



# FOCUS

NUMBER 191  
AUGUST 2015

A group of diverse business professionals, including men and women in various attire, standing on a reflective floor in a futuristic cityscape at night. The background is filled with illuminated skyscrapers and digital data visualizations.

## PRODUCTIVITY AND INNOVATION

IMPROVING OUR CULTURE,  
FOCUS AND OUTCOMES

We need a better innovation culture,  
an enhanced productivity focus and stronger  
links between research and the marketplace.

# Clunies Ross 2016



## 2016 NOMINATIONS NEW FORMAT AND CATEGORIES CALL FOR NOMINATIONS

**Nominations for the 2016 Clunies Ross Awards will open on Monday 3 August and will close on Friday 30 October, 2015**

There will be a new format and specific categories for the Awards in 2016.

Over the past quarter of a century the Awards have recognised contributions by dedicated individuals to the application of technology for the benefit of Australia, highlighting ATSE's commitment to fostering innovation and commercialisation and acclaiming the work of those taking the nation's leading technologies to the marketplace.

In recognition of the complex nature of such activities, from 2016 the Awards will be made in three categories with a single winner in each category. The winners will be announced at **ATSE's Annual Challenge Conference in Sydney, planned for 15/16 June.**

**IF YOU WISH TO NOMINATE A 2016 AWARD CANDIDATE THE RELEVANT DOCUMENTS WILL BE ON THE ATSE WEBSITE SOON.**

### CATEGORIES

The three award categories are:

#### **Clunies Ross Entrepreneur of the Year Award**

For those who have been responsible for the creation of a product or service with a financially successful outcome, in either an early stage or mature company environment with demonstrated impact for Australia.

#### **Clunies Ross Knowledge Commercialisation Award**

For those who have been responsible for a technology which has been commercialised, most likely by licensing, with a financially successful outcome.

#### **Clunies Ross Innovation Award**

For those who have been responsible for the adoption of a technology, at a stage where the financial outcomes are yet to be realised and/or the benefits are of a measurable broad community nature.

### CRITERIA

The award criteria are:

1. The award winner has made an identifiably significant contribution to the advancement of industry and/or the community through the application of science and technology for the economic, social and environmental benefit of Australia;
2. The award winner is able to demonstrate the impact or potential impact of the technological based innovation; and
3. The award winner has advanced the promotion of innovators and community awareness of technological innovation.

**INQUIRIES [clunies.ross@atse.org.au](mailto:clunies.ross@atse.org.au)**

## Clunies Ross

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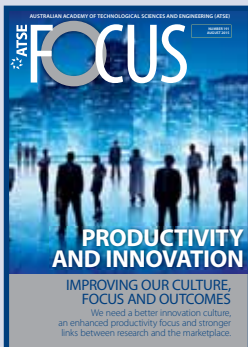
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# FOCUS

ATSE *Focus* is produced to stimulate discussion and public policy initiatives on key topics of interest to the Academy and the nation. Many articles are contributed by ATSE Fellows with expertise in these areas. Opinion articles will be considered for publication. Items between 800 and 1400 words are preferred. Please address comments, suggested topics and article for publication to [editor@atse.org.au](mailto:editor@atse.org.au).

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By Kathryn Fagg  
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# Moving Australia into the 21st century

We need a blueprint for innovation in our organisations – strong leadership, a strategic imperative, clear metrics and targets, adequate resources and the recognition of success.

The early years of this century were prosperous ones for Australia. As a beneficiary of China's massive investment in infrastructure, the demand for our resources, particularly iron ore and coal, led to the strongest terms of trade in 150 years.

That demand, and associated higher prices, led to very strong investment in Australia for further resource development. As data from the Reserve Bank shows, mining investment as a percentage of GDP peaked at close to eight per cent in 2012, around four times the level of investment before the boom.

Furthermore, this investment in resources will continue to pay dividends as the projects shift into a production phase. The growth in resource exports has contributed around one percentage point to annual GDP growth in recent years, and this is expected to continue, especially given the large LNG projects now coming on-line.

The strong performance in the resources sector, along with the strength and resilience of our financial system, helped Australia weather the Global Financial Crisis in a much more robust way than most other countries.

However, cycles turn. The Australian economy is now going through a transition as the investment in the resources sector declines. Last year, investment fell by 12 per cent and similar falls are expected this year and next.

Ideally, the decline in investment in the resources sector would be matched by

an increase in investment in other sectors – but this is not occurring. In fact, as a share of GDP, non-mining business investment is just above the levels reached during the recession in the early 1990s.

It seems that businesses will not increase their level of investment until there are clearer signs of more robust and sustainable demand for their products and services. This is despite the very low interest rate environment that prevails in Australia and most of the rest of the world.

So, although Australia has enjoyed an almost unprecedented 23 straight years of growth, at this time of transition we must consider what can be done to support Australia's

prosperity over the coming decades.

For the economy it would obviously be helpful to see greater expenditure on infrastructure but, in addition to investment by government, we do need Australian businesses to be finding and developing opportunities that will provide robust returns.

This issue is particularly important given the very strong forces of change that are transforming the global economy – most notably the rapid evolution of digital technology, which is fundamentally redesigning business models.

There are various ways to look at how new technologies are changing the economy. However, it is perhaps the

question of what will happen to jobs that most clearly paints the picture of the level of change that can be expected.

A recent Committee for the Economic Development of Australia (CEDA) report estimated that almost 40 per cent of current Australian jobs, including some highly skilled ones, could be redundant in 10 to 15 years as a result of technological change.

Australia has successfully adapted to the major shift in the make-up of our economy over the past century – from agriculture, to manufacturing, to services. Nonetheless, the CEDA figures highlight just how much change is likely to happen and at what speed – and therefore how important adaptability and resilience will be in our economy and in our communities.

The tough reality is that most industries are changing



Collaboration between Deakin University and DSTO aims to protect troops with this prototype bomb disposal unit.

and becoming more competitive – with new entrants, new business models, and a more informed and discerning customer base. In some cases, whole new industries are emerging, replacing existing ones.

For most existing businesses, there is going to be a need for relentless innovation if they are to survive and thrive. And for the economy to be successful, we will want to see new firms start up.

But on the world stage Australia is not a leader in innovation. Of particular concern is the low level of collaboration between our research institutions and industry participants.

OECD statistics on Australia's level of collaboration between firms that are innovating and higher education and public research institutions are disturbing. For leading countries on this measure, including Finland, Slovenia, Austria and Hungary, over half of all innovating large firms are collaborating. But for Australia, right at the bottom of the scoreboard, it is less than one in 10.

Given that Australia does not have a tradition of deep engagement between its research institutions and its businesses, incentives will most likely be required

to encourage greater collaboration.

On the research side, ATSE is advocating for and trialling a set of metrics to recognise and reward university researchers for engaging with industry through Research Engagement for Australia (REA), to complement the current focus on research quality through publication metrics.

On the industry side, there is a strong commercial driver for greater innovation and improved productivity. However, to date, this commercial driver has not been sufficient to foster strong collaboration with research institutions. It just does not seem to be in our industry DNA to have strong linkages with research institutions.

Although there are some public policy changes that would support greater collaboration, the primary challenge seems to be increasing the focus on innovation in our businesses and building the capability to deliver on it. This is a task for both management teams and boards.

Over the past couple of decades we have learnt what is needed to bring about change in our organisations – whether to bring about improved safety, or to introduce a 'lean' approach to operations, or to build a

more inclusive culture supporting diversity.

A similar blueprint is needed for the elements to bring about a much greater focus on innovation in organisations – such as strong leadership, a strategic imperative, clear metrics and targets, adequate resources, the monitoring of progress and the recognition of success.

The extra dimension that is going to be needed to foster a more innovative culture is a greater tolerance for risk – accepting that within a portfolio of initiatives some will work and some won't.

Becoming more innovative is a fundamental challenge for Australian industry. But it is challenge that we need to rise to, because change is coming.

A quote from Bill Gates seems particularly apt: "We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next 10."

We need to be prepared for the changes that will be coming over the next decades. That means working to be more innovative, competitive and productive for a stronger economy. We need to more effectively link what businesses need with the work that researchers are doing.

And as a nation, we will need to ensure that we are developing the skills and capability from our education system through our various industry sectors that ensure that we maintain our prosperity and wellbeing after such a strong start to this century.

Over the coming decades, this will mean building the capacity for an appreciation and application of technology and a relentless focus on innovation.

MS KATHRYN FAGG FTSE is a Non-Executive Director on the boards of the Reserve Bank of Australia, Boral, Djerriwarrh Investments and Incitec Pivot. She chairs the Melbourne Recital Centre and is on the Board of the Breast Cancer Network of Australia. She qualified as a chemical engineer, starting her career as a petroleum engineer with Esso, before moving into management consulting with McKinsey and then pursuing an executive career with ANZ, BlueScope and Linfox. She chairs ATSE's Industry and Innovation Forum, is a member of its Gender Equity Working Group, and recently led an ATSE delegation to Tokyo for the Japan–Australia Science and Innovation Collaboration (JASIC) research exchange program.

## Collaboration leads to productivity

Australian businesses that engage in collaborative innovation with research organisations are 242 per cent more likely to report increases in productivity, according to IP Australia.

Despite the clear advantages associated with collaborative innovation, Australia is falling behind, IP Australia says: we ranked 81 out of 143 countries in 2014 on how effectively we produce returns from research, ideas and institutions.

Among the reasons identified for this was the insufficient transfer of knowledge between the research and business sectors.

IP Australia – the Government agency that administers legislation governing intellectual property – has developed Source IP as a digital marketplace for sharing information, indicating licensing preferences

and facilitating contact for IP generated by the public research sector in Australia. It says Source IP is aims to make it easier for Australian businesses to access public-sector innovation and technology and strengthen the focus on boosting collaboration between science and industry.

The site intends to achieve the following objectives for the public research sector:

- drive innovation and commercialisation by enabling IP Rights holders to signal their patent licensing intent; and
- provide a single source of information to increase understanding of potential collaboration between interested parties to promote innovation and technology specialisation.

The Source IP marketplace is due for release late in 2015.



By Peter Gray and Tanya Monro

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# Harnessing our greatest resource – ideas

Are we missing a golden opportunity to add value and create new industries, high-value jobs, and societal and economic benefits from our outstanding research?

Australia's place as the leading global exporter of iron ore has played a big part in our enviable standard of living.

Despite falling prices, Australia's iron ore exporters are price-competitive because they have invested heavily over many years to optimise the productivity of their mines.

But we have another national resource that is largely untapped: the capacity of Australia's public research sector to generate ideas and discoveries.

The industries of the future are based on novel, innovative research and technology – robots, ubiquitous smart communications and cancer immunotherapies are revolutionising our society.

Countries such as Singapore and Germany that are successfully harnessing their research investment are seeing their comparative standard of living rise. But Australia has a problem in translating its public-sector research into commercial benefit.

Australia ranked dead last of the 33 surveyed countries in a recent OECD report when it came to collaboration between public-sector researchers and their counterparts in industry.

We doubt that public-sector researchers are fundamentally disinterested in seeing the fruits of their research translated into economic and community benefit but there are systemic factors stacked against collaboration between our researchers and industry, which is the first step in successful research translation.

For the past six years, the quality

of research carried out in Australian universities has been assessed by the Excellence in Research for Australia (ERA) criterion. On this measure, heavily weighted to publications and citations, Australia's public-sector research performs very well.

Because the ERA ratings affect reputations, support from university administrators and some degree of university funding, many researchers prefer to work on publications rather spend time on engaging with industry. This was not the intention of the ERA, but it is an unintended consequence.

There is growing acknowledgement in government and industry that the ERA model – currently the only accepted measure of research 'quality' – cannot adequately encourage research commercialisation or other translation into community benefit.

This raises the important question: are we missing a golden opportunity to add value and to create new industries, high-value jobs, and societal and economic benefits from our outstanding research?

The answer is emphatically 'Yes'. Something needs to be done. The Federal Government is expressing a rising level of concern.

If we had a measure of public-sector research engagement with industry and other end users of research it would start to modify behaviour.

The Australian Academy of Technological Sciences and Engineering (ATSE) is spearheading a campaign

to introduce such a measure, using data that is already available.

It has produced a major report, *Research Engagement for Australia (REA)*, which proposes to reward research engagement, under the REA banner, alongside research excellence (ERA).

The ATSE report was welcomed by Education and Training Minister Christopher Pyne, who said it provided a practical framework for measuring how universities and researchers work with industry and other stakeholders.

"The findings of this report highlight the importance of collaboration between researchers and industry," Mr Pyne said. "The metrics developed in the *Research Engagement for Australia* report have the potential to increase the return on public investment in science, technology, engineering and maths research, as well as research in humanities and social sciences.

"ATSE's work provides encouragement to researchers to engage with industry. What it does not explicitly do is encourage industry to engage with universities. I urge business leaders to meet researchers at least halfway – to engage with them more often, and more deeply, and to bridge the gap which currently exists between the two sectors."

ATSE's approach has been pragmatic, with the key REA principle being to assess revenue from industry and other research end-users as a measure of research engagement. The underlying assumption is that ongoing engagements are a good proxy for the eventual impact of the research.

CONTRIBUTIONS  
ARE WELCOME

**Opinion pieces on technological science and related topics, preferably between 600 and 1400 words, will be considered for publication.**

They must list the full name of the author, if a Fellow of the Academy. Other contributors should provide their full name, title/role and organisation (if relevant) and email address.

**Please address to editor@atse.org.au**

# UNCONVENTIONAL GAS Opportunities and Challenges

22-23 SEPTEMBER 2015

SOFITEL WENTWORTH, SYDNEY



Australia and other countries need sensible policies to address the opportunities and challenges presented by UNCONVENTIONAL GAS. **The Australian Academy of Technological Sciences and Engineering (ATSE)** will hold a two-day Conference in Sydney, Australia to address the complex issues related to UNCONVENTIONAL GAS. This interdisciplinary Conference will involve Australian and international scientists, engineers, social scientists, economists and community representatives, recognising that many of the issues surrounding UNCONVENTIONAL GAS are key issues for community debate that need to be informed by evidence.

## TOPICS

International perspectives; water; economic issues; community issues and experiences; infrastructure; fracking; well integrity and induced seismicity; land use conflict and biodiversity; regulation and governance.

## SPEAKERS INCLUDE

- ▶ **Dr Francis O'Sullivan**, Massachusetts Institute of Technology – Energy Initiative
- ▶ **Professor Mark Zoback**, Stanford University
- ▶ **Councillor Ray Brown**, Western Downs Regional Council, Queensland
- ▶ **Emeritus Professor Peter Flood**, Independent Expert Scientific Committee on CSG
- ▶ **Dr Paul Hardisty**, CSIRO Land and Water Flagship
- ▶ **Associate Professor Will Rifkin**, Centre for Coal Seam Gas – University of Queensland

## OUTCOMES

Following the Conference a one-day Workshop, comprising international Academies of Engineering and Science, will develop a set of Findings for future policy development on unconventional gas.



Gas Industry Social & Environmental  
Research Alliance



Department  
of Industry



Government of South Australia  
Department of State Development



Australian Government

Geoscience Australia



UNSW  
AUSTRALIA

Engineering



MELBOURNE  
ENERGY INSTITUTE

To register and for further information, go: [www.atse.org.au/gas](http://www.atse.org.au/gas)



For this reason, ATSE's REA is preferred over qualitative measures of impact such as case studies, which are indicators that often lag many years after the work was carried out, are expensive to implement, and involve considerable effort and subjectivity on the part of all involved in the process.

External funding, on the other hand, as utilised by the REA proposal, is tight, auditable data that provides an excellent measure of true, ongoing engagement.

REA would encourage university researchers to reach out to industry and end users, and allow universities to recognise excellence in end-user inspired research. If linked with complementary policies designed to encourage industry to seek out university researchers, REA could see Australia accelerate the rate of translating public-sector research, with benefits ranging from high-tech start-ups through to mature, large-scale industries.

To test this hypothesis ATSE is now engaged in a trial to pilot and refine the REA metrics in Queensland and South Australia.

With support from both state governments, the Academy is working with the three universities in SA and eight in Queensland to trial the metrics as proposed in the REA Report.

Reports on the performance of each state's universities as a group have been prepared for the SA Economic Development Board and the Queensland Department of Science, Information Technology and Innovation. Individual institution results have been provided to each university.

In addition, the pilot is also consulting with the participating universities to refine the REA metrics and address a number of unresolved questions from the original REA Report. The results of these consultations will be used to prepare an updated set of REA metrics, which will be delivered to the Federal Department of Education and Training, which funded development of the REA Report.

Given the focus on increasing research engagement in recent Government policies and reviews, including the Watt Review of research funding, ATSE anticipates the REA metrics will provide a useful tool for measuring and encouraging our



Taking research into the sugar industry.

university researchers to engage with industry and other end-users of research.

The prospects are exciting.

It is worth contemplating how Australia could benefit if our successes in developing our mineral and agricultural resources were complemented by increasing the uptake of our intellectual strengths to develop a modern advanced manufacturing sector, and re-energise the capabilities of industry overall to create higher value jobs and export markets.

**PROFESSOR PETER GRAY FTSE** is a Vice President of ATSE and Director of the Australian Institute of Bioengineering and Nanotechnology (AIBN) at the University of Queensland. Prior to joining AIBN, he was Professor of Biotechnology and Director of the Bioengineering Centre at the University of NSW and Senior Principal Research Fellow at the Garvan Institute of Medical Research in Sydney. He has held

academic positions at University College London and at the University of California, Berkeley, and has had commercial experience in the US working for Eli Lilly and Co and the Cetus Corporation. Professor Gray is a founder and a past President of the Australian Biotechnology Association (AusBiotech).

**PROFESSOR TANYA MONRO FAA FTSE** is a Vice President of ATSE, and Deputy Vice-Chancellor (Research and Innovation) and ARC Georgina Sweet Laureate Fellow at the University of South Australia. Professor Monro is a member of the SA Premier's Science and Industry Council (PSIC). She was awarded the AAS Pawsey Medal for 2012 and in 2011 was SA's Australian of the Year and Scopus Young Researcher of the Year in Physical Science. In 2010 she was named SA Scientist of the Year and Telstra Business Women of the Year (Community and Government category). In 2008 she won the Prime Minister's Malcolm McIntosh Prize for Physical Scientist of the Year.



