us know your news and stories.

Or have you an idea for a feature?

Editorial assistance is available!

Contact is Teresa Sergot
(address on page two).

**COPY DEADLINE FOR NEXT ISSUE IS
FRIDAY 17 FEBRUARY**

More from Downunder

PROFESSOR Graeme Jameson (former Chem Eng staff) was honoured recently with the award of the Order of Australia and his appointment as the University of Newcastle's first professor laureate. Graeme was the inventor of the Jameson flotation cell which is used worldwide in mineral dressing and waste water treatment.

Since retiring from Head of the Chem Eng Department at Toronto University, Jim Smith (Chem Eng PG in late 1950s) has formed Apollo Environmental to promote a patented process for odour removal from gas streams.

He was in Sydney recently supervising the commissioning of a biogas scrubber.

CHEMICAL ENGINEERS 1957-60



From the left, Dave Wilbrahim, Mike Heath, Malcolm Cross, Paul Gallagher, Alan Nethercott, Dave Martin, Brian Stevens, Jim Friend, Barry Daniels, Tony Davis and Don Latimer.

Venue adds to success

DURING February, a group of 11 1957-60 chemical engineers held their annual meeting at The New Cavendish Club. 'This is an excellent venue with helpful and friendly staff – CGCA please keep this facility going', reports Tony Davis.

'There are a few still working away, probably reflecting the different types of employment we had all taken up. In discussing past careers in chem eng there was pretty much agreement that if we were to start again we wouldn't change our career paths'.

Mike Heath announced a group visit to the new Chemical Engineering Dept which was scheduled for September next. To avoid the hassle of arranging their annual meet in the last weeks of the year they agreed on 15 February – again at the New Cavendish.

'Finally, if there are any more of the 57-60 class out there who may have an interest in coming along, please contact Malcolm.Cross@btopenworld.com or me on email for details (ardavis@btinternet.com).

Tony Davis.

It's as though they'd never been apart!

THE 18 civil engineers who graduated in 1955 and their respective ladies were suitably impressed by the elegant council room of 170 Queens Gate, where they held the formal opening dinner of their reunion in June. Among those who spoke during the evening was David Hattersley, the key organiser of the 50th anniversary event.

Next day, as Barry Hatch reports, they enjoyed a guided visit to the present-day department of Civil & Environmental Engineering. This followed a

presentation in Powerpoint by Professor David Nethercott, present head of the department. 'All a bit different from the days of Professor Pippard', he comments.

After lunch at the Polish Club, they toured the campus and were told about future developments. Tea at Queen's Gate completed the reunion.

'We picked up just where we left off 10 years ago', says Barry. 'It seemed like yesterday.'

For any future events or contacts, you can find Barry on bandahatch@aol.com.

CIVIL ENGINEERS 1952-55



Those attending were Peter Clark, Wolf Deane who travelled from Australia to be present, Barry Hatch, David Hattersley, Ian Hemmin, Tony Hoadley, Lawrance Hurst, David Kluth, Robin Law, Joe Modro, Paul Pearce, John Perkins, Mike Phipps, John Quinlan, Ernest Taylor, David Wardle and David Willet (who travelled from Canada)

CAN YOU HELP?

We are intending to carry advertising in Imperial Engineer, especially from companies which provide our members' employment base.

As we did in the last issue, we are asking YOU, our readers, to be our salesmen and women and approach your own organisations to generate some interest and opportunities.

The editors will be happy to follow up your lead if needed.

Please forward all ideas and contact details to Teresa at the Chapter office.

Peter's war childhood on show

IN MARCH 2005 the Imperial War Museum opened an exhibition called 'The Children's War'. The largest item in the exhibit is a house – a full-size reproduction of the 1940s' house made famous by Channel 4 in a series it produced on living through World War II. A selected volunteer family, the Hymers, coped with the food, clothing and other circumstances (other than bombing!) typical of that period.

The boy of the real 1940s' house, Peter Richardson, has it on his birth certificate as the family home. He later became an Imperial engineer and took his BSc(Eng) and ACGI in mechanical engineering in 1952-55 and his PhD and DIC in 1955-58.

Peter Richardson provided personal materials for the exhibition, including photographs, a kindergarten school report and a drawing he made of an airplane which had crashed close behind a house.

Brilliant

'Just a very small component', he says, 'of a very meticulously curated exhibition, highly-evocative of those times, and a brilliant job by the Museum'.

Peter thinks being a child in WWII helped him choose engineering. 'My father was in the Ministry of Aircraft Production', he notes, 'and the first book he gave

me to read was one on how to fly a single-engined propeller-driven plane, with good illustrations about how the controls were connected to the various components'. After the war, engineering seemed rich with opportunities for innovation. It still does.

Charter

Peter is currently active as Professor of Engineering and Physiology at Brown University in Providence, Rhode Island. He points out its original charter was granted by King George III, 'a direct historic connection to my homeland which is rare among universities on this side of the Atlantic'.

His interests in innovation have taken him in directions he had not dreamed of as an undergraduate – biomedical engineering and artificial organs.

After his election as FRS in 1986, he returned to Imperial to give the Sir Owen Saunders Lecture. This focused on artificial organs. At the time Imperial was moving towards incorporating the medical colleges and it was a convenient moment to illustrate that its people were already involved with the subject.

He points out that the inter-departmental alliance of staff and academic visitors who made up the Physiological Flow Studies Unit at IC were major pioneer and have made enduring contributions.



An engineer in the making: Peter, at 18 months, in the garden in 1937. INSET: During a visit to a virtually unchanged house in 1998.

Peter recalls very positively the opportunities students had to take advantage of cultural opportunities that surrounded them, from the many museums to the concerts, including the Proms.

Promenader

'We could get a soup and dessert at the Union building', he says, 'and go and queue for whatever was on at the Proms'.

Lately, he discovered a personal twist at the British Museum: – a piece of sculpture from Persepolis, which he had often enjoyed. It had been found by an ancestor who'd conducted

trenches there in the early 19th century, brought it back and given it to the Museum. So giving items to national museums is nothing new in his family.

'My bits for the Imperial War Museum are nothing like as hefty or as permanent as sculpture like that. Maybe we need to change the old saying about studying history. It should be "If you study history in detail, you are likely to find you have repeated it already"!'.

Contact Peter on peter_richardson@brown.edu The Children's War, compiled from memorabilia and views from children about WWII, is open till 2008 at the Imperial War Museum. Opening hours are from 10am to 6pm.

Tribute to a (virtually) unbeatable team

THERE is no coincidence that the obituaries of Kim Ash and Herman Ramstad were published simultaneously. My time at IC overlapped with theirs and our common thread was the Boat Club.

Rowing then, as now, was a very demanding sport. The weekly schedule of five outings a week in an eight was a feature of the start of every academic year, plus a little sculling and tank work.

Charles Bristow was the club president and head coach, whose life seemed to be bound up with training and motivating

batches of freshers, from whom much of the college rowing talent was drawn. Charlie Newins (I think I have spelt it correctly) was the resident boatman. He had a sympathetic ear for those who kept getting various bits of anatomy in the wrong place at the wrong time, not to mention giving us advice on handling the perennial problem of blisters.

Kim and Herman were a particularly powerful combination in a pair oar and dominated the IC scene for several years. Pair oar rowing is a great deal more difficult than it appears and requires complementary contributions. Put

simply, Kim (stroke side) supplied beef and Herman (bow side) the strategy.

The reason I can write of this with some feeling is that I also rowed pair oar at the time with a very able sculler from Guilds called Martin Gaylard.

Again our contributions complemented. Martin and I had our greatest success in the summer of 1957, when we beat Kim and Herman in the semi-final of the IC intra-college pair oar and then went on to win the final.

I am still unsure how we beat them. Kim and Herman were perhaps less fit than usual,

due to academic pressures. Their sheer power let them lead us off the start just below Hammersmith. When put under pressure from Martin (and me), they started pulling unevenly, allowing us to overtake them and reach Putney first.

This is not written to denigrate them in any way, but simply to confirm their stature. Many in the Boat Club were totally unbelieving of their defeat, and Martin and I were in the position of having dented the image of two indefatigables. Mixed feelings still about that one. **Bill Bradford**



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