

Modelling the future:
Engineering for clever outcomes

School snapshots

Graduate profile:
Sittichai Pookaiyudom



Worth talking about...



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From the Dean's desk ...



What will the 21st century be like? How will it be different to the 20th century for our children, their children and many generations to come? My children's lives are already very different from the way I grew up.

Contrary to (my children's) popular belief, electricity, telephones and cars did exist when I was born. However, radios were only portable by a couple of strong men (definitely men back then!), stoves mostly had to be stoked with wood and took ages to heat, and toilets were mostly outhouses – and not the nice composting ones you now find in Australia's national forests. Contrast this with my children's life where phones have always been mobile, computers get smaller by the day, almost everything is microwaveable, and many diseases that were taken for granted are now not only significantly reduced thanks to vaccination but some, such as polio, are close to eradication.

Given the changes we have seen, it's difficult to predict what the new century will bring. We do know that engineers have played an enormous role in the developments of the last century and they will continue to do so in this one. In this issue, the feature article looks at some of the ways in which engineering modeling and design at UNSW will contribute to these developments.

I've had a very successful and enjoyable year as Acting Dean of the Faculty of Engineering. As always, our staff, students and alumni have attained some amazing achievements in the short time since our last issue. You can read about some of these on pages 4–7. And you can read about our incoming Dean on page 4.

As I step down to take up my new role as Senior Associate Dean of the Graduate Research School at UNSW, I'd like to thank you all for your continuing involvement in the Faculty of Engineering. Our Faculty is successful because of the success of our alumni, our staff and our students. We continue to develop and improve our capabilities because of our partnerships with our alumni, industry supporters, donors and our staff and students. I look forward to working with you in new ways to do great things for Engineering@UNSW.

Dianne Wiley

Professor Dianne Wiley
Acting Dean, Faculty of Engineering

UNSW ENGINEERS

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Phone +61 2 9385 4023
Fax + 61 9385 5456
Email unswengineers@eng.unsw.edu.au

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NEWS

UNSW Engineering welcomes a new Dean

Professor Graham Davies has been appointed as the new Dean of the Faculty of Engineering. Professor Davies comes to UNSW from the University of Birmingham, where he was Chance Professor and Executive Dean of the School of Engineering.

Prior to joining the University of Birmingham in 2001, Professor Davies was General Manager (Vice President) of Technology Acquisition and International Development at British Telecom Research Laboratories, one of the largest industrial research laboratories in the UK.

Professor Davies is a Fellow of the Royal Academy of Engineering, a Founding Fellow of the UK Institute of Nanotechnology and a Fellow of the Institution of Electrical Engineers. He has been Chairman of the UK Engineering and Physical Sciences Research Council's Review Panel for Nanotechnology, Chair of the Materials UK Science & Technology Committee and has an extensive record of publications and patents.

His research interest is in nanotechnology in general, and semiconductors and MEMs (micro-electro-mechanical systems) in particular. "Nanotechnology is something I am very keen to promote and I think it's something that's going to be very important in all our lives now and in the future," Professor Davies said. ●



Professor Graham Davies

Solar powerhouse in Sydney

Suntech Power, the solar-cell manufacturing success story established by UNSW alumnus Dr Zhengrong Shi [BSc '83 (Jilin), MSc '86 (Shanghai), PhD '92 UNSW], has established a presence in Sydney to focus on business in Australia, New Zealand and the Pacific Islands.

Dr Shi said the new Sydney office and collaboration with local partners would help promote the development of the solar industry in Australia. "Australia is ideally suited to distribute solar energy generation and well placed to take a leading role in the development and utilisation of this clean and sustainable energy solution," he said.

Among the representatives of UNSW to join Dr Shi at the April launch of the Sydney operation was Director of the Centre of Excellence for Advanced Photovoltaics and Photonics Professor Stuart Wenham, who said Suntech's presence in Sydney was significant for Australia and for UNSW. "To have Suntech choose to open Australian operations shows their growing optimism about how things are developing in Australia," Professor Wenham said.

Each year, UNSW recognises alumni who have achieved excellence in their chosen field through the Alumni Awards for Achievement. In February, Dr Shi received the award. ●



Dr Zhengrong Shi

Water and solar projects for Singapore

UNSW has entered into an agreement with Singapore's Economic Development Board (EDB) to establish research projects and provide PhD scholarships in photovoltaics and water membrane technology. The research collaborations will be cofunded by the EDB and UNSW with industry and academic partners. ●

National Drilling and Well Control Program

The School of Petroleum Engineering, in collaboration with the Australian oil and gas industry, opened a state-of-the-art drilling-rig training facility in Perth in March. The National Drilling and Well Control Program training facility is the first of its kind in Australia and South-East Asia, and will provide essential training and certification for about 450 engineers and drilling-rig professionals annually.

Professor Sheik Rahman, from the School of Petroleum Engineering, said the \$600,000 facility provided the same level of realistic training for oil and gas professionals as

NEWS

flight simulators provided for commercial pilots. "This is a full-scale one-to-one simulator. What you will see on a drilling rig you will see on this facility."

The program is a joint project involving the School of Petroleum Engineering and the Australian oil and gas industry. ●

Aerospace engineer remembered

The family of the late Professor Douglas Archer has endowed a prize for excellence in Aerospace Engineering, named for the internationally respected aerospace engineer. Professor Archer joined UNSW in 1964 and led the Aeronautical Engineering group for more than 25 years. He retired in 1990 but remained involved in research and teaching until his death in 2004.

In a signing ceremony in April, his widow, Olga Archer, and son, Dr Robin Archer, made a donation to fund the annual Douglas Archer Prize in Aerospace Engineering. Dean of Engineering Professor Graham Davies paid tribute to Professor Archer and thanked the family for their donation. ●

Sharing the challenges with Asia

The University appointed 85 Visiting Research Fellows from Asia's leading universities at the first UNSW international research workshop in February. The Fellowships

formalise regional research ties in the key areas of science, engineering and medicine.

The new international cohort from China, India, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, Thailand and Vietnam bring with them world-class expertise in areas such as cancer research, HIV, immunology, nanotechnology, sustainable engineering processes, renewable energy and information technology. ●

Navigating through GPS dropouts

Global Positioning System (GPS) technology is a great invention, able to map your movements and save you from getting lost in strange city streets – until you go into a tunnel, between tall buildings or hit any other barrier that might block the satellite signal.

Spatial information system researchers at UNSW are working to end GPS dropouts by combining satellite-reliant GPS with a non-satellite-based technology called Inertial Navigation System (INS). The goal is to create an affordable positioning system which works accurately and seamlessly indoors and out.

Now the work of Dr Yong Li and colleagues in UNSW Engineering's Satellite Navigation and Positioning Lab (SNAPlab) could be the breakthrough that makes seamless GPS/INS navigation available for everyday use. ●



Mrs Archer and Professor Davies

Mapping out strong China ties

When members of China's State Bureau of Surveying and Mapping came to UNSW in February for their annual seminar, it was the first time in 50 years the meeting took place away from its usual venue in The Netherlands. China's State Bureau of Surveying and Mapping (SBSM) is the body responsible for surveying and mapping work across all of China and UNSW has signed a five-year agreement with the Bureau to conduct annual training courses for SBSM administrators. ●

Volunteer honoured

Kevin Scott, who gave thirty years of volunteer service to UNSW through programs in Food Science and Technology, has been awarded a Doctorate of Science *honoris causa*. Dr Scott is a research scientist with fifty years' experience in the field of post-harvest horticulture. As an Honorary Visiting Fellow at UNSW, he has mentored, advised and supervised numerous research students. He has a career total of more than 100 publications and has independently attracted almost half a million dollars of research funding to the University. ●



more NEWS



Photo: Prudence Upton

The Golden Boys of 1958 Engineering Alumni Celebrate the 50th Anniversary of their Graduation

On Saturday 19 April 1958, 71 students of the Faculty of Engineering received their degrees at the University's seventh graduation ceremony. Fifty years later, on Friday 18 April 2008, 27 of those graduates returned for a day of celebration and reminiscence.

Joined by family members, the '58ers braved the dismal weather and started the festivities with a bus tour of the Kensington campus.

The Golden Jubilee celebrations continued in the Tyree Room, where the graduates were met by current and former Engineering staff and treated to a delicious lunch. A photographic montage of the campus, then and now, was screened, highlighting some of the many changes that have taken place during the life of the University.

The new Dean of Engineering, Professor Graham Davies, outlined in his speech some of the developments planned for the Faculty, and thanked the graduates for helping to make the Engineering Faculty at UNSW what it is today. "You are our best ambassadors," he said. "You enhance our profile because of the achievements you have made in your professional lives."

Vice-Chancellor Fred Hilmer also addressed the graduates, commenting that Engineering is the heart of the

University and is now the largest and best engineering faculty in the country. "I don't think we would have such a great reputation today if you hadn't helped build the credibility of the education that is provided to our engineering students," he said.

Next on the agenda was a chance for the 1958 graduates to share memories of their time at the University. Ernest Armstrong (Civil Engineering), Charles Sapsford (Mechanical Engineering) and Dr Malcolm Somers (Chemical Engineering) regaled the guests with stories of campus life and colourful characters, and Mr Armstrong also detailed some of the professional achievements of the graduates over the last half-century. The event concluded with a re-enactment of the 1958 graduation ceremony, but this time instead of receiving degrees, each graduate was presented with a pair of commemorative champagne glasses.

"It has been a very emotional day," said Jenö Toppler, a 1958 Civil Engineering graduate who had travelled from The Netherlands to attend the event, "and a wonderful opportunity to catch up with old friends." • *Ben Allen*

Handing along the baton

A graduation ceremony in April, in which almost 200 Engineering graduands collected their testamurs, saw a senior Faculty academic collect his DSc – one of only a handful awarded by the University each year – and a number of PhD candidates received their doctorates. On hand was the immediate past Vice-Chancellor of UNSW and former Dean of Engineering, Emeritus Professor Mark Wainwright.

The DSc was collected by Professor Neil Foster of the School of Chemical Sciences and Engineering and an international leader in supercritical fluids research. Thirty years previously, he had



Dr Barrett, Prof Foster and Emeritus Prof Wainwright

been the first doctoral student supervised by Professor Wainwright.

At the same graduation, Professor Foster's student Angela Barrett, the postgraduate student representative on the University Council, received her doctorate. Dr Barrett, a recipient of a 2008 UNSW Alumni Association Graduand Award, titled her doctoral thesis 'Processing Pharmaceuticals using Dense Gas Technology'. She is now working for the NSW Department of Environment and Climate Change in their Climate Change, Policy and Programs Group.

More about the work of Professor Foster, whose DSc thesis was entitled 'Supercritical Fluids & Dense Gas Technologies: Fundamentals, Process Development & Applications', appears in the feature article of this issue, page 10. •

Alumni Anniversary Dinner

The Faculty of Engineering Alumni Anniversary Dinner, in celebration of the graduation classes of 1958, 1968, 1978, 1988 and 1998, will be held on Friday 19 September 2008 at the UNSW Kensington campus. Please contact Luciano Ferracin (details below) if you would like to contact your past classmates who will be happy to help.

2009: 60 years of UNSW Engineering

The History of the UNSW Faculty of Engineering 1949–2009 is planned as part of the University's 60th anniversary celebrations. Do you have any photographs that tell the story of your time at UNSW? If so, please contact Luciano Ferracin on (telephone) +612 9385 5364 or at l.ferracin@unsw.edu.au.

achievements

Solar rollers' dazzling result

The UNSW Solar Racing Team has completed its World Solar Challenge campaign, finishing fourth in its class and

winning the CSIRO's award for the most energy-efficient vehicle. Jaycar Sunswift III, the UNSW solar racer, crossed the finish line of the 3,000km race in Adelaide on Friday, October 26, after setting out from Darwin on Sunday 21 October 2007.

The car placed fourth in its division of Adventure Class and was 11th overall in a race won by the Dutch Nuon team. However it was the unexpected CSIRO Technical Innovation Award for the most energy-efficient vehicle which gave the Sunswift crew their biggest thrill. "It was because our car was the most efficient in the race, which is fantastic because that's the point of the entire event," team leader Yael Augarten said. •

Undergrads shine at Dean's Awards

Ninety-one engineering students, ranked among the top two percent of the Faculty, were honoured for outstanding academic performance at the 2008 UNSW Engineering Dean's Undergraduate Awards. The event was sponsored



by Parsons Brinckerhoff, represented on the evening by Mr Mark Dimmock.

Among the award recipients were four students – David Maunder, Jarryd Pla, George Lam and Eugene Lubarsky – who each received Dean's Awards for the fourth consecutive year. Another twelve students won their third award in as many years. •

Honour for research innovators

Three UNSW researchers – two from Engineering – have been honoured as Fellows of the Australian Academy of Technical Sciences and Engineering (ATSE) for their outstanding contributions to advancing scientific and engineering knowledge. Engineering Professors Mark Bradford and Neil Foster were among thirty new ATSE fellows named in late 2007.

Professor Bradford, the Director of the Centre for Infrastructure Engineering and Safety, was nominated for his outstanding research and his published work on steel and composite engineering structures – a

body of literature that has had widespread practical application.

Professor Foster, from the School of Chemical Sciences and Engineering, was nominated for his technological advancement of nanoparticle and microparticle formation in supercritical fluid solvents – work that has particular application to the pharmaceutical industry. •

Excellence in teaching

Richard Buckland from the School of Computer Science and Engineering received further acknowledgement of his teaching prowess when he won the Australasian Association of Engineering Educators [AAEE] 2007 Teaching Excellence Award. The AAEE award recognises outstanding contributions to engineering education, taking into account both a teacher's technical teaching ability and their ability to inspire students.

The award is the seventh that Mr Buckland, a computing teacher who specialises in cryptography, has won for his teaching style. Last year he was named one of Australia's most outstanding university teachers when he won a prestigious Carrick Award for Teaching Excellence. •

Australia Day Honours

Adjunct Associate Professor Alex Churches, a Senior Visiting Fellow with the

School of Mechanical and Manufacturing Engineering, was one of five UNSW academics included in the 2008 Australia Day Honours List. Professor Churches was cited for his work in the promotion and development of mechanical design and his service to engineering and education. •

Industry salutes young engineer

Chemical Sciences and Engineering alumnus Ross Dunbar, 27, has won the Alstom Award for outstanding contribution to industry from a chemical engineer under the age of 30 for his work with global oil and gas group ExxonMobil in Victoria.

The award recognises Ross's achievements in improving production and process efficiency at Exxon-Mobil's Longford gas plant in Sale (Vic).

"The bulk of the work was working on the gas plant to improve the production and process efficiency, to reduce the amount of energy it took to produce the condensate products and maximise the yield of the more lucrative LPG components," Ross said. •



THE FUTURE FOR ENGINEERING holds many challenges. These range from the needs of emerging economies and infrastructure renewal in the developed world to climate change; the effects of globalisation, such as competition for resources; how to feed the world; increased communication and the speed of growth of knowledge; the impact of the interconnectedness of society (such as interest rates or energy supplies); the requirements of an ageing world population; and changes brought about by technology.

“Engineering design has the ability to offer solutions in many of these areas,” Dean of Engineering, Professor Dianne Wiley, said. “What engineers bring to the design process is a rigour in approach and the fact that we develop technological and feasible solutions.”

“Frequently, we rely on complex modelling and computation techniques to aid our designs and these are also made possible through engineering advancements. As engineers, we also rely on fundamental scientific and engineering principles, and as we design solutions, we develop knowledge and insights of these principles.”

Louisa Wright spoke to researchers in the Faculty of Engineering about modelling the future.

MODELLING THE FUTURE: Engineering for clever outcomes

The power of the chip

For Sri Parameswaran, of the School of Computer Science and Engineering, the objective is not only to design a faster, more secure chip with good performance, small size and carrying multiple processors, there is also the challenge to imagine how widely they can be used in embedded systems, often with significant benefit to people’s daily lives. As he says to his students, the most important questions are “Why are you designing this? What will it be used for?”

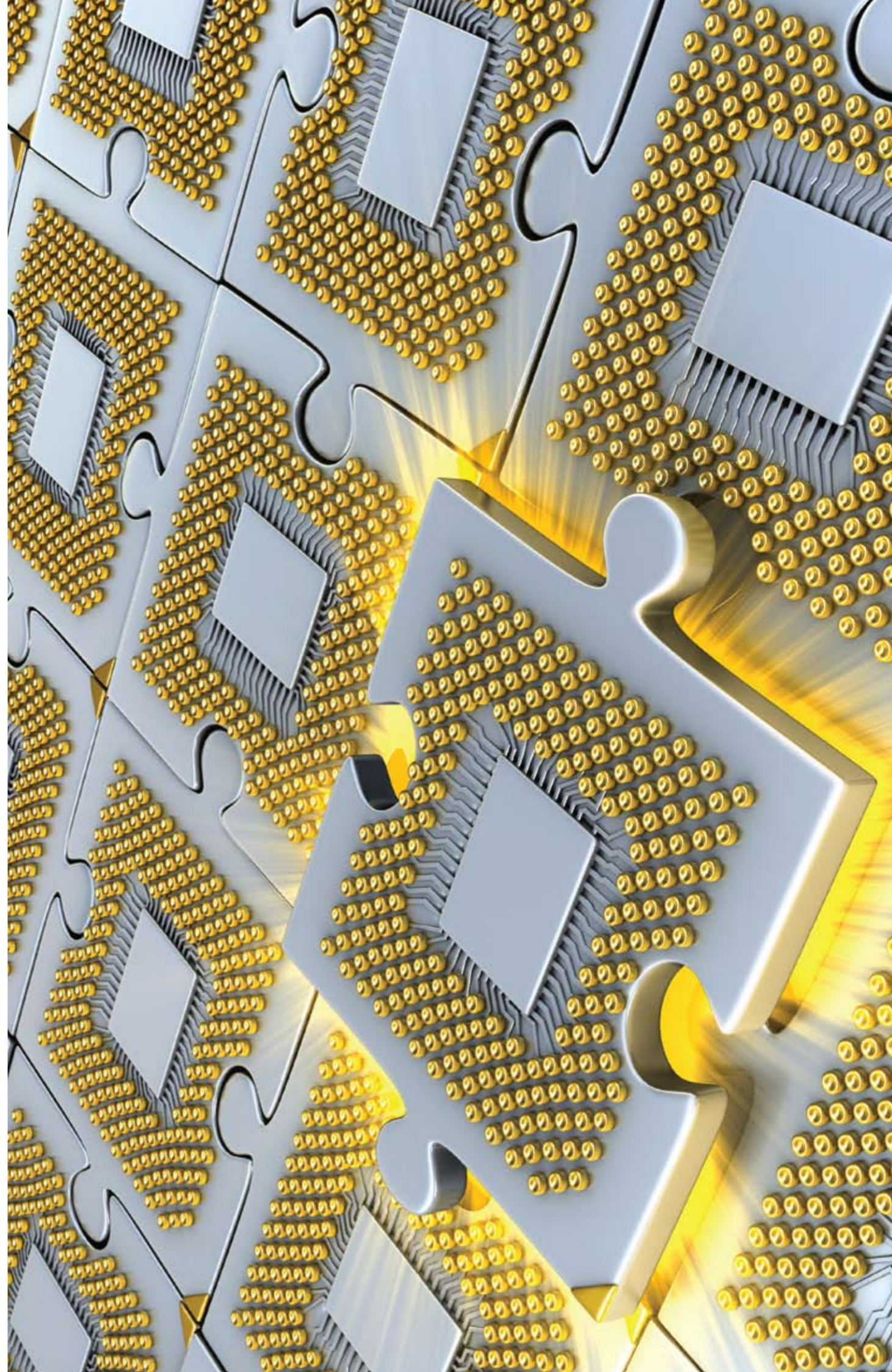
Professor Parameswaran, who is also the Program Director for Computer Engineering, designs embedded processors while thinking globally about their potential applications. “Multicore processors are already widely used,” Professor Parameswaran said. “They are in everyday use, in mobile phones, in cars, in medical equipment, in aeroplanes. We are designing future chips very quickly, because the commercial considerations mean that new designs are developed at high speed. Size matters, because of cost, and lower power consumption affects how quickly they cool down.”

Professor Parameswaran’s group also addresses the chip architecture with a view to improving security and reliability of the system. His group designs chips with multiple processors. Today some of the chips from his group contain eight or nine processors, and he expects that to grow to 40 or 50 in the next few years.

While increasingly sophisticated systems permit a range of indulgences in the Western world, including shoes that indicate balance and gait of the wearer, or implanted microchips allowing entry to the VIP sections of clubs – developments already in use – Professor Parameswaran is more interested in systems that bring less ambiguous benefits.

In 2008, one-half of the world’s population will either have a mobile phone or have access to one, Professor Parameswaran says. A significant number of these people – estimated at more than 20 percent – are numerate, but illiterate. These two factors have already spawned a range of benefits, including banking and cash withdrawal in several developing countries, and a series of booths in rural India giving access to necessary documents.

In the developed world, there will be continual need for chips that can survive in embedded systems in hostile environments, such as the extreme heat of an aeroplane engine or submerged in an urban sewage plant where the function is to warn of impending malfunctions. Professor Parameswaran also points to a range of implantable replacement parts in humans, such as bionic eyes, the Australian-developed cochlear implants, and an artificial hippocampus, part of the functionally related neural structures in the brain.



Making smarter drugs

When Neil Foster decided that his Supercritical Fluid Research Group would turn its attention to the efficiency of pharmaceutical drug delivery, he began the effort by first examining experimental behaviours of pharmaceutical drugs within supercritical fluids and supercritical fluid systems. Over a period of five years, the data and experimental observations amassed contributed to a comprehensive database, which has since been extensively cited by virtually every other group working in the same area.

This understanding of fundamental science supported Professor Foster's decision to design a process to overcome issues arising during the reformulation of therapeutic drugs, using supercritical technology. He chose to develop a technique from first principles, which also drew from his early professional experience with the CSIRO. With postgraduate student Roderick Sih, Professor Foster looked for gaps in existing knowledge and technology, and opportunities for improvement; they examined existing data, to establish what further processing dynamics would

be ideal, and as they workshopped their ideas in the lab, no alternative was left unexplored, as Professor Foster exercised his trademark of "turning negatives into positives". "The world is full of laboratory curiosities," Professor Foster said. "We wanted something useful, viable, and with a commercially relevant endpoint."

"At least forty percent of drugs in the future will have extreme water solubility problems," Professor Foster said. "There are significant bioavailability issues. To increase the rate of solubility, we have used supercritical fluid [SCF] technology to make smaller particles out of existing drugs." The work has multiple applications, producing drugs suitable for pulmonary delivery, and the design of systems that allow targeted delivery of

therapeutic drugs, using the magnetic qualities of iron oxide nanoparticles to deliver the therapy to a particular site as a current example. Vaccines may also be a potential application for this SCF work.

When this work began, the emphasis was on inhalable insulin, which had captured the imaginations of scientists, diabetics and pharmaceutical companies alike. By building on concepts derived from imagination as well as experience, Foster and Sih integrated design with purpose and were left with both a method of extracting extraordinarily fine-grade particles of insulin, and a flexible low-cost delivery system, as well as a set of design principles applicable to other outcomes.

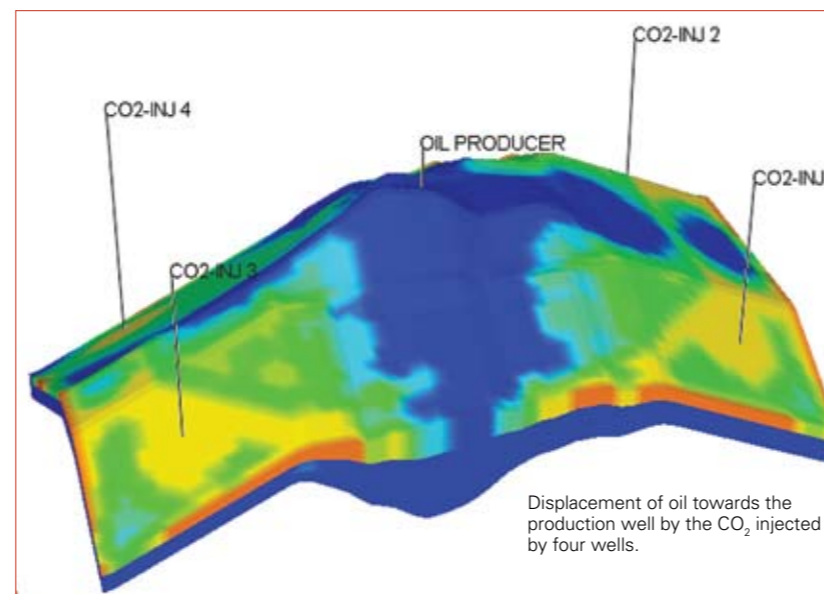
Co-optimisation: a win-win program

Maximising the recovery of hydrocarbons makes good economic sense in times of rising oil prices and dwindling reserves. One method, already used for decades to enhance oil recovery, has been to pump carbon dioxide (CO₂) into reservoirs, as it becomes miscible in reservoir conditions. As awareness of the threat from greenhouse gases has grown, research has turned to geosequestration and co-optimisation: creating a win-win outcome in the same reservoir with maximisation of both recovered oil and stored CO₂. The cooptimisation research is focused on recovery from oil and gas fields as well as coalbed methane reservoirs.

The School of Petroleum Engineering's Dr Yildiray Çinar uses commercial software tools, called numerical reservoir simulators, to model the range of scenarios arising from cooptimisation. Numerical simulation is a tool to understand reservoir behaviour and a complicated interplay of oil, gas and water flows in porous media. The precision of numerical simulation depends on the number of grids and grid sizes, and the number of parameters (how many wells, the number of phases and years on the project, personnel or operating costs).

Traditionally, the results of the numerical reservoir simulation are incorporated into an economic model to predict rates of return for different scenarios and reach a net present value (NPV) of the project. But the same simulations can be used to model the injection of CO₂ back into an oil or gas reservoir, or into a coalbed methane reservoir, in order to improve hydrocarbon recovery. Each project has different physical processes to control the recovery mechanisms, and a thorough understanding of recovery mechanisms by means of numerical simulators is crucial to minimise the uncertainty in economical estimations. In some cases, the partly-depleted oil and gas reservoirs can also be used to sequester the CO₂ and the same process, under a carefully managed degree of pressure, can at the same time extend the life of oil and gas extraction, giving (with rising oil and gas prices) an economically viable product.

Numerical reservoir simulation is an invaluable tool in these circumstances and is consequently a vigorous area of research, both internationally and at the Co-operative Research Centre for Greenhouse Gas Technologies (CO2CRC), Australia's collaborative research organisation focused on CO₂ capture and geosequestration.



“The whole world is changing in ways that few people understand ... it's important that we start planning now, for the changes in the future”

Planning for changed rainfall

Climate scientists have taught us to regard our rainfall with greater respect, and no longer to assume that enough will fall. Only a handful of years ago, however, the School of Civil and Environmental Engineering's Ashish Sharma and his hydrology group identified a more subtle but no less significant downside to global warming: the rain that does fall will come in different patterns, mostly in sharp, shorter and more intense bursts. This pattern is changing due to

increased CO₂ emissions and will bring greater risk of flood, increased erosion, and altered pressures on reservoir capacity.

"The whole world is changing in ways that few people understand," Associate Professor Sharma said. "It's important that we start planning now, for the changes in the future. We were surprised to find so little work on this here or internationally."

Professor Sharma and his then-doctoral student and now research fellow

Dr Raj Mehrotra have developed software allowing them to use the data from the General Circulation Models, or GCMs, which provide information on rainfall, temperature and other atmospheric circulation variables on a large scale. Sharma and Mehrotra take the GCM outputs and translate them to a much smaller, catchment-size scale to produce rainfall, temperature, evaporation and other key hydrologic variables. Using this information, it is possible to assess the water-planning implications of a future, warmer climate.

They present the likely rainfall outcomes and water supply risks for up to seven or eight plausible emission scenarios, factoring in the different ways society may evolve in the future, allowing for better-informed infrastructure planning.

As one of the early groups in the world to do this work, and now among the forefront in expertise in the area, Sharma and Mehrotra's papers are highly recognised and the group has attracted significant ARC and other funding. Much of their present work addresses the future capacity of Warragamba Dam and its catchment area to supply Sydney's needs up to 2070. The modelling gives multiple plausible rainfall outcomes over the decades, which in turn give the range of possible flows entering the reservoirs, allowing a risk-based assessment of the capability of our water supply systems to cater to future demands. They are preparing a version of the software that will allow non-hydrologists to use the program.

Going with the flow: CFD

Work on fluid dynamics is both computational and experimental, and applies to a wide range of areas, from aerodynamics and ships to problems that involve temperature, flows around bodies and biomedical flows. "CFD covers the whole area of fluid flow or heat transfer, and the fluids are air, water, smoke – anything that moves," said Dr Tracie Barber of the School of Mechanical and Manufacturing Engineering.

In Dr Barber's case, her work also covers a wide area, from participation in two ARC grants with the NSW Fire Brigade to high-performance racing cars, biomedical flows and supermarket refrigerators. In these cases the fluids are smoke and heat, air movement around a high-speed object, blood and chilled air. In all cases, she uses computational fluid dynamics (CFD) to model the flow and tag-teams the results with experimental work in the School's Advanced Fluid Dynamics Laboratory.

The challenge for the NSW Fire Brigade and ARC Linkage grant partner, design and consulting firm Arup, is the accurate re-creation of the behaviour of smoke and fire in order to prepare firefighters for the real thing. "We are designing a training tool, a piece of software, and behind it is very advanced computational modelling and advanced experimental techniques," Dr Barber said. "We're hoping to develop software that looks like a computer game. The firefighters will choose a scenario, and it will be exactly what happens in a real fire – the smoke will be the exact colour and the temperatures will be right." Dr Barber hopes that the software will be in place by late 2009.

A second Linkage grant concerns similar work with computational models and lab experiments to model ceiling-installed sprinklers, to understand what happens when the sprinkler is activated. "Do the water droplets hit the fire?" Dr Barber asks. "Do they turn to vapour, or are they making the fire worse? If we show it's not useful, then there would be a huge cost benefit, but if we show it is useful, then it can save lives to require them to be installed."

The computational tools necessary to analyse those droplets have only recently become available. "It's only really now that we are able to do good computer models of a sprinkler," Dr Barber said, "and the experimental systems that we use are also quite new, so to get this really detailed understanding of what the droplets are doing is something that we can really only do now with the tools we have."



Breaking bonds, making bonds: catalytic conversion

The conversion of natural gas into a range of enabling liquid fuels, aka GTL – gasoline, aviation fuels, diesel and alcohols – gives an exciting glimpse of meeting future energy needs with less waste, greater efficiency and lower energy use. The design of tuneable GTL catalysts with predictable performance for a desired product slate, using mathematical modelling combined with experimental chemistry, has been the Holy Grail in this process development.

Professor Soji Adesina and his Reactor Engineering and Technology group in the School of Chemical Sciences & Engineering have been at the forefront of this work. They recently devised a mathematical strategy that can be used to select precise recipe conditions for a catalyst tailored to meet competing, simultaneous best-performance indices. This breakthrough work will be published before the end of 2008.

Developing smart catalysts to deliver particular clean fuels requires the reduction, or even elimination, of unwanted by-products – the ultimate goal. Manipulation of catalyst synthesis conditions, so that it only gives the products that are wanted, involves a great deal of "tickling of the system", as Professor Adesina says. The key issue is the provision of a reliable quantitative relationship between the conditions for synthesis and the catalyst attributes (for example activity, stability, longevity and selectivity) to ensure that the end product is the liquid fuel of choice. He likens the catalyst to a facilitator, engineered to ensure that the correct bonds are broken and remade with maximum precision.

This model, known as QSAR (quantitative structure-activity relationship), was a product of "experience, good chemistry and good engineering," Professor Adesina said. "We have improved the mathematics of the process significantly. It is not finished – I don't expect it will be completed in my lifetime because of the unknowns and uncertainties which still cannot be answered, but it is a significant jump forward." ●

Graduate profile The can-do man: Sitthichai Pookaiyudom



Potential obstacles, to Dr Sitthichai Pookaiyudom, are no more than invitations to action. Concerned that Thailand needed a stream of high-quality engineers, he founded his own technical university. Annoyed by the time wasted in haggling over taxi fares, he invented a fare meter now used in every Bangkok cab. Seeking a supply of affordable Australian wine, he set up

a trading company to import a single shipment of 44,000 bottles, enough to supply his own requirements and those of his colleagues for years.

Sitthichai Pookaiyudom (BEng '72, PhD '76), who received an Alumni Award in 1998, came to UNSW on a Colombo Plan scholarship. "I always wanted to be an engineer since I was very young," Dr Sitthichai said. "My father was a technical man and I have never wanted to be anything else. I chose electrical engineering, because in those days, the area of electronics was booming. Solid state electronics was the most exciting area, and to study solid state electronics, you had to do electrical engineering."

Dr Sitthichai stayed on at UNSW to do his doctorate in solid state electronics, awarded in 1975, largely because of his respect for Professor Lou Davies. "He was such a good supervisor," Dr Sitthichai said. "He left his students to develop their own ideas, but he always had time for us if there were questions we couldn't solve."

The student Sitthichai worked very hard. "I didn't really have time to socialise during my PhD. I was working 10 or 12 hours a day – I never stopped, my research was so exciting, I didn't want to do anything else." It does appear, however, that enough socialising was included to leave Dr Sitthichai with a lifelong fondness for Australian drinking habits. "I learnt to drink beer fast at closing time in Australia and how to hold your alcohol."

He spent 14 years at King Mongkut's Institute of Technology Ladkrabang (KMITL), rising to become Dean of the Faculty of Engineering. He is proud that he and his colleagues drastically improved the reputation of KMITL, largely through its research program. But the restrictions of government-allocated budgets drove him to establish Mahanakorn University of Technology (MUT) in 1990: "At the time I was younger, you think the world is your oyster, I just went ahead with no thought that it wouldn't work."

MUT is now the biggest producer of engineers in Thailand, graduating up to 3,000 students every year. It was one of the first overseas universities to have an agreement of co-operation with UNSW, largely through the good offices of Professors Chris Fell and Mark Wainwright, with whom Dr Sitthichai maintains warm links.

Dr Sitthichai believes that if he had been an academic in a Western country, he would have generated more formal research. However, in Thailand, he turned his capacity for design to a wide range of devices, from the taxi meter to specialised machine guns (theoretically able to fire a million bullets per second), a video compression system and an ingenious telephone switchboard.

"When I was young, telephones were scarce and you couldn't call directly to an extension. I invented a special switchbox 30 years ago, I called that the magic exchange junction for telephone switching; that got a lot of publicity."

In a time when South-East Asia was consumed with military conflict, and Vietnam had invaded Thailand's neighbour Cambodia, Dr Sitthichai and his colleagues did extensive weapons research and he produced a simple anti-tank radio-controlled missile. He also invented a machine to check the quality of rice, which allowed farmers to ensure the quality of their paddy rice and to be paid appropriately by the rice millers. "It was used for about 10 years and it's the machine I am proud of most."

In 2006, Dr Sitthichai took up the government post of Minister for Information and Communication Technologies (ICT). "When I was appointed minister of ICT, I had to resign as president of my university, and I am not interested in running the day-to-day operations of a university any more," he said after the recent election of a new government in Thailand. "I plan to spend the next year or two writing a few more books, so our young persons can have proper resources for textbooks in the high-technology area."

He is concerned about the future of engineering education, both in Thailand and in Australia. "The engineering profession in Australia is slowing down as Australia becomes more of a service-providing economy, such as financial services and winemaking, rather than hard-core engineering. I was trained in a conservative period and I believe the wheels of a nation can only be built up by the engineers; you need engineers to make the nation prosper."

"I told my students at Mahanakorn that they should concentrate hard in science and mathematics, the two most important tools an engineer can have. You have to know science better than scientists and maths better than mathematicians, because they can dream, but we engineers turn dreams into reality." ●

SCHOOL snapshots

Graduate School of Biomedical Engineering

The step from perception to performance

Perception is a personal response to a circumstance and, as such, is sometimes difficult to correlate with data or mathematical indicators. The doctoral work of biomechanical engineer and PhD candidate, Lauren Kark, addresses that nexus in the responses of lower-limb amputees to the fitting of their prostheses. In the process, she hopes that her work will lead to clinical guidelines to improve the efficacy of amputee therapy and treatment.

Lauren's work is with transfemoral (above the knee) and transtibial (below the knee) amputees, many of them members of support groups in NSW and Queensland. Many limbs were lost to illness, including diabetes or cancer, or trauma, such as road and boating accidents, gunshots and farming accidents. Her research addresses two areas. The first is how well the person perceives that they ambulate and the variables associated with their mobility. Many factors contribute to these perceptions and to the person's expectations of mobility, including comorbidities, age and the time elapsed since amputation. More than 130 patients have responded to these issues in a questionnaire.

A subset of independently ambulatory respondents will then have the mechanics of their ambulation assessed. Aspects such as gait analysis, balance testing and energy expenditure will be measured and the results will inform Lauren's doctoral hypothesis, that people with chronic physical disability can provide an accurate assessment of their own level of physical function. Lauren believes that

this has the potential to improve both patient care and the patient's level of satisfaction, as well as reduce the need for expensive tests and further consultations.

Another area to be explored is the discrepancy between patient preference and the objective performance, biomechanically, of the prosthetic limb. "Patients often clearly prefer one type of prosthesis over another," Lauren said. "Biomechanical testing might show no difference between the two, and it would be useful to understand the factors that influence the clear preference."

Lauren intends to stay in the area of amputee and rehabilitation health, and sees the issue of prosthesis socket design as a major area of work. "There are also questions about the costs of amputation, both to the individual and to the funding bodies," Lauren said, "as well as issues regarding different ways of providing rehabilitation services." ●



School of Chemical Sciences and Engineering

Water, water everywhere

The public image of water recycling usually includes infrastructure with a huge footprint: energy-consuming desalination plants or paddock-wide settling tanks. Among the advantages of membrane bioreactor (MBR) technology are its small footprint and the ease of retrofitting water treatment plants. One of the persistent disadvantages of this now-established processing option, however, is the inevitable fouling of the membranes, which remains a brake on the wider use of MBR technology.

One method of inhibiting the build-up of fouling agents on the membrane is to introduce air on the membrane surface, which both limits the fouling propensity of the biomass (by scouring the membrane with coarse bubbles) and also provides oxygen to the biomass, the activated sludge made up of a mass of micro-organisms which degrade the pollutants in the waste water. This aerobic system has the drawback of requiring a high level of energy.

Two pilot-scale aerobic MBRs were set up at the Sydney Water's Malabar site two years ago as part of an ARC Discovery grant awarded to the UNESCO Centre for Membrane Science and Technology with the in-kind support of Sydney Water. The School of Chemical Sciences and Engineering's Professor Vicki Chen and Dr Pierre Le-Clech, with the Centre for Water and Waste Technology's Dr Richard Stuetz and Dr Heather Coleman, were the key players in the work.



The data from the research at this site is particularly useful as, unlike much of the research around the world in this area, it is from the process of treating real effluent, as opposed to synthetic or analogue material, and therefore observing fouling factors in non-laboratory conditions.

Work started at Malabar in early 2008 under a second three-year ARC Discovery grant on an anaerobic system, in which the circulation needed at the membrane's surface is not provided by air. One alternative is to pump biogas, captured as a by-product of the MBR process. While this work is in early stages, it has the potential to use as little as half the energy of the aerobic system.

Dr Le-Clech is encouraged by the level of interest in water treatment technologies. He sees many students keen to do their final-year project in the area, and is also hosting increasing numbers of academics from Europe, South-East Asia, China and the US. ●

School of Civil and Environmental Engineering

Fitting together the pieces of the puzzle

When large schools of fish began dying and rotting at the mouth of the Tweed River, on the north coast of NSW, two decades ago, the Tweed Shire Council and local communities wanted to know why. Was it the pesticides or other additives used in the local sugar cane industry? Professors Melville (Science, UNSW) and White (ANU) and, more recently, Head of School Professor David Waite, joined the search for the cause and possible solutions. The outcome of that research, assisted by three consecutive ARC grants, has not only yielded answers to the problem applicable around the coast of Australia and overseas, but has also led to increased agricultural output with a reduced environmental footprint.

Painstaking work revealed that pyrite (a mineral containing Fe(II), a reduced form of iron and sulphur), which had accrued in the sediment at the time of deposition, was being oxidised to ferric (Fe(III)) forms of iron when these deep sediments were disturbed and exposed to oxygen. This oxidation process generated acid that subsequently dissolved the sediments and resulted in substantial quantities of acid, iron and aluminium being washed downstream. The excavation work disturbing and exposing the deep-laid sediments was not only housing developments, but also the construction of drains built to enable the cultivation of sugar cane.

The problem, once analysed, was not dissimilar to that around mine sites but on a broader scale. Methods used to remediate acid mine drainage were effective for localised problems, but

prevention of the initial acidification combined with a reduction in pathways for acid transport were required. Laser levelling of the farms reduced the need for deep drains, minimising the deep disturbance of soil and reclaiming land for planting. Actions as simple as tractor movement on paths constructed along the drains were found to compact the soils and reduce acid movement to waterways.

Professor Waite believes that the large-scale problem requires larger solutions, and future work in the Tweed River will be directed at clearer identification of the source of acid and a better understanding of the flow of contaminants and of their environmental impacts. Senior research fellow Dr Richard Collins has established that the sources of acid are more localised than expected, particularly in the Tweed's upper catchment area, and this pinpointing of the problem will allow the costs of remediation to be minimised. ●



SCHOOL snapshots

School of Computer Science and Engineering

Ten million chips a month and counting

The students in Gernot Heiser's class on advanced operating systems are a privileged group. Professor Heiser, who was seconded full-time to NICTA (National ICT Australia) at its establishment in 2002, only teaches one course each year but the class also serves as a potential entry point to one of Australia's IT success stories.

NICTA's philosophy is to generate opportunities by combining excellence in research, education and commercialisation and encouraging entrepreneurialism. This environment allowed Professor Heiser to develop the microkernel operating systems that had been his focus since 1994. (A microkernel is a tiny operating system core that provides the foundation for modular and portable extensions.) By 2001, he was working with a group of a dozen PhD students on novel approaches to embedded and real-time operating systems and when NICTA was created, the whole group moved across.

"NICTA provided the opportunity to develop an ambitious vision aiming for major impact," Professor Heiser said. "Our software is now on chips for mobile phones which are shipping at the rate of ten million a month."

Industry was keen to adopt more sophisticated operating-system technology, largely due to the explosion of functionality and the resulting software complexity, and the work of Professor Heiser's group was the most advanced in this area. His desire to create a new operating system for embedded systems came to fruition at a time when he could move from the

standard methods of research funding into an institution with a strong emphasis on commercialisation.

"NICTA gave us the opportunity to scale things up to the next stage," he said. "We could combine research with a development component to allow us to produce this technology for industrial use." An approach from an international company, Qualcomm, for a solution to a technical problem has become an ongoing commercial relationship.

Professor Heiser now spends half his time with his company, Open Kernel Labs, which he co-founded with NICTA's first entrepreneur-in-residence, Steve Subar and which is now a leader in high-performance protected operating systems and virtualisation technology for embedded systems. In April this year, Open Kernel announced its products will soon ship in high-definition set-top boxes. The group continues to work on developing the technology to broaden its appeal to other kinds of embedded systems, focusing on techniques meeting highest security and safety requirements, suitable for life-critical and national security uses. ●



School of Electrical Engineering and Telecommunications

Speaking the language

Dr Julien Epps, who took up a post as senior lecturer at the start of 2008, is no stranger to Electrical Engineering and Telecommunications, being an alumnus twice over (BE '97, PhD 2001). His professional experience between the completion of his doctorate and his return to Kensington, however, may have given him a valuable edge in an international competition in his field of speech-signal processing.

The US-based National Institute of Standards and Technology (NIST) is responsible for standardising the evaluation procedure for speaker verification, a technology whereby the claimed identity of a person is verified using only their voice. The evaluation process is in the form of a competition, and the outcomes are watched closely within the speech-processing community. A win in the NIST contest brings professional recognition and close attention to the work; more than one win would be likely to attract significant standing in the area and commercial interest.

Dr Epps, EET's Director of Academic Studies Professor Eliathamby

Ambikairajah, and two co-supervised doctoral students Ms Mohadese Nosratighods and Mr Tharmarajah Thiruvaran, will enter this year's NIST competition using frequency modulation features, which are not traditionally used in speaker verification and have not been entered in this competition previously. The team has been working on the system for some time, and will be submitted to NIST as a joint submission with A*STAR, the Singaporean Agency for Science, Technology and Research.

This collaboration has resulted from "an extremely useful and productive time" during 2007 which Dr Epps spent with the A*STAR Human Language Technology Department, whose expertise lies strongly in the decision-making processes that follow speech modelling. He developed and advised A*STAR on the nuisance attribute projection technique, which also forms part of the joint submission. "I had a lot of freedom and expert guidance to explore ideas," Dr Epps said.

Dr Epps says the field of speech-signal processing is highly competitive, with applications in speech-recognition and dictation software; in speech coding for applications such as mobile phones and Skype; and in speech enhancement.

A new area of Dr Epps' work, in which he is leading in Australia, is in genomic signal processing. In this research, similar tools are applied to the problem of detecting patterns of periodicity in the DNA sequence, leading to greater recognition of the location of the gene and exon regions within each sequence. ●

School of Mechanical and Manufacturing Engineering

Two plus two makes more

In an exciting development for the Faculty, the School of Mechanical and Manufacturing Engineering has signed an agreement with Shandong University to offer a 'two plus two' undergraduate degree.

Shandong, which is one of China's top universities and whose Department of Mechanical and Manufacturing Engineering was ranked in the country's top four, will enrol the first group of about 30 students in September 2008. They will be drawn from the most qualified students not only in Shandong Province (population 100 million) but from all over the country.

The cohort will undertake the first two years of an engineering degree as well as an intensive English-language program. Then, if they attain an average pass rate of 70 percent in all subjects, they will receive two years advanced standing towards the UNSW Bachelor of Engineering (Manufacturing Engineering and Management). They will attend UNSW for the final two years of an undergraduate degree program with the same status as an equivalent-stage, fee-paying international student. UNSW will be the conferring institution, and each institution will have a program co-ordinator to assist students. These program co-ordinators will also collaborate to ensure that the first two years of engineering education at Shandong includes appropriate academic components to enable them to successfully complete the UNSW stage of the program.

The driver of the agreement with Shandong has been Associate Professor Jun Wang, who joined UNSW three

years ago and has retained an honorary appointment at Shandong since 2003. In the course of his activities with Shandong, which includes giving workshops and lectures, and supervising postgraduate students, Professor Wang also hosted a senior Shandong academic at UNSW in 2005. Their discussions about ways to build greater links between the two institutions led, with the enthusiastic support of outgoing Head of School Professor Hartmut Kaebnick, to the formation of the 'two plus two' program.

"Once this program is underway, we hope that it might go beyond just teaching," Professor Wang said. "We hope to offer a small number of scholarships for the highest-achieving students, and we are also looking at retaining a small percentage of fees paid in this program to bring one or two Shandong academics to UNSW on exchange."

Shandong has a long and distinguished record in the field of engineering education. China's only academician in the field of machine manufacture is based at Shandong. ●



SCHOOL snapshots

School of Mining Engineering

An international education

The School of Mining Engineering is one of six leading mining engineering education institutions around the world which have come together to offer a unique program. An initiative of the Swedish company, Sandvik Mining and Construction, the program is made up of two-week modules delivered in Australia, South Africa, Finland, the UK, the USA, and in Austria, whose University of Leoben is both the manager of the program and the institution conferring the postgraduate qualification.

The two dozen participants, all selected Sandvik employees and future management candidates, include students from a number of engineering disciplines and other areas of the company including finance and marketing. Students are from eleven countries, including one Australian, demonstrating Sandvik's international scope. They started the program late in 2007 and will complete the two-week block sessions over 18 months, arriving at UNSW in late April for the first Australian session.

Head of School Professor Bruce Hebblewhite and Associate Professor David Laurence are leading the UNSW module, on risk management and mine safety. The session will include several site visits for inspection and evaluation of training and rescue systems as well as a hands-on experience of the School's virtual reality mine-safety training modules.

This unique short course has been developed from components of the existing undergraduate and postgraduate



course materials and will involve a number of UNSW academics and some outside speakers to deliver lectures. Three representatives of the University of Leoben visited UNSW in March to finalise the module. Planning for the Sandvik International Mining Program only began in the first half of 2007, and the initial agreement is for the program, which is fully funded by Sandvik, to run annually for five years. The second intake of students will begin their course, at the University of Leoben, in October this year.

News has travelled quickly within the industry about this program, unique in the industry as it is fully funded by a private company, and Sandvik has already reported approaches from associated companies exploring the possibility of including their employees in the program. This raises the possibility of further international collaborations for the School to respond to the untapped demand for specialist mining education. ●

School of Petroleum Engineering

A revolution for oil and gas field evaluation

UNSW and the ANU are jointly commercialising research that will revolutionise the way in which the upstream petroleum industry evaluates oil and gas discoveries and plans field developments.

The ANU/UNSW research team, headed by Head of School Professor Val Pinczewski and Professor Mark Knackstedt of the Department of Applied Mathematics in the Research School of Sciences and Engineering at ANU, has developed high-resolution three-dimensional imaging facilities and large-scale computer algorithms which allow small reservoir rock fragments to be analysed in a virtual or Digital Core Laboratory.

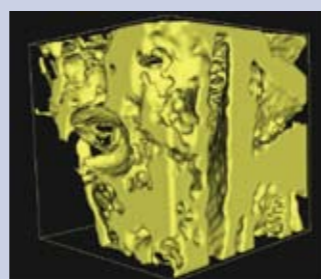
This breakthrough technology will greatly reduce the cost of cutting conventional core samples, significantly increase the quality and quantity of data, and reduce analysis time.

Core analysis data is crucial to field development decisions costing billions of dollars. In offshore areas of Western Australia alone, which accounts for less than one percent of the world's known petroleum reserves, the expenditure on drilling wells and cutting core was

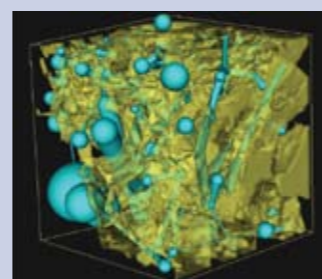
more than \$2 billion in 2007. The corresponding planned expenditure for oil and natural gas developments was in excess of \$60 billion.

The 3-D micro-imaging CT laboratory is the only facility of this type in Australia. It is playing a crucial role in the training of young scientists and engineers in this rapidly emerging area of technology. The value of the work in enhancing the understanding of processes critical to oil and gas recovery and improving exploration outcomes has been clearly demonstrated by the support from the industry worldwide and widely recognised by the international scientific community.

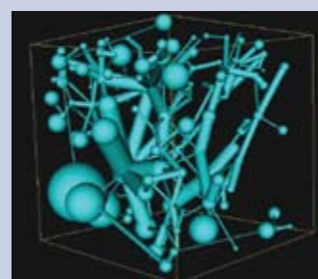
The research group is supported by a consortium that includes BP, BHP Billiton, Chevron, ExxonMobil, Shell, Saudi-Aramco, Schlumberger and Total amongst others. The group has recently completed the installation of a micro-CT facility for the Oil and Natural Gas Corporation of India at their Institute for Reservoir Studies in Ahmedabad and is finalising contracts for a similar installation for BR Research laboratories in Houston. ●



Small sub-set of 3-D image (1/2000 of volume imaged)



Embedded network



Network with solid removed

School of Photovoltaic and Renewable Energy Engineering

The gift of water

When Loun village in Vanuatu ran out of water three years ago, the local Tanna people tried negotiating with distant neighbours to take a pipe from their source. Approvals were given, and later withdrawn when their water supplies also dwindled.

Hopes for a solution were pinned on a multidisciplinary UNSW team, including Head of School Richard Corkish, microbiologist David Roser and Mary O'Malley, who had personal links with the community. We had been discussing a joint water/solar energy project but did not have the means to finance it until Sydney engineering firm Cundall stepped up.

Cundall is a supporter of many charities and was looking for an engineering project in a developing nation. When Richard Corkish mentioned our exploratory trip to Loun last year, an alliance was formed. Two Cundall engineers – a water and a solar engineer – committed to the project and the company asked its clients to help contribute to the cost of material components.

Local people have gathered essential data, under the guidance of Professor Corkish, and contributed what small funds they have to the project. By July 2008, Loun children hope to drink the first drops from newly installed water tanks and turn on power in their schoolroom.

"We hope the project will be a model for community engagement, showing what's possible when tertiary



Photo: Dr. Richard Corkish

institutions, private enterprise and local people work together," said Professor Corkish, who hopes to visit Tanna annually with his second-year students as part of the School's developing countries program.

"It has been an interesting experience, teaching local people how to gather data like GPS co-ordinates and rainfall data so we could assist with the right advice."

"Three years ago we formed Cundall Community to demonstrate our part in the wider community, and commit one day per employee to voluntary activities," Cundall Managing Director, Simon Wild, said. "As a company specialising in sustainable design, Cundall Community blends well with our company ethos.

"Being involved in the Vanuatu trip and with UNSW provides us with the avenue we had been looking for, to allow us to support local communities, and also support the University where many of our high-calibre graduates have studied." ● Mary O'Malley

School of Surveying and Spatial Information Systems

Our Professor in Spatial Information

UNSW has collaborated with the NSW Government and the Co-operative Research Centre for Spatial Information (CRCSI) to fund a Professorship in Spatial Information. Dr Linlin Ge is the inaugural appointment to the position, which is expected to enhance the NSW Department of Lands' investment in spatial information as well as to increase the development of spatial knowledge.

Dr Ge, who took up his appointment at the start of 2008, had previously been a senior lecturer at the University as well as project leader and senior research fellow at CRCSI. His doctorate areas of GPS and imaging were particularly suited to the areas of interest at Lands, which has recently purchased an aerial digital camera to map the whole state at very high resolution, as low as 15 to 20 centimetres. The data from this work has use in a range of applications, including environmental, industrial, housing and post-disaster recovery. One weekly mapping exercise is a joint initiative with the State Emergency Services, to track recovery after hail damage.

Dr Ge sees his role with Lands, which is still being developed, as that of policy and science advisor. "Everyone's aims are complementary," he said. "Lands predicts a shortage of spatial information staff by 2013, and the University needs more undergraduate and postgraduate students in the discipline. The government is interested in boosting its capacity in the area." One aspect of his appointment will address methods of encouraging recruitment to the field.



Dr Ge is an enthusiast for Australia's capacity in spatial information. "We have the potential to be leaders in the field," he said, pointing to Australia's clear skies and low vegetation, two factors that permit highly accurate imaging data. His ongoing research at the University includes two ARC-funded projects, as well as work through the CRCSI in which Lands is an industry participant. "The work is also closely connected," Dr Ge said.

One of Australia's specialists in radar imaging, Dr Ge has been a leader in using radar for terrestrial, rather than ocean, work. "Compared to optical, radar is recent," he said. Within the last several years, improvements in the technology have allowed greatly improved resolutions, as low as one metre, in this area of work.

Dr Ge's five-year appointment was the third by the CRCSI, following similar arrangements with the University of Melbourne and Curtin University of Technology. A fourth appointment is anticipated at the Queensland University of Technology. ●

Letters

I read my daughter's copy of this excellent magazine. I thought your analysis of Climate change: the engineering challenge was one of the best stories I have seen on the need for change and who will be responsible for the work needed. It should be distributed to people outside of the engineering profession so the public can see that changes can be engineered. Australia has already solved many of the technical problems and we have many of the skills needed to design and build clean solutions. Give engineers the money and they will give you the change.

If you have PDF copies which I could distribute this will also help. The benefit to you is promotion of UNSW Engineering and engineers in general.
Cheers,
Noel McIntosh, BSc Engineering ●

Editor's note:

All issues of UNSW Engineers are available as PDFs on the Faculty website, at www.eng.unsw.edu.au/alumni/unsweng/index.htm

Bruce F. Rabbidge, BE, took issue with the illustrations used for the feature article in Issue 16. This is an abridged version of his letter: That evil-looking stuff belching forth from the top of the venturi-shaped towers on page 9, and the white cloud issuing from the rectangular-topped structure on page 11 is nothing more than beneficial water vapour. In the first photograph it is cleverly made to look nasty by deliberately silhouetting against a late-afternoon sun. You don't mention the actual locations, but the context of the article suggests strongly that it is a coal-fired electricity-generating station. Anyone with a smattering

of knowledge about power stations or the steam cycle will tell you that such water vapour comes from the spraying of ordinary water on pipes lining the inside walls of the towers, the pipes carrying the hot water, steam or gas which requires cooling as part of an efficient steam cycle. Similar water-spray cooling towers are used widely to cool all sorts of things in industrial plants where there is a limited supply of cooling water, because most of the water (which drains to the bottom of the tower) can be recirculated after it has cooled in a pond of some sort...

Another issue I have with this article is that it does not mention the role of methane in the greenhouse effect. Even the most one-eyed climate-change fanatic will agree that methane is about an order of magnitude more important than CO₂, but because it is produced mainly by nature, it gets little attention.

Yours faithfully,
Bruce F. Rabbidge, BE ●

Reply from the Editor:

Mr Rabbidge is correct in his view that the photographs were selected at least in part for their intrinsic dramatic quality. We were aware that the clouds were water vapour. However, there was editorial integrity in the choices. The photograph on page 11 was placed directly above material from the School of Electrical Engineering and Telecommunications, headed 'Building a better boiler', which concerned efforts to achieve more efficient boiler control, potentially leading to lower gas emissions. He is also correct that we did not raise the role of methane, as the article was showcasing areas where engineering could play a beneficial role in climate change.

blast from the past

Eggs Away

Project LEM, or Lightweight Egg Module, was the second of two 'design and build' projects for second-year Mechanical and Industrial Engineering students. The projects, which included Project LIFE, or Low Impact Failure Experiment, were intended to stimulate interest in the engineering problems of vehicle design, passenger protection and crash resistance. Both projects used a raw egg as a passenger. Project LEM took place by dropping the eggs in their modules down the main staircase onto judiciously located plastic sheets. Of the 67 modules dropped, 36 landed without harming the 'passenger'.

Project LEM was developed by then-Dr Alex Churches (more about whom appears in the Achievements section, page 7), who was then a lecturer in the Department of Applied Mechanics.

This photograph of the modules made by the students was taken on 11 August, 1972. Who were they? Email us at unswengineers@eng.unsw.edu.au.



This photograph stimulated many replies. A selection is below:

The bearded gentleman on the left is (Hairy) John Geremin who was a laboratory assistant/technician in the school of highway and/or traffic engineering during the late '60s to early '70s. At that time the school was based at the old Randwick tram workshops. John started but did not complete electrical engineering. After leaving traffic engineering, he moved into computer operations.
(Hairy) Jim Morgan, BE (Chem) 1967

The photo is of John Gerimen with a beard on the left, with a British Pendulum Friction Tester on a then-new compound used for marking pedestrian crossings (1964). The project was funded by the old NSW Traffic Authority and supervised by Dr Jim Croft of the UNSW Institute of Highway and Traffic Research. Howard Sherrard was the Director. The man on the right was a red-headed Geordie (ex British Army).
Bill Yandell

I take issue with your comment that traffic engineering "was a little more primitive in the 1960s". Actually the portable skid resistance tester is still widely used today, as detailed in AS1141.42-1999. They are obviously testing the skid resistance of the paint on the zebra crossing.

What may be 'primitive' is the safety aspect – these were the days before mandated safety procedures – but on reflection, the occasional EH/EJ Holden (or whatever, I am no expert in car models) serenely trundling past really didn't pose a great risk. I expect there was a mob of kids playing cricket a bit further down the street!
Kyle Wayne, Regional Geologist (not traffic engineer), Qld Dept Main Roads

I'm surprised that the caption to the photo didn't name the British Pendulum, which is the device they are using. Although these have been around for a while and there are other methods available for carrying out skid resistance testing, the British Pendulum is still in use today.

Robert Swears, MEngSc (Transp) 2001

Obituaries

Gordon Samuels 1923–2007



Cliffen PUGH, Portrait of The Hon. Mr Justice Gordon J. Samuels, M.A., O.C.M., Chancellor, 1976-1994, 1978

The University held a memorial service in February for our longest-serving Chancellor, the Honourable Gordon Samuels, AC, who died in December 2007. Many thousands of Engineering undergraduates and higher degree candidates received their testamurs from Mr Samuels, who was Chancellor of UNSW from 1976 to 1994. He also held the positions of 36th Governor of NSW (1996–2001) and Judge of the Supreme Court and the Court of Appeal.

Mr Samuels was twice President of the New South Wales Bar Association, a judge of the Supreme Court of NSW and a judge of the Court of Appeal. Interwoven with his legal career was an almost 50-year commitment to education, culminating with the Chancellorship of the University of New South Wales.

Immediate past Vice-Chancellor and former Dean of Engineering, Professor Mark Wainwright, spoke at the service about Mr Samuels' commitment and contribution to the graduation ceremonies over his time as Chancellor.

"Gordon Samuels brought greatness to graduations at UNSW," Professor Wainwright said. "He may well hold the record for officiating at graduations at any Australian university, and a record unlikely to be broken at UNSW."

"He truly loved graduations and loved to reminisce about them. He was also in a competition with Dame Leonie Kramer, Chancellor of the University of Sydney, over who had presided over the most graduation ceremonies or who had awarded the most degrees.

"He could have written a complete book on his experience at graduation ceremonies having presided over hundreds, and awarded tens of thousand degrees and shaken tens of thousand hands ... for me graduations will always be one of Gordon Samuels' greatest legacies."

The Australia Ensemble, the seven-person chamber group founded by Mr Samuels in 1980, played a selection of music at the memorial service. ●

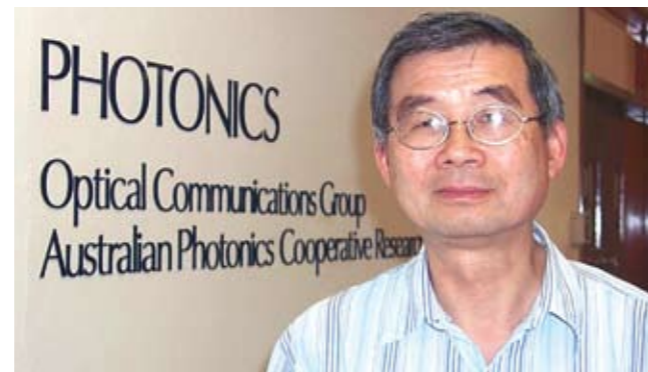
Pak Lim Chu 1940–2008

Many Electronic Engineering alumni will remember with affection Pak Chu, the internationally renowned pioneer in optic fibre technology who spent 30 years at UNSW, much of that time as head of the Optical Communications Group (OCG).

Emeritus Professor Pak Lim Chu took his undergraduate degree at UNSW in Electrical Engineering, his ME in 1966 and PhD in 1971. Under Pak's leadership, the OCG was working at the leading edge of photonics technology and he is credited as one of the first scientists in the world to pioneer the work on optical fibres. He also pioneered the work on soliton interaction and soliton switching. He led the first experimental research group on optical fibres in Australia, at UNSW. He pioneered the development of non-destructive index profile measurement technique, which has been adopted by industry, and went on to develop other techniques to measure the stress distribution in optical fibres. He and his group made significant contributions to the study of non-linear effects in rare-earth-doped fibre and waveguides, optical switching based on twin core-fibres, planar waveguides and devices, sensing and particularly the fibre hydrophone, as well as other diverse fibre applications.

Pak was an internationally recognised leader in his field, highly respected by researchers here and overseas. In 2001, the year he retired from UNSW, he was awarded the Centenary Medal of Australia.

After he left UNSW, Pak accepted a professorial chair in the Department of Electronic Engineering at the City University of Hong Kong (CUHK), and the directorship of the Optoelectronics Research Centre of the same university. He continued his research and developed three-dimensional waveguide switching until he retired from CUHK in 2006. ●



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