Brian Schmidt delivers his Clunies Ross address.

## What does an innovation policy look like?

Professor Brian Schmidt AC FRS FAA is a Nobel Laureate physicist who has been appointed the next Vice-Chancellor of the Australian National University. This is an edited version of his keynote speech at the Academy's 2015 Clunies Ross Awards in Brisbane.

I am passionate about innovation – about the importance of taking knowledge and transforming it into products and services that contribute to human prosperity.

We undertake basic research because it is interesting – but the reason that governments pay for it is because it is useful.

I have been highly critical of our nation's innovation policy and I think it is only fair for me to do something more than complain.

Fixing innovation in Australia isn't easy – there is no silver bullet. Rather there is a very large and complex array of issues that need to be understood and solved. In 2008 the Australian Government commissioned a review of the innovation system by Terry Cutler (Dr Terry Cutler FTSE FAHA). This report made 72 recommendations in total with almost none of them having yet been acted upon.

The Senate Economics References Committee is due to report on innovation this year but, with all due respect to our elected parliamentary officials, they are not the ones to come up with the policy solutions. Instead, they need to implement a strategy that has been designed by a large, well-resourced team that cuts across the whole system.

In all my time in Australia, we have had a piecemeal approach to solving our innovation policy woes.

The nation needs a group focused on this 'piecemeal' issue. I support calls for a 'National Innovation Agency' – or perhaps a taskforce – which:

- can cut across and above the silos of government;
- doesn't get reconstituted every time there is a Cabinet reshuffle; and
- is focused on what has to be one of the most pressing issues of Australia's economic future – innovation.

It doesn't have to be big, but it needs to look at the entire system surrounding innovation. Lots of effort is placed right now on existing stable businesses – but we have so few businesses that are of the high-growth, high-innovation flavour that I think the bulk of effort needs to be directed at creating and growing new businesses, of a different character than the

average business government thinks about.

So what are some of the issues this group needs to think about?

When I go and talk to many of the people who have successfully innovated – especially outside of established companies or government research laboratories – there is a common thread to all of their stories. They were passionate, they were smart, and they were reckless with their careers and personal finances.

### Price of failure

We do not want people to have to take unreasonable risks to become innovators. To put it another way, we need the upside risks of being innovative to outweigh the downside risks.

We need to put a price on failure to get the incentives right – but it probably should not involve your house, your career or your family. Getting the incentives right is imperative, because failure is at the heart of innovation.

There is a price for failure here in Australia. If you work in a university or a research organisation and survive on grants and want to leave the research nest to innovate – especially when you are early in your career – you'll put a hole in your track record. You'll probably need to give up the postdoc or position you

currently have and your ability to come back into the research field is close to zero once you depart. There are very few pathways back. The price of playing in innovation is typically your research career.

There are alternatives.

A policy that allows researchers time to pursue innovation – with a guaranteed pathway back to research within a limited amount of time – seems warranted.

A track record that includes industry experience as a positive element in getting a grant would also help.

Government incentives to research organisations that perform well in industry engagement (without destroying the incentives of doing good, curiosity-driven research) would also help.

Australia's corporate governance laws place significant barriers on how company directors can invest in risky opportunities, especially in the early stages of companies facing liquidity issues. And before an innovator has to deal with directors or investors, our bankruptcy laws – which are particularly punitive – mean the downside risk is high when you're involved in a start-up in Australia.

### Limited upside

What is available on the upside? The policies and structures we have in place in Australia to help make you rich if you choose to innovate?

In many universities and CSIRO, you do not own your own IP – it belongs to your employer. Although there are some incentives in place in these organisations to get employees to innovate – they aren't yet working very well, although Queensland is probably the closest place to an exception.

We simply have not developed an entrepreneurial culture here in Australia. It is not part of our university system, and unfortunately it's not quite as simple as just 'turning it on'.

But there are some ways to do it better. A whole range of systems has developed to support technical entrepreneurs, although

– while the number of angel investors, incubators, accelerators and venture capital funds are increasing – Australia is still highly limited compared to other countries.

Access to expertise, networks, mentoring and capital are all in short supply for people trying to undertake a start-up.

It is not just the capital. Of the 25 venture capital funds created in Australia since 1997, the annualised internal rate of return over a 15-year horizon was –0.85 per cent, with the top 25 per cent returning 0.65 per cent. We're not



Developing an innovation policy will help develop innovation.

ready to throw open our superannuation funds – we really need to have programs that develop the whole skill set surrounding innovation (including where and when to deploy capital) so that venture capital will get a good return.

Government policies and support which encourages high-quality skill development, mentoring and access to relevant networks through accelerators and incubators, seems to be a logical policy, in line with what the most successful countries are doing.

But we have a problem: there are so

few people with the relevant skill sets in Australia that we need to have policies to recruit the relevant people from overseas. For example, there are visa regulations that make it hard to attract people to high-tech industry and there are tax disincentives for expatriates who have made it big overseas to return home.

A headline number to think about is that 0.2 per cent of GDP is contained in venture-capital-backed companies in Australia. That isn't much compared to the US, where 21 per cent of GDP and 11 per cent of private-sector employment comes from US venture-capital-backed companies.

Besides not having many to begin with, another big reason is that many of our start-up successes have left Australia in search of talent, capital and more favourable regulatory environments. If we look at the big deals that have occurred over the past year in high-growth technology companies – about 80 per cent of the highlights involve companies getting capital from or relocating overseas.

While in principle I have no objection to overseas people investing in Australian companies, it seems to eventually precipitate a move of the company overseas, which is problematic. Government policies that help ensure Australian companies stay in Australia are fundamental for the country to receive long-term benefits from its innovation, but I'm afraid I do not have even half an answer on how to retain global technology companies here in Australia.

These are big policy issues for government. If we want to raise our productivity, grow job numbers and increase prosperity, we need to create high-value-added companies to replace our commodity income as it sags into the future.

Government debt needs attention, but how to grow the Australian economy needs even more attention is – and that is what an innovation policy is all about.

**LETTERS  
TO THE  
EDITOR**

**ATSE Focus welcomes letters from readers in response to published article or on technological science and related topics.**

**PLEASE KEEP LETTERS BRIEF. LONGER LETTERS MAY BE RUN AS CONTRIBUTED ARTICLES.**

**Please address to [editor@atse.org.au](mailto:editor@atse.org.au)**



# BATTERHAM MEDAL FOR ENGINEERING EXCELLENCE

One of Australia’s most innovative young engineers will win the 2015 Batterham Medal.

Nominations close on 21 August

The Batterham Medal is an early career award for a graduate engineer who has achieved substantial peer/industry recognition for his/her work in the past five years. The Academy administers the award on behalf of the Group of Eight Deans of Engineering and Associates and the Medal will be awarded at ATSE’s Oration Dinner on 27 November 2015 in Melbourne.

The winner will receive the Batterham Medal and a cash prize of \$5000.

THE WINNER WILL BE AN ENGINEERING GRADUATE OF AN AUSTRALIAN UNIVERSITY, UNDER 40 AT 1 JANUARY 2015 AND WILL:

1. have demonstrated excellence, innovation and impact in a field of engineering;
2. be clearly acknowledged by peers for a signature contribution to engineering in the five years prior to his/her nomination; and
3. have advanced the standing of the engineering profession.

The Batterham Medal recognises Professor Robin Batterham AO FREng FAA FTSE, an Australian science and technology leader who was Chief Scientist of Australia from 1999 to 2006, President of the Academy from 2007 to 2012 and is Kernot Professor of Engineering at the University of Melbourne.

THE BATTERHAM MEDAL GUIDELINES AND NOMINATION FORM ARE ON THE ATSE WEBSITE AT [ABOUT > BATTERHAM MEDAL](#).

NOMINATE AN INNOVATIVE YOUNG ENGINEER TODAY



By John Bell  
j.bell@acilallen.com.au

# Winning economic and social benefit from research

There is an urgent need for Australia to improve the application of outputs from its investment in publicly funded research.

Australia has embarked on a project to find ways to better apply research for the nation's benefit, by adapting approaches adopted by other countries.

This work is being undertaken as the ninth project in the Securing Australia's Future Program (SAF09) initiative undertaken by the Australian Council of Learned Academies (ACOLA) for the Chief Scientist.

The evaluation will be complete before the end of the year as there is an urgent need for Australia to improve the application of outputs from its investment in publicly funded research.

This project is analysing international best practice approaches to encouraging and facilitating research translation, commercialisation and collaboration – including analysis of measures to facilitate collaboration between researchers, businesses and other organisations, focusing on government strategies as well as industry, institutional and sectoral approaches.

The resulting report will make evidence-based findings about how current levels of translation, commercialisation and collaboration in Australia could be improved and examine how international models could be applied in Australia.

All of this fits with other initiatives currently on foot in Australia to improve the nation's poor record in translating research into business initiatives and innovations and follows an earlier ACOLA study (SAF04) on the role of science, research and technology in lifting Australian productivity

The project is examining successful measures in other countries to identify international best practice approaches that encourage and facilitate research translation,

commercialisation and collaboration.

The project report will include an analysis of measures to facilitate collaboration between researchers, businesses and other organisations, focusing on government strategies as well as industry, institutional and sectoral approaches.

The report will make evidence-based findings about how current levels of translation, commercialisation and collaboration in Australia could be improved and examine how international models could be applied in Australia.

Supporting studies have been commissioned in 13 countries and a thorough search of the literature has been undertaken.



Getting more from publicly funded research.

## Early results of this work show that:

- Most of the countries examined have a range of measures in place to facilitate the transfer of research results from universities. By contrast, State and Federal Governments in Australia have done little in this area.
- The policies and programs offered in other countries comprise a mix of measures – including funding for start-ups, university-based incubators and technology parks, favourable treatment of revenues from the licensing of intellectual property and training/mentoring for university student and faculty entrepreneurs.
- Some countries are providing funding to universities to help technology transfer offices. Such funding recognises that, while there may be potential economic benefits to the university from the commercialisation of research, there are also wider economic and social benefits that the universities cannot capture. These spill-overs justify government support.
- Some countries have taken new initiatives. For example, in 2009 Canada's Natural Sciences and Engineering Research Council (NSERC) launched its Strategy for Partnerships and Innovation, accelerating commercialisation, linking university expertise to industry and helping students obtain skills of value to business. NSERC now has partnerships with more than 3000 businesses, 75 per cent of which are small or medium-sized.
- Among relevant government policies and programs that have been examined, some features stand out: the long-running nature of programs (for example, the US Small Business Technology Transfer Program, which has been in place since 1992) and the

ability of support programs to respond quickly to opportunities (for example, the Magnet Programs of Office of the Chief Scientist in Israel, which are flexible, focused and generous).

- Some countries have set ambitious goals in relation to the transferring public-sector research. For example, Denmark has developed a comprehensive Innovation Strategy that includes collaboration between enterprises, universities and government institutes. The 2010-13 goals included an objective that Danish universities should be attractive business partners, with at least 15 per cent of innovative Danish enterprises collaborating with universities. Denmark is an example of a country that is using sectoral approaches to achieve better translation of public-sector research.
- The role of university technology-transfer offices is changing. In the past these offices have sometimes been seen as contributing to the problem of low levels of translation of research.

However, the emerging trend is for university technology-transfer offices to take on a broader role. No longer is the revenue from licensing the most important measure of success. Instead collaborations facilitated are being given greater emphasis.

- Licensing of intellectual property is only one of a number of ways by which the private sector benefits from university research results and expertise. The employment of graduates and general research collaboration are much more significant.
- Start-up companies based on university research outcomes are only a very small element in the commercialisation of university research. This approach is only rarely suitable as a pathway to commercial outcomes. A number of prerequisites for success of university-based start-ups are now well understood.

Very few universities make money from licensing technology or university-based start-ups. However, the view around

the world is that, in order to achieve their mission, universities need to help parties outside the university to benefit from their research and expertise.

Around the world, universities are taking a broader view of their role in this knowledge and expertise transfer.

To quote the US National Academy of Sciences: "Discovery, learning and societal engagement are mutually supportive core missions of the research university. Transfer of knowledge to those in society who can make use of it for the general good contributes to each of these missions."

DR JOHN BELL FTSE is a Senior Associate with ACIL Allen Consulting and chairs the Expert Working Group for SAF09 referred to in this article. His experience includes representing Australia at the OECD and leading the OECD division responsible for policy and program analysis in science, technology and innovation. He is a former Deputy Secretary and Chief Science Adviser in the Department of Industry, Tourism and Resources, and Chairman of the Commonwealth Coordinating Committee on Science and Technology.

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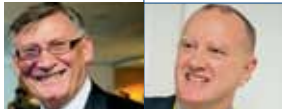
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By Paul Wood and Tony Radford

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# Putting your money where your mouth is – with IMNIS

IMNIS is about developing a more entrepreneurial culture in universities and improving the opportunities for PhD students in STEM.

**T**ackling the disconnect between academia and business is a key issue for Australia as it seeks to boost its links between research and the marketplace.

Having graduates feel familiar with the mores and language of the marketplace – and the values and vision of those who have been successful – is necessary to improve the nation's productivity and innovation culture.

OECD data shows that Australia consistently has one of the lowest levels of engagement between the academic and industry sectors despite government and business investment. The IMNIS (Industry Mentoring Network In STEM) concept aims to tackle this issue head-on.

This student mentoring program, which has the important backing of the Academy, grew out of a consideration of what type of activity, if sustained and replicated across Australia, might start to shift the culture of academic–industry interactions?

The IMNIS concept capitalises on the value of mentor relationships and the power of networks and plans to link PhD students with experienced mentors in industry and government to enhance students' understanding of business issues and language and encourage better long-term collaboration between business and publicly funded research organisations.

IMNIS is about developing a more entrepreneurial culture in universities and improving the opportunities for PhD students in STEM so that in future we will see the best and brightest leading the technological development of the country, creating the necessary government policies and leading the companies they work for, or have founded.

While mentoring programs and other course-related industry placement schemes exist already, they are usually course and institution specific.

IMNIS aims to establish in the longer term a sustainable national industry mentoring network system to complement these existing activities.

Taking the 'walk before you run' approach, we have launched the program with two pilots, which will run for at least six months in 2015 to facilitate development of the IMNIS program on a small, controllable scale.

Experience gained in the pilots will facilitate the next stage of IMNIS development – and if the launch enthusiasm of these two pilots is an indication, the concept will be quickly and positively adopted.

Pilot 1 – launched by the Victorian Premier, Daniel Andrews, in June – is running in Victoria and focusing on biotechnology, with participation from Melbourne, Monash, RMIT and La Trobe universities, targeting some 50 mentee students. The industry coordinating organisation is Ausbiotech, with oversight from Dr Anna Lavelle FTSE, AusBiotech CEO.

Pilot 2 – launched by the Western

Australian Minister for Mines and Petroleum, Bill Marmion, in Perth in July, with the support of Engineers Australia – will run in WA and focus on energy and mineral resources with participation from four WA universities – The University of Western Australia, Curtin University, Edith Cowan University and Murdoch University – again targeting some 50 mentees. The coordinating organisation will be UWA's EZONE, which aims to revolutionise engineering education and research, with oversight from EZONE Director, Dr Peter Lilly FTSE.

Both Dr Lavelle and Dr Lilly are members of the IMNIS Steering Committee established by the Academy.

The advantages of the IMNIS concept compared with existing mentoring programs, is that it will:

- be scalable across Australian universities and all STEM-based industry sectors;
- be capable of involving large numbers of PhD students;
- have a relatively low operational cost per student; and
- be able to capture the goodwill of

Now that the two pilot programs are underway, the IMNIS team is planning for the expansion of this initiative in 2016 into other states and industry sectors, subject to results of the initial pilots. If you are interested in

exploring the idea of introducing the IMNIS program into your specific industry sector please contact the IMNIS team (at [admin@imnis.org.au](mailto:admin@imnis.org.au)).

PHOTO: ISTOCKPHOTO



Experienced executives will mentor STEM PhD students.

# ATSE | CLUNIES ROSS AWARDS DINNER

*Research in action*

**Brisbane 2015**

The Awards are an initiative of The Australian Academy of Technological Sciences and Engineering (ATSE). They are the only Australian headline awards for science and technology which highlight the hard work, extraordinary risks and long-term commitment needed to achieve, through commercialisation, the practical marketplace impact on applied science and technology.

## THE ACADEMY CONGRATULATES THE 2015 ATSE CLUNIES ROSS AWARDS WINNERS

**Dr Cathy Foley PSM FTSE**

Deputy Director and Science Director  
CSIRO

**Mr Keith Leslie**

Research Scientist  
CSIRO

**Associate Professor Leigh Ward**

Reader in Metabolic Biochemistry  
The University of Queensland

**Professor Zhiguo Yuan**

Director, Advanced Water Management Centre  
The University of Queensland

## 2015 ATSE CLUNIES ROSS LIFETIME ACHIEVEMENT AWARD

**Professor Jim Patrick AO FTSE**

Chief Scientist and Senior Vice President  
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the significant numbers of industry professionals who wish to give back to the STEM community.

The target is to recruit some 500 students STEM PhD students into IMNIS nationally, with a matching 500 industry-based mentors. IMNIS aims to have students see the program as being highly prestigious, competitive and providing them with tangible benefits.

IMNIS seeks to recruit as mentors people who have strong industry backgrounds and commercialisation knowledge. While companies may support/encourage individuals to be mentors, IMNIS is not an industry placement or recruitment program. IMNIS has had strong support from both industry and various state government departments, with several senior government individuals agreeing to act as mentors for the program.

Our aim is to eventually deliver mentoring networks nationally covering a wide spectrum of STEM fields of study, focusing on the ATSE National Technology Challenge areas.

We are working with a Melbourne company, Mentorloop, which has developed software specifically for managing not-for-profit mentoring programs, enabling

mentees and mentors to connect and communicate in real time. Ronnie Wood, an IMNIS Director, is Coordinator for both the pilot programs, working closely with both the mentees and mentors.

IMNIS will be developed via a staged process, with small-scale pilot studies being implemented first. The results of these pilot studies will be used to shape and refine as needed the ongoing IMNIS program.

ATSE has established an IMNIS Steering Committee, to provide program oversight and guidance to the IMNIS Project, comprising:

- Professor Calum Drummond FTSE, Deputy Vice-Chancellor Research and Innovation and Vice-President, RMIT;
- Dr Margaret Hartley FTSE, ATSE CEO;
- Dr Anna Lavelle FTSE, AusBiotech Ltd CEO;
- Mr Peter Laver AM FTSE, ATSE Senior Adviser, Research, and former BHP senior executive;
- Dr Peter Lilly FTSE, Director, Engineering Zone (EZONE UWA), University of WA; and
- Professor Judy Raper FTSE, Deputy Vice-Chancellor (Research), University of Wollongong.

The IMNIS Project Team is:

- Dr Paul Wood, IMNIS Executive Officer, who has held senior R&D roles in CSIRO, CRCs, CSL and Pfizer;
- Ms Ronnie Wood, who has more than 30 years' experience in the education and training sector;
- Dr Tony Radford, a biotech executive with 30 years' experience in pharmaceuticals and diagnostics; and
- Mr John Kirby AM, Deputy Chairman and non-executive Director of Village Road Show Ltd.

DR PAUL WOOD has held senior R&D roles at CSIRO, CSL the CRC for Vaccine Technology and Pfizer. He has received a number of awards for his work on tuberculosis, including a CSIRO medal and the Clunies Ross Award in 2013. He established a consultancy company when he returned from the US in 2012, has been on the Board of start-up companies and is also an Adjunct Professor at Monash University.

DR TONY RADFORD is a senior biotech executive with 30 years' experience in pharmaceuticals and diagnostics, and was a founding Director and CEO of Cellestis Ltd until its acquisition by QIAGEN NV. For his contributions to tuberculosis diagnosis he received the 2013 Clunies Ross Award for application of technology, and is a Distinguished Alumni of La Trobe University.

## EA certifies Monash Masters program

Engineers Australia (EA) has announced the certification of Monash University's new Master of Advanced Engineering program, the first Masters program in Australia that aligns with Chartered Engineer status.

"Engineers Australia welcomes the opportunity to collaborate with Australia's tertiary institutions in delivering postgraduate qualifications that are valued by students and employers due to the high-quality knowledge and skills developed, and which directly support a path to international recognition via Chartered status," said Mr Stephen Durkin, EA's CEO.

Graduates of program can rely on their qualification as evidence of progress towards attainment of competencies required for Stage 2 accreditation. When combined with the necessary engineering work experience, and completion of the required Engineers Australia application, graduates will be eligible to become Chartered Engineers.

"This new Masters certification service is a response to the changing needs of the tertiary sector, and a component of Engineers Australia's evolving program for improving our support of and engagement with individuals and organisations in the sector," said Dr David Pointing, EA's Tertiary Development Manager.

## UWS SEEKS STEM MENTORS

The WISE Program at the University of Western Sydney is seeking mentors for women studying science, technology, engineering and mathematics at the university. The program aims to broaden the experience of students and help them build career skills while they are studying. It comprises face-to-face courses, visits to workplaces and online resources for students. There is also a mentoring strand in which final year and second-to-final years students will be given priority.

The mentoring period will run during the Spring Session at UWS (20 July to 23 October).

A mentor's involvement would be:

- an initial face-to-face meeting with their mentee, if possible;
- weekly or fortnightly email/telephone contact; and
- accompanying the mentee to an industry-specific event, if possible, or a workplace visit.

Mentors will also be invited to WISE Program events but are not obliged to attend. They may also consider involving their mentee in other events, networking opportunities and activities related to their work.

Mentors and students will be given guidelines on the extent of the mentor's contribution.

Inquiries to Wendy Bortalazzo, WISE program coordinator, UWS (email [w.bortalazzo@uws.edu.au](mailto:w.bortalazzo@uws.edu.au)).

# ATSE IN ACTION

## Community support key to electricity reform

The recent ATSE Symposium 'Intelligent Grids - Pathway to our Energy Future', held in Sydney, concluded that the biggest challenge in the development of efficient electricity supply is to gain broad community support for measures on which the experts largely agree.

The Symposium answered three key questions relating to intelligent grids:

- intelligent grids hold the promise of a better and brighter energy future;
- these benefits are well documented and established through multiple trials and studies both within Australia and overseas; and
- the reform necessary to achieve change will require the removal of cross-subsidies, regulatory change and complex bureaucratic processes.

The Symposium was told that modern communications and the internet had enabled digital information to move around the world at virtually no cost.

Mobile technology, low-cost sensors, and advances in capturing, storing and analysing huge amounts of data with ever-lower costs and increased reliability and security had provided the context for disruptive changes to the electricity supply industry.

As photovoltaic (PV) generators came down in cost and relatively low-cost battery storage looms, a revolution was coming.

Speakers said the forces that would shape future trends included the rate of connection of PV generators; the uptake of battery storage; demand management; and how quickly personal transport moves from petroleum to electricity – influenced by how tariffs incentivise consumers and the availability of new products and services.

While electric vehicles (EVs) were a huge potential game-changer for the grid, mass adoption was some time away but, perhaps within five to 10 years, uptake would accelerate exponentially, with the consequence that – without careful management – the grid would not be able to cope.

Poor regulation and tariff design had led to high prices, with poor load factors (the ratio of peak to average demand) and cross-subsidies



Panel members answer questions.

unfair to large numbers of electricity customers. Additionally, networks with about 25 per cent of their capacity needed for less than one per cent of the time were faced with increasing peak demand but lower energy delivered.

Delegates heard that smart grids offered customers the opportunity to control their own energy supply and demand, as well as greater efficiencies and lower costs.



NSW Industry, Resources and Energy Minister Anthony Roberts addressed the Symposium.

Investment would be required in the necessary meters, communications and data-management systems, providing challenges for policy-makers and regulators.

Pricing reform, supported by new market rules, would be the key but was difficult and complex, resting on the need for behavioural changes.

Investment in battery storage for peak lopping or smart-charging of electric vehicles

would need to be supported by incentives large enough to impact behaviour.

Tariff reform is not only complex and difficult, but would also be politically unpopular because there would necessarily be winners and losers.

Governments had so far been generally supportive of new technology, but it remained to be seen whether they would be "up for the challenge when things got tough", or if regulators and institutions would be able to achieve results unfettered by the short-term focus of governments.

Presenters included:

- Dr Alan Finkel AO FTSE, ATSE President;
- Mr Steve Sargent FTSE, former global Vice President of General Electric;
- Mr Tony Wood, Energy Program Director, Grattan Institute;
- Mr Hugh Gleeson, CEO United Energy and Multinet Gas;
- Riccardo Pagliarella, formerly Toyota Australia sustainability executive;
- Mr Adrian Clark, CEO Landis and Gyr ANZ;
- Mr Mervyn Davies, a Director of a number of major networks;
- Dr Glenn Platt, Energy Flagship Research Director, CSIRO;
- Mr Louis Tirpou, Group Manager Planning, AEMO; and
- Professor Tony Vassallo, University of Sydney.

Symposium presentations are available on ATSE website at [Subjects>Energy](#)

# ATSE IN ACTION

## Investment and measurement keys to better education

Continuing investment in staff, research training and equipment is essential to achieve research excellence in technology and engineering across the university system, and measures of excellence need to be complemented by impact and engagement measures that relate to both national and global goals.

This is a key comment in the Academy's recent response to the Federal Department of Education and Training's call for consultation on the Draft National Strategy for International Education.

ATSE said it encouraged multidisciplinary research (such as that undertaken in CRCs)

that addressed real and complex problems, but with outcomes that did not necessarily fit simplistic research excellence metrics.

ATSE also urged investment, such as that provided by the Office for Learning and Teaching, to ensure that Australian universities scored well on robust measures of teaching excellence and student satisfaction.

It also urged internal and external Quality Assurance processes, saying they were essential to maintain system integrity and reputation, and noting "widespread and public concerns about the English language standards of international students, reports of academic fraud amongst student groups, and questionable practices"

among a small number of private colleges operating in the VET sector.

The submission noted there were already many institutional partnerships at university level in STEM disciplines, often built on links of academics who had migrated to Australia, and in higher proportions than non-STEM disciplines.

ATSE noted the challenge of delivering meaningful outcomes from partnerships and urged identification and strengthening of the best links, supported where possible by government-to-government links.

[The Academy submission is online at Publications>Submissions>Education](#)

### McGAGH HEADS ACOLA RESEARCH REVIEW

Mr John McGagh FTSE, Chair of the Institute of Chemical Engineers Australia and former Global Head of Innovation, Rio Tinto, will chair the ACOLA Expert Working Group to conduct the review of the Research Training System, announced by the Minister for Education and Training in May.

The members of the EWG include Fellows: Professor Helene Marsh FAA FTSE (Deputy Chair), Dean, Graduate Research, James Cook University; Professor Robyn Owens FTSE, Deputy Vice-Chancellor (Research), UWA; and Professor Michael Barber FAA FTSE, Chair, ACOLA Securing Australia's Future Program Steering Committee and former Vice-Chancellor, Flinders University.

Other members are: Professor Mark Western FASSA (Deputy Chair), Director, Institute of Social Science Research, UQ; Professor Jim McCluskey FAA, Deputy Vice-Chancellor (Research), University of Melbourne; Professor Stephen Garton FAHA FASSA, Provost and Deputy Vice-Chancellor, University of Sydney; Professor Majella Franzmann FAHA, former Pro Vice-Chancellor, Humanities, Curtin University; and Emeritus Professor Cindy Gallois FASSA, Emeritus Professor of Psychology, UQ.

### URANIUM THE TOPIC FOR WA EMINENT SPEAKER

**The WA Division's 2015 ATSE Eminent Speaker Series will feature public lectures by Dr Vanessa Guthrie, Managing Director and CEO of Toro Energy Ltd, who will discuss the science and facts behind the mining and use of uranium globally.**

The first will be held at The University of WA on 19 August and the second at Murdoch University on 24 August. The UWA lecture is presented by ATSE and the UWA Institute of Advanced Studies; the Murdoch event is supported by Inspire Australia and WA's Scitech.

Dr Guthrie has more than 25 years' experience in mining operations, company strategy, sustainability, Indigenous affairs and environment. She is a former mine manager for WA's Huntly bauxite mine at Dwellingup, and was head of Sustainable Development for Alcoa World Alumina Australia and then Woodside Energy for more than eight years. She won the 2013 Outstanding Professional Woman award from the WA Chamber of Minerals and Energy and was also recognised in 2013 in the world's Top 100 list of inspirational women in mining globally.

Dr Guthrie will address some key questions about uranium including safety, use, life cycle, weapons use and waste disposal.

She will also reflect on her long career in the mining sector, how she started with a deep interest in science that grew into a passion for delivering value to the whole community

from the resources sector, and how being a woman has proven to be an advantage at times.

She will share some of her insights and experiences, as well as what it takes to succeed in what is a challenging and, at times, controversial industry.

Dr Guthrie has a PhD in Geology and Diplomas in Natural Resources, Business Management and Law. Her doctorate was completed under an Australian Institute of Nuclear Science and Engineering postgraduate scholarship, and she was the recipient of a six-month Fellowship with France's Commissariat à l'Énergie Atomique.

The WA Division of ATSE holds an Eminent Speaker Lecture series annually to engage students and the general public with an eminent scientist or engineer

talking about her/his work and career.

Vanessa Guthrie





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# ATSE IN ACTION

## Fellows honoured with Clunies Ross Medals

Two ATSE Fellows were honoured at the 2015 Clunies Ross Awards dinner at the Brisbane City Hall in May.

Dr Cathy Foley PSM FTSE shared a Clunies Ross Award and Associate Professor Jim Patrick AO FTSE received a Lifetime Achievement Award.

Dr Foley and Mr Keith Leslie – both from CSIRO – shared a Clunies Ross Award for their work on LANDTEM™, a highly sensitive magnetic detection device capable of detecting ore bodies with extremely weak magnetic fields.

Associate Professor Patrick was honoured for his career achievements as one of the original engineers who pioneered the development of the multichannel cochlear implant and being a world authority on cochlear implants.

Other winners were Associate Professor Leigh Ward, from the University of Queensland (UQ) – who was acknowledged for his work using bioimpedance spectroscopy (BIS) to develop an accurate yet inexpensive tool for early detection of lymphedema – and Professor Zhiguo Yuan, also from UQ, who was awarded for his campaign to “put science in sewers”, which has fundamentally changed industry’s understanding of and practice around sewer corrosion and odour management.

The dinner attracted a crowd of more than 500 guests. UQ Vice-Chancellor Professor Peter Høj FTSE delivered the opening address, Academy President Dr Alan Finkel AO FTSE



Cathy Foley and Keith Leslie receive their award from Shaun Kenny, MD of Bechtel Australia, a Clunies Ross sponsor.



Jim Patrick receives his award from Professor Kevin Galvin FTSE, from the University of Newcastle, a Clunies Ross sponsor.

delivered the closing address and the guest speaker was ARC Laureate Fellow and Nobel Laureate Professor Brian Schmidt AC FRS FAA.

The following day, Award winners and leading scientists joined 200 students and

teachers from Queensland schools for the Wonder of Extreme Science (WoES) event at Queensland University of Technology, which showcased both ATSE’s STELR program and the Queensland Wonder of Science Program.



Brian Schmidt talks with students at Wonder of Extreme Science (WoES).



Students get ‘hands-on’ at the WoES wind power workshop.

# ATSE IN ACTION

## Batterham Medal recognises engineering excellence



One of Australia's most innovative young engineers will win the 2015 Batterham Medal, which will be awarded at ATSE's Oration Dinner on 27 November 2015 in Melbourne.

The award comprises a medal (The Batterham Medal) and a cash prize of \$5000. Nominations close on 21 August.

The Batterham Medal is an early career award for a graduate engineer who has achieved substantial peer/industry recognition for his/her work in the past five years. The Academy administers the award on behalf of the Group of Eight Deans of Engineering and Associates.

The 2015 winner will be an engineering

graduate of an Australian university, under 40 at 1 January 2015 and will:

- have demonstrated excellence, innovation and impact in a field of engineering;
- be clearly acknowledged by their peers for a signature contribution to engineering in the five years prior to his/her nomination; and
- have advanced the standing of the engineering profession.

The award is intended to:

- elevate the profession of engineering among the technology and innovation communities;
- bring to the attention of Federal and State parliamentarians and administrators the key role engineers play in the nation's development; and

- reinforce with these communities the contribution engineering makes to Australia's reputation as a centre of technology and innovation leadership.

The Batterham Medal recognises Professor Robin Batterham AO FREng FAA FTSE, an Australian science and technology leader who was Chief Scientist of Australia from 1999 to 2006, President of the Academy (2007–12) and is Kernot Professor of Engineering at the University of Melbourne.

**Batterham Medal Guidelines and Nomination form are on the ATSE website at [About > Batterham Medal](#)**

## Smart engagement, stronger Australia

The rise of Asia requires vision and action in Australia, according to a new ACOLA report, *Smart Engagement with Asia*, which provides new insight to the complexities of our relationships in the region and a blueprint for the bridges Australia can build.

Speaking at the launch of the report, Australia's Chief Scientist Professor Ian Chubb AC FTSE called for a national commitment to our future in the region.

"The ambition of our Asian neighbours is reflected in their strategies to grow their economies through innovation," Professor

Chubb said. "It is no coincidence that science and research are central to their national plans.

"Our geography opens opportunities for business and research alike, but our strategy will determine what we make of them."

Professor Ian Ang, Chair of the Expert Working Group and report co-author, said the report was a timely reminder of the barriers that still remain to cultural understanding and economic exchange.

"We need to progress from short-termism and opportunism to see the two-way benefits of deeper engagement," she said.

### Priority actions identified in the report include:

- using Asian communities in Australia and Australian communities in Asia to play a bridging role;
- encouraging greater interest and proficiency in Asian languages;
- investing strategically in science and cultural diplomacy through a national framework;
- recognising and nurturing grass-root community initiatives as an essential complement to short-term missions and delegations.

## AUSTRALIA SHOULD "ACT QUICKLY" ON GAS RESERVES

Australia needs to act quickly to assess its shale gas reserves and resources, the Academy has told the Victorian Parliamentary Inquiry into Unconventional Gas in Victoria.

It should also consider the potential social, economic and environmental impact of shale gas production – including the benefits and the challenges.

In its submission, ATSE noted that, due to the manner in which shale gas is produced, there is potential for shale gas exploration and extraction to have an impact on the

landscape and on biodiversity in Australia.

Referencing the 2013 ACOLA Report *Engineering Energy: Unconventional Gas Production – a study of shale gas in Australia*, the submission said there are many shale gas fracking processes that could impact the environment but most, if not all, could be managed.

But, if not adequately managed, land clearing and levelling of the site, and establishment and construction of access roads could result in impacts on soil, increased fire risk, spread of invasive species and

fragmentation of patches of native vegetation, habitats and landscape function, ATSE said.

Other potential environmental impacts may include impacts on surface and groundwater systems, ecosystems and induced seismicity.

Research into Australia's sedimentary basins and related water resources, landscapes and ecosystems, and how best to monitor them, would be essential to ensure careful management of shale gas production and minimisation (and avoidance) of potential impacts.

# ATSE IN ACTION

## IMNIS launches pilots in two states

The IMNIS (Industry Mentoring Network In STEM) concept has been launched with the establishment of pilot programs in Victoria and Western Australia.

This student mentoring program, with Academy support, plans to link PhD students with experienced mentors in industry to enhance students' understanding of business issues and language and encourage better long-term collaboration between business and publicly funded research organisations (PFROs).

As part of the market testing of the program, the two pilots will run for at least six months to facilitate development of the IMNIS program on a small, controllable scale. Experience gained in the pilots will facilitate the next stage of IMNIS development.

Industry, student, government and academic interest was evident at both the launches.

The Victorian pilot program is focusing on biotechnology, with participation from four universities (Melbourne, Monash, La Trobe and RMIT) and targets some 50 mentee students. The industry coordinating organisation is AusBiotech, with oversight from Dr Anna Lavelle FTSE, the AusBiotech CEO. It was launched by Victorian Premier Daniel Andrews in June at a ceremony



Key players (from left) Tony Radford, Ronnie Wood, Paul Wood, Daniel Andrews, Anna Lavelle and Alan Finkel.



Peter Lilly (left) and Minister Bill Marmion at the Perth launch.



WA mentees at the Perth launch.

attended by more than 100 participants.

The WA pilot was launched by the Western Australian Mines and Petroleum Minister Bill Marmion in Perth in July, with the support of Engineers Australia. It will focus on energy and

mineral resources with participation from four WA universities – UWA, Curtin, Edith Cowan and Murdoch – and also targeting some 50 mentees. The coordinating organisation will be UWA's EZONE, which aims to revolutionise engineering education and research, with oversight from EZONE Director, Dr Peter Lilly FTSE.

Both Dr Lavelle and

Dr Lilly are members of the

IMNIS Steering Committee established by the Academy.

The IMNIS Project Team is:

- Dr Paul Wood, IMNIS Executive Officer, who has held senior R&D roles in CSIRO, CRCs, CSL and Pfizer;
- Ms Ronnie Wood, who has more than 30 years' experience in the education and training sector;
- Dr Tony Radford, a biotech executive with 30 years' experience in pharmaceuticals and diagnostics; and
- Mr John Kirby AM, Deputy Chairman and non-executive Director of Village Road Show Ltd.

Dr Wood and Dr Radford were recipients of the Clunies Ross Award in 2013 for their work in improving tuberculosis diagnosis in cattle and humans.

## INNOVATORS OF INFLUENCE

The Australian Science and Innovation Forum, with the support of ATSE, is compiling the inaugural Australian Innovators of Influence List, for which nominations close on 11 September.

The Forum aims to compile and publish an annual list of influential Australian innovators, entrepreneurs and investors (individuals or teams) working in the field of science, engineering or technology or employed by a company whose core business involves a science, technology, engineering or mathematics innovation.

Nominations are sought from the public and from science and technology-related organisations. Nomination of female innovators and entrepreneurs is encouraged.

Further details will be available shortly on the Forum website (<http://asiforum.net/>).



## 3D printing technology. A giant leap towards regrowing bones.

At QUT, researchers are successfully regrowing damaged bone and soft tissue, achieving reconstructive feats once thought impossible. At QUT's Institute of Health & Biomedical Innovation, Professor Dietmar W. Hutmacher is using this pioneering technology to build custom-made and patient-specific scaffolds by combining 3D-printer technology and bio-ink infused with the patient's own cells. The result: an implant which eventually dissipates within the body to be replaced by new living cells and tissue. Biofabrication technology has the potential for specialised medical teams to custom-create new body parts to order, and give rise to an entirely new industry of personalised medicine.

Find out more at [www.qut.edu.au](http://www.qut.edu.au)



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# ATSE IN ACTION

## Funding should support new medical technologies

**Funding for medical research in Australia should support the commercialisation of medical technologies from medical research institutes, universities and start-up firms, the Academy has told the Senate Standing Committee on Community Affairs.**

The committee has conducted an Inquiry into the Medical Research Future Fund Bill 2015 and Medical Research Future Fund (Consequential Amendments) Bill 2015.

The key to maximising economic benefit from medical research is to ensure the MRFF harnesses all of Australia's medical research expertise and that clinical and market-based outcomes are specifically pursued, ATSE said in its submission.

To achieve this, MRFF funding allocations should be competitive, assessed by expert review and merit-based.

ATSE suggested that a significant

proportion (at least 50 per cent) of the funding should be allocated for translational clinical trials and for project-driven multidisciplinary research (such as towards a bionic eye, limb prosthetics and other medical devices). This would ensure the Fund promoted not only improved health outcomes for all Australians but enhanced researcher–industry engagement, a highly skilled and innovative workforce and profitable and competitive companies in the biomedical, medical technology and devices sectors.

ATSE said discoveries in medical research require translation into medical services, technologies and devices through established or start-up firms, which gain commercial benefits, grow the sector, create jobs and ultimately strengthen the economy.

The submission suggested that the definition of medical innovation be widened for

its focus on “medical treatments” to include medical technologies and devices.

“While medical treatments are necessary for improving the health and wellbeing of individuals, devices and technologies are powerful tools in the diagnosis and management of disease, and the ongoing monitoring and maintenance of health,” ATSE said.

The MRFF was an opportunity to consider specific investment in multidisciplinary, project-driven research. Today's healthcare system is technology-dependent and many future advances will depend not only on medical expertise but on collaborative contributions from engineers, computer scientists, physicists and chemists.

**The submission is on the ATSE website at [Submissions>Health Technology](#)**

## ICT can offer Australia huge opportunities

**The use of information and communications technology (ICT) to transform existing infrastructure systems into so-called smart or intelligent infrastructure will provide enormous opportunities for Australia.**

ICT-enabled smart infrastructure will provide improved efficiencies and service delivery, and improve public safety.

But the benefits of smart infrastructure will flow only if it is widely adopted and applied, and governments can facilitate this adoption and encouragement through regulation and proactive adoption as technology penetrates every aspect of business. These are key points made in the Academy's submission to the Inquiry into the role of Smart ICT in the design and planning of infrastructure by the House of Representatives Standing Committee on Infrastructure and Communications.

Effective infrastructure planning was a critical issue for Australia, ATSE said, particularly as our population continues to grow. Infrastructure – notably transport, water, energy and communications – is vital for driving productivity, underpinning prosperity and our way of life, and impacts on all aspects of our society.

In addition, there would be rich opportunities for Australian companies to develop the ICT and other technologies needed to underpin smart infrastructure.

“ICT will be central to smart health systems, smart road and transport infrastructure, smart agriculture and energy networks, and is critically important to the growth of existing and future Australian businesses and industries,” the Academy's submission said.

In the health sector, despite large national investments in health ICT very little policy work has been undertaken in Australia in deploying telecare and telehealth as a solution to the increasing demands and costs of managing chronic disease.

Intelligent transport systems (involving autonomous vehicles and vehicle-to-vehicle, vehicle-to-infrastructure and vehicle-to-human communications) have the potential to significantly improve traffic flow and the demand for road construction, ATSE said.

Integration of ‘big data’ and autonomous car technologies could make a substantial contribution to ensuring best use of our current infrastructure, potentially reducing the need for future large investments in new roads.

ICT systems could also place Australia's agricultural sector in a competitive position as a global producer as the sector faces pressures on the availability of natural resources for agricultural production due to drought, changing land and water-use patterns, competition from other industries, increased input costs and environmental degradation. Improved natural resource management would require the support of reliable and timely information through integrated databases and improved ICT infrastructure.

Australia needs intelligent electricity networks and enabling policy frameworks to ensure that future electricity supply systems provide efficient, affordable and low-emission energy to the Australian economy, ATSE said. Intelligent networks (sometimes called ‘smart grids’) would contribute to improved network utilisation and the need to acquire, store and use large sets of data to model a more complex network and predict its operation, increasingly in real time, will rely heavily on ICT.

**The submission is on the ATSE website at [Submissions>Infrastructure](#)**

# WOMEN IN TSE

## 15 women changing our world

Two ATSE Fellows are key players in a new University of NSW publication titled *15 women changing our world – Scientia Professors Rose Amal FAA FTSE and Veena Sahajwalla FTSE*.

Professor Amal is developing a revolutionary way to use water and solar energy to recycle carbon dioxide into environmentally friendly fuels. Professor Sahajwalla is creating a 'new industrial revolution', transforming rubbish into commercially viable 'green' materials.

Professor Amal, using only energy from the sun, aims to split water to liberate its hydrogen and then to hydrogenate carbon dioxide in a second reaction to create a new generation of commercially viable, renewable fuels. To develop fuels that are based on environmentally neutral H<sub>2</sub>O and sunlight, and at the same time recycle increasingly problematic CO<sub>2</sub> from our atmosphere, would be an incredible achievement.

"In the 1970s we started to put a lot of resources into developing solar cells to transform energy from the sun into electricity. That's the process we're all familiar with as roof-top solar panels and arrays," Professor Amal says.

"Now, as chemical engineers, we are looking at harnessing solar energy, not to convert into electricity, but for chemical reactions to create new fuels. This would overcome the current limitations of solar power, because fuels can be stored and used when needed, not just when the sun is shining."

Currently, sourcing hydrogen from water uses much more energy than is created. The reduction of carbon dioxide is also an 'uphill' reaction, meaning a great deal of energy is needed to pull apart the strong bonds that bind carbon and oxygen together as a stable gas.

Professor Amal is leader of UNSW's Particle and Catalysis Group and is a globally recognised pioneer and authority in the fields of particle technology, photocatalysis and functional nanomaterials.

Boosting the energy conversion efficiency in photocatalysis will be essential to creating the new generation of sustainable fuels, she believes.

"We require a system-wide approach, which means understanding the basic science, developing new materials, and engineering the right hybrid system to deliver practical, real-world applications."

Professor Sahajwalla is using previously unexplored high-temperature reactions to transform some of the world's most problematic and toxic wastes into commercially viable new 'green' materials.

Her successes have led her to be dubbed the 'modern-day alchemist' and could lead to a new manufacturing revolution.

The internationally recognised materials scientist and engineer is the director of UNSW's Centre for Sustainable Materials Research and

Technology (SMaRT@ UNSW), and also leads an \$8.8 million ARC green manufacturing research hub developing new processes to direct waste back into industrial production.

In her sights are complex automotive



Veena Sahajwalla

waste materials, which can be transformed into metal alloys, renewable agricultural waste that can be integrated into ferrous processing and new green ceramics that use waste plastics.

Professor Sahajwalla is also working to deliver cost-effective solutions for e-waste – the world's fastest-growing waste stream – that could transform this toxic mix of plastics and metals into valuable alloys. This would use her locally deployable new technology 'micro-recycling'.

Professor Sahajwalla's initial breakthrough came more than a decade ago when she began investigating carbon reactions at high temperatures, leading to her famous 'green steel' making process that partially replaces non-renewable coke with waste tyres and plastics in electric arc steel furnaces (EAF). Ultimately, she aims to eliminate coke injected in EAF steelmaking altogether by using renewable agricultural waste as a carbon source.

Green steel is now in commercial production around the world, under licence to research industry partner Arrium. It reduces coke consumption, cuts electricity usage and absorbs millions of waste tyres.

Professor Sahajwalla's research is underpinned by a highly original 'waste to value' approach. Today's conventional waste management processes, she says, either recycle waste – turning glass back into more glass, for example, usually with a reduction in quality and performance – or burn waste for energy.

However, by considering waste in terms of its elements and by investigating how those elements can be recombined, or reacted, at high temperatures, she has opened up an almost infinite number of possibilities for transforming waste into new value-added materials.

An example is her recent world first transformation of laminated automotive glass into a ferrous alloy, by reacting the waste with iron oxide at high temperatures.

"What was so fascinating with that was none of the inputs were metallic. By reacting waste glass, plastic and iron oxide, the output is a metallic alloy," she says.



Rose Amal

# WOMEN IN TSE

## Canberra launch for Kanga strategy

A strategic framework to increase diversity and inclusiveness in Australia's STEM sector was launched by the Minister Assisting the Prime Minister for Women, Senator Michaelia Cash, at an event hosted by Engineers Australia at Parliament House, Canberra, in June.

"The science, engineering and technology sector needs clever people with an interest in building a better world – this ability is independent of age, gender or cultural background. Diversity is important for innovation and to create our future industries," Dr Marlene Kanga AM FTSE said.

Dr Kanga is the author of the strategy document – *A strategy for inclusiveness, well-being and diversity in engineering workplaces* – a member of ATSE's Gender Equity Working Group and 2013 National President of Engineers Australia, only the second women to achieve this position in the organisation's 96-year history.



The Parliament House launch attended by (from left, front) ATSE Vice President Dr Susan Pond, Mrs Andrews, Senator Cash and Dr Kanga.

"The Australian Government has recognised science, technology, engineering and mathematics skills are important to Australia's future workforce, as industries increasingly rely on new and emerging technologies. Yet the numbers of young people studying science and mathematics continues to be low.

"Of further concern is that female engineers continue to leave STEM professions in large numbers, many about 10 years after university graduation, a critical time for career formation.

"This is the first time the science and engineering profession, through organisations like Engineers Australia, Consult Australia and the Academy of Technological Sciences and Engineering, have come together to endorse a practical approach to address the low numbers of women in STEM.

"This strategy uses an innovative, world-first approach, drawing on the lessons learned in transforming the culture of organisations in Australia to achieve world-class safety performance.

"This is a leadership issue. Our leaders have achieved significant cultural change in safety; they know how it can be done. They now need the will and the courage to make the cultural changes needed in our engineering and technology workplaces to make them more inclusive," Dr Kanga said.

Senator Cash said: "Boosting women's workforce participation in such industries, and indeed across the entire workforce, is good for the economy and means a more prosperous future for Australia."

The Parliamentary Secretary to the Minister for Industry and Science, Karen Andrews, participated in a panel discussion at the launch and said the strategy highlighted how determined leadership could make a big difference in changing attitudes.

"As an engineer myself, I know that women in particular do face challenges when it comes to pursuing a career in the sciences," Mrs Andrews said. "The situation for women in STEM (science, technology, engineering and maths) merits particular action because the proportion of women employed in these fields in Australia is comparatively low.

## TAKING THE GIRLS TO UNSW ENGINEERING

Australia's biggest engineering faculty, at the University of NSW, hosted 'Power of Engineering' in July – a full day of events, talks, workshops and hands-on activities for 160 girls in Years 9 and 10.

The events include programming robots, building bionic hands, designing housing for the developing world and erecting wind turbines, as well as inspirational talks from female engineers and students across the disciplines.

Among the speakers were Sally-Ann Williams of Google and Janine Sidhome of engineering consultants Arup, as well as female engineers from Transurban, Downer EDI and Seymour Whyte.

The 160 students were selected for their interest in maths and science, and the program – funded by UNSW and staffed by 50 female student volunteers – aimed to introduce them to the diversity of careers in engineering.

"Women make a significant contribution to engineering in Australia but, proportionately, they are under-represented in academia and other parts of the profession," says Professor Mark Hoffman FTSE, the Dean of Engineering. "Nationally, the proportion of women working in the profession is 13 per cent. While we're proud that among UNSW academic staff it's 21.5 per cent, we all need to do better."



Focus on engineering careers.



*Our vision is to create sustainability and excellence in Australia's power engineering.*

## What is the API?

The Australian Power Institute (API) is a not for profit national organisation established by the Australian power industry to boost the quality and numbers of power engineering graduates with the skills and motivation for a career in the energy industry which encompasses:

- Generation, transmission and distribution utilities
- Manufacturers and suppliers to the industry
- Consultants to the industry
- End users of electricity in their operations.

## Value Proposition

To deliver a sustainable supply of highly skilled power engineering professionals working effectively to meet the challenges of creating Australia's new energy future, and underpin the technical and commercial success of member companies in the energy sector.

The key objectives of API are to achieve the following:

- Provide a sustainable supply of quality power engineering graduates to industry
- University power engineering teaching and learning provides relevant industry skills
- Value added continuing professional development programs
- A respected organisation leading the national development of power engineering skills.




## Further Information

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## Seashells inspire new drug capsule

Australian scientists have developed a protective seashell-inspired capsule to preserve the active biological ingredients needed to create promising new drugs.

Published in the journal *Nature Communications*, the development overcomes a critical challenge in biomedicine by ensuring important proteins remain effective in hostile environments.

The new shell, developed by CSIRO, The University of Adelaide and the Australian Synchrotron, could hold the key to cost-effectively preserving and extending the shelf-life of vaccines in extreme temperatures without refrigeration. This could significantly benefit healthcare in developing countries, where life-saving vaccines often need to be transported over long distances to reach everyone who needs them.

The shell is made of an extremely porous material – a metal organic framework (MOF) – that has a flexible and customisable cage-like structure.

The shell also paves the way for the manufacture of new and improved consumer products. For example, shell-encapsulated enzymes in laundry washing powder would perform better, resulting in cleaner, softer and more fragrant clothing in less time.

## BROADBAND GOES BUSH TO BEAT BLINDNESS

Using satellite broadband technology, CSIRO scientists have connected metropolitan-based eye specialists to patients in remote areas of Australia to help prevent blindness.

The technology combines CSIRO's Remote-I platform with satellite broadband and has been used with more than 1000 patients from the Torres Strait Islands and southern Western Australia who received a free eye screening appointment at a local community health centre.

The screening program has identified 68 patients who were at high risk of going blind, including patients with macula edema.

The Remote-I platform works by capturing high-resolution images of a patient's retina with a low-cost retinal camera. These images are then uploaded over satellite broadband by a local health worker and accessed by metropolitan-based specialists from a tablet or a desktop computer.

"Once the health worker uploads the patient's image, I can access it anywhere, at any time. It takes me about five minutes to read the images, create the report, and then send it back to the health worker," consultant ophthalmologist for the project Dr Mei-Ling Tay-Kearney says.

"Diabetic retinopathy often causes irreversible blindness, and it affects the Indigenous population at nearly four times the rate of the non-Indigenous population," says trial leader, CSIRO's Professor Yogi Kanagasam. "In almost all cases this can be avoided by having regular eye checks. However, those in remote communities simply don't have access to these services. If we can pick up early changes and provide the appropriate intervention, we can actually prevent blindness.

"After successful trials in Queensland and Western Australia, we're really looking to see how we can work with governments and healthcare providers to continue the rollout of this technology across other states and territories."

Professor Kanagasam and his team have also been successful



Trialling Remote-I.

in obtaining a National Health and Medical Research Council (NHMRC) development grant to create an algorithm that can automatically identify all the pathologies related to diabetic retinopathy. Trials of this technology will be undertaken to see how it supports current and new referral pathways for patients.

CSIRO has licensed Remote-I to a Silicon Valley spin-off TeleMedC, which plans to take the technology to the US and world markets. TeleMedC focuses on ophthalmic medical imaging devices and smart diagnostic software for the screening and management of chronic diseases and eye conditions.

## BACK PAIN TOPS OUR ILLS

Lower back pain is the leading cause of ill health in Australians, according to an international study supported by the University of NSW.

Led by the University of Washington and published in *The Lancet*, the study analysed 301 acute and chronic diseases and injuries in 188 countries, assessing the impact of each of the conditions on mobility, hearing and vision, or whether it caused pain in some way, to determine years lived with disability (YLDs).

In 2013, neck pain, migraines and anxiety disorders were among the 10 leading causes of YLDs in Australia. For women in Australia, diabetes and Alzheimer's disease have replaced iron-deficiency anemia and hearing loss in the top 10 causes of YLDs.

It also found people across Australia were living longer but spending more time in ill health as rates of non-fatal diseases and injuries, including lower back pain, major depressive disorder and other musculoskeletal disorders such as shoulder injuries and fractures from osteoporosis, decline more slowly than death rates.

Co-author of the study Professor Louisa Degenhardt, of the National Drug and Alcohol Research Centre (NDARC) at UNSW, says the health of Australians is increasingly threatened by non-fatal ailments such as back and neck pain and mental health disorders like depression and anxiety.

"At the same time, deadly diseases like chronic obstructive pulmonary disease and diabetes are also costing Australians many years of healthy life. It is critical that we understand which diseases and injuries are causing disability so that we can effectively allocate resources."

## Difficulties with compulsory maths

**“Mathematical literacy is empowering, mathematical illiteracy is debilitating,” says Professor Geoff Prince, Director of the Australian Mathematical Sciences Institute.**

But he’s not sure making maths compulsory is a workable solution.

The numbers of Year 12 students studying intermediate and advanced maths has fallen in recent years, which has prompted a move for science, technology, engineering and maths (STEM) subjects to be made mandatory for all Year 11 and 12 students in Australia.

In an ABC Radio interview, Professor Prince backed the underlying sentiment that maths should be mandatory for Year 12 students in Australia, but said he was concerned about teacher resources.

“We definitely need to boost maths and science, technology and engineering interest in our schools – no doubt about it,” but acknowledged “really significant problems with resourcing” compulsory maths study.

“Between Years 7 and 10 in Australia, nationwide about 40 per cent of maths classes aren’t taught by maths teachers, so it would put a lot of pressure on the system if, in the short term, we insisted that students take maths all the way through to Year 12.”

He said that making maths compulsory, without mandating intermediate and advanced maths, would not necessarily generate more maths teachers.

“The schools which are best equipped to teach intermediate and advanced maths, where lots of kids do them, are generally schools in well-off areas where the students who pass through Year 12 and into university are generally not the ones who want to teach.”

## ‘EXPONENTIAL’ INTERNET GROWTH TO CONTINUE

**Cisco says Australia is set to continue experiencing exponential growth in internet usage and will reach a stage of hyperconnectivity faster than anticipated.**

It points to huge increases in IP traffic, mobile usage, number of connected devices, consumption of data per capita and video consumption.

Commenting on the 10th annual Cisco Visual Networking Index™ (VNI) Australian results, Mr Kevin Bloch, Chief Technical Officer for Cisco ANZ, said The VNI predicted that IP traffic in Australia will increase three-fold by 2019, with a compound annual growth rate of 22 per cent.

IP traffic would reach 1.4 Exabytes ( $10^{18}$ ) a month in 2019, up from 499 Petabytes ( $10^{15}$ ) each month in 2014. This equated to 45 Petabytes per day in 2019 (up from 16 Petabytes a day in 2014). “To put this in some context, that’s 154 times the amount of traffic in 2005,” Mr Bloch added.

“This type of growth is unparalleled. Our research shows that technology and connectedness are being embraced and driven by consumers faster than businesses have time to adapt or that the current network has the capacity to hold. The implications of this are that growth and, importantly, consumer satisfaction will be hampered by companies’ technological shortfalls.”

Although there would be an increase to the number of people online in Australia by 2019, the growth in internet use would come more from the number of devices that would be connected and the mobility of those devices. People would be online for more hours of the day and there would be more things connected.

The Cisco VNI research highlights that in Australia there will be a massive 219.6 million networked devices by 2019, up from 115.7 million in 2014. Wi-Fi and mobile connected devices will generate 72 per cent of IP traffic by 2019. Wi-Fi will become the dominant form of mobile connectivity and cross the half-way mark (60 per cent) of total traffic. Cellular will comprise 12 per cent. In 2019, mobile device traffic will be equivalent to 19 times the entire volume of the Australian internet in 2005.

Business IP traffic is set to double in size by 2019, a compound annual growth of 14 per cent. Business mobile data traffic will grow five-fold, and business Internet video will grow 3.4-fold from 2014 to 2019.

## BoM SUPERCOMPUTER TO ENHANCE FORECASTS

**The Bureau of Meteorology expects its weather forecasts and warnings across the country will be enhanced, more accurate and delivered faster thanks to a new supercomputer.**

Global supercomputer company Cray Inc. will supply the computer under a US\$59 million (A\$77 million) contract. It is expected to significantly increase the BoM’s current supercomputing power, delivering about 16 times the capacity of the current computer.

“This will enable the BoM to issue forecasts and warnings more often and with greater certainty and precision than ever before, giving the community and emergency services unprecedented information, particularly prior to and during severe and extreme weather,” Environment Minister Greg Hunt said.

“Every summer we see how vital Bureau services are in warning of weather associated with bushfires, thunderstorms, tropical cyclones, flooding, rain, and dangerous winds. Our nation is always going to be vulnerable to these events and the Bureau gives us the information we need to plan and act.”

Earlier, the BoM’s management of Australia’s official temperature record was endorsed by an independent review by a Technical Advisory forum of scientists and statisticians, led by Dr Ron Sandland AM FTSE.

## SMART WIRELESS DEVICES KEEP TOILETS STOCKED

**The cost of commercial cleaners having to constantly check cubicles can be huge, not to mention the waste involved in replacing almost-empty soap containers and toilet rolls to avoid users finding them bare.**

But how can cleaning companies keep the soap, hand towels and toilet rolls stocked efficiently, with minimum wastage?

Over the past year students from Deakin University have been using maths and engineering to solve the problem, in an AMSI Intern program involving KCrown, a Melbourne-based cleaning products supplier.

Student Vikram Nadar designed an electronic wireless system that senses the level of stock and transmits the data to a webserver, so staff can simply check the interface to know which bathrooms need restocking.

Jennifer Lewis, who switched from accounting to engineering, wrote and improved the software that allows the sensors to relay information to each other, using ‘mesh networking’ to provide layers of nodes that cooperate with each other, so the sensors can be placed further away from each other and further away from the master node.

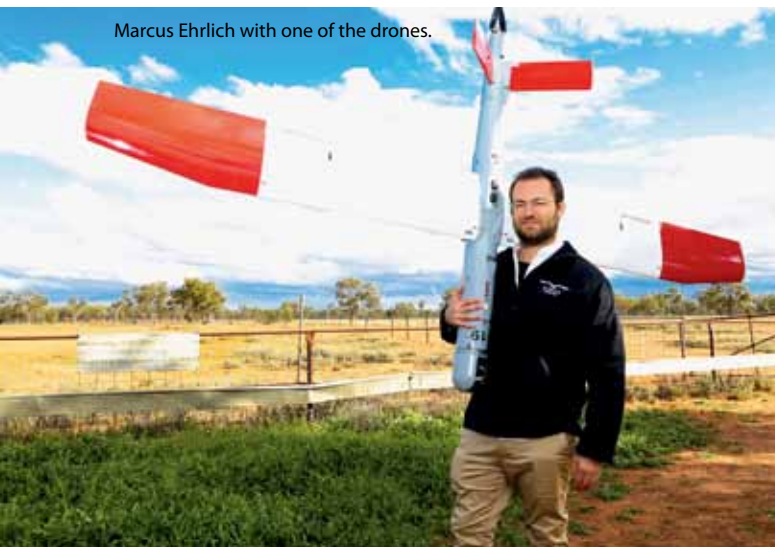
AMSI Intern is a not-for-profit program funded by Australian universities, government agencies and mathematical societies. The program aims to link students and industry.

# UAVs chase pests, day and night

A new surveillance tool is planned to be introduced into the fight against Australia's billion-dollar invasive pest problem, following the trial of military-grade unmanned aerial vehicles (UAVs) or drones.

The trial, conducted in July by Ninox Robotics, was the most ambitious civilian drone trial ever conducted in Australian airspace, using UAVs with advanced real-time thermal imaging capabilities to detect invasive pests in rural areas.

Marcus Ehrlich with one of the drones.



Regulatory approval for the trial included a number of firsts for a non-military operator in Australia, including:

- an enhanced flight ceiling of more than 400 metres;
- flight range beyond visual line of sight, all autonomously; and
- the ability to fly at night, making the thermal camera most effective.

The ability to fly the drones at night makes the UAVs particularly effective, as most pest activity on rural farms is more prevalent at night.

The UAVs, which have been supplied by world-leading tactical UAV manufacturer Bluebird Aerosystems, have a wingspan of almost three metres and a fuselage more than one metre long. An individual UAV's average flight time is about four hours and it can cover an area of up to 100km<sup>2</sup> with a top air speed of 120km/h.

Video captured by the camera is streamed live to ground control stations that are manned by trained UAV pilots, as well as passive screens viewed by landholders and other relevant stakeholders, enabling the viewers to determine the location, number and type of targeted pests.

Unlike other aerial pest-detection methods, which rely primarily on the human eye and are ineffective at night, the UAVs use dual-payload cameras that can switch easily between normal visual spectrum (RGB) and far infrared (thermal) sight.

The three-week trial, at selected sites in southern Queensland and northern NSW, was designed to test the capability of the UAV's thermal imaging camera to spot invasive pests and domestic animals in a variety of terrain types both at night and in the daytime.

"Australian landholders and managers have been struggling against the problem of invasive pest species – including feral dogs, pigs, deer and rabbits – for decades. The issue has caused, cumulatively, billions of dollars in

damages and lost revenue, as well as significant destruction of the country's unique biodiversity," says Marcus Ehrlich, Ninox Robotics Managing Director.

"With the application of UAVs, we have a new weapon in this fight, which will provide unparalleled effectiveness in pest detection and enhance existing control techniques. It's a quantum leap over any of the current pest intelligence gathering methods currently available."

Ninox Robotics intends to commercialise the service, with its first team of trained UAV pilots able to be deployed across the country.

## FARM PRODUCTION NEARS \$54 BILLION

The total value of Australian farm production is forecast to reach a record high of nearly \$54 billion in 2015-16, while farm export earnings will ease slightly, according to figures released by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES).

The gross value of farm production is forecast to increase by 3.1 per cent to about \$53.7 billion in 2015-16, following an estimated increase of 2.1 per cent to \$52.1 billion in 2014-15. At this forecast level, the gross value of farm production in 2015-16 would be about nine per cent higher than the average of \$49.1 billion over the five years to 2014-15 in nominal terms.

While the value of farm production is expected to reach record levels, the total value of farm exports is actually expected to ease slightly, down 1.4 per cent on 2014-15.

ABARES forecasts the total value of farm exports in 2015-16 at \$41.8 billion dollars, compared with an estimated \$42.4 billion in 2014-15. This would be about 10 per cent higher than the average of \$38 billion over the five years to 2014-15 in nominal terms. Agricultural commodities for which export earnings are forecast to rise in 2015-16 include coarse grains (by six per cent), dairy (two per cent), lamb (two per cent), live sheep (six per cent), wool (five per cent) and sugar (five per cent).

These forecast increases are expected to be more than offset by forecast falls in export earnings for beef and veal (four per cent), wheat (five per cent), canola (five per cent), cotton (33 per cent), live feeder/ slaughter cattle (four per cent) and mutton (13 per cent).

## LICENCE TO PRINT CHOCOLATE

RMIT PhD researcher Rohit Ashok Khot has found the sweetest way in the world to get people to exercise – he rewards users with chocolate treats made on a 3D food printer. And the more they exercise – the smoother the chocolate.

RMIT researchers are equipping 10 Melbourne homes with 3D food printers capable of churning out chocolate in a unique experiment to test if people undertake more exercise when rewarded with food treats. Heart monitors will measure participants' physical exertion and then deliver the equivalent amount of energy as chocolate, piped out of the 3D printer.

"The more they exercise, the better the quality of chocolate will be printed out which they get to enjoy as a reflective reward of their physical activity," Mr Khot says. "Participants will be able to see their chocolate printed out after they exercise and we will study if this new edible mode of representation is enough to make exercise more engaging and enjoyable."

Only antioxidant-rich dark chocolate will be used in the study and participants will be restricted to about two small squares from a 200-gram block of chocolate.

# New focus on research priorities and returns

The Australian Government has announced new national Science and Research Priorities to ensure the science, research and innovation system delivers maximum benefit.

The nine cross-disciplinary priorities are food, soil and water, transport, cybersecurity, energy, resources, advanced manufacturing, environmental change and health – and link with ATSE's strategic priorities.

The Government says the priorities will help Australia's science and research efforts to reflect the needs of industry, the national economy and the community and says it will work with universities, research institutions and industry to identify projects and investments to address the priority areas.

"We will always make a considerable investment in science, research and innovation and continue to support a range of high-quality basic and applied research across all disciplines and in all areas," Prime Minister Tony Abbott said.

"Nevertheless, we have finite resources and need to be strategic in how we invest. Setting priorities and, over time, aligning a proportion of Australia's research investment to them will help us build critical mass and scale in areas vital to our future."

The priorities were developed in consultation with Australia's Chief Scientist Professor Ian Chubb AC FTSE, industry and science and research sectors. They were agreed by the Commonwealth Science Council and endorsed by the Government.

Education and Training Minister Christopher Pyne, Industry and Science Minister Ian Macfarlane MP and Health Minister Sussan Ley also announced the Government's Boosting the Commercial Returns from Research strategy.

The Ministers highlighted that Australia's research sector is highly productive and recognised globally for the quality of its research but noted that, when it comes to collaboration between business and researchers Australia's performance falls away.

Minister Pyne said that the Government was determined to address the challenges Australia faces in turning good ideas and research breakthroughs into commercial results.

"For Australia to prosper, we must improve our ability to translate publicly funded research into commercial outcomes. The strategy we announce today includes 14 important actions to support economic growth and to ensure Australia's competitiveness into the future."

Minister Macfarlane said Australia's future competitiveness depended on collaboration between business and researchers.

"The need for reform is clear," Mr Macfarlane said. "Our universities, science agencies and businesses are critical to capitalising on new economic opportunities and for building our industries and jobs of the future, but they must collaborate more effectively so we can get the most value from our research spending."

Minister Ley said the Government's Medical Research Future Fund (MRFF) was expected to reach \$20 billion in 2019-20 and would fund research to help Australians enjoy healthier, more productive lives.

Boosting the Commercial Returns from Research is a key initiative under the Government's Industry Innovation and Competitiveness Agenda released last year by the Prime Minister.

## Agenda for action

The Government announced a 14-point approach to improve collaboration between research and industry:

- 1** The Government's Science and Research Priorities will align areas of national research excellence with Australia's industrial strengths, global trends and community interests.
- 2** The Government will develop simpler, more transparent research block grant arrangements.
- 3** The Government is identifying further opportunities to enhance collaboration between publicly funded research agencies and industry.
- 4** The Government has commissioned a review of research training arrangements to prepare excellent researchers who work productively with industry to bring their ideas to market.
- 5** The Government is examining the operation of the Research and Development (R&D) Tax Incentive, within the broader context of reviewing the effectiveness of existing tax incentives for collaboration with public research institutions.
- 6** The Government will continue establishment of the Medical Research Future to support collaboration between researchers and industry partners to assist in the translation and commercialisation of Australian medical research.
- 7** The Government is working with the ARC and the NHMRC to ensure rules for competitive grants appropriately recognise industry-relevant expertise or research.
- 8** The Government has committed two years of operating funding to NCRIS, a critical element of the nation's innovation system.
- 9** The Research Infrastructure Review findings will provide a solid base for the Government to plan for national-scale research infrastructure to support priority research of national significance.
- 10** The Government is developing an intellectual property (IP) toolkit to facilitate collaboration between research and industry.
- 11** The Government will implement a strategy to provide business with greater online access to research.
- 12** The Government will consider options to consolidate relevant research programs that focus on industry to increase their scale and effectiveness.
- 13** A whole-of-government policy will be developed for opening business and community access to publicly funded research publications and data.
- 14** The Government will work with the research sector and industry to develop a plan to improve the assessment of the research system.

## RECORD NUMBER OF UNIVERSITY PLACE BIDS

There were a record number of university applicants in Australia in 2015 – 314,918 applications for university places, according to the *Undergraduate Applications and Offers, February 2015 report*.

Year 12 applications through Tertiary Admissions Centres increased by 1.3 per cent and more non-Year 12 applicants are applying directly to universities.

"Direct applications to university are up 6.8 per cent on last year, 96 per cent of which are non-Year 12 applicants," Education Minister Christopher Pyne said.





## Copper miner goes solar

**Sandfire Resources has started construction of the \$40 million solar power station at its DeGrussa Copper Mine, at Sandfire, between Port Hedland and Broome, in northern Western Australia, on the western edge of the Great Sandy Desert.**

The 10.6MW solar power station will be the biggest integrated off-grid solar and battery storage facility in Australia.

The solar array at DeGrussa will use 34,080 solar panels covering 20 hectares. It will be combined with 6MW of short-term battery storage and will provide peak power to the mining operation by being integrated with the existing baseload 19MW diesel-fired power station.

The Clean Energy Finance Corporation is contributing \$15 million towards the project, while the Australian Renewable Energy Agency is providing \$20.9 million. German renewable energy group juwi, the developer and operator of the project, is contributing most of the balance. French renewable energy firm Neoen will own the facility and infrastructure group OTOC has been awarded the procurement and installation contract for the project in a joint venture with juwi.

Sandfire Resources is a mid-tier Australian mining company. The DeGrussa Mine has an annual production range of 65,000 to 68,000 tonnes of copper and 36,000 to 38,000 ounces of gold.

Sandfire Managing Director Karl Simich says the project could reduce the mine's diesel consumption, reduce its carbon footprint, make an important contribution towards improved environmental outcomes and promote the use of renewable energy in the Australian mining industry.

ARENA CEO Mr Ivor Frischknecht says the project joins a small but growing number of renewably powered mines globally and will be a world-leading example driving further advancements.

## HELIOSTATS POINT TO SOLAR FUTURE

**CSIRO has had two new boosts to its solar technology, which has been exported to Japan and incorporated in an Adelaide manufacturing plant.**

Mitsubishi Hitachi Power Systems (MHPS) will establish a field of 150 heliostats – a smaller version of the CSIRO solar farm at Newcastle – in Yokohama to run research projects. It is the second international deployment of CSIRO's solar thermal technology, following a similar project in Cyprus.

And CSIRO-designed heliostats are being constructed by a South Australian manufacturing company dealing with the downturn in the

**The juwi Konkoonsies solar project in South Africa.**

automotive industry. Heliostat SA was created with the support of four SA organisations: Precision Components (a company involved in the car industry), The University of South Australia, May Brothers and Enersalt.

CSIRO's Energy and Resources Executive Director Dr Alex Wonhas says the two projects are a strong vote of confidence in the science agency's solar capabilities. "To have CSIRO's heliostats selected by MHPS, a global leader in energy, proves that our technology is up there with the best in the world. Our successful collaboration with Heliostat SA also shows the benefits of science working closely with industry to create value for the Australian economy."

Industry and Science Minister Ian Macfarlane visited the Heliostat SA plant in June. The Australian Government provided \$1 million of matched funding to Precision Components from its Automotive Diversification Program, which has enabled the car manufacturer to diversify into renewable energy.

■ *Solar thermal tower technology uses a field of mirrors whose angle is under computer control (heliostats) and each of which rotates accurately to reflect and concentrate sunlight onto a receiver on top of a tower. The concentrated sunlight is used to create superheated steam, which can then be used to drive a turbine for generating electricity.*



(From left) Ian Macfarlane, Alex Wonhas and Darrin Spinks, Executive Director Heliostat SA, inspect the Heliostat SA plant in Adelaide.

## CARNEGIE & WINDLAB WIN CLEAN ENERGY HONOURS

**Carnegie Wave Energy and Windlab took top honours at the 2015 Clean Energy Council Industry Awards.**

Carnegie Wave Energy was presented with the Clean Energy Council Innovation Award for its CETO technology, while the Clean Energy Council Community Engagement Award went to Windlab for its community ownership program at the Coonooer Bridge Wind Farm in Victoria.

Clean Energy Council Chief Executive Kane Thornton said innovative new renewable energy projects continued to inspire the rest of the industry, and Carnegie's success with its CETO technology over the past year was undeniable. "Carnegie's three-unit array with the Department of Defence in WA is currently the only grid-connected wave energy project in the world, and produces both renewable energy and desalinated water."

Mr Thornton said effective community engagement should not be underestimated, given the amount of new renewable energy that would be built over the next five years.

"Windlab's community ownership program at Coonooer Bridge in Victoria has allowed those living near wind farms to have a collective sense of ownership of the project, and help to make the company a part of the local community.

## Remote control your electricity

Australian householders may soon be able to track their electricity usage in real time and remotely switch appliances on and off using CSIRO technology.

The technology, known as 'Eddy', is being commercialised by Australian company HabiDapt, which is trialling it in Perth and, in conjunction with Ergon Energy Retail, in regional Queensland.



'Eddy' allows real-time electricity tracking technology for household use.

Using an online interface (computer or smartphone) Eddy keeps track of electricity use, collects and analyses the data, and makes recommendations to help users save money. It also allows users to remotely control major appliances such as air conditioners, hot water systems and pool pumps.

To reduce demand on the grid during peak periods, the technology allows users to take part in demand-management programs offered by their energy company and receive rewards in return, such as discounts on their energy bill.

The technology was developed at CSIRO's energy centre in Newcastle and uses cloud-based software and mini smart meters that look like meter box circuit breakers. The smart meters connect to the cloud via a small internet communication device in the house. Once connected, the appliances linked to the meters can be remotely controlled.

## ROADMAP TO TRACK ELECTRICITY MARKET

The Electricity Network Transformation Roadmap, a joint project involving the Energy Networks Association and CSIRO, aims to help the Australian electricity sector adapt to a fast-changing world of new technologies, innovations and customer-driven reform.

"By mapping the ways in which Australian homes and businesses are likely to use power in the future, as well as improvements in the way power is delivered through the network, Australia's electricity sector will be more flexible and more responsive to consumer needs," Industry and Science Minister Ian Macfarlane said when he launched the project.

"Australia's electricity system is rapidly changing. We once relied on a highly centralised system to deliver electricity to our homes and businesses and underpin our economic growth. We are now seeing a broad range of energy generation, delivery and consumption behaviours, meaning one size no longer fits all. Importantly, this change is consumer-driven, therefore the electricity industry needs to respond in a way that will deliver a product that electricity users want. Our world-class science agencies can help with the transition.

"The Roadmap project will use different scenarios to examine the impacts of possible changes, such as the make-up of Australia's electricity mix as well as the impact of technologies such as smart meters and batteries.

"The rapid uptake of air-conditioners, as well as the widespread adoption of photovoltaic (PV) rooftop solar, are two examples of how

Australia's electricity needs are evolving. More than three-quarters of Australian households have air conditioners and about 1.4 million houses have PV systems installed.

"Forecasts show that by 2035, 35 per cent of houses with solar power will also have battery storage, so instead of relying heavily on grid-supplied power as 'back-up' they will have more of an ability to control the time of day they use self-generated power.

"Electricity networks will have to keep pace with these changes in the way Australians use electricity. It's important that we model the future environment to allow industry to respond appropriately, and so we can implement policies that support innovation and maintain consumer confidence."

## BIOWAVE PILOT UNIT FOR PORT FAIRY

BioPower Systems (BPS) has completed the construction and onshore testing of a 250kW bioWAVE pilot demonstration unit, to be deployed off Port Fairy, in western Victoria, later this year.

The project is supported by an \$11 million grant from the Australian Renewable Energy Agency (ARENA), a \$5 million grant from the Victorian Government and \$5 million equity from BPS.

The unique bioWAVE comprises a 26-metre-tall oscillating structure that sways back and forth beneath the ocean swell, capturing energy from the waves and converting it into electricity, which is fed into the grid via an undersea cable.

The data collected from the project, combined with the experience gained, is expected to help reduce the cost of wave energy and contribute to development of the bioWAVE towards commercial production.

To protect itself during extreme wave events, the structure will automatically assume a 'safe' position, flat against the seabed. This reduces structural design requirements (and hence cost) while maintaining reliability.

"Achieving practical completion of the bioWAVE is a major milestone in the development of this technology," says CEO of BPS, Dr Timothy Finnigan. "We look forward to seeing it operating in the Southern Ocean, developing the next generation machine and exploiting the technology around the world."

ARENA CEO Mr Ivor Frischknecht says the \$21 million project will further cement Australia's position as a leader in renewable wave energy.



The bioWAVE unit.

## Blueprint roadmap for minerals exploration

A new industry-sponsored resources roadmap has established a set of priority activities to make a dramatic improvement in greenfield and under-cover mineral exploration in Australia.

The UNCOVER Roadmap, launched in Perth by Industry and Science Minister Ian Macfarlane and WA Mines and Petroleum Minister Bill Marmion, outlines the minerals industry's long-term R&D and new pre-competitive geoscience data needed to help to locate and recover new mineral deposits.

Mr Marmion said the UNCOVER Roadmap clearly identified 16 high-priority research and technology development activities out of 45 focus areas that would boost success for the exploration and geoscience community over the next decade or so.

"The UNCOVER Roadmap is an outstanding example of the industry collaborating to define the priority research requirements for future minerals exploration for Australia," Mr Marmion said.

"The coordinators of the roadmap development project, AMIRA International, have a great track record for facilitating collaborative mining industry projects.

"Work by the company in 2005 for the drilling exploration sector laid out a multitude of opportunities for cheaper, safer and smarter ways of going about one of the core activities of minerals exploration.

"This led to the Deep Exploration Technologies CRC, which has been creating commercialised solutions for the drilling industry ever since."

Mr Macfarlane said Australia had developed a high-quality, efficient and world-renowned mining sector, but exploration success rates had declined over time.

"Exploration has become more costly and technically difficult because new discoveries will inevitably be more deeply buried than the minerals that have been already found," Mr Macfarlane said. "We need to develop new technology and ways to enable us to search beneath the 80 per cent of the continent that is covered by non-mineralised rocks and sediments."

## \$74M FOR RESOURCE AND MANUFACTURING CRCs

Industry-led research to improve resource extraction and support innovative manufacturing will be boosted with \$74 million in Government funding for two Cooperative Research Centres.

The established CRC for Optimising Resource Extraction (CRC ORE) will receive \$34.45 million to fund its ongoing activities in improving the efficiency and cost-effectiveness of mineral extraction to 30 June 2021.

The new CRC for Innovative Manufacturing (IM CRC) will receive \$40 million over seven years to 30 June 2022 to assist Australian manufacturers transition to high-value internationally competitive manufacturing.

Announcing the grants at the CRC Association annual conference in Canberra, Minister for Industry and Science Ian Macfarlane said CRCs would continue to be an important asset for driving greater collaboration between industry and research.

"CRCs are a highly successful way of bringing industry and research organisations together to apply the latest research knowledge to the real-world problems facing industry," Mr Macfarlane said.

"The CRCs will work closely with the new Industry Growth Centres to address common goals and priorities, ensuring an integrated approach to overcoming challenges and developing market opportunities for local businesses."

## FIVE BILLION LIGHT YEARS AWAY ...

Scientists have revealed a galaxy five billion light years away, using a new hi-tech telescope in remote Western Australia.

The galaxy was uncovered in radio emission travelling to Earth using CSIRO's Australian SKA Pathfinder telescope (ASKAP), located at the Murchison Radio-astronomy Observatory (MRO).

CSIRO's Dr James Allison led a research team using ASKAP and the MRO's unique radio quietness, to crack open a window to a little-explored period of the universe's history. The team used a special technique to detect a change in radio waves coming from within the bright centre of the galaxy PKS B1740-517, located near the Ara constellation.

The five-billion-year-old radio emission was stamped with the 'imprint' of hydrogen gas it had travelled through on its way to Earth. The gas absorbs some of the emission, creating a tiny dip in the signal.

"At many observatories, this dip would have been hidden by background radio noise, but our site is so radio quiet it stood out clearly," Dr Allison says.

Dr Allison is an affiliate of the ARC Centre of Excellence for All-sky Astrophysics (CAASTRO), which is led by Professor

Elaine Sadler of the University of Sydney. Both researchers are part of a team that will use the absorption technique with ASKAP to find hundreds of galaxies that are up to 10 billion light years away and determine how much hydrogen gas they contain.

This will help astronomers understand why star formation, which is fuelled by hydrogen gas, has dropped off in the universe since its peak 10 billion years ago.

"These latest research findings are demonstrating that ASKAP can do what other telescopes can't," Dr Allison says.

CAASTRO is a collaboration between Curtin University, The University of Western Australia, the University of Sydney, the Australian National University, the University of Melbourne, Swinburne University of Technology and the University of Queensland. The CAASTRO Advisory Board is chaired by Academy President Dr Alan Finkel AO FTSE.



James Allison



A section of the Doug Foster Wave Flume facility.

## UNSW expands wave research

**A new wave-flume facility – essential for modelling coastal and inland water behaviour – is operating at the UNSW Water Research Laboratory (WRL) in Manly Vale in Sydney's north.**

The flume, known as the Doug Foster Wave Flume facility, was named in the memory of Professor Douglas Foster (1930–2001), widely known by engineers and researchers in the field as Australia's 'father of coastal engineering'. A foundation staff member of WRL, he became its second director in 1973 and led it for 14 years.

In recognition of his contribution, Engineers Australia created the Doug N. Foster Memorial Fellowship Fund in 2001 to encourage engineering students to take up careers in coastal or ocean engineering.

The laboratory, considered the birthplace of coastal engineering in Australia, has four instrument-laden laboratories across four hectares downstream from Manly Dam, where large-scale physical models of coastal and inland waterways are recreated for research. It is part of the largest coastal hydraulics research complex in Australia.

This new facility will expand the WRL's coastal research programs, which seek to improve fundamental understanding of the forces that are shaping coastlines now and in the future. Importantly, the facility will improve the WRL's ability to deliver practical advice and better inform 'best practice' design and planning of future coastal development.

"In many ways, the WRL is a model for the kind of engagement we aim for in academia: doing research work of high excellence while also solving real-world problems for industry and government," says Professor Mark Hoffman FTSE, Dean of Engineering at UNSW.

The new wave flume – a wave channel for the physical modelling of waves to study their properties and effects – is 44 metres long, 0.9m wide and 1.4m deep, making it the largest such facility in Australia.

"Flumes are essential in fluid dynamics research, allowing engineers to understand coastal and offshore structures, sediment transport and

other water transport phenomena," says Professor Ian Turner, the newly appointed director of the laboratory.

The new wave flume is being used to examine, for the first time anywhere in the world, the interaction of coastal engineering structures as coastlines evolve in response to rising sea-levels.

## 25-YEAR WORLD RECORD

**June marked the 25th year for which Tasmanian shipbuilder Incat has held the record for the fastest Transatlantic Crossing and the Hales Trophy.**

On 23 June 1990 *Hoverspeed Great Britain*, a ship built by Incat in Tasmania for operation between England and France, broke the record for the fastest crossing of the Atlantic Ocean by a commercial passenger ship. The crossing, from Ambrose Light at New York, commenced at 7.30pm on 19 June 1990 and ended the 2922-mile trip at Bishop Rock in the UK on the morning of 23 June. The previous record had been held for 38 years (since 1952) by the *SS United States*.

The *Hoverspeed Great Britain* held the record until another Incat-built ship, *Catalonia*, took the record in June 1998. However, just a month later, in July 1998, another ship built by Incat, *CatLink V*, broke the record again. It was the first time in the history of transatlantic records (dating back to the 1860s) that three ships built by the same shipyard had won the trophy in succession.

The record set in July 1998 still stands: a 41.284-knot (76.5km/h) average over two days, 20 hours and 9 minutes.

## AUSTAL'S SHIPS WIN THE US NAVY

**Shipbuilder Austal has christened the latest of its US Navy littoral combat ships (LCS), *US Gabrielle Giffords*, at its Mobile, Alabama, shipyard – the third of 10 being delivered in a US\$3.5 billion contract.**

The ship is a 127-metre aluminum trimaran capable of being outfitted with reconfigurable payloads (mission packages), which can be changed to support mine countermeasure, anti-submarine and surface warfare missions. It has a maximum speed of 40 knots (74km/h) and will be delivered in 2016.

More than 400 naval and shipyard guests attended the ceremony, which highlighted Austal's US Navy links.

The LCS program is in full swing at Austal, with seven ships under construction. Austal has also been contracted by the US Navy to build 10 103-metre joint high-speed vessels (JHSV) under a US\$1.6 billion contract.

Austal is a global designer and manufacturer of defence and commercial ships. For over 25 years the company has been designing, building and maintaining ships for governments, navies and ferry operators around the world. More than 250 vessels have been delivered in that time.

Austal also designs, constructs, integrates and maintains an extensive range of patrol and auxiliary vessels for government agencies globally, including the Cape Class Patrol Boat Program for Australian Customs and Border Protection.

Defence vessels are designed and constructed in Mobile and at Henderson, south of Perth, where the business started. Commercial construction is centred in Balaban, the Philippines.



*USS Coronado*, sister ship of the *USS Gabrielle Giffords*.



A Carbon Revolution wheel.

## Victorian wheels for the Ford Mustang

Victorian specialist manufacturer Carbon Revolution has signed a contract to supply its carbon fibre wheels to the Ford Motor Company in the US for the legendary Ford Mustang.

It will be the first time the Geelong firm's innovative wheels – half the weight of alloy wheels – have been fitted as original equipment to a production car.

Formed by engineering graduates of Deakin University, Carbon Revolution is still based at Deakin's Waurn Ponds campus, near Geelong.

Last year it won a \$5 million grant to build a new \$24 million plant from a fund planned to ease the impact on Geelong of the closure of large manufacturing operations by Ford and Alcoa. At full capacity, this facility will be able to produce 50,000 carbon fibre wheels a year.

The company pioneered commercial production of carbon fibre wheels made from a single piece of material. Its wheels have previously been sold in the aftermarket to owners of prestige vehicles.

Industry and Science Minister Ian Macfarlane said that supply of cutting-edge, one-piece carbon fibre wheels to a global automotive manufacturer was a glowing endorsement for the Geelong-based company.

"This is a great day for Carbon Revolution and Australian advanced manufacturing," Mr Macfarlane said.

## CSIRO BACKS METAL 3D PRINTING

CSIRO has launched a new innovation centre in Melbourne to accelerate industry adoption of metal 3D printing and other emerging additive manufacturing technologies.

CSIRO says the \$6 million centre, called Lab 22, provides Australian companies with affordable access to specialist additive manufacturing equipment and expertise, and offers huge efficiency and productivity benefits for product development.

By lowering their capital investment risk and allowing companies to 'try before they buy', Lab 22 overcomes one of the major barriers facing smaller businesses in adopting 3D printing with metal, CSIRO says.

"This advanced equipment is in the

range of \$1 million per unit, but the vast majority of small and medium-sized businesses (SMEs) don't have that amount of capital on-hand to take a leap of faith on a new or emerging technology," CSIRO additive manufacturing research leader, Alex Kingsbury, says.

"We're providing Australian companies with a unique opportunity to access some of the most advanced additive manufacturing equipment with the help of our experienced technical experts, for a comparatively minimal daily fee," she says.

Australian 3D printing service companies Made for Me and Keech3D were the first companies to sign to use Lab 22's new space, with the aim of growing their metal 3D printing services.

CSIRO has partnered with industry on a range of world-firsts using its Arcam 3D printer, including a titanium heel bone implant to treat a cancer patient, a mouthguard for treating sleep apnoea and a customisable 'orthotic' for horses suffering laminitis.

## \$23.4 MILLION GRANTS FOR COMMERCIALISATION

Six Australian companies will receive \$1 million grants to propel their innovative ideas from the drawing board into the marketplace under the Australian Government's Accelerating Commercialisation program.

Industry and Science Minister Ian Macfarlane said the first round of \$10.6 million in funding under the Accelerating Commercialisation element of the Australian Government's \$484.2 million Entrepreneurs' Infrastructure Programme would be backed by business investment in new opportunities and new jobs.

"These Accelerating Commercialisation investments will help 18 innovative Australian businesses get their ideas to market. Importantly, the \$10.6 million of Government funding is more than matched by investment from businesses themselves, leading to a total value for the projects of \$23.4 million," Mr Macfarlane said.

The biggest grants go to: MyHealthTest Pty Ltd for commercialisation of dry blood spot pathology testing; AquaHydrex Pty Ltd for a pilot manufacturing facility; Smart Steel Systems Pty Ltd for a fully automated steel fabrication system; Australian Bay Lobster Producers Ltd for a controlled manufacturing process growing soft-shelled bay lobster; Clarinox Technologies Pty Ltd for wireless technology to connect with the global 'Internet of Things'; and One Atmosphere Pty Ltd for commercialisation of its Pegasus Aircraft Emergency Buoyancy System.

Other projects include:

- development of a 3D printer learning program for primary school children;
- development of a state-of-the-art plant that produces hydrogen at a fraction of the cost of current methods;
- commercialisation of a device that tests strength and injury risk in hamstring muscles; and
- manufacturing scale-up of a scratch-resistant acrylic glass.

Alex Kingsbury leads CSIRO's additive manufacturing research.





## Now it's a 3D bridge

3D printing technology has been put to all kinds of uses and is now at the heart of an ambitious project to build a fully functioning bridge across one of Amsterdam's canals.

3D printing research and development firm MX3D is working with designer Joris Laarman Lab, software developers Autodesk and construction company Heijmans, among others.

The plan is that two 3D-printing robots will start on one bank and gradually make their way over to the opposite side, building the steel bridge as they go.

The robots will create the bridge out of steel, heating the raw material to about 1500°C before welding the structure in place. Designers say the resulting bridge will be strong, sturdy and protected against the elements.

MX3D says a visitor centre, where people will be able to follow the progress of the robots, will open in September, although as yet the exact location of the bridge has not been confirmed.

Apart from demonstrating a new concept for 3D printing, it is expected to open up new applications for 3D printing.

"What distinguishes our technology from traditional 3D printing methods is that we work according to the 'printing-outside-the-box' principle," says Tim Geurtjens from MX3D. "Printing a functional, life-size bridge is, of course, the ideal way to showcase the endless possibilities of this technique."

Key to the bridge is robotic 3D printing technology that makes it possible to draw in mid-air. Using an advanced welding machine, the robots will print without the need for support structures. Adding small amounts of molten metal at a time, they will print lines in mid-air.

*Fast Company* reported that MX3D's bridge will be made of a new steel composite as strong as regular steel created by the University of Delft, which can be dolloped out by a 3D printer, drop by drop.

The plan is for the robots to progressively print their own supports and gradually move over the water, creating the bridge as they go.

## WEARABLE SAFETY SENSORS

RMIT University researchers have created wearable sensor patches that detect harmful UV radiation and dangerous, toxic gases such as hydrogen and nitrogen dioxide (NO<sub>2</sub>).

These transparent, flexible electronics can be worn as skin patches or incorporated into clothing.

Dr Madhu Bhaskaran, project leader and co-leader of the RMIT

The 3D bridge concept.

Functional Materials and Microsystems Research Group, says the sensors can be placed on work and safety gear to detect dangerous gases.

"Hydrogen leaks can lead to explosions as happened with the Hindenburg disaster and NO<sub>2</sub> is a major contributor to smog," she says. "The ability to monitor such gases in production facilities and coal-fired power stations gives vital early warning of explosions, while the ability to sense NO<sub>2</sub> allows for a constant monitoring of pollution levels in crowded cities."

## UNSW TEAM WINS ROBOT AWARDS

An Australian team from the University of NSW has taken a swag of awards at an international 'agility course' in the US for autonomous robots.

Six UNSW engineering students and their robot 'Pepper' travelled to Michigan to compete in the International Ground Vehicle Competition against 40 other teams.

"Pepper managed to break both course records and ran twice as fast as the only other robot that managed to complete the advanced course," says Dr Mark Whitty, UNSW mechatronics lecturer who travelled with the students.

What was unique about this tournament was that competitors didn't know the structure of the course ahead of time. "All we knew is

The UNSW team with 'Pepper'.

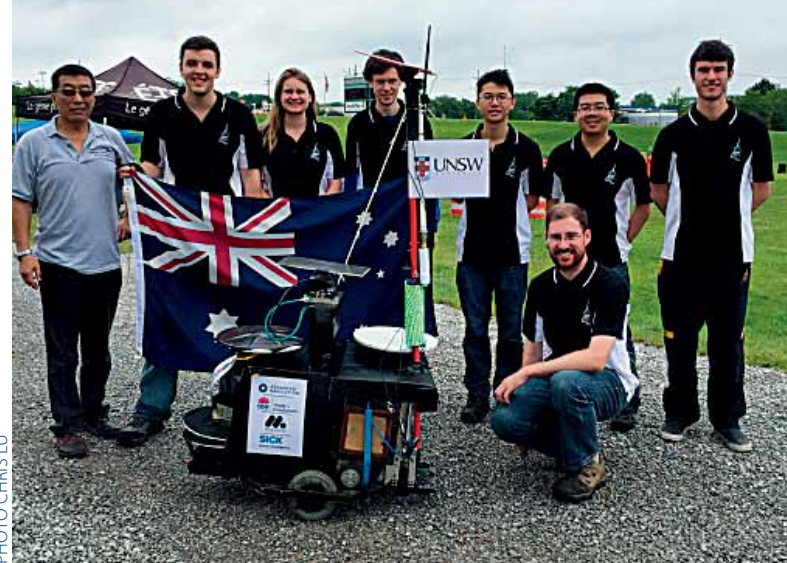


PHOTO CHRIS LU

that there would be white lines and fences, there would be obstacles of an approximate size and we had a vague idea of the course's shape," Dr Whitty says. "Other than that, the robot has to deal with whatever it sees."

The students won a total of five awards, including: second place overall, Rookie of the Year, best performance on the basic and advanced courses, and fourth place in the Interoperability Challenge.

The team was inspired to compete at the international level last year after winning on Autonomous Ground Vehicle Challenge on home ground.

"With our robot 'Buttercup' we blitzed the field by far last year, taking out first place," Dr Whitty says. "The \$15,000 in prize money and flights to the US meant that we could go global."

The competition is a training ground for students in how to use robots, artificial intelligence and other autonomous systems. It gives them hands-on experience in how to make systems fool-proof and fault-tolerant, and ensure they can run in any conditions.

# ATSE IN FOCUS

## Wellcome support for synthetic skin research

Tony Weiss at work.



Professor Tony Weiss FTSE and his collaborators at the University of Sydney's School of Molecular Bioscience have received a \$1 million Wellcome Trust Translation Fund Award to pursue the development of tropoelastin mesh, which mimics tropoelastin, the self-assembling elastic protein that allows the body to repair elastic tissues in the skin, arteries, bladder and lungs.

"Imagine a car accident victim who has major injuries or a patient who has just had a piece of skin containing a cancerous lesion removed," Professor Weiss says.

"The surgeon places our tropoelastin mesh on the wound and it not only instructs the wound how to repair, it helps accelerate the healing. It could reduce the need for hospital stays and for skin grafts.

"Tropoelastin is a building block of human biology and the more we learn about how it assembles then the greater the range of applications we can achieve.

"We are replicating human tissue and its behaviour – by making it in the laboratory and not by extracting it from a living organism.

"Its potential to benefit the sick and injured, from cardiac and cancer patients to accident victims, from burns victims to

wounded children, is incalculable.

"This program enables us to fast-track the technology to clinical trials within two years. The Wellcome Trust is known for funding research which is revolutionary not evolutionary – they look for projects that can leap from the lab to helping people, with immediate and major benefits."

It took Professor Weiss and his collaborators more than 15 years to tame this 'wild animal' of the protein world. They eventually succeeded in painstakingly producing milligrams of synthesised elastin and successfully transitioning this process to industrial scale, enabling them to produce kilograms of it.

Professor Weiss, elected a Fellow last year and Sir Samuel McCaughey Chair in Biochemistry at the university, is also the founding scientist of the pioneering medical company Elastagen, whose product development, based on tropoelastin, ranges from dermatology and scar remodelling to tissue repair, surgical implants and glues.

Through separately funded research, Professor Weiss and his colleagues continue to explore additional applications of the tropoelastin protein, including how to repair

and build blood vessels and other elastic tissues.

They recently received a National Health and Medical Research grant of \$587,000 to develop an adhesive elastic bone filler which uses tropoelastin. It sets at body temperature and rapidly restores mechanical performance at fracture sites.

"Australian researchers are sometimes discouraged by the 'tyranny of distance' being a hurdle to attracting major overseas funding so the fact we are now being supported by two overseas grants, at the same time as receiving Australian funding, is heartening," Professor Weiss says.

### JOHN BEYNON WINS BESSEMER MEDAL

Professor John Beynon, Chair of the Global Engineering Deans Council and Executive Dean of the University of Adelaide's Faculty of Engineering, Computer and Mathematical Sciences, has been awarded the Bessemer Gold Medal by the Institute of Materials, Minerals and Mining (IOM3).

He will be presented with the award in the UK in November.

He has been President of the Australian Council of Engineering Deans and spent seven years as Dean of Swinburne University of Technology, following a substantial career at the University of Sheffield.

The Bessemer Gold Medal is an annual prize awarded by IOM3 for outstanding services to the steel industry. It was established and endowed by Sir Henry Bessemer, the English inventor whose steelmaking process established the town of Sheffield as a major manufacturing centre. The Bessemer Process involved using oxygen in air blown through molten pig iron to burn off the impurities to make steel.

IOM3 is a major UK engineering institution whose activities encompass the whole materials cycle from exploration and extraction, through characterisation, processing, forming, finishing and application, to product recycling and land reuse. It was formed from the merger of the Institute of

Materials (IoM) and the Institution of Mining and Metallurgy (IMM) in 2002. The institute's roots go back to the Iron and Steel Institute, which received its first Royal Charter in 1899.



John Beynon

# ATSE IN FOCUS

## Greg Constable named top cotton researcher



Greg Constable

**C**SIRO senior principal research scientist Dr Greg Constable FTSE, a 2006 Clunies Ross Award winner (with Dr Gary Fitt FTSE and Dr Danny Llewellyn FTSE), has been selected as the International Cotton Advisory Committee (ICAC) Cotton Researcher of the Year for 2015.

Narrabri-based Dr Constable, a Fellow since 1991, is an eminent leader in the international cotton research community. He is the current chairman of the Internal Cotton Researchers Association and played a leading role in its establishment.

Dr Constable's experience in cotton research is spread over four decades. His achievements are well recognised in three fields of research: agronomy, breeding and physiology, and scientific leadership.

Dr Constable's research has extensively benefited the cotton industry in Australia. He has received wide recognition in Australia and has also received an Outstanding Research Award in Cotton Physiology at the US Beltwide Cotton Conferences.

Average cotton yields in Australia are currently not only the highest in the world but are almost three times the global average for 2014-15.

Dr Constable has made a significant contribution to this outstanding performance. His knowledge of cotton physiology and his ability to link physiology with cotton varietal development have led to significant breakthroughs in the creation of new varieties.

He has made significant contributions

to the development of scientifically based farming approaches to agriculture and the development of novel breeding strategies for increased yield and water use efficiency in cotton that have added value to the GM cotton varieties being developed in his program.

The CSIRO cotton breeding team at Narrabri, in northern NSW, has made great strides in the development of elite cotton varieties which dominate the Australian industry and now have substantial adoption in many other countries, notably the US, Brazil and Greece.

Dr Constable was the first Director of the Cooperative Research Centre (CRC) for Sustainable Cotton Production, through the planning phase in 1992, its successful establishment in 1993, and up to its renewal in 1999 as the Australian Cotton CRC.

He is also an Adjunct Professor at the School of Crop Sciences, University of Sydney.

Apart from his 2006 Clunies Ross Award, he has been awarded the 2003 and 2011 CSIRO Chairman's Medals and named 2006 Researcher of the Year by the Australian Cotton Growers Research Association.

### AGRICULTURE LEADER HONOURED IN INDIA

Professor Kadambot Siddique AM FTSE, Hackett Professor of Agriculture Chair and Director of the UWA Institute of Agriculture, was elected a Foreign Fellow of the Indian National Academy of Agricultural Sciences at its silver jubilee celebrations in New Delhi in June.

He was honoured for his outstanding

contributions to crop science and higher education in agricultural science.

Professor Siddique delivered the Silver Jubilee Lecture titled 'Innovations in adaptation to climate change in dryland agriculture'.

During the past two decades Professor Siddique has established strong links between Australian and Indian Institutions engaged in agricultural research and teaching. These include formal collaboration between The University of Western Australia (UWA) and the Indian Agricultural Research Institute, Indian Council of Agricultural Research, ICRISAT, National Institute of Plant Genome Research, Punjab Agricultural University, Panjab University, Haryana Agricultural University, Bangalore Agricultural University, Kerala Agricultural University, Kerala Veterinary and Animal Science University, Tamil Nadu Agricultural University and Indian Institute of Technology – Kharagpur.

Professor Siddique and his colleagues from Australia have undertaken numerous research projects with these Indian institutions with funding support from Australia (Australian Centre for International Agricultural Research, AusAID, Australian Research Council, Australian Department of Science and Technology, Australia-India Strategic Research Fund, Council of Grain Grower Organisations and UWA) and India.

Professor Siddique has published numerous papers jointly with Indian scientists and has trained several PhD students and postdoctoral fellows from Indian institutions in his UWA laboratory. Professor Siddique has also assisted (as an international adviser/steering committee member) Indian scientists in organising various international conferences in India.



Kadambot Siddique (left) joins the Indian National Academy of Agricultural Science.



# ATSE IN FOCUS

## 29 Fellows among Top 100 Engineers

**A** total of 29 Fellows, including 10 women Fellows, were named in the Engineers Australia list of 2015 Top 100 Most Influential Engineers.

A record 19 women appear in this year's list – up from 11 per cent last year and just five per cent the year before.

The main innovation in this year's list was the introduction of a new category called 'Panel's Pick', recognising a number of people who are influential simply because they are inspirational.

The Selection Panel of six engineers included three ATSE Fellows: Dr Robert Care AM FTSE, Principal, Arup Group; Professor Paul Douglas FTSE, former CEO of Sinclair Knight Merz and company director; and Professor Robin King FTSE, former Pro Vice-Chancellor, University of South Australia and current Chair of the ATSE Education Forum.

Seven Fellows were named in the 'Academia/Research' section: Professor John Beynon FTSE, Chair, Global Engineering Deans Council; Professor Archie Johnston, Dean, Faculty of Engineering and IT, University of Sydney; Professor Peter Lee FTSE, Vice-Chancellor, Southern Cross University; Professor Iven Mareels FTSE, Dean, Melbourne School of Engineering, University of Melbourne; Dr Adi Paterson FTSE, CEO of ANSTO; Professor Judy Raper FTSE, Deputy Vice-Chancellor Research, University of Wollongong; and Professor Ian Young AO FTSE, Vice-Chancellor, Australian National University.

Fellows dominated the 'Associations and NGOs' section: Dr Bronwyn Evans FTSE, CEO, Standards Australia; Dr Alan Finkel AO FTSE, President, ATSE; and Mr David Singleton FTSE, Chair, Infrastructure Sustainability Council of Australia.

Dr Marlene Kanga AM FTSE, Chair, R&D Incentives Committee, was the only Fellow named in the 'Community' section and ATSE did not feature in the 'Consulting and Contractors/Services' sections.

Nearly half those named in the 'Entrepreneurs/Experts' section were Fellows:

Professor Rose Amal FTSE, Graduate School of Biomedical Engineering, University



Judy Raper



Archie Johnston

of NSW; Professor Jay Guo FTSE, Director, Global Big Data Technologies Centre, University of Technology, Sydney; Professor Nigel Lovell FTSE, Graduate School of Biomedical Engineering, University of NSW; Professor Karen Reynolds FTSE, Director, Medical Devices Research Institute, Flinders University; Professor Veena Sahajwalla FTSE, Director, SMaRT, UNSW; Professor Stan Skafidas FTSE, Director, Centre for Neural Engineering, University of Melbourne; and Professor Scott Sloan FRS FAA FTSE, Founding Director ARC Centre of Excellence for Geotechnical Science and Engineering, University of Newcastle.

Named in the 'Industry' section were: Mr Peter Coleman FTSE, CEO, Woodside; Dr Bob Every AO FTSE, Chair, Wesfarmers and Boral; and Ms Kathryn Fagg FTSE, Director, Reserve Bank of Australia. Dr Andrew Liveris AO FTSE, Chair and CEO, Dow Chemical, and Dr Chris Roberts FTSE, CEO, Cochlear, were chosen in the 'Manufacturing' section.

Named in the 'Public Service' section were: Mr Jim Hallion AM FTSE, SA State Coordinator General; Mr Colin Jensen FTSE, CEO, Brisbane City Council; Professor Mary O'Kane FTSE, NSW Chief Scientist and Engineer; and Dr Alex Zelinsky FTSE, Chief Defence Scientist. Ms Sue Murphy FTSE, CEO WA Water Corporation, was selected in the 'Utilities' section.

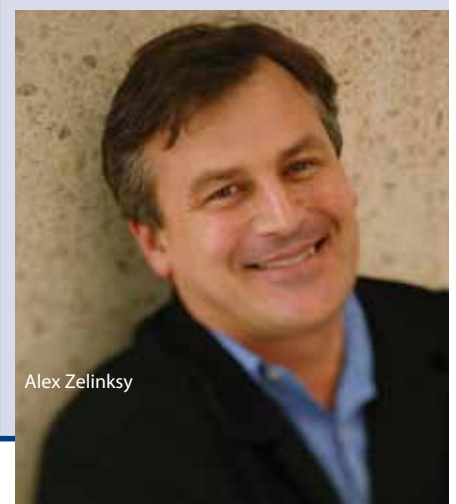
Ms Kathy Hirschfeld FTSE, Company Director, was named as a 'Panel's Pick', along with 2015 Clunies Ross Award winner Professor Zhiguo Yuan, Director, Advanced Water Management Centre at the University of Queensland.



Sue Murphy



Stan Skafidas



Alex Zelinsky

# ATSE IN FOCUS

## Three Fellows win national honours

Three ATSE Fellows were recognised in the 2015 Queen's Birthday Honours.

Professor John Boldeman AO FTSE was appointed an Officer in the General Division of the Order of Australia for distinguished service to nuclear science and technology, particularly through the design and construction of the Australian Synchrotron particle accelerator, and as a mentor of young scientists.

Two Fellows were appointed Member (AM) in the General Division of the Order of Australia. Mr Peter Cockbain AM FTSE was honoured for significant service to electrical engineering, particularly in the mining and energy sectors, and to professional organisations. Ms Dianne Davidson AM FTSE was honoured for significant service to the

wine-making industry, to horticultural management science and to higher education administration.

**Professor John Boldeman** has a long list of achievements, including a Clunies Ross Lifetime Achievement Award in 2010. He has been involved in nuclear science and medicine throughout his career and has been ANSTO's Distinguished Laboratory Fellow and Technical Leader, Australian Hadron Therapy Practice Accelerator Project, and Professorial Fellow, Institute of Nuclear Science, University of Sydney, since 2009.

He was Director, Centre for Synchrotron Science, University of Queensland (2001–03), Foundation Technical Director, Australian Synchrotron Project (2001–02) and Principal Science Adviser, Australian Synchrotron Project (2003–07).

Professor Boldeman has served the Academy with distinction since his election in 1993. He has served on the NSW Division



John Boldeman

## MARK RAYNER A NATIONAL FIGURE IN RESOURCES AND BUSINESS

The capacity crowd at Mark Rayner's funeral at Christ Church, South Yarra, spoke volumes about his standing in the community and respect in which he was held in business.

Mr Mark Rayner FTSE died in Melbourne on 30 May 2015, aged 77.

He was elected to the Academy in 1990, was its Treasurer (1993–96) and Vice President (1999 to 2002). He helped lead the Academy's major study (1994–96) of the competitiveness of the Australian minerals industry.

His funeral service was marked with eulogies from his three children and also from long-time colleague and family friend Sir Rod Carnegie AC Kt FTSE. They spoke to a large crowd of political and business leaders who had known Mr Rayner over his long career.

Attendees included a number of Fellows – Mr Brian Loton AC FTSE, Mr John Ralph AC FAA FTSE and Professor John Zillman AO FAA FTSE, former ATSE President – and many of his former colleagues from CRA.

Sir Rod described Mr Rayner as a true gentleman, a role model and someone who could always be relied on. Sir Rod referred

to Mark's integrity and his sunny disposition and noted that Mark had always enjoyed the total confidence and respect of both subordinates and superiors.

Mr Rayner graduated in chemical engineering from the University of NSW in 1960 and joined Comalco at its aluminium refinery and smelter at Bell Bay, Tasmania. His career covered operations, production management, project engineering, international marketing and development of major joint-venture projects in Australia and overseas.

He was later CEO of Comalco (1978–89), a member of the CRA Group Executive (from 1982) and, from 1989, Finance Director of CRA Ltd, Deputy Chair of Comalco and a Director of Bougainville Copper and Pasminco.

He retired as a Group Executive and



Mark Rayner

Director of CRA and as Chairman of Bougainville Copper in 1995 and as Deputy Chair of Comalco in 1997.

He was a Director of Leighton Holdings and Boral and Chair of National Australia Bank, Pasminco and Mayne Nickless.

Mr Rayner took many leading roles in national and international bodies.

He was Vice President of the Australia Japan Business Cooperation Committee

and Chairman of the Australia Japan Business Forum. He served as President of the Australian Mining Industry Council and the International Primary Aluminium Institute.

He was a member of the Hilmer Committee for National Competition Policy Review (1992–93).

In retirement, he took a strong interest in farming superfine wool Merinos at his Victorian property.

# ATSE IN FOCUS



Peter Cockbain



Di Davidson

Committee since 2008 and from 1994 to 2001, and was a Councillor (the Assembly predecessor) (1996–99).

He has represented Australia on many national and international committees, initiatives and conferences since 1982.

**Mr Peter Cockbain** is a former President of Engineers Australia who joined the Academy in 2008. He has been a member of

the Standards Australia Board since 2009 and is a Council Member of the University of Newcastle.

Dr Bronwyn Evans FTSE, Chief Executive Officer of Standards Australia, said Mr Cockbain was a deserving recipient of the honour.

“Peter’s insights and considerable experience have helped Standards Australia to fulfil our strategic objectives of developing internationally aligned standards for the net benefit for Australia. We are honoured to have him on our Board

and we warmly congratulate him on his well-deserved award,” Dr Evans said.

“His illustrious career has been dedicated to the betterment of the electrical engineering profession and in so doing, has benefited the entire Australian community and industry.”

He co-founded Ampcontrol in 1968 and has been its Technical Director since. He received Engineering Excellence awards from

Engineers Australia in 2010 and 2013.

**Ms Dianne Davidson** is Deputy Chancellor of the University of Adelaide and is widely known and respected in the Australian wine industry as Founder and Managing Director of Davidson Viticulture Consulting Services and Davidson Vineyard Management, 1987 to 2012.

She was previously Senior Consultant Horticulturalist, Australian Agricultural Consulting and Management Company (1983–87) and before that National Vineyard Manager for Penfolds (1975–83).

A Fellow since 2001, she is an Inaugural Member of the Murray–Darling Basin Authority (since 2009) and the SA Premier’s Climate Change Council (2008–10) and a Member of the Plant Biosecurity CRC.

She is a former chair of the SA Wine Industry Council, former Director of the Royal Automobile Association of SA and served on the Academy’s SA Division Committee (2011–12).

## DES KELLY HAD A KEY ROLE IN WA MINERALS BOOM

Desmond Roy Kelly AM FTSE was a prominent civil engineer – remembered as an outstanding public servant who gave close to 50 years of service to Western Australia.

He first worked with the WA Public Works Department in the early 1950s on projects at Fremantle Harbour before moving to the Kimberley Region where he worked on the Wyndham, Derby and Broome jetties.

In 1967 he joined a small group in the department responsible to the then Premier, Sir Charles Court, for the planning, coordination and development of infrastructure associated with the iron ore industry in the Pilbara Region including ports, townships, railways and water supplies.

Between 1970 and 1980 Des was employed by the Department of Industrial Development where he was involved in the negotiation and administration of State Agreements with companies involved in major mining projects in WA.

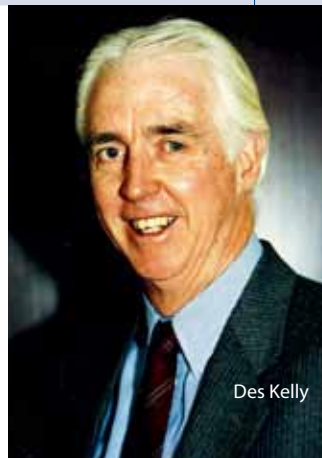
In 1980 he was appointed Undersecretary for Mines and was the first professional appointed to such a role in WA. The

Department included: the Geological Survey, the Government Chemical Laboratories and divisions responsible for explosives and dangerous goods;

the registration of mineral and petroleum titles; worker safety, environmental management and royalties for the petroleum and mineral industries in WA.

In 1993 Dr Kelly was appointed CEO of the new Department of Resources Development (DRD) with responsibility for policy, planning, coordination and promotion of the resource industries in WA. During the next six years, up to his retirement in 1999, he travelled widely throughout Asia, Europe and the US with the (then) Premier Mr Richard Court and Minister (now Premier) Colin Barnett promoting investment in the resource sector in WA.

He was appointed Chairman of the



Des Kelly

Steering Committee established to sell the Dampier-to-Perth natural gas pipeline and oversaw the completion of that sale to Epic Energy for \$2.4 billion in 1998. After his retirement in 1999, he became Chairman of the Steering Committee to sell the government-owned Alinta Gas and this project resulted in the public listing of the company and proceeds of about \$1 billion coming to the state.

He served on the Murdoch University Senate (1982–91) and as Pro Chancellor in 1991. He was a Fellow of the Institution of Engineers Australia and was elected to the Academy in 1989.

Dr Kelly was a keen hockey player and served as Executive Councillor of the WA Hockey Association (1981–90) and was made a Life Member of the WA Hockey Association in 1995.

Dr Kelly, who graduated from the University of WA in 1956 and earned a PhD in structural engineering from the University of London in 1963, died on 17 May, aged 81.

# ATSE IN FOCUS



Mike McLaughlin



Ziggy Switkowski

## Four Fellows join Australian Academy of Science

**B**usiness leader and nuclear physicist Dr Ziggy Switkowski AO FAA FTSE is one of four ATSE Fellows elected to the Australian Academy of Science, among 21 new AAS Fellows, announced in May, taking its numbers to more than 500.

Others are Professor Michael McLaughlin AM FAA FTSE from The University of Adelaide, Professor Helene Marsh FAA FTSE from James Cook University and Professor San Thang FAA FTSE from Monash University.

**Dr Ziggy Switkowski** was elected for his advocacy of science and technology at the highest levels.

Trained as a nuclear physicist, he is one of Australia's most highly respected technology, innovation and business leaders.

He is chairman of the Suncorp Group and NBN Co, and Chancellor of RMIT University. He is a former chief executive of Telstra, Optus and Kodak (Australasia), the former chair of ANSTO and Opera Australia, and currently a non-executive director of Tabcorp and Oil Search.

Dr Switkowski has previously served as Chairman of ANSTO and chaired the Government's Review Panel on Uranium Mining, Processing and Nuclear Power. As one of the very few scientifically trained PhDs among Australia's business leaders, he has written extensively on questions of technology, science and academia, and maintains close contact with relevant organisations.

**Professor Michael McLaughlin** is a leader in developing and evaluating fertiliser

technologies, and developing biosolid re-use, and his approach to assessing contamination risk has been adopted around the world.

His research combines fundamental science and commercial application. He uses novel methods to study fertiliser and contaminant reactions in soils and plant uptake, including isotopic tracing and spectroscopy. He created the Australian National Biosolids Program, which forms the

## GORDON DUNLOP WON ACCLAIM ON MANY FRONTS

New Zealand-born, rugby-loving Professor Gordon Dunlop FTSE had a long and varied career across four countries and became best known in Australia for his expertise in materials science.

He had more than 40 years' experience in materials engineering research, education and commercialisation in Australia, North America, Europe, Scandinavia and Asia.

A Fellow since 1997, he was the founding Director of the CRC for Alloy and Solidification Technology (CAST) at the University of Queensland, established in 1992.

More recently Professor Dunlop was the ATSE Queensland Division chair and the energising force behind the Queensland Wonder of Science program.

He died at his home in Brisbane on 21 May, aged 69. He was diagnosed only six weeks earlier with acute myeloid leukaemia.

He attended Invercargill's Southland Boys' High School and commenced his metallurgical studies at Otago University before transferring to the University of Melbourne, from which he graduated in 1967 – also becoming Captain of Melbourne University Rugby Club, playing in the First XV.

He worked with the Australian Lead Zinc

Development Agency before he joined the Department of Mechanical Engineering at the University of Waterloo, Ontario, in 1969, studying creep fracture and superplasticity in copper alloys.

He earned his Masters at Waterloo University in 1971 and his PhD from Cambridge in 1974. He subsequently achieved docent status at Chalmers University in Sweden (1978).

Professor Dunlop returned to Australia in 1989 after 20 years in Canada, the UK and Sweden to take up a position as Professor of Materials Engineering at UQ and subsequently as Director of CAST (1993–99) and CEO of the CRC for Cast Metals Manufacturing (1999–02).

He brought with him a strong reputation for innovative R&D on a wide range of materials important to industry.

His 1997 nomination notes that "he has contributed strongly to the rejuvenation of a university department, established close links with the CSIRO and Australian industry and provided the technical and managerial leadership" for the establishment of CAST



Gordon Dunlop

"that is of considerable importance to the downstream processing of Australian light metal resources and the development of Australia's automotive component industry".

He later served as General Manager Europe (2002–03), Chief Operating Officer and General Manager of Technology

Development of Advanced Magnesium Ltd (2003–08) and as Executive Director of Business Engagement at UQ (2008–12). He served as a Non-Executive Director of UQ Holdings Pty Ltd, JKTech Pty Ltd, i.lab Incubator Pty Ltd, and CMTE Development Ltd. He also served as a Director of UniQuest Pty Ltd.

Professor Dunlop served as Queensland Division Chair (2010–13), was a Queensland Assembly delegate to over several years and served on the extremely successful Queensland Organising committee for the 2015 Clunies Ross Awards.

He played a strong role in the development of the Wonder of Science program, which aims to build enthusiasm for science and science careers in students across Queensland.

# ATSE IN FOCUS

basis for guidelines controlling biosolid re-use.

He developed concepts to recognise soil and environmental variability in contaminant risk assessments that have been adopted internationally and recognised by both US and EU regulators. His research has gained strong commercial results and his laboratory is regarded internationally as a leader in developing and evaluating fertiliser technologies.

**Professor Helene Marsh** is the world's premier authority on the ecology and conservation biology of dugongs, and she has been instrumental in advancing scientific understanding of marine megafauna and management of coastal marine mammals.

She is internationally recognised for her extensive research on the life history, reproductive ecology, population dynamics, diet, distribution, abundance and movements of dugongs. Her work integrates species ecology with a broader evaluation



Helene Marsh

of the links between threatened species and the welfare of human societies, particularly in developing countries and among remote Indigenous Australian communities.

This research, which is strongly cross-disciplinary and problem-focused, has contributed to policy outcomes in Australia and other tropical countries and has been recognised by several international awards.

**Professor San Thang** is a research



San Thang

innovator in polymer and materials science and a leading expert in the field of radical chemistry, with several key innovations to his name. He won the 2014 Clunies Ross Award – with Dr Ezio Rizzardo FRS FAA FTSE and Dr Graeme Moad FAA – for their invention of the reversible addition-fragmentation chain transfer (the RAFT process), which is used to make better polymers with a tailored chemical structure and defined properties.

RAFT has generated enormous academic and industrial interest worldwide, with a huge range of applications including performance coatings, adhesives, hydraulic fluids and membranes, cosmetics, biosensors and drug delivery.

Professor Thang came to Australia as a refugee from Vietnam in 1979. He is an Honorary Fellow at CSIRO Manufacturing Flagship and Distinguished Professor (Research) at Monash University's School of Chemistry.

## JOHN SWAN WAS A MONASH GIANT

Emeritus Professor John Swan AO FAA FTSE was a towering figure on the Monash University campus over nearly 40 years. He was integral to the establishment of Monash University, and the Victorian Government of the day adopted his suggestion that it be named after Sir John Monash.

Professor Swan began teaching at Monash in 1966. He was the Foundation Chair of Organic Chemistry until 1971, when he was invited by then Vice-Chancellor, Sir Louis Matheson, to take the position of Pro Vice-Chancellor.

He remained Pro Vice-Chancellor until 1975. With a desire to return to his scientific roots, he took the position of Dean of the Faculty of Science in 1976, which he held until 1984.

Professor Swan passed away on 15 June 2015, aged 91.

To maintain close and continuous contact between science inside and outside of the university, Professor Swan gave much of his time to various funding and policy-making bodies.

These included the Australian Research Grants Committee, the Australian Marine Sciences and Technologies Advisory Committee, the Council of the Australian

Academy of Science and the Victorian Conservation Trust.

He retired in 1985 and continued his research, establishing the Victorian Institute of Marine Sciences and conducting studies on the environmental impacts of offshore oil and gas exploration.

He received an Honorary Doctorate of Science in 1994.

The John Swan Chemistry Honours Scholarship, established in his honour, is the Monash School of Chemistry's premier award at the undergraduate level. It is awarded to high-achieving undergraduate students who wish to pursue their passion for chemistry through research programs.

John Swan worked first in 1941 at the Melbourne explosives factory of ICIANZ (now Orica), studied chemistry in the evenings at the Royal Melbourne

Technical College (now RMIT) and was rejected for military service because of his eyesight.

He enrolled at the University of Melbourne and graduated with a chemistry degree in 1946 before winning a CSIRO Overseas Fellowship to study for a PhD at Imperial College London.

He returned to Australia and joined CSIRO in

1949, focusing on the study of amino acids, peptides and proteins.

He won a Fulbright Scholarship to the US for 12 months in 1952, working at Cornell University, and returned to CSIRO Melbourne from 1954 until 1966, when he moved to Monash.

In addition to his professional life in science research and academia, Professor Swan was also a devoted

conservationist, environmentalist, inventor and public speaker, and lover of art, music and poetry.



John Swan

# ATSE IN FOCUS

## Ron Huckstep famous for his orthopaedic devices

Born in China and educated in England, Emeritus Professor Ron Huckstep CMG FTSE became a distinguished surgeon who won an international reputation for his inventions of implants, splints and other orthopaedic devices.

A Fellow for more than 30 years, Professor Huckstep won many international honours, awards and prizes in an academic and medical career spanning nearly 70 years.

A giant in the world of medical technology, Professor Huckstep died in Sydney on 10 April, aged 88.

His education was interrupted at the age of 15 when the Japanese, who had invaded China, interned him and his family near Shanghai. A missionary in the camp, who took him under his wing and taught him science and ignited an interest in engineering, gave him a recommendation that allowed him to study at Cambridge at the end of the war.

He spent his early years at London's Middlesex Hospital in surgical roles, with a break in 1954-55 at King George VI Hospital in Nairobi, Kenya, where he observed and studied typhoid.

He extended his interest and skills in orthopaedics in the late 1950s at the Royal National Orthopaedic Hospital and St Bartholomew's Hospital, London.

Returning to Africa, he worked in increasingly senior roles at Makerere University in Kampala, Uganda, from 1960 to 1971, serving as Professor of Orthopaedic Surgery (1967-71) before life became intolerable under the rule of Idi Amin.

While in Uganda Professor Huckstep treated many victims of polio and later wrote a book on the subject. He also developed his skelecast, a form of lightweight fracture immobilisation suitable for the tropics.

He was awarded his CMG (Companion of the Most Distinguished Order of St Michael and St George) in 1971 for his work with polio sufferers in Africa.

He came to Australia in 1972 and joined the University of NSW as Professor of Orthopaedics and Traumatology at the Prince

of Wales Hospital, Sydney, where he and his racing green Triumph Stag, number plate RLH 333, became identities and he made his mark in surgical devