



Imperial ENGINEER



**FUKUSHIMA
FALL-OUT
WATER AS
GREENHOUSE GAS
ACADEMICS KNOW BEST
WINNING ESSAY**

ISSUE FOURTEEN *SPRING 2011*

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

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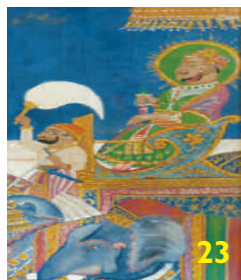
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COVER PICTURE: The district heat plant by the Blue Lagoon that will now produce methanol for motor fuel. See story page 18 and 19.

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I HAVE thoroughly enjoyed the last 10 months in my role as president and it would be traditional to sound a note of regret at how fast my term has passed. Like many of my predecessors, I have found that the time has flown and we have not yet achieved half the things that I set out to do. However, with your support, I hope to continue as your president for another year and I am looking forward to seeing some of the initiatives that we have started come to fruition.

We have set up a new group on the LinkedIn social network (City & Guilds College Association – see the news item on page?). There are already 30 or so members but I hope that many more of you will join. We have also developed some new publicity material which is targeted at recruiting new student members and fresh graduates. In an effort to reach the next generation of Association members, we will be producing a series of YouTube videos about aspects of the Association's history and work. Volunteers to help with the latter will be warmly welcomed!

One of the most pleasurable aspects of the role of president is the opportunity to meet members at the various events organised by the Association. The Decade Reunion Lunch in 2010 was particularly well-attended and I hope to meet many more of you at this year's lunch. By the time you read this, the 2010 Annual Dinner (our 98th) will be a fond memory. We were lucky to have Sir Keith O'Nions and Lady O'Nions as our principal guests and we also had the new Principal of Engineering (Professor Jeff Magee) and two deans of Engineering amongst our other guests. Read more about the dinner on page 7.

On a final note, the Annual General Meeting will be held on June 1 this year. Professor Jeff Magee will be the speaker. The meeting is important because it is when we renew our committee membership. It is a challenge for all voluntary organisations to find sufficient numbers of members who are both willing and able to serve on the committee. If you have an interest in becoming more involved in the Association in this way, please contact me (c.hankin@imperial.ac.uk) or the Honorary Secretary.



**Chris
Hankin**



**Coen
Louwarts**

PRESIDENTS REPORT

FIRST things first: the Bottle is back where it belongs! On a wet and windy February afternoon at Harlington, RSM students celebrated a hard-fought win over Camborne, 25-20!

It is amazing how time flies. In June it's already two years since I took over the presidency of the RSMA. During the AGM/Final Year Barbecue I will hand over the president's chair to Mark Burridge.

During the last two years, the RSMA set out to achieve a number of initiatives, some finalised, some ongoing, others impractical. There have been significant improvements on the communications front, with now over 500 alumni using the RSMA LinkedIn group regularly and this has become an established way to reach alumni quickly. The first of the 'regular' informal student/alumni gatherings was held in January and more are planned for the future. A good start was made to increase sponsorship of students and this will continue. All of this would be impossible without the sterling contributions of the RSMA committee members and a special mention to Teresa, without whom we all would be lost.

Throughout my term I have been fortunate enough to meet many RSM alumni and students. It is fantastic to see the RSM 'can-do' attitude live on so strongly. A number of alumni have started their own resource companies, others are successful in a variety of industries, be it mining, oil or finance. Others have branched out in completely different directions, but all still have a strong connection with RSM and their fellow students. To keep this unique and strong Mines' spirit alive and give current students the opportunity to experience it for themselves, it is important that the RSMA has enough funds to keep supporting the students through various scholarships, grants and social activities. Please keep the Association in mind. We will be very grateful for all donations received!

Finally, I would like to say how much I enjoyed my time as a president and working with the dedicated members of the Committee and College. I hope to meet many of you at future RSMA events.

LEADER

Plus ça change, plus c'est la même chose

IT IS EASY to forget at times that Imperial described itself for many years simply as a 'College of Science and Technology'. In recent decades it has expanded into medicine, the environment and management, which have tended to dominate the public image. This leader should not be construed as a criticism of these changes; simply a plea to rebalance both the reality and the image.

Quite surprisingly, the college motto remains, 'Knowledge is the adornment and protection of the Empire'.

When I trained at the RSM in the 1950s, the ethos of serving in the British Empire was still clearly embedded both in the mindset of many of the staff and in the syllabus. Inevitably this changed as the political balance of the world was so drastically altered in the second half of the 20th century.

These changes peaked (or bottomed?) in the 1990s when the job sector of choice for many graduates was the City of London.

Since then commodities have re-emerged as the driving force of the world economy. This includes both agricultural and mining products.

It seems certain to me that graduates and postgraduates in these and related fields will be in demand for the next two decades at least. I suggest that it is essential that this change is reflected in the way that Imperial both sets itself up and also presents itself to the world.

Bill Bradford

CGCA strengthens links on-line

CGCA has set up a group on the LinkedIn networking service and will use it as another channel of communication with members and prospective members. As with all LinkedIn groups it also allows people to interact, join in discussions and find old friends.

The group is called 'City & Guilds College Association'.

To find us, sign in to www.Linkedin.com, go to Groups, 'Groups Directory' and search for 'City Guilds College Association' and we should be top of the list.

The group has just started and we will expand the information and facilities into the future. 'We encourage all Association members and

prospective members to join the group and keep in touch with Association and College activities,' says group manager Nigel Cresswell.

Both the CGCA LinkedIn group and the LinkedIn service are free. For further information please contact the group manager, **Nigel Cresswell** nigel.cresswell@hotmail.co.uk

CEEQUAL extends range

CEEQUAL, the assessment and awards scheme for improving sustainability in civil engineering and the public realm, has undertaken some major developments in recent months.

In January, CEEQUAL International was specifically created for assessment beyond the UK and Ireland.

On March 1, CEEQUAL Term Contracts started. This was created to enable CEEQUAL methodology to be used on contracts for maintenance and multiple small works.

The very first CEEQUAL Outstanding Achievement Awards were presented at a dinner on March 14, almost 12 after Roger Venables'



(Civils 69) idea of developing CEEQUAL was first discussed by the Institute of Civil Engineering.

Fourteen infrastructure and civil engineering projects in the UK either won one of eight Outstanding Achievement Awards or received one of nine Highly Commended Awards.

A measure of the high standards set by judges is that no Outstanding Achievement

Award-winning Olympic Park deep foul sewer pumping station made to mimic Joseph Bazalgette's philosophy for public buildings to be iconic architectural features in the urban landscape.

Awards or Commendations were made in Energy & Carbon and Transport. For more info go to www.ceequal.com.

The Bottle's back

NOT ONLY did RSM regain the famous Bottle during February's weekend matches against Camborne School of Mines it also triumphed during a number of other fixtures.

Played this year at Imperial's Harlington grounds, the score of 25-20 means the Bottle is back where it has lived during the majority of the days since the weekends first started.

Apart from men's hockey, which Camborne won 1-4, football at 2-3 and basketball (40-64), all the other rosettes went to RSM.

The ladies' hockey team

won 5-3, squash was won by 3-2 and the golf by 2.5-0.5.

After a jolly time throughout the weekend, the visiting teams returned to Cornwall, threatening revenge when the RSM visits the Duchy.

More to follow?
FOLLOW computer links at the end of articles to read more.
Or go to www.imperial.ac.uk/about/alumni to read more of articles marked at the end with an asterisk*.

Tune to Imperial

IMPERIAL'S new channel on iTunes U offers more than 700 pieces of audio and video content covering all areas of the College's research, teaching and student activities. The channel allows users to download audio and video clips. They include gems from Imperial archives, scenes of modern campus life and interviews with academics explaining their research.

It is an educational resource that can be used within the College community and more widely. Organisers are looking forward to staff and students getting involved.

iTunes U: <http://bit.ly/hqPJAp>

Communications director starts alumni news update

FOLLOWING last year's appointment of Tom Miller (Biology 95) as director of communications and development (which includes alumni development), nearly 50% of alumni groups have made contact.

His first quarterly update email has announced the publication, in May, of a 'refreshed and revitalised' Imperial magazine for alumni worldwide.

Sir Keith O'Nions has already hosted alumni events in Beijing and Taipei, in conjunction with local alumni groups.

As these events are so

popular, Sir Keith is also making plans to visit New York, Hong Kong, Geneva, India and probably Singapore later this year.

Local association chairman will be given good warning as the aim is to schedule alumni opportunities during the visits.

'I hope my update email will be the beginning of greater collaboration between the College and alumni groups,' says Tom. 'Your comments are always welcome to me and Zoë Perkins, head of the Alumni Office. t.miller@imperial.ac.uk and z.perkins@imperial.ac.uk.



FIFTY years after he drove Bo in the London to Brighton Run, Robert Gilmour (EE 61) took this picture of Bo passing the Brighton Pavilion. She was en route from the 2010 finish to the reception on Brighton's Madeira Drive. gilmour6@btinternet.com

Fukushima fall out?

AS WE go to press, the efforts to stabilise the damaged Fukushima reactors are far from complete. The initial hysteria seems to have abated but the damage to the image of the nuclear power industry will take a major long-term effort to repair. To put matters in perspective, a brief review of the facts is in order.

The Fukushima plants use boiling water reactors (BWRs) and were built by General Electric in the late 70s. As Professor Robin Grimes (Materials) has said: 'There are certain

design features of this generation-one reactor which would not be allowed now.'

However, they successfully withstood a Richter 9 earthquake whilst being designed for a Richter 8. The reactor shutdowns started normally, with backup diesel generators running the cooling water pumps. These were unfortunately overwhelmed by the tsunami cresting over the protection wall. After depleting backup battery power, the pumps shut down and the reactors began to overheat, which started the emergency.

The cooling process seems now to be getting under control and the immediate threats

to public health from radiation appear to be minimal. Although the recent upgrade to a Level 7 incident underscores the seriousness of the situation.

While being worse than Three Mile Island (1979), it is probable that the overall impact will be similar, ie primarily psychological. No future 'western' reactor accident is likely to approach the Chernobyl catastrophe (1986) and it is instructive to review its effects so far.

After 25 years, the total directly attributable

fatalities are approximately 50.

Regarding the future, the UN Scientific Committee of the Effects of Atomic Radiation states that, with the exception of a possible 500 early deaths from thyroid cancer, 'there is no evidence of a major public health impact attributable to radiation exposure two decades after the (Chernobyl) accident.'

The major thing we have to fear, it seems, is fear itself.

We look forward to our readers' comments which we will incorporate into a more detailed report on the accident.

Bill McAuley

COMMENT

Fees hike

IMPERIAL College is one of a group of universities which has decided to set fees at £9,000 for home and EU students for the 2012 entry. This is subject to agreement by the Office for Fair Access.

The reason for the hike is, as the rector, Sir Keith O'Nions said:

'To maintain the excellence of the education Imperial College gives students. We still have a way to go in our considerations about what forms of financial aid would attract and support the most able, but needy, students,' he concluded.

Royal visit

DURING Prince Andrew's visit to Imperial recently, he heard

about the College's international partnerships, visited early-stage companies in the Imperial Incubator and learnt about developing robotic technologies to enhance surgery.

Speaking at the time, Sir Keith O'Nions said that broadening the reach and impact of Imperial's education and research brings most value to society.

Top investor

IN DECEMBER, Imperial Innovations Group plc, the company that commercialises technologies and discoveries from Imperial College, announced a fundraising worth £140 million to the Stock Exchange. It will boost support to inventions inspired by College research.

The investment makes Imperial Innovations the UK's largest company investing in university inventions, and will accelerate the number and size of investments that can be made to Imperial spin-out companies.

<http://bit.ly/ijYP93>

OC Trust entertains

LEADING staff members from the Engineering Faculty, including the principal Professor Jeff Magee and three heads of department, attended the Old Centralians' Trust's reception held on January 18.

This annual event is organised to thank staff for the valuable assistance they have given during the year and to enlist their support for the next year.

The Trust relies heavily on staff to help publicise awards and in the selection of preferred candidates for awards such as those for 'Student Activity'.

Where students find themselves in financial hardship, it is often a senior tutor who will bring it to the Trust's attention, so that the student can be encouraged to apply for assistance.

DIARY

Wednesday June 1

CGCA AGM & President's Evening, Pippard Lecture Theatre 17:30. Supper in Tower Rooms, South Kensington 19:00

Tuesday June 21

Faculty of Engineering Teaching Awards Ceremony and Reception Skempton Building, Room 164, 16:00

Saturday June 25

London Walk –Without the City Walls: Tower Hill along the eastern boundary to Spitalfields via Aldgate and Brick Lane

All welcome. Please email johnsheilabackhurst@tiscali.co.uk for further details

Thursday June 30

RSMA AGM /Final Year Barbecue, 58 Prince's Gate, South Kensington, 18:00

Thursday October 20

Careers Advisory Service / Chapter Engineering Careers Fair, Queen's Lawn Marquee. Networking Reception tbc

Thursday November 17

Careers Advisory Service IT & Technology Careers Fair, Queen's Tower Rooms

Friday November 18

RSMA 127th Annual Dinner Ballroom, Polish Club Ognisko, 55 Exhibition Road, 19:00 for 19:30

Saturday November 26

CGCA 2011 Decade Reunion Luncheon, Polish Club Ognisko, 55 Exhibition Road, 12:00 for 12:30

Friday December 9

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

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

Noughties remember student days

NOVEMBER'S convivial Decade Lunch was host to some for the first time since graduating. The most were from the 80s, followed by the 60s. Sadly, there was no-one from the RSMA.

Everyone had ample opportunity to mingle and chat before their first course, after which Peter Warner (Mech Eng 70s) gave a couple of anecdotes about Peter Moore. In one, Peter had carried on two telephone conversations simultaneously, and two additional conversations – one with lab staff and another with his tutor group. And whilst he should have been at an tutorial!

Robin Davies (Civils80s) recalled the Calla-



ENJOYING a ride in Bo. A trio from Civil Engineering 80, from left: Colin McKinnon, Fay Grace (née Hood) and Tim Crome.

ghan to Thatcher transition, managing with only a modest overdraft and working with computer cards and Fortran, after slide rules in the first year.

Tim Wadsworth (Mech Eng 60s) commented how Imperial has a terrific press these days and celebrated that 'I had been there'. How many of his vintage would get in now, he wondered. Tim noted how much fun he had had, yet at minimal cost.

Tim had driven to the lunch in his lovely, dark green 1931 two-litre Lagonda, which he and a couple of others had acquired whilst at college. Tim has kept it ever since, and, in addition to offering it as stylish wedding transport, he also races and hill-climbs with it.

Finally, Victor du Mesnil du Buisson, C&G Union president, whose term of office had been a touch unconventional thus far, apologised for being French and for studying computing! He expounded eloquently – amongst other matters – on how students were appreciating the notable sums spent in upgrading the union.

This year's luncheon is on Saturday November 26. See application form: www.cgca.org.uk/events/ **David Law**

Cyber wars threaten, warns Sue

BEFORE last December's CGCA Christmas Luncheon, president Chris Hankin introduced Baroness Garden (right) to speak about the subject *Protecting Europe in a cyber world*.

Sue Garden, widow of Tim Garden, also a great friend of Imperial, is now a government whip and a spokesperson for Business Innovation and Skills, also for Culture, Olympics, Media and Sport.

She began by speaking about the coalition and said that, right from the start, MPs and peers from both parties forged effective working partnerships, mostly with mutual respect and a very real will to reach consensus.

'Not for the first time, many stories in the media are a far cry from what is actually happening.

'As a member of the



home affairs committee before last May, we decided to look into EU measures to protect its member countries against cyber-attacks.

'Anyone who doubts the havoc which successful cyber attacks can cause, need look no further than May 2007 when Estonia virtually ground to a halt because of attacks thought to be by a number of disgruntled Russian students.

'More recently there was Stuxnet, a highly-sophisticated computer 'worm' designed to attack specific

industrial infrastructure.

'Network security is largely in the hands of the Computer Emergency Response Teams (CERTs). JANET, the CERT for the academic world, protects up to 16 million people.

The EU proposed that all member states should have national CERTs. The UK has no need for one but realises that some countries have little or no CERT capacity. For them it would be valuable internet protection.

'Strategists call cyberspace the fifth domain of warfare, in addition to land, sea, air and space. The virtual world is ruled by computers, linked by the internet and threatened by weapons that are no more than lines of software code. They are potentially as destructive as any bomb could ever be.'

Colleen Shilstone Richards

Spirit still strong at RSMA

THE RSM and RSMA have always known how to party and November's 126th RSMA Annual Dinner at the Polish Club lived up to tradition.

A delicious dinner over, the toasts and speeches were introduced by president Coen Louwarts. He referred to the great spirit he had seen still present among current students and made two presentations.

Giles Baynham, president from 2003 to 2005, received the Peter Harding Medal for his 'sustained and outstanding commitment to the RSMA'. In his thank you speech he reminisced about Peter Harding, his service to Association and College and the numerous verses of the Mines Song he could recite.

Chemical Engineering student Norman Ng received a cheque for his winning essay in the annual competition run by RSMA. It is now open to all engineering students. (See pages 14 and 15 to read the essay.)

Guest speaker Mark Wellesley-Wood, now head of mining at Ambrian Partners, admitted that many of his student lectures remain a mystery, especially those on thermodynamics. He spoke about how being at RSM opened one's eyes to different countries, people and life-styles.

The industry needs all sorts of people with varying skills as 'we are going into a resource war against very rich and new competitors. As



An evening of fun and friendship. From left, Jeremy Mockridge (ESE 72), Coen Louwarts (ESE 96), Mark Wellesley-Wood (ESE 73) and Danny Hill (ESE 09).

people get richer the price of resources tend to rise,' Mark said. 'But you ain't seen nothing yet!'

However, if you are happy and successful, said Mark, he was there to persuade you to give something back.

Committee member Simon Pike (Materials 07) had already taken 'donations' from diners for a very successful raffle. He also proposed the toast to guests.

Answering RSMU president Ben Moorhouse gave

heartfelt thanks for RSMA's generosity in supporting students, particularly in a time of cuts.

With those present, he rejoiced in the return to union status and thanked Coen and Giles for their particular help.

Other thanks for the event went to Teresa Sergot for her organisation and to concert pianist Heather Charlton for her recital. Heather was guest of Nick Fern (Min Tech 65).

Lynn Penfold

SOME 137 CGCA members and guests, including 18 students, convened for the Annual Dinner at Saddlers' Hall in March. Association president Professor Chris Hankin welcomed all to this 98th gathering.

The toast to the Association and the Faculty of Engineering was delivered by Sir Keith O'Nions (below), rector of Imperial College. Sir Keith's address concentrated on the new government policy for higher education, 'the biggest change for 50 years'. What does this mean for the future?

In research, the post-



CGCA celebrates

WWII policies of the UK and the US have been very similar. They have been founded on the belief that research 'in the purest realms of science' has been essential for new technologies.

In teaching and training, the US relied on a mixture of public and private institutions, with students providing a portion of the costs. In the UK, the state paid for all qualified to attend. This has changed, with the UK moving to US-style funding.

What will be the result? Top institutions will charge top fees and there is a risk that low-income students will be dissuaded despite loans being available. However, Sir Keith was optimistic that private industry would help, and government would support with fiscal and soft

loan incentives. In the long run, strong institutions like Imperial would benefit. The President endorsed these views and proposed the toast to the guests.

Sir Kevin Tebbit, chairman of Finmeccanica UK, replied for the guests.

Before the proceedings ended with the traditional Boomalaka, dean of Engineering Professor Richard Vinter presented an engraved tankard for the Holbein Memorial Award to Guilds 'Sportsman of the Year', Joseph Harris. Another, for the Peter Moore Memorial Award, went to the 2010-11 Boanerges driver, Rob Carter.

Bill McAuley

RIGHT: Laura Hare who received an OC Trust enterprise award for working with sea cadets in Willesden.



TOP: David Hankin (Aero) and fiancée Anna Kavakava (ChemEng) talk to his dad, the president.

ABOVE: Andrew Smith and Matthew Wright lead with Bolt and Spanner.



DEVELOPMENTS AROUND THE ENGINEERING FACULTY

Sharp stones to stone axe

STONE-AGE humans were only able to develop relatively advanced tools after their brains evolved a greater capacity for complex thought, according to a new study by Bioengineering. They investigate why it took early humans almost two million years to move from making razor-sharp stones to a hand-held stone axe.

They used computer modelling and tiny sensors, embedded in gloves to assess the complex hand skills that early humans

needed during the Lower Palaeolithic period. Evidence from studying both tool-making techniques, confirms that the evolution of the early human brain was behind the development of the hand-held axe.

From crude stone tools to handheld axes was a massive technological leap. The study also reinforces the idea that toolmaking and language evolved together, so the end of the lower palaeolithic was a pivotal time in our history.

Biomass is burning issue

GOVERNMENT subsidies that encourage energy companies to burn timber are distorting the market for wood and forcing up prices in certain industries

'The idea behind subsidising burning of biomass in coal-fired power stations was to try and establish domestic growers, and a domestic supply

chain for wood,' explains Dr Rob Gross (Centre for Environmental Policy).

'If that could be made to happen, then that would be a very good thing for biomass fuel. It should also relieve the pressure on furniture makers and other users of wood.

'Unfortunately, despite trying for about the last 10 years,

Parasite detector wins prizes

A TEAM of undergraduates from Imperial won three awards at the International Genetically Engineered Machine (iGEM) competition with 'Parasight'.

The prototype device detects parasites in water supplies by using a modified bacterium to make water turn yellow if it is contaminated with the flat-

worms that cause schistosomiasis. This is a neglected disease that affects 200 million people in tropical countries.

Ben Miller of Bioengineering said: 'We want to develop Parasight to provide an inexpensive, rapid and easy-to-use tool so people can monitor water in their communities.'

Journey to the centre of the earth

AN INTERNATIONAL group of scientists wants to drill through the Earth's mantle for the first time.

The Integrated Ocean Drilling Program (IODP)'s scientific programme for 2013-2023 includes plans for a 1.5km deep bore-hole into the base of the world's largest known crater, Chicxulub in Mexico. It was created by an asteroid strike

thought to have ended the age of the dinosaurs about 67 million years ago.

Dr Joanna Morgan (Earth Science and Engineering) said: 'Something very strange has happened to these rocks during the impact event – this will tell us where they're from and what sort of shock pressure they were subjected to during the impact.'

Green aviation revving up

IMPERIAL'S new Green Aviation Forum is acting as a conduit for new collaborations between the College, the aviation manufacturing industry, climate scientists, the regulator, airline operators, airport authorities and government.

Professor Ferri Aliabadi, head of Aeronautics, says: 'We are working with our partners towards a new generation of ultra light commercial passenger aircraft that can fly faster over longer distances, producing lower emissions and less noise.'

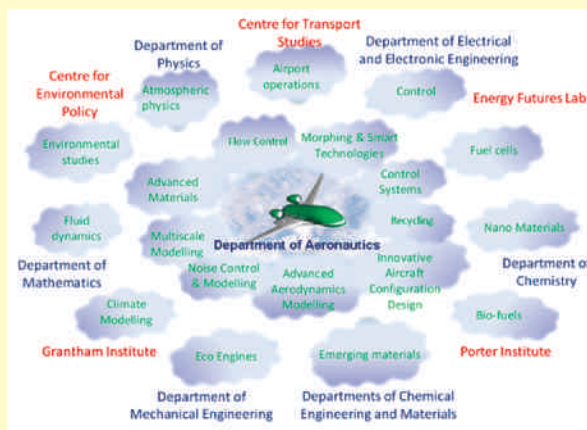
At present emissions from the aviation industry account for around 3% of CO₂ emissions, while air travel is expected to increase by approximately 5% per year over the next 20 years.

Europe's aviation industry has agreed to a set of targets that would reduce fuel and carbon dioxide emissions by 50% per passenger kilometre,

nitrous oxide emissions by 80% and noise pollution by 50%.

Aeronautics' Professor Christos Vassilicos and his team are designing new types of spoilers (flaps) to create high frequency sound when a plane comes into land, dissipating the low frequency sound and neutralising the noise pollution. In Chemical Engineering, Professor Jonathan Morrison and

colleagues are developing a new electro-active plastic for covering aircraft fuselages and wings to reduce drag by pulsing low-level, electrical currents through it that keep the plane stable in the air. Reducing the number of parts and giving the plane a streamlined body makes the plane lighter, lessening drag and improving fuel efficiency.



Apocalypse how?

RESEARCHERS from Earth Science and Engineering have updated an asteroid disaster calculator first produced in 2004. Users can vary a range of factors on the online calculator, such as the speed and size of the looming asteroid.

The program then provides an estimate of the effects of the collision, including the size of the crater. It was devised at Imperial and Purdue University.

Dr Gareth Collins of Imperial said: 'We've had to update things as knowledge has improved. One of the major new additions is the estimates for tsunami wave height at a given distance away from an ocean impact.'

The source of most of these articles is the College's press releases. For more on these stories go to www3.imperial.ac.uk/news

CCS could promote growth

DEVELOPING carbon capture and storage (CCS) technologies on a large scale in the UK could promote economic growth, according to two papers published by Imperial's Grantham Institute for Climate Change.

It would spawn new, green technology companies and services which would build and maintain CCS infrastructure.

CCS technologies are de-

signed to trap CO₂ from industry, transport it via pipelines and store it in offshore underground reservoirs.

CCS has never been used on a large scale to capture emissions from industry and power plants.

The papers point out that the UK is in a unique position to develop CCS on a large scale. It has extensive oil industry expertise and a con-

centration of industries along the coast close to depleted offshore oil and gas reservoirs where CO₂ can be stored.

A large-scale CCS network could be built along the east coast of the UK. This would use a pipeline network to carry CO₂ from industries to local storage facilities (hubs), which would pump the gas onwards to underground offshore reservoirs.

Humberside is a good example. It has several power stations that emit 60 megatonnes of CO₂ a year.

However, UK government and industry needs to invest more money in R&D, so that rapid improvements can be made to CCS technologies.

Governments will also need to develop credible policies and regulatory frameworks, to assess and manage the economic, health, legal and environmental issues associated with full-scale use of CCS.

A TEAM of Imperial engineers has collaborated with the producers of BBC's Blue Peter recently to test the theory behind the fairy tale Rapunzel.

The team made a simple contraption of four hanks of plaited human hair from which Andy, the presenter, was suspended (right). Fellow presenter Barney cut through two of the plaits before Andy fell, proving that Rapunzel's prince could have climbed up her hair.

Speaking about the project Dr Andrew Phillips (Civil and Environ-



Fairy tales can come true

mental Engineering) said: 'This project provided us with a wonderful opportunity to demonstrate to children how fascinating engineering can be. It's not every

day that a fairytale provides the impetus for a project that helps a young audience to see how engineering can be used to solve problems and explain things.'

DURING the Late Heavy Bombardment (LHB), a time in the early solar system when meteorite showers, lasting around 100 million years, barraged Earth and Mars, sulphur dioxide was discharged into the upper atmospheres.

Professor Mark Sephton, an author of the study says: 'Far less of the Sun's energy was reaching Earth four billion years ago,

Apocalypse then

which would have made it hard for early life to emerge. Mars was starting to lose its greenhouse gases at this time, causing global cooling. The influx of sulphur dioxide into the Mars's atmosphere would have dealt a further blow to a planet already on the ropes.'

This study is a continuation

of earlier work which has discovered that meteorites are not the source of the present-day methane in the atmosphere of Mars, raising hopes that the methane is being generated by life on the red planet. Their work has also shown that meteorites delivered other important gases to Earth during its early history.

Is solar too much of a good thing?

THE MOVE to push Germans into installing rooftop solar panels and then sell surplus power back to Germany's ageing power grid, has been very successful. So much so that too much power could be fed back to the

grid and overload the system.

It is a timely lesson the UK could learn from, now that there are government grants for the same purpose here.

Professor Tim Green (Electrical and Electronic Engineering) has

commented that the grid would need strengthening in areas where solar power generation could overtake demand, adding: 'If you lose flexibility on the supply side, you need to gain some on the demand side.'

Nuclear not dead in the water

AN OUTLINE of a 20-year master plan for the global renaissance of nuclear energy has been developed at Imperial and the University of Cambridge. It could see replaceable parts, portable mini-reactors and ship-borne reactors supplying countries with clean energy.

Professor Robin Grimes (Materials) said: 'Imagine portable nuclear power plants at the end of their working lives that can be safely shipped back to the manufacturer for recycling.'

Shallow quake more deadly

NEW ZEALAND's 6.3 magnitude earthquake occurred just 5km below the Earth's surface. This shallow depth meant that the quake was more destructive on the surface compared with earthquakes at deeper depths.

Dr Peter Stafford (Civil and Environmental Engineering), who was born in Christchurch, said that the strong lateral movement of the plate was more than the city could take. 'Initial reports ... indicated that the levels of shaking, that were observed in and around Christchurch, were significantly greater than the levels that structures are typically designed to withstand,' he said.

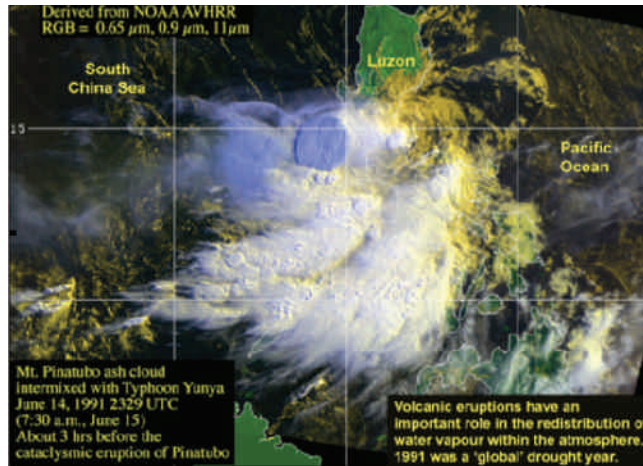
Professor Wyss Yim (RSM 74) takes a look at

Climatic effects of atmospheric water vapour distribution through volcanic eruptions and human activities

VOLCANIC eruptions and human activities are both important in changing atmospheric water vapour distribution. In comparison with the emission of carbon dioxide released during the consumption of fossil fuel, water vapour's role in climate change has been grossly underestimated. Studies made of volcanic eruptions, including satellite images of cloud cover and meteorological records, have revealed climatic effects in different parts of the globe through the migration of volcanic clouds, depending mainly on their timing, location and Volcanic Explosivity Index (VEI).

The largest eruption in the past 50 years is the June 15 1991 eruption of Pinatubo in the Philippines (VEI = 6), when the maximum cloud height reached 55 km above sea level. This eruption coincided with the passage of Typhoon Yunya over Luzon (see above). Because a large quantity of water vapour transferred from the troposphere and the volcano into the stratosphere, 1991 was a year with global rainfall significantly below normal while temperatures in the northern hemisphere were lowered by ~0.5°C

Particularly noteworthy is the variability in rainfall through the occurrence of extreme environmental events, shown below. Although dry years with below-normal rainfall are more common than wet years during years of major



Satellite image showing the Pinatubo volcanic cloud (blue) and the Typhoon Yunya cloud (white) over the Philippines on June 15, 1991. Typhoon Yunya dissipated into a tropical depression within two days.

eruptions, the regional increase in wetness may be explained by wind shifts and/or wind strengthening.

Climatic effects of volcanic eruptions include:

- * reduction in solar heating because of the particulates discharged;
- * interference with the 'normal' atmospheric circulation and/or oceanic circulation;
- * the ash and aerosols provide condensation nuclei for water;
- * the transfer from the troposphere into the stratosphere of water vapour which act as an important greenhouse gas;
- * variability in regional rainfall including droughts, floods, crop

* Anomalous regional wind-storms.

* Acid rain.

Human activities, including water supply schemes, farming, deforestation and the use of groundwater may also change the natural water cycle significantly to contribute to climate change.

A recent example is the Three Gorges Project in China which is a form of 'water pollution' through the introduction of 'unnatural' water to other regions where there otherwise was a supply shortage.

There is an under-estimation of the importance of water vapour as a greenhouse gas in causing climate change. This is shown by the redistribution of water vapour during major volcanic eruptions as well as the overwhelming effect of water vapour in comparison with the current carbon dioxide level of ~390 parts per million. This conclusion is supported by a recent study by Paulo Soares (*Int. J. Geosciences* 2010/1: 102-112). Unlike carbon dioxide, water vapour in the atmosphere rises in tune with temperature changes, even on a monthly scale. Consequently, reducing the current levels of carbon dioxide alone cannot be an effective solution to the problem of climate change.

Wyss Yim is senior research fellow, School of Energy and Environment, City University of Hong Kong and honorary professor, Earth Sciences, University of Hong Kong.

CLIMATIC EFFECTS OF SELECTED VOLCANIC ERUPTIONS SINCE 1960

Volcanic eruption	Main eruption date	Climatic effects
Agung, Indonesia	18/2/1963	Worst drought year on record in southern China
El Chichón, Mexico	28/3/1982	Second wettest year on record in Hong Kong
Pinatubo, Philippines	15/6/1991	Year with global rainfall significantly below normal
Chaitén, Chile	2/5/2008	Wettest June in Hong Kong since record began in 1884
Okmok, Alaska, USA	12/7/2008	Severe winter in north America and northern Europe
Kasatochi, Alaska, USA	7/8/2008	Severe winter in north America and northern Europe
Sarychev, Russia	15/6/2009	Severe winter with heavy snowfalls in Manchuria
Soufrière Hills, Montserrat	11/2/2010	East Atlantic frontal activity storms including Xynthia
Eyjafjallajökull, Iceland	14/4/2010	Severe floods in central Europe, Pakistan and China
Shiveluch, Russia	23/10/2010	Worst drought in 200 years in Shandong, China
Kliuchevskoi, Russia	28/10/2010	Worst drought in 200 years in Shandong, China
Shinmoe-dake, Japan	2/2/2011	Worst drought in 200 years in Shandong, China

GORDON JACKSON (Civils 72) looks back at the three principles, learnt at Imperial in 1969 – when he first started programing in FORTRAN – which he uses now to help organisations employ web technology strategically.

They are:

Audience Principle – identifies desires, mindset and expectations of your intended audience.

Language Principle – understand the way your audience wants to express its needs and the way it can best understand the results.

Stewardship Principle – conserve your audience's time through efficient and effective use of computer resources.

While everyone agrees that computer technology has undergone radical change, the skills and principles imparted by Imperial – over 40 years ago – have repeatedly withstood the test of time.

BRIDGING PAST AND PRESENT

I'm tremendously grateful that I was offered ample opportunity to write 100 word abstracts, learn how to organize reports and how to write clearly and concisely during my seven years at Imperial. I'm also tremendously grateful for the excellent tutoring received during my seven years at Imperial.

The web audience principle learned!

In 1969, the college library catalog was accessed by using 5x30 record cards that were created on a typewriter. To find books and articles required a clear understanding of language and keywords that librarians used for indexing purposes. The language principle learned!

In 1969, the state-of-the-art at Imperial College was punched cards running on a vacuum tube mainframe – an IBM 7094 with 32K of RAM memory. See background illustration.

Back then, even programing simple tasks required detailed knowledge of hardware, software and the operating system. I have continually used this understanding of computer data processing principles to perform differential diagnosis and to bring data retrieval and page display times to acceptable levels.

The stewardship principle learned!

WEB AUDIENCE PRINCIPLE

While the word 'audience' is often tied

PRINCIPLES STAND THE TEST OF TIME

to a 'performance', its application to web site design can help focus thinking in the design of effective web interfaces and processes. An effective site will be tailored to the personality and educational background of the intended audience.

To accurately define the audience's personality, desires, mindset and expectations may take research with quantitative analysis and/or subjective review. For example, a very recent research article, by Adriene Lim examined the effectiveness of web content on academic web sites for diverse user populations. She evaluated content using quantitative and subjective assessments from a focus group of university professionals familiar with providing services and advocacy for first-generation undergraduate students.

Another example is a website designed by me. The intended audience comprises engineers who want to specify and obtain price quotes for prototype quantities of electronic hardware and fasteners:

www accuratescrew.com

LANGUAGE PRINCIPLE

Again it is helpful to broaden the concept of language beyond that of a country. Easiest comprehension of page content and the fastest navigation occurs



Born in Tokyo, Gordon's education culminated with a PhD in computer applications from Chemical Engineering in 1972. Gordon (pictured in Rome) lives in Western New York and is CEO of Trio Company which he set up in 1980. It helps organisations deploy web technology strategically. gjackson@triocompany.com

when a site uses the 'language' of the audience. This is determined by analysing factors such as the reading level, vocabulary and audience. For example, the author discovered that chemical engineers loved and could rapidly assimilate the results when concentrations were converted to PPM or percentages rather than expressed as decimal numbers.

Using the audience's language and giving their vocabulary prominence in the content may also have the additional benefit of providing search engine optimisation (SEO). For example, returning to accuratescrew.com, a recent Google search for 'Captive Screw Assemblies' ranked the site number one out of approximately 54,000 entries.

Also, some learn visually – so that should be factored in when considering communication approaches. In effect, they understand the 'language of graphics'.

STEWARDSHIP PRINCIPLE

Usability rules the web, and to achieve that usability requires the application of the stewardship principle to the audience's time and to the use of computer resources. Well-programed, clearly organised websites, tailored to the audience and their language, will use time and resources wisely.

Assuming that the correct content has been prepared in a way that can be found easily by the audience and/or search engines, time stewardship will probably relate to the time it takes to load the page.

Whatever the design point, fast page load times will always require detailed optimisation in areas such as search functionality, bandwidth utilisation, processor speeds, content and layout.

In today's parlance, one might also say green web programing is mandatory, since computer resources are still not infinite!

FEATURES

Tynemarch – a company whose original concept is still strengthened by College connections

TYNEMARCH was founded in 1983 by three staff members from Civil and Environmental Engineering with the agreement of the College. Two founding directors, Jeremy Lumbers (Civils PhD 87) and Stephen Cook (Civils PhD 83) are still with the Company, being chairman and managing director respectively.

The third director Paul Jowitt (Civils 72) chose an academic career with a chair at Herriott Wattt. Paul is immediate past president of the Institution of Civil Engineers. In 1991, he was replaced on the board by Robert Warren (Civils MSc 84), an Imperial environmental engineering MSc graduate.

The Imperial connection remains strong with associate director, George Heywood (Civils MSc 84), another environmental engineering MSc, and other staff such as senior analyst, Julian Rickard, having a PhD in modelling and optimisation from Chemical Engineering (99).

ACHIEVEMENTS

The company focus was, and continues to be, the application of advanced modelling, optimisation, risk analysis and database technologies to maximise operational efficiency and to identify the most cost-beneficial capital investment, mainly but not exclusively in the water industry.

Tynemarch has become a leading company in its field with a strong

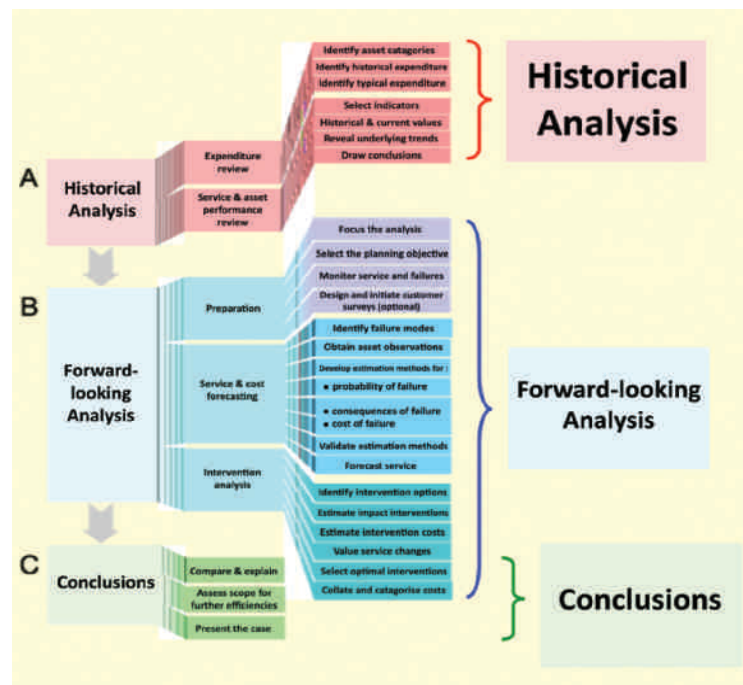
track record of achieving innovation in the water industry such as:

- The first on-line application in the 1980s of water pump and valve scheduling to minimise energy costs,

- Data validation and derivation software that processes all the telemetry and logger data gathered to manage the London Tunnel Ring Main for water supply – a vital component of the capital's water supply system

for water supply – a vital component of the capital's water supply system

- The development of MISER, a software package that supports the optimal management of water resource and supply systems – both for operation and investment planning. MISER is used by 13 of the UK water companies, four of the major engineering consultancies, British Waterways and



Components of the Common Framework

running 24-7 and achieving savings equivalent to a one year pay-back period of the system cost.

the Environment Agency.

- The development of the Common Framework for Capital Maintenance Planning for optimising the maintenance and repair of water industry assets published in 2003. This UKWIR and Ofwat funded project has moved the industry into the adoption of a forward-looking, risk-based approach to assessing the most cost-beneficial investments to achieve target levels of customer service. The approach proved successful for the 2004 price review and has been embedded in the 2009 Price Review.

- A National Mains Deterioration project which developed 24 water mains burst rate models, calibrated using both national and company-spe-

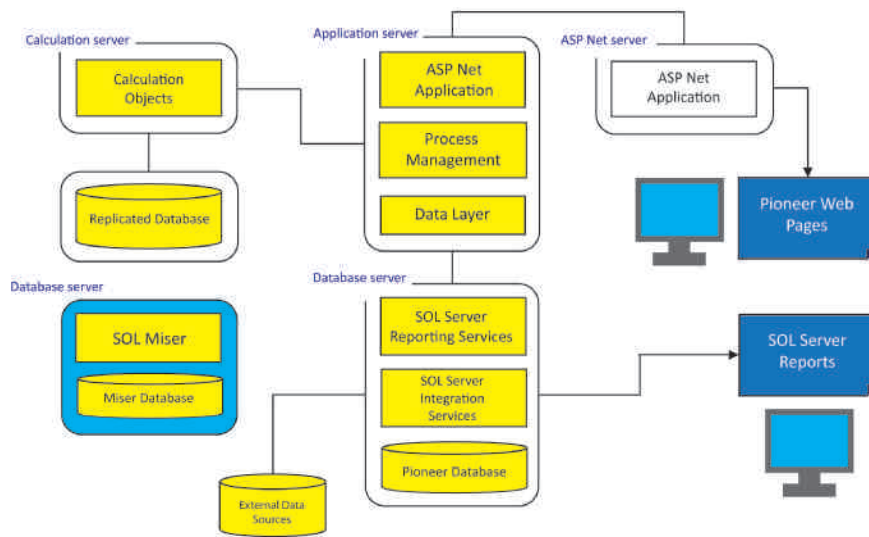
Author of this article, Jeremy Lumbers has a PhD in environmental engineering from Imperial and his MSc in water resources technology from Birmingham. His experience includes considerable international activity and he acted for many years as a consultant to the WHO and several UK consulting firms.



He was project director of the development of the UK Water Industry Regulator Common Framework for Capital Maintenance Planning in the water industry and the subsequent development of a manual of good practice.

Jeremy was a senior lecturer civil and environmental engineering when he left Imperial in 1991 after 12 years. He had a key role in introducing environmental engineering into the undergraduate programme and the move to a four year course.

His main area of activity was post-graduate training and research, with a focus on modelling, optimisation and risk applied to many aspects of the water cycle.



PIONEER systems architecture

cific data sets and covering a range of material types. A 'maximum likelihood estimation approach' was used which involves finding the combination of model parameters that maximises the probability of observing a set of historical records identical to that used for model calibration. Formal calibration and validation were undertaken using different data sets.

PIONEERING

The most recent system developed by Tynemarch is a software environment called PIONEER within which a variety of asset deterioration and service forecasting models can be run. The system operates on a client's intranet and is accessed via a web browser.

The principal components of PIONEER are:

- An asset data store that collects together data from a number of sources for use in serviceability forecasts and optimisations.
- A serviceability and cost forecaster that stores and allows user configuration of models for estimating future values of serviceability indicators and costs, with and without maintenance interventions.
- A set of user-configurable intervention options to be considered for assets, and the models to be used to estimate their costs and benefits.
- An optimiser that selects the interventions required to meet a user-defined planning objective.
- A job scheduler that allows the

user to set up and run a series of forecasts and optimisations.

- Flexible tools for results presentation and reporting.
- Maintenance of an audit trail.

The analysis is based on the principle that future Serviceability Indicators are related to the likelihood of assets to fail and the extent to which they are improved through capital maintenance. The manner in which an asset can fail and the characteristics of the failure are known in the system as a Failure Mode. Failure modes have associated serviceability consequences and costs. Consequences are measured against Serviceability Indicators, which may be environmental, such as pollution, or service, such as poor water taste and odour, or asset performance, such as pipe bursts.

The models used to predict the burst rate of water mains and the associated consequences make use of a wide variety of data including:

- Mains data such as age, material, diameter, length, hydraulic characteristics, connectivity, connection density and network configuration.
- Environmental data such as: soil corrosivity, soil fracture potential, temperature variations, water pH, socio-economic data and surface use.

The PIONEER system allows the integration of leakage targets with other measures of service so that the overlapping benefits of mains replacement work can be taken into account explicitly.

On the other less glamorous, but equally important, side of the water

business is the maintenance of the sewerage system. Similar innovative modelling work has involved forecasting sewer collapse and the resultant pollution or flooding. Models of sewer condition deterioration, collapse rate, blockage rate and flooding and pollution consequences have been developed.

The data used included:

- defect data obtained from CCTV surveys;
- sewer attribute data such as estimated age, material, depth, hydraulic characteristics, connectivity, type, manhole locations;
- digital terrain data to calculate overland flow distance to assess pollution and flooding risk;
- historical maps to estimate age of sewers where unknown;
- environmental data such as soil type, depth, surface type;
- socio-economic data including housing type, income, occupancy,
- hydraulic model outputs.

Deterioration models have been derived from detailed sewer defect data from CCTV surveys, utilising both the number density and severity of defects recorded. The deterioration modelling has made use of improved estimates of the dates at which sewers were laid, based on a unique approach to the automated analysis of historical maps.

IMPERIAL CONNECTION

Tynemarch is actively involved in both internal and collaborative R&D. The Company has been one of the most successful in winning and delivering UKWIR funded projects. A variety of exploratory projects have been undertaken by environmental engineering, hydrology and environmental technology MSc students. They have provided useful experience to the student as well as being a cost-effective way of undertaking the preliminary research. A number of undergraduates have also spent a year with the Company on industrial placement.

The Imperial College connection remains a strong on-going influence within the Company where academic rigour is the ethos. The many ex-colleagues and students continue to be a unique professional network and an enjoyable social contact.

‘SUCCESS. Now all you have to do is report that insurgents destroyed Desert Cry 1 before the National Guard could arrive,’ said the man on the other line as Green walked out the door. Suddenly Green caught a sound from the corner of his ears. Bang! He turned around. Bang! Two more shots were fired as he fell to the floor. Suresh crawled up and shut the gas valves. His life’s work was saved. He took a deep breath as he stared out the tower. Dark clouds covered the land. He sighed in relief. The series of events began lapsing through his mind.

Seven hours ago

‘As we can see from the satellite images, Hurricane Nakahara will break land in four hours. In the European front, a super cell has dumped eight inches of snow and caused chaos in central London. Now back to the world headlines of year 2069. Project DC promises...’

‘Papa, what is a hur-rica-ne?’ exclaimed little Chandra.

‘Turn off the television and come have your breakfast. It’s off to school with you young man.’

The desert heat was already starting to get on his patience as he took his eyes off the microscope. ‘Tensile strength = 28,000 pounds per square inch’ the envelope said. He sealed the specimen in and kept it in his lab coat pocket.

‘I don’t want to go to school! It’s alright my son, let those kids laugh. There’s nothing wrong if you haven’t seen rain before. I promise you that you will see it soon. Now go pack your bags.’

It was a promise that Dr Suresh made a million times. He might have to make it a million more. For you see, little Chandra was born in Desert Cry 3. Right in the middle of the Sahara, Project Desert Cry is a series of outposts that hopes to lead a revolution. Like any revolution, there are those who live it and those who oppose.

In the distance, a loud boom echos. A black SUV pulls out in front of the veranda, stirring up the desert sands.

‘Stay here Chandra, until Mummy comes back.’

‘The national guard will be here soon. Why do you need me?’ Suresh exclaimed.

‘Dr Suresh, the attack on DC 1 has gotten worse. If the insurgents blow the plant, it will start a chain reaction in all 50 outposts. We have to safely cut DC 1 off the grid or lose the project! You have the

Each year the RSMA awards a prize for the best essay by an engineer by an engineering course. The winner for 2010, Norman Ng, la

access codes and the know-how. You will be vital help. I know you will,’ yelled the driver.

In Suresh’s mind that meant two generations of hard work is about to be destroyed – two billion jobs along with it.

‘OK, let’s go Mr Green.’

Dr Suresh got into the vehicle. ‘Why would someone do this? Bomb a waste treatment facility,’ asked Green as he put the pedal to the floor. ‘It’s not only a waste-treatment facility my friend. It’s a source of life!’ replied Suresh.

Desert Cry was a pilot project in year 2030, to prove that humans can reverse the climate change and even terraform inhospitable land. The project saw wastewater being diverted from major cities across the continent into a series of reservoirs beneath the desert sands. Flora slowly replaced the undulating desert drive.

‘Look around you, Green. See what a little bit of wastewater has done.’ Around them was a vast ocean of vegetation, towering some 50 feet above their heads.

Everyone laughed at the thought of greening the desert. Earth engineer Dr Suresh proved naysayers wrong. Funded by world carbon credits, a forest the size of England suddenly appeared in the middle of the desert. It was no easy task though. Like his father before him, he struggled with criticism and sabotage. The concept of sinking so much carbon has shifted the balance of power in the world and some factions will stop at nothing to see Project Desert Cry be reduced to ashes.

‘So, there are terrorists wanting to destroy this forest of kwalu?’

‘No, Green. These are mercenaries. There are many companies who would do better without the existence of OUR kwalu forest,’ Suresh replied.

Kwalu is Zulu for bamboo. A common grass, it is the plant kingdom’s fastest growing woody plant. It grows up to three feet a day and produces lush clusters up to 50 feet. Desert Cry started with one million tonnes of bamboo. Now after the years, it has a hundred billion tonnes. Its rapid growth makes it one of the largest natural carbon sinks in the world. Bamboo is now harvested every year and the bulk of it used for food, wood, textiles, hydrocarbons and fuel.

‘So that’s the objective of Desert Cry?’

‘That’s only a by-product. DC is actu-

Pearls

ally a rain-making operation. By putting moisture into the desert atmosphere, we want to demonstrate that we can control the climate. Earth’s climate control system is the equilibrium of water, but at any one time only so much of the Earth is inundated by rain. Rain not only brings life to the land, it helps clear the air of particulate matter that causes air pollution. In most places, moisture is low, so the air remains smoggy. Few machines can rival nature’s million year old solution,’ explained Suresh.

Underground

The two pulled over at a guarded checkpoint. Ahead was a tunnel leading underground. The barriers were raised and they sped in. There was no speed limit here – 100 mph clocked the speedometer. The perfectly straight tunnel led them 50 feet underground to a tunnel as wide as a three-lane highway. Dazzling lights zoomed past the windscreen. A pungent smell filled the air.

The lower deck of the tunnel transports wastewater from the closest cities. Starting from the populous cities, the tunnel dropped at an angle into a gigantic wastewater storage tank beneath a DC outpost. Gravity did the work. Due to the anaerobic conditions, methane gas forms and passes over the opposing wastewater and flows to the city where it is used for power and heating. The flow of water inland has also helped the seas recover from polluting coastal cities.

‘It was ingenious how the engineers built this tunnel. Their machines only



Norman KK Ng is an engineer from Kuala Lumpur, Malaysia. He says, ‘I simply enjoy coming up with ideas to solve real world problems. I like to see my ideas to be shared. As a global citizen, I believe that the ideas, especially the ones that benefit the Earth which we all share. Hopefully, my work will help to build a better world. kok!’

ering student. Usually they take a conventional look at topics raised
 ks at engineering the Earth in the future from a different angle.

from Heaven

drilled through the circumference of the tunnel and then removed the centre part intact.'

The clock was ticking. The hour that went felt like forever. There was a battle going on above. Year after year, there would be unrest and attacks on the outpost were common. Yet, as the project neared its goals, and threatened the balance of the economy, opposition seemed to be on the rise. Pickets were swapped for guns and bombs. Hence, guards like Green were hired to protect the project sites.

'There it is, DC1.' The underground tunnels were still a safe refuge. Suresh and Green hurried into the elevator. A sea of people evacuated DC1, rushed their way. To the world, DC supported billions of jobs. To environmental engineers, DC1 is merely a giant wastewater plant. To earth engineers, it is the first true terraforming machine mankind has seen. The reservoir could swallow an aircraft carrier whole. Yet, the vapour inside is a thick cloud of methane from ancient bacteria digesting the waste.

'I hope your fancy wall holds,' exclaimed Green as they ascended 150 feet up to the surface.

A five-foot geopolymer wall separated them from the wastewater. The desert had plenty of raw material for a structure this massive. As strong as cement, geopolymers phased out Portland cement as a material of choice. Compared to cement, the same amount of geopolymer produces 90% less carbon dioxide and other greenhouse gases. Suresh was confident that his legacy would stand for millennia to come.

The elevator took them past the overflow limit of the reservoir and into the lobby. The

sound of guns and explosions rocked the background. A glass panel separated them from the methane power plant section.

These massive engines burn the methane-rich gas to power the entire facility. The waste heat treats the colossal amount of biological sludge. Once stabilised, it is applied as a soil conditioner, turning the desert sands into fertile soil. The sludge comes from water treatment processes, which then discharge semi-clean water into an artificial lake. The nutrients in the water nourish the bamboo forest while sunlight is complementary from the desert. The bamboo forest then purifies the water which flows into an artificial river.

To date, DC has almost achieved its goal. Weather forecasts have predicted rain for the region, something that would have been absurd years ago.

Attack

The lobby was sprawled with the wounded and sirens were blaring. The end of the corridor was collapsed and engulfed in flames that were slowly creeping towards the engine room. Another explosion rocked the building as grenades went off.

'Head for the tunnels!' shouted Green. Suresh helped a wounded guard into the elevator. He eased a pistol out of his bloodied hands and kept it in his back pocket under his lab coat. Another set of elevators took them up a control tower.

'Tenth floor - control room.' The voice from the elevator was the only thing calm about the situation. Out the window was a different world: smoke plumes danced in the wind as mercenary forces traded fire with the guards. Warehouses stood in flames out in the vast expanse of bamboo. Suresh scanned his ID card and his eyes on the console and the thick doors of the control room flung open. Far upwind, cirrocumulus clouds displaced the blue skies. Precipitation now would mean success, more funding and global recogni-

tion, given that the facility still stood after tomorrow.

'Sir, the National Guard will be here any moment,' reported a voice from Green's two-way radio.

A 10-tonne solid steel fail safe was built to seal the opening to the biggest man-made pocket of methane. 'This should protect the facility,' Suresh reached for the big red button on the console.

Suddenly, cold steel pressed hard against his back. 'Well done, Suresh. Now hands off and back up.' Green gave a devilish grin, a gun in his hand.

'NO! THAT WILL FILL THIS WHOLE BUILDING WITH METHANE!'

Green pulled a lever - 'Gas Release'. Gas began filling the engine room. Only time stood between critical concentration and the biggest methane fireball in the world.

'You traitor! How much did they pay you to betray your own kin!' a furious Suresh demanded, raising both hands in the air.

Handsome. I have you to thank for giving me access to the control room. Looks like rain.'

The afternoon sky was unusually dark. 'You were almost there my friend, but that's as far as you go. Now if you would excuse me, I've got things to blow up before the National Guard arrives. It was nice knowing you.'

Bang!

Time seemed to stop. Suresh felt a sharp pain on his chest. The bullet hole in his coat soaked with blood. His vision tunneled and his breathing stopped. Suresh fell onto his knees and collapsed. Visions of his time planning his brainchild flashed across his mind. Years seem to pass with every remaining heartbeat. A small voice resounded, 'You promised, Papa, you promised!'

'Am I dreaming?'

Suresh regained consciousness. The bullet had hit the bamboo in his pocket and left just a minor cut on his chest. He picked up his remaining strength and with the bloodied gun in his pocket, he aimed it at Green, who was walking out the control room doors. Suresh put his finger on the trigger.

His mind came back to the present. Cumulonimbus clouds veiled the sunlight.

Suresh looked up into the sky. The first pearl of rain fell from the heavens.

fourth year chemical engineer from Pen-
writes: 'As an engineer in the 21st century,
ng up with creative and innovative ideas
needs and wants. But a good idea is meant
ch, creative writing is one way I share my
en the subject is the environment and
take for granted with our every breath.
x will encourage aspiring engineers to come
unique ways to ensure that we will inherit a
g07@imperial.ac.uk

FEATURES

Recession busting

CONSULTANCY at Imperial College isn't like normal consultancy. Yes, you can tap into the brains of an expert who can help you with a problem and get access to hi-tech equipment and facilities, but there are differences.

Academics have papers to publish and grants to win, so when they take on industrial challenges, they do so with a wealth of peer-reviewed knowledge.

It will come as no surprise that throughout the recession, before and after, Imperial engineers have experienced a constant stream of industrial attention. Clients ranging from Shell and npower, through to Ford and Euro-tunnel, are all keen to get academics on board to solve their challenges.

In fact, Arnab Majumdar, consultant and doctor of transport risk management, has found his services more in demand than ever. 'When times are good there are plenty of people out there who claim they can do everything, but in an economic recession people don't buy that; they want to see evidence that it will be done properly. That's where Imperial College has an advantage: it has an excellent reputation so clients come to us.'

With an economy driven by the generation and exploitation of knowledge, the entwining of UK industry and academia is inevitable. To compete on a large scale, businesses need cutting-edge products or services. Academics realise that access to their knowledge is a necessity, not a bonus, and they're rising to the challenge.

'Sometimes in a university you can be so theoretical, so intense, that when you interact with people running a business, it's too much,' says Dr Majumdar. We always try to involve their staff with ours, so that we understand their

*Knowledge is power, but only if
you know how to acquire it.*

*Industry has long recognised the benefits
of turning to Imperial academics in
times of need because*

Academics know how

by Anne Coleman

needs and our research is applicable to real life situations.'

Impact

Transferring academic expertise to an industrial context can involve significant costs, so it needs to have impact.

Andy Pullen, a research fellow and consultant in the Department of Civil and Environmental Engineering (Civils 80), is convinced that the combination of high-specification facilities and experience in his department can offer real value.

'The defence industry has an ongoing need to understand and model the dynamic mechanical behaviour of various materials. Sometimes this can be addressed by traditional research, but often the requirement is at short notice, so a consultancy approach (through Imperial Consultants) is more effective.

'A client may send us concrete, soil or rock samples, which we will charac-

terise in the structures laboratory. The data we produce will feed directly into their computational predictive models. Often there will be unusual aspects of material behaviour which we can comment on and suggest improvements to their methods.

'There are certainly laboratories elsewhere that are capable of standardised testing, but we can add academic knowledge and expertise to answering a simple request,' says Andy.

Imperial academics have been asked to step in when other commercial laboratories have been unable to complete consultancy work satisfactorily. Although the cost to the client was greater, the work was finished successfully and useful intellectual value was added. As Dr Majumdar comments: 'Sometimes things take a bit more resource, a bit more time, but they deliver real impact in the end.'

Confidentiality in consultancy can protect a company's idea and an aca-



SPOTLIGHT project one

Imperial Consultant: Professor David Nethercot. Department: Civil Engineering (head of). Industry sector: Nuclear

Problem: A company was required to produce a case in support of the safety of a structure in a nuclear power station. Since its design back in the 1960s, requirements had changed and the structure now appeared questionable. Large-scale testing was initially suggested by the company since the steel work was inside a contaminated region, so entering it to make any modifications indicated by an unsatisfactory result would involve enormous costs and consideration of health and safety.

Solution: Professor Nethercot applied the sophisticated idea of numerical modelling to the situation and was able to assess that the structure was safe, thereby removing the need to access a contaminated region. Impact: The company saved thousands of pounds and time through using a professor who could see the problem from an informed, scientific perspective. Having used an Imperial academic, they were able to put an authoritative stamp on their report.

*Imperial consultant: Dr Arnab Majumdar
Department: Air traffic control centre
Industry sector: Aviation*

Problem: A major low-cost airline wanted to find out whether their pilots and crew were working at an optimum level, to make sure they did not pose a safety risk to passengers through fatigue.

Solution: Professor Majumdar suggested carrying out a thorough fatigue assessment of pilots and crew over a carefully-designed, three-week, flight schedule. Subjective data was collected on how tired pilots felt over the course of a day and the quality of sleep they got, along with objective measures such as heart rate and skin temperature. This type of physiologi-

SPOTLIGHT project two



cal data was obtained automatically every minute from a bio harnesses worn by pilots during flights. Analysis of the large data sets enabled Professor Majumdar to determine whether the new schedule design was adequate.

Impact: The costs of a single aircraft crash would be catastrophic for a low cost carrier business in the UK. The public's perception of the airline would dive, and the rest of the sector would feel the effects too. Having a comprehensive fatigue risk management strategy in place ensures that passengers are safe, insurance costs to the business are low and airline

SPOTLIGHT project three

*Imperial consultant: Dr Anthony Bull. Department: Bioengineering
Industry sector: Sporting equipment*

Problem: Mongoose is an innovative cricket bat design company. They wanted to determine how much of an improvement their radically-designed MMI3 bat was on the standard cricket bat, whilst still being within MCC rules.

Solution: Dr Bull conducted a tests on the bat, including vibration analysis, bending stiffness and moment of inertia. He was able to confirm that the MMI3 was 20% more powerful than a conventional bat and had 15% more bat speed.

Impact: Mongoose was happy with the results, publishing them on their website. The MMI3 bat took the 20:20 cricket world by storm, with stars such as Marcus Trescothick acknowledging its power.

demical intellectual property. But sometimes a solution is too good to hide.

Working with a major low-cost airline, Dr Majumdar is proud to say that his assessments are effectively setting safety standards throughout the industry. His client shares risk assessment results on cabin crew fatigue with competitors because, in aviation, one aircraft crash can cause repercussions across the entire sector.

Consulting through the cuts

Although Imperial Consultants is the leading provider of academic consultancy in the UK, with an annual turnover of £15m, it cannot prop up publicly-funded research at the College. In fact, academics here rely on public funding to attract industrial attention.

Back in 2010, a campaign called 'Science is Vital' got under way. Its mission: to prevent government cuts to science. Within days, it had partners across the private, charitable and scientific communities and gained 35,000 signatures in support. People recognised the major impact of science on

society and its importance in driving economic growth.

Imran Khan, director of Campaign for Science and Engineering, echoed the views of a concerned private sector. 'Industry leaders have consistently said their private sector investment depends on public support for science. If that support disappears, they will have no other choice but to look abroad for their raw materials - world class research and talented scientists and engineers.' A cut in funding would diminish research capacity, and research capacity earns the reputation that consultancy depends on.

Knowledge triumphed in the end and the science budget was frozen at £4.6bn. This still represents a 10% cut in real terms, over the next four years.

Providing a balance is maintained, the lucrative nature of consultancy can help. Retaining the best brains in academia is important, but when industry equivalents take home much larger pay packets there is the risk that

researchers will switch sides.

Professor Nethercot, head of Civil and Environmental Engineering at Imperial, has found that his consultancy work helps to make up the gap, allowing him to follow his research interests, whilst maintaining industry connections.

It is rare in academia that money is handed out without being earmarked for something, but through Imperial Consultants, departments are gifted money with no strings attached. Professor Nethercot stresses how useful this can be. 'It gives us the opportunity to spend money in constructive and imaginative ways. One of the things we do is support our PhD students, extending their funding or sending them to conferences.'

Through good times and bad, academics are finding out that knowledge has the power to solve their own problems as well as others'. And as a result, industry is reaping the rewards.

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Author of this article, Anne Coleman, is communications and web officer for Imperial Consultants. Her role is



to promote its work through managing showcases and news stories for its website, updating its Twitter profile and producing a range of publications.

FEATURES

MANY of you will have enjoyed the Blue Lagoon spa at Svartsengi whilst visiting Iceland. This artificial hot lake is fed by very hot water coming up from the red-hot rocks around the place where the European and North American plates are moving apart.

The temperature of the subterranean rocks is such that water from the deeper wells contains very high levels of silica, which has been shown to be helpful in the treatment of psoriasis and eczema.

Electricity from steam

It is, however, the hot steam, both from dry steam wells about 600m deep and flashed off from water from the deeper wells, which is used to generate electricity and provide heat for a large (150 MW) district heating scheme.

This steam also brings to the surface CO₂ and H₂S. The latter gives rise to the distinctive sulphurous smell common to most hot springs. Carbon Recycling International (CRI), who have developed this project, is most interested in the former.

The flow of steam is produced by the earth's internal heat and hence is considered to be a sustainable source since, if it was not exploited the heat and the steam would leak to the surface via the vents and geysers so familiar to visitors to Iceland.

CRI was looking for ways of making this energy into sustainable fuel for motor vehicles. Hydrogen from water electrolysis had been looked at but is unsustainable for a number of reasons. Methanol is easily made from carbon dioxide and electrolytically produced hydrogen. It is a liquid which can be mixed with motor fuel. From five to 15% generally only timing changes are needed

New plant to make motor fuel from hot water in Iceland

by Frank Brown

to ensure good combustion. Above 15% more changes to injection and engine control are most likely, but most existing engines can be made to work up to 100%.

To find out the economics of doing this on the small scale, by modern standards of 100 tonnes a day (t/d) of methanol, CRI started a development programme.

Although virtually all the world's methanol production is based on gases containing mixtures of carbon monoxide and carbon dioxide, almost none is made from CO₂ and H₂ alone.

A laboratory plant was designed and built to make about 30 litres a day, using purified CO₂ sourced from one of the high-concentration wells in Iceland. This is also the source of CO₂ for locally manufactured carbonated drinks!

Making methanol

CRI also engaged Jacobs whose process and technology group in London is one of the world's leading designers of

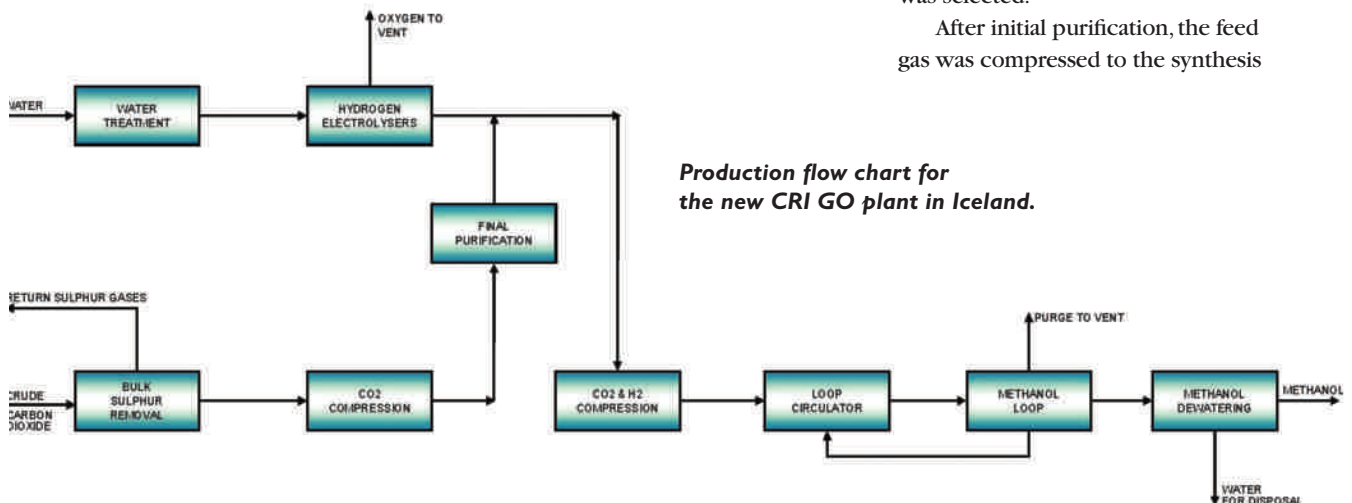
methanol plants, employing Johnson Matthey synthesis technology.

Jacobs established that the average 75-100 MW geothermal power plant in Iceland produces enough CO₂ to make 100 t/d of methanol. This is very small by today's standards so it was necessary to produce a scheme with the lowest possible erected cost. This was achieved by making the plant much simpler than a modern highly integrated unit and hence much easier to control. This feature is very important as it was decided early on that the plant should have minimal staffing to keep operating costs as low as possible.

Fortunately, methanol production is a simple technology. It does however require very pure feedstocks as the synthesis catalyst is very easily poisoned.

The main impurity in the CO₂ is H₂S which is there in considerable quantity. Most of the solvents for removing H₂S also dissolve CO₂ so a different technology, where the H₂S is oxidised to sulphur in the liquid phase, was selected.

After initial purification, the feed gas was compressed to the synthesis



Production flow chart for the new CRI GO plant in Iceland.

Frank Brown graduated from Chem Eng in 1962. Since then he has spent all except the first two years in chemical engineering contracting with Humphreys and Glasgow and its successor companies Enserch and now Jacobs Engineering. His lifetime interest has been in the technologies for converting hydrocarbons, from coal to natural gas, into major products like methanol, ammonia and clean electric power. After many years as process department manager, he is now a consultant to and for Jacobs. frank38brown@yahoo.co.uk



pressure. At an intermediate stage, the gas was finally purified by reaction with solid adsorbents.

The study showed that if a lower tax rate were applied to the methanol, then



The 75MWe generating plant by the Blue Lagoon that also provides heat for a large district heating scheme.

it could compete with that from more conventional large plants.

Then what could have been disaster struck. Iceland's financial system went into meltdown. Loans were no longer available. This technology had never been applied with feedstocks derived from similar sources so the future appeared very bleak.

The promoters did not wish to waste their investment up to this point, so Jacobs was asked what could be done with a much smaller sum of money.

It came up with a scheme where the expensive H₂S removal process was replaced with a simple chemical solvent wash as CO₂ loss was no longer impor-

tant. Jacobs directed CRI to Chinese compressor manufacturers, who even when meeting EU standards for the first time, were much cheaper than Western machines. At the same time, a very advanced, but lower cost, pressurised water electrolysis supplier was also identified in China.

On stream

A quick estimate revealed that a 12 t/d plant could be built for the available sum of money. In spite of several hiccups, the plant is now scheduled to begin operation as Imperial Engineer goes to press. The initial output of 5 t/d will be added to the majority of Iceland's gasoline up to the maximum permitted level of 3%.

Thus very hot water will have been turned into sustainable motor fuel. As production increases, the methanol level in the fuel will be increased.

Plans are already underway to build a plant to produce first 100 t/d and then 250 t/d once the co-produced oxygen is used to make more synthesis gas from the gasification of biomass.

THE BOLD AND THE BRAVE: A History of Women in Science and Engineering

by Monique Frize (EE 70)
with contributions by Peter R D Frize and Nadine Faulkner
ISBN: 978-0-7766-0725-2
Published by University of Ottawa press (tel. 613.562.5246) Paperback, available from Amazon

The Bold and the Brave investigates how women have strived throughout history to gain access to education and careers in science and engineering.

Author Monique Frize, herself an engineer for over 40 years, introduces the reader to key concepts and debates that put into context the obstacles women have faced, and continue to face, in the fields of science and engineering.

She focuses on the history of women's education in mathematics and science through the ages.

Opportunities for women were often purposely limited, but she reveals how many women found ways to ex-

BOOKS & REVIEWS

plore science outside formal education.

The book examines the lives and work of three women -Sophie Germain, Mileva Einstein, and Rosalind Franklin - that provide excellent examples of how women's contributions to science have been dismissed, ignored or plagiarised outright.

She concludes with an in-depth and often personal look at women's participation in science and engineering throughout the 20th century and the current status of women in science and engineering, which has experienced a decline in recent years.

To encourage more young women in these fields, she advocates re-gendering them by integrating feminine and masculine approaches that would ultimately improve scientific and engineering endeavours.

Monique Frize is a professor at the Department of Computer and Systems Engineering, Carleton University, and the School of Information Technology and Engineering, University of Ottawa.

Sustainable Oz

A PAPER given recently by civil engineer turned artist and activist, Jolyon Nove (Civils 60), offers an engineered solution to sustainability for Oz that, in a different format would have done credit to Verne or Wells.

Taking as his inspiration the work of Sir William Hudson, who created the Snowy Mountains hydroelectric system, he offers the concept of five mega- cities centred on the conurbations of Brisbane, Sydney, Melbourne, Perth and the Ord River region of Northern Territory and Queensland. Each would support a population of 10 million and would be self-sufficient in water, energy, food and all other essentials for living. They would make use of, or recycle, all waste products and be designed for minimal environmental impact.

No doubt we can look forward to further instalments on how this can be accomplished, particularly considering the formidable social as well as physical engineering challenges presented.

FEATURES

IN THE UK, we turn on the tap and expect clean water. We flush the loo and sewage flows away to be dealt with efficiently. But many of our population are not disciplined with regard to energy conservation, so we cannot be too smug.

In Balochistan the problems are fundamental. The authorities do little or nothing and the people accept the situation which has not changed, despite dramatic increases in population and wealth.

In the large town of Sibi, the brightest shop in the high street is the hepatitis clinic. The residents do not relate the clinic to the stream of raw sewage meandering through the centre. Sibi is one town amongst many which discharges its sewage directly to irrigate food crops without secondary treatment.

THE BACKGROUND

The World Bank-funded Balochistan Project was divided into institutional strengthening and rehabilitation of natural resources. I was the project leader for the industrial and urban waste disposal sub-group for the strengthening of the Balochistan Environmental Protection Agency (BEPA), ably assisted by Dr Malik and the unique Mr Ashraf, the counterpart team member who, besides the Director General (DG), was the only staff member who knew what the environment was about.

The object of this component of the project was to develop capability within BEPA for monitoring environmental pollution and to provide guidance on how national and provincial quality standards could be enforced.

The scope of work broadly covered the following -

- establishing base-line information on all industries and urban areas;
- identifying needs and preparing specs;
- reviewing and prioritising pollution problems, *etc.*

Louis Solway is a consultant infrastructure and environmental engineer who graduated from Civil Engineering in 1958. While there he played hockey and the violin. He is a Fellow of the Institution of Civil Engineers. Louis has carried out assignments in Europe, Ghana, Libya, PRC, Syria, Pakistan and Iran. 'I try not to compromise where environmental issues are involved,' he says.



Trying to control urban and industrial pollution in Balochistan

FACT FILE: BALOCHISTAN

- ★ Covers the largest area, 350,000km² (45%), of four independently governed provinces of Pakistan and has 8% of the population – 8-10,000,000. Population surveys, particularly of females, are difficult.
- ★ Provincial capital Quetta, close to Afghan border, has a population of some 1,000,000, including fluctuating number of Afghan refugees. Twenty other towns have populations over 10,000 and three have around 100,000.
- ★ Terrain predominantly dry to arid. Where irrigation is available a range of crops is grown.
- ★ Has extensive gas fields, some oil, mines, ship-breaking, quarries and brick manufacture. A few manufacturing industries in Quetta industrial estate and a lot more in the Hub estate on Arabian Coast.
- ★ Significant increase in population over recent years. Family planning is an incomprehensible concept for many where children are perceived as a labour source.
- ★ Literacy rates are very low for men and even lower for women, due to lower provision of schooling.

The role of BEPA is similar to that in Pakistan's other three provinces namely -

- developing and maintaining a data base on all industries;
- measuring and monitoring urban and industrial discharges into air, soil and water *etc.*

NEPOTISM

The reality was that BEPA suffered from a lack of trained and enthusiastic staff, equipment, funds and achievable objectives. When asked why he didn't advertise for more staff, the DG replied that if he did, that evening he would receive telephone calls from 'senior

people' putting forward their highly-qualified nephews. He couldn't refuse them but they would add no value.

We were allocated two vehicles. Both disappeared, acquired by 'senior people', so we relied on the DG and his vehicle.

On the first day, the DG welcomed us to the dingy, inadequate BEPA offices, where more local men loitered in the corridors than in the offices saying 'consultants only come to Quetta to write reports'. Some time later, I handed over a short report and a substantial operational manual.

VISITS AND MEETINGS!

This fascinating, partly-tribal area of the world needed many visits and meetings. One with the Secretary for the Environment, who took away my passport. Another with the chief public health engineer before setting out for Sibi, when he asked me to look at the water supply and sewage systems.

On submitting my report identify-

LEFT: Putting Balochistan on the map.



ing the silted settlement tanks, derelict treatment plant and polluted feed channel, in addition to the sewage problems, he refused to see me!

This was a similar reaction to the comments of the Chief Secretary when a colleague and I were invited as observers and to give a presentation to the first meeting of the Balochistan Environmental Council, the Senior Minister and 25 other secretaries and relevant officials, including two women.

While colleague Anthony Latham projected his depressing photographs of environmental pollution around Quetta, I explained the significance of the problems including water, sewage, scavenging hospital waste and other problems.

These environmental issues are reflected in the records of diarrhoea,

dysentery, acute respiratory infection, fever and scabies in Balochistan. Despite the meeting being instigated at the request of the World Bank, the Senior Minister did not attend as he had gone hunting and the Chief Secretary was angry with us for highlighting pollution problems in Quetta to the meeting rather than 'nice aspects'.

VISITS AND MEETINGS!

The visit to Gadanni ship-breakers, spread along a 20km length of the coast west of Karachi, was impressive. BEPA had the responsibility of carrying out an environmental impact assessment and issuing the NOC before a ship could be broken up. The enormous size of this task sinks in when you look up at a 40,000 ton ship sitting on the beach. Most ships

contain bilge water and heavy fuel, some asbestos, chemicals and radioactive material. The DG was told that it was out of order for BEPA to take on this task. Interestingly, although the upper beach was covered with the residue from cutting, the waters of the Arabian Sea were crystal clear.

The promoters of the proposed Quetta power plant dumped their EIA documents on us with a request (in reality an instruction) for the issue of the notification of commencement (NOC) within 24 hours. As it had already been reviewed by the Power (World Bank) Team they said this was a mere formality. It was quite likely that the aspects that BEPA drew attention to in their review were considered by the power company.

The fundamental flaws which were overlooked by the World Bank review team, have bequeathed the city of Quetta a power plant which is in the wrong place, adds to the city's air pollution, takes scarce water resources away from the city and sells electricity at a rate higher than necessary.

The visits to the Quetta and hub industrial estates were constructive with a good response from the industries and requests for advice on environmental pollution control. Many of the industries completed the BEPA information schedule, forming the start of an industrial data base.

THE SOLUTION

'If you want to sort out environmental pollution, sort out industry' was advice given me initially. In fact, the key environmental issues showed that it was the public sector (water supply, sewage and solid waste) more than industry which had the main responsibility for urgent action.

The residents of Quetta and Sibi did not cooperate with international aid projects. So what hope is there for a few staff in the Protection Agency making any progress with standards after the BEPA consultants leave?

Perhaps what is needed is full rights for women as men have neglected the environment. Accountability and responsibility from all officers with technical projects and firm control of funds is sadly lacking.

Runner to cycle Pennines

ALISTAIR Dunn (Min Tech 94) is taking on the challenge of cycling 150 miles coast to coast in a day to raise money for Oxfam and the Prostate Cancer charity.

'Oxfam has a great reputation worldwide for providing humanitarian aid, and the Prostate Cancer charity does wonderful work supporting cancer sufferers and their families here in the UK, so I would welcome any donations,' he says.

'Just to make the route a little more scenic, as well as crossing the Pennines I'm going to take in the Lake District, Yorkshire Dales and North York Moors National Parks.'

Alastair, quarry manager with Tata Steel at Shap, Cumbria, will be starting and finishing his ride at two other Tata Steel plants in Workington and Redcar respectively.

'I run quite a few miles every week, so wanted to do something different for charity this year,' he said. Since leaving the RSM, Alastair has worked for much of that time in his Lake District which is where he first discovered the sport of fell run-

ALUMNI NEWS & VIEWS

Six pages of who's doing what and where



ning. He has gone on to win six British Open Fell Running Championships and five British Hill Championship titles held annually in Scotland. At last year's event, Alastair beat a team of 12 Gurkhas visiting from Nepal.

Alastair is aiming to raise £1000 in sponsorship and can receive donations at VirginMoneyGiving.com. Just put

Alastair running at Shap. Picture courtesy of Phil Rigby, Cumbrian Life.

Alastair Dunn in the 'find a friend' box. He's already been offered company for part of the ride, but if anyone else would like to join him for a few miles he can be contacted at Alastair.Dunn@TataSteel.com.

Designer makes a move

MARZBAN Cooper (Mech Eng 90) has been appointed managing partner of Herraiz Soto & Co (www.herraizsoto.com), a digital creative agency based in Barcelona. It is an award-winning pioneer in the field of interactive advertising, judged 35th digital agency in the world and the first in Spain.

He's a jolly good fellow

LINO Jacovides (EE 65) has been elected to two societies in the last year. This, the first, is as fellow of the Society of Automotive Engineers, by far the largest automotive engineering society in the UK.

Election to fellow is an exceptional professional distinction bestowed on around 20 recipients each year. A distinctive fellow pin is presented to the new fellow at the annual dinner with a framed certificate.

He has also been elected to the US National Academy of Engineering which has around 2200 members. This is one of the highest professional honours accorded to an engineer. This year there were about 70 new members elected. linos@aol.com



Chem Eng celebrate 50 years

CHEM ENG 60 group held their annual meeting in the Beit quadrangle bar on February 8. A fair turnout for this year's gathering is shown above. From left, Dave Martin, Barry Daniels, Tony Davis, Erik von Schmidt, Malcolm Cross, Don Latimer, Alan Nethercott, Jim Friend, Mike Heath, Paul Gallagher and Brian Stevens. 'Our thanks to the barman's steady hand,' wrote Tony Davis. Group members remain pretty active with Barry Daniels moving up in boat size and a summer or early autumn group event, with partners, in planning.

Roger's contribution commemorated

ROGERS Knight (Mech Eng 38) receives a standing ovation at the recent British Compressed Air Society (BCAS) Ball for his life-time service to the industry. He also celebrated his 95th birthday in December. Rogers, a stalwart supporter of the CGCA, instigated the Wine Committee which lays down supplies for annual dinners

Making sure steel continued to flow from the USA for WWII, Rogers secured the UK import agency for the CA Norgren, Colorado, manufacturers of compressed air filters, regulators and lubricators. It was the start of half a century of collaboration with Norgren and the BCAS. Rogers became



Rogers stands for his ovation.

recognised worldwide as an authority on lubricating steel mill bearings where constant motion, weight and intense heat, can create havoc.

LOWTECH – LOW CAPITAL

Managing director Steve Le Chevalier (Min Geol 75) writes
about his family company which is the antithesis of minerals processing and distribution

CONTRASTING a gourmet restaurant to a fast food chain is how I describe our company Specialist Aggregates, in comparison with multi-million tonne suppliers of metallic ores and industrial minerals.

Whilst the company may be seen as low tech, low capital, commissions in the last twelve months have included sands for film sets for *Dr Who* and *Harry Potter*, to say nothing of products for Kylie Minogue's latest album cover and promotion for her 2011 tour.

Apprenticeship

Specialist Aggregates was formed in 1999 following my 'extended apprenticeship' with leading UK aggregates supplier Tarmac. It was apparent that there was a small volume, niche demand for aggregate products.

As a sole trader start-up, the initial challenge was to establish a differentiation in what was, and remains, a mature, price driven market. This was achieved through collaboration with suppliers of glass cullet and the purchase and re-orientation of a small manufacturing company producing decorative coloured gravels for aquaria.

The first five years saw rapid growth with the establishment of retail markets for decorative glass gravels, primarily through garden centres, and the introduction of colour-pigmented sands and gravels into major high street stores as a component of floricultural products. However, an early lesson was that fashion-driven markets (even for aggregates), are fickle! Having placed products in over two million homes in a period of three years, the life-span for even the most innovative coloured aggregate was finite.

The company had been one of the first to launch an aggregate information website



A busman's holiday 'messing around with rocks' in Iceland with wife Steph.



Website

in 2000 and by 2005 a decision was made to further develop its potential.

The key premise of the re-launch was to produce a content driven site with on-line purchase facilities – essentially it set out to provide 'everything in aggregates' and importantly to provide customers with a method both to find and to purchase them on-line.

From that time, and with the recruitment of graduate IT expertise, the company has evolved into what is affectionately referred to as a 'clicks and mortarboard' enterprise. Combined with capacity to manufacture and technical understanding across a broad range of products, the web rapidly established itself as an efficient tool to substantially reduce the cost of customer acquisition in both 'business to business' and 'business to consumer' transactions and to make a significant indirect off-line contribution.

Away from web copywriting

and image enhancement, the passion remains with aggregates. Be it for 'something lightweight and non-combustible but to resemble coal' for a Broadway musical, a floating aggregate upon which bees can land to take up sugar solution feed, or simply 'can you find me a laterite soil for a Chelsea Flower Show garden?' The answer is always 'yes, we can'.

Boundless

The recipe for development and on-going success of a small enterprise is no less challenging than the management of a line function within a multinational.

Coloured sand, supplied to John Hicks, a renowned street and event artist, was inspired by the tradition of Buddhist sand mandalas. John produced this stunning 'mural' in Ernst and Young's foyer to promote the Maharajah Exhibition at the V&A.

Picture courtesy of creator John

However, the scope knows no bounds. How many for example, could claim that they have made a decorative aggregate from champagne bottles for Sir Elton John or developed sands that can be detected under UV light for marine surveys?

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).

**FINAL COPY DEADLINE FOR NEXT ISSUE
SEPTEMBER 26**

IN BRIEF

Outstanding

JOHN MONHEMIUS (Meta 77) has been awarded the 2011 Futers Gold Medal by the Institute of Materials, Minerals and Mining (IOM3). The Futers medal is awarded for outstanding services to the international minerals industry. 07912 248 850 j.monhemius@imperial.ac.uk

Hello to Berlin

AFTER 20 years in the USA GEORGE MELLER (Aero DIC 51) has left his retirement residence in Miami for Berlin. ggm@ggm.net

Toronto meet

MINING industry people, including any IC alumni, hold their casual get-togethers on the last Friday of every month at the Jason George Pub, 100 Front Street, Toronto. For info email Harry at hburgess@micon-international.com

Integrated move

MURAT ESKIYERLI, (EEE PhD 98) has moved back to Ankara, Turkey, where he is working as a consultant in analogue and radio frequency integrated circuit design. eskiyerli@gmail.

Congratulations...

...to ALEXIS BILLIER (Min Eng 02), who married Marilyne Lopes on June 19 in France and again on July 17, in Portela das Cabras, Portugal.

Joining dots

ANDREW WHEEN (EE 77) has published a popular science book covering the history of telecommunications. It's called DOT_DASH TO DOT.COM: How Modern Telecommunications Evolved from the Telegraph to the Internet. It's available at Amazon and other bookstores. For a review, see next issue. Andrew.Wheen@mottmac.

Mayoral role

LEN TAYLOR (Civils 52, DIC 53) is mayor of Cowbridge with Llanblethian in the Vale of Glamorgan. He sends his salutations to his contemporaries. lenetaylor81@yahoo.co.uk

Chem Eng call

THERE WILL be a reunion lunch on Tuesday September 20 in South Ken, plus a visit to the Engineering Faculty, for the Chem Eng set who started in 1958.

So far Chris Marchant has contact details for 28 of this group as well as three 1957 starters. If you are in touch with anyone from this Chem Eng vintage, please let them know and give them Chris's contact or email him to check.

Chris is on 01794 522003, c.marchant@ntlworld.com

ELECTRICAL Engineering class of 1978 to 1981 is celebrating its 30th anniversary in 2011 with a special reunion on Saturday September 17. Many who have not seen each other for 30 years are coming, some from overseas.

The event will start with lunch in the Queens Arms pub at 1pm and then a tour of Electrical Engineering with head of department Prof Peter Cheung. There will be a walk around College followed by drinks and dinner in an Indian restaurant.

'We would be very interested to hear from former classmates, even if they can't come on the day,' says Alan Higginson.

Live wires plan visit

alan.r.higginson@btinternet.com, or phone or text to 0044 7827 387053.

Vancouver date

CHEM ENG class of 1967 is arranging a reunion in Vancouver on September 2 2012. It's attracting alumni from Brazil, Singapore, Australia and Turkey as well as Canada, USA and UK.

Seven couples have booked an Alaskan cruise afterwards while others plan to see the Rockies and visit other parts of Canada and the US.

Contact Clive Sanders at clivesanders@shaw.ca for more information.

Midas touch?

STEPHEN QUIN (Min Geol 80) has stepped down as president and CEO of Capstone Mining Corp which operates copper mines in Canada and Mexico. He has taken the helm at a new private company, Midas Gold Inc, which controls a large gold-silver-antimony deposit in Idaho, USA. Stephen plans to take the company public in Canada in 2011. quin@midas-goldinc.com



USA's president Barack Obama inspects an AT&T Ford Transit Connect Electric, all-electric vehicle, produced by Azure Dynamics, where Nigel Fitzpatrick (Meta 65) is chairman of the advisory board. The Ford vehicles will be on sale in the UK soon. President Obama recently announced a partnership with five major companies, including AT&T and PepsiCo, to use electric vehicles and employ fuel-saving meas-

Charity engages with student projects

THREE Imperial alumni, Michael Maks Davis, Sebastian Kaminski and Saskia de Longvilliers, founded the charitable company Engage for Development, in 2008, to help engineering projects in poverty-stricken communities worldwide.

Having taken part in the El Salvador Project while at Imperial, they felt students would find it easier to raise funds for their project through a registered charity. They would benefit financially by being able to claim Gift Aid from their donations, amongst other things. Engage was also set up to share knowledge and experience of engineering projects in developing countries.

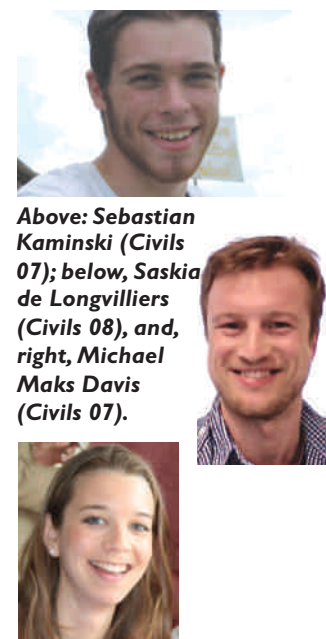
Project teams are able to fundraise for Engage and, in return, receive a grant equal to the amount they have raised.

Engage also acts as a knowledge base where accumulated lessons are learnt and useful information can be disseminated.

Engage provides a networking hub where people interested in similar projects and development work can share experiences and make useful contacts.

This summer, Engage is supporting two student group projects from Imperial – The El Salvador Project and the Rain-catcher Imperial Project.

They hope to support a larger number of student projects every year and continue to



Above: Sebastian Kaminski (Civils 07); below, Saskia de Longvilliers (Civils 08), and, right, Michael Maks Davis (Civils 07).

promote development work through engineering. See www.engagefordevelopment.org

Stamina put to test

RUTH Easterbrook (Geol 01) will be taking part in the Lands End to John O'Groats cycle challenge from July 29 to August 7 this year, partly in memory of her dad. Her dad, David, (Min Geol 73) died three years ago.

With her partner Matt Cole, and a team of colleagues from the National House Building Council, she hopes to raise a minimum £1950 for Marie Curie Cancer Care on her own.

This will provide 98 hours of nursing care to give terminally ill patients their final wish of dying in their own home, with those who they care so much for close by.

The challenge will involve cycling 964 miles over 10 days,

which will be quite a test for Ruth and Matt who are still relatively new to cycling. To help her to her target go to: www.justgiving.com/Ruth-Easterbrook 07921 106622 or reasterbrook@nhbc.co.uk

To be repeated

A WET evening in October saw an unofficial dinner to mark the 50th anniversary of Chem Eng undergraduate arrivals in 1960. Twenty (about 40%) of the original innocents attended with partners and enjoyed a department tour before convening at Ognisko. The event was great and they agreed to do it again to mark graduation.



DURING an open day arranged for its sixth form students at Hampton School, Middlesex and neighbouring Lady Eleanor Holles School, a small stall manned by Tony Davis (Chem Eng 60) was inundated. He ran out of leaflets because of the interest shown and queues were rather long. As Tony, an old Hampton pupil reported: 'To me it was evident that the difference between doing chemistry and chem eng is not well-known to school age pupils (or their teachers), so I had a lot of explaining to do.'

Alumni take pot luck in California

Parris Hawkins (MSCI 80) reports ON A BALMY January evening, 27 IC graduates and significant others met for our second annual pot luck dinner. Patrick Yin (EEE 71) and his wife Irene generously hosted the group in Fremont, California (south of

Oakland). The members outdid themselves with the variety of delicious dishes contributed.

Our speaker was Professor Jean Brodie (Physics 72) who explained the use of globular star clusters as fossil tracers of the creation of galaxies.

Jean showed some wonderful Hubble telescope pictures and video simulations that left us truly awestruck by this new perspective on space. A lively question and answer session ensued! The evening ended with the election of the 2011

board of directors and thanking outgoing president Howard Wise.

Our next event will be the traditional spring hike and picnic on Saturday May 21 in the coastal mountains south of San Francisco.

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Memorial to Neal

SINCE Lt Neal Turkington (Civils 06) of the Royal Gurkha Rifles was killed by a rogue member of the Afghan National Army, his family and friends have considered how best they could leave a tribute to him. Neal's two passions were the Gurkhas and humanitarian work. He had participated in the student El Salvador project as well as others in Mexico and Nepal. This voluntary work inspired him to coin his own *modus operandi* – 'seize the moment, make a difference, no regrets'.

During his time in Nepal in 2003, he became enthralled with the Nepalese culture and inspired by the distinguished Gurkhas. Commissioned from Sandhurst into the Gurkhas in 2008, he spent three months in Nepal learning Nepalese. During this visit Neal committed to a project to provide much-needed education facilities in a country where 50% of the population are illiterate.

Consequently, friends and family have set up the Neal Turkington Nepal Project, a non-profit organisation in association with the Gurkha Welfare Trust. A rural primary school in Thansing Village, where Neal taught in 2008, that is currently overcrowded and dilapidated, has been identified as the project for restoration, a six classroom extension, new lavatory block and incinerator.

Sitting at an altitude of 1250m, the school is currently attended by 476 pupils from dozens of surrounding mountain villages. Many walk for four hours daily over narrow and precarious paths.

The estimated cost of the project is £55,000. Incredibly, in only two months, over £27,000, has been raised with money coming from Neal's old school and college in Portadown, N Ireland.

Neal's friends and family are striving to raise the remaining money



Neal pictured talking to younsters in Afghanistan.

through a variety of challenges. For example, five teams, the majority of them Imperial alumni, have now been formed to take part in the Trailwalker Challenge, a 100km trek in the South Downs that must be completed within 30 hours. Each team will raise at least £1500 for the project, bringing in at least another £7500. The Trailwalker Challenge was started as a team working exercise by the Gurkhas 30 years ago. Neal took part along with some friends in 2007 finishing in a very impressive third place, raising over £6000.

Work is planned to start in November. It is also likely that this will not be the last of it, as many of Neal's Imperial friends are keen to continue with other projects, possibly taking advantage of the enthusiasm of Imperial's engineering students to deliver additional projects alongside Nepalese NGOs.

If you would like to learn more about the project or donate, please visit www.ntnp.org.uk

ALUMNI NEWS – OBITUARIES

This obituary has reached us some time after James Alastair Collingwood Andrews (Civils 47) died on March 30 2009. It was printed in New Zealand's Devonport Yacht Club newsletter

A life on the ocean wave

ALASTAIR ANDREWS excelled at all sports and, in 1948, he was part of Imperial's winning coxed eight crew at the Henley Regatta.

Alastair settled in Vancouver in 1955 and his sailing started. He was a founding partner of N D Lea Associates, the company he managed and worked for until he retired. It specialised in designing and project managing roads, bridges and transportation hubs in Canada and developing nations such as Nepal.

Alastair hankered after blue water sailing and, with his sons, took a year to finish a 35 foot yacht from hull and decks in his

very steep driveway. The boat took them to Hawaii and Alaska as well as the coastal waterways of British Columbia.

Anticipating retirement, an even bigger steel, 41-foot hull and deck, were delivered down the same steep driveway. He sailed from Malta to New Zealand via the Suez and over the next 10 years Alastair sailed one and a half times around the world.

He found a permanent home in New Zealand and, in 2002, hung up his 'blue water hat' and was content to enjoy the tranquil waters of the Hauraki Gulf.*

Rolls Royce of a career

KENNETH Clack (Mech Eng 47), who died on April 6 worked for much of his career with Rolls Royce in Hertfordshire, after an early job with De Havilland En-

gine Company. In the 70s, he was with the Small Engines Division, and in 1978 with the Helicopter Engine Group. He retired from Rolls Royce in 1992.

A live wire in his business

PETER FRANK VERMEYLEN (EE 60) was latterly director of European operations for FMC Corporation (UK) Ltd, based

in Windsor. He had previously worked for Wright Machinery in Uxbridge. Peter died last September 4.

Exciting career cut short

PHILIP LLOYD (Mech Eng 72, Tribology 75) passed away on December 15, aged 60 years – he had been in a wheelchair for over 31 years. Philip was a Formula Ford 1300 Champion and went on into FF2000.

Unfortunately, Philip was involved in a serious start-line accident in a FF2000 race at Mallory Park in 1979. A serious neck injury left him in a quadriplegic state for the rest of his life.

Very much due to the efforts of his wife, Linda, he had, despite being totally paralysed, a very good quality of life, with two devoted children. Despite his horrific injuries he always remained cheerful and busy, retaining many connections with the motor racing world

**Paul Jeffs (Mech Eng 77)
020 3116 0510**

PATRICK Wodehouse (EE 39,49), who died on January 29, aged 90, was son of PG Wodehouse's beloved elder brother Armine and wife Nella.

As his parents lived in India, he spent school holidays with Uncle Plum (as PG was known) and Aunt Edith, who maintained a grand but slightly dotty household

Although he inherited his uncle's sense of humour, Patrick Wodehouse's talents lay not in literature but in mathematics and electronics. He entered Imperial College but, when war was declared, he volunteered for the RAF and was quickly seconded to work on a secret new technology – radar.

During the war, he helped maintain radar stations in the Cocos Islands, Ceylon, India and West Africa, and finally on the Isle of Wight. After the war, the RAF funded his return to Imperial College.

A life messing about in boats celebrated

GORDON DEAR died on February 2, surrounded by friends from The Skiff Club of which he was president. The Club, based on the Thames at Teddington, is the oldest skiff club in existence.

Having gained his degree in 1943 after two years in Electrical Engineering, Gordon joined the Navy. He was a life member

of the CGCA. Gordon worked for various GEC Group companies from the 60s and was principal development engineer at GEC Sensors, in Essex, until after retirement age.

However, it was for his involvement with boating for which Gordon was most known and loved. He also skied until not long before he died.

As the Skiff Club's website (www.theskiffclub.org.uk) says in a tribute to Gordon: '...he will be greatly missed – and not just by The Skiff Club but by a vast number of people in the skiffing, punting and rowing fraternities who have benefited from knowing him.

'He was a unique man who gave so much during his lifetime, keeping tradition alive, developing and promoting all these sports as a true ambassador'.

Gordon always had a twinkle in his eye and was a great favourite with the ladies, as pictures on the website show! *

Gordon in typical, jaunty, nautical mode.



A Wodehouse in radar

He served for 14 years with the Royal Auxiliary Air Force, working for the Ministry of Defence. He marketed electronic instruments and was consultant on a project to develop a magnetically-levitated train. The next 20 years were spent successfully and happily in Rome, working

on advanced radar systems for the Tornado and later for the European Space Agency.

Wodehouse was a member of the Institution of Electrical Engineers for more than 70 years and was the proud owner of one of the first ham radio licences (call sign G4CA).*

Talented design engineer

COLIN McCHESNEY (Mech Eng 56), affectionately known as 'Cheese,' died after a long illness on July 17, aged 76. He was a talented design engineer who spent the major part of his career working for Rolls Royce Aero Engines.

He thoroughly enjoyed his time at College, entering with great enthusiasm into all aspects of its life and was elected a Link in 1956.

At Rolls Royce, Derby, Colin was employed in the design office where his analytical mind coupled with his methodical and patient approach to things enabled him to develop a career as a capable design engineer. He worked in Scotland and Derby and returned to the latter to become head of the advanced engineer group. On retirement he became visiting professor for the Royal Academy of Engineering to the University of Nottingham until 2007.*

Paff had long and fascinating life

WILFRED PAFFORD (EE 31) died peacefully on January 21 aged 102.

Paff, as he preferred to be called, won a royal scholarship to Imperial and after he gained his degree with honours joined the BBC where he went on to be a leading light in the development of that familiar box in the corner. He was present at the birth of TV whilst working at Alexandra Palace London, affectionately known as Ally Pally. He also spent some years in Daventry at the BBC World Service transmitters where he became chief engineer.

In 1939, at the outbreak of

WW II, Paff was recalled to Ally Pally to lead a team of RAF technicians in an operation named by Churchill – ‘The Battle of the Beams’ – which involved jamming German aircraft navigational technology.

He witnessed the bombing of Coventry during the war and many years later was asked to



design lighting for part of the newly-rebuilt cathedral. He considered this to be an honour and privilege.

After the war, Paff continued at Ally Pally as head lighting engineer for the new TV. Later he joined the newly-formed ITV.

Paff had a life-long interest in politics and his beliefs and passions were very much part of him. In his university days he joined the Jarrow Miners march.

In 1973 Paff retired from the busy ‘show biz’ world of TV in London and moved to Ferring, where his wonderful garden soon became a showpiece.

Paff had many talents and his love of art shone through in many forms and his cartoons for every occasion were very much a part of him, where his charming sense of humour shone through every day till the last. He was a talented watercolour artist and in recent years he wrote poems, which were published from time to time.

‘Dad never ceased to amaze us with his never-ending quest for knowledge and being able to master the computer at the age of 95, quickly followed by his culinary skills with the microwave and cake decorating.’

*Margaret (née Pafford) **

Peter transferred railway love to work

PETER DOWELL (EE 61) died of a heart attack, at his home in Holte, near Copenhagen, on February 6, aged nearly 71.

While at Imperial, he was an active member of the Youth Hostelling Club and the Railway Society. For his second-year work experience abroad, he spent several weeks in Denmark in the summer of 1960, working for GNT Automatic. That was where he met his Danish wife-to-be, Jytte.

They settled in Denmark but continued to maintain good contact with several of his fellow graduates, visiting them and their families in the UK.

Peter worked first in the

UK for the Mullard Research Laboratory in Salfords, Surrey - and then in Denmark for Teleteknisk Forskningslaboratorium, a Danish telecommunications research lab, in Ferrite applications. During his time at Mullards he published a paper, *Effects of Eddy Currents in Transformer Windings*, (Proceedings IEE). This is now known as the Dowell method.

Peter moved to GNT Automatic with involvement in miniature relays and computer peripherals before joining the Danish State Railways, now Banedanmark, as a radio engineer. He was the Danish project manager in developing

and implementing integrated radio and GSM-R across Europe

He served on a number of international committees dealing with the application of radio and GSM-R to railways, travelling widely. *



Worldwide miner

HAVING been born in Shanghai, Colin Smith spent his younger days in a Japanese concentration camp before being repatriated to Tanganyika and returning to England to complete his education. After graduating from the RSM in 1958, he started his career as a mining engineer in South Africa.

Colin worked in every continent apart from Antarctica and was respected for his expertise. He moved with his family to the USA and lived in Denver and Salt Lake City. Colin worked until 2009 when his brain cancer forced his retirement.

Long life completed

ERIC Cox died after a short illness, aged 90, on January 21. He graduated in Electrical Engineering in 1949.

STOP PRESS

WE HAVE just had news of the deaths of Anthony Hoadley and Peter Turner. Obituaries, based on information we are sent, will be published in the next issue.

A stickler for high standards

JOHN ‘JACK’ CHAPMAN (Civils 42) died just before his 88th birthday. He first became associated with Civils as a student during WWII, returning after service in the Royal Engineers to conduct research and to join the academic staff. He twice captained C&G Tennis Club.

After some 20 years he left to become the first director of Constrado (the Research and Development arm of British Steel) and subsequently to become technical director of Wimpey, with major involvement in its offshore activities.

On retirement he returned to Imperial as a visiting professor, directing funded research projects in Structures that made good use of our laboratory facilities, supervising PhD students and publishing journal papers. He is believed to be the oldest elected member of the Institution of Structural Engineers Council at the age of 82 and often provided reports on the evening technical meetings.

Always impeccably turned out, Jack was one of the characters of this department, highly professional in all he did, a

stickler for the highest technical standards and a great supporter of Imperial.

His passing means the loss of a link with a former era. Those of us who knew him well will miss a singular character. **David Nethercot head of Civil and Environmental Engineering**

WE REGRET that it has become necessary to abbreviate obituaries published in these pages. In particular, notices of alumni deaths which are more than a year old will be very brief. Those marked with an asterisk * will be available to read in full at www.imperial.ac.uk/engineering/about/alumni/imperialengineer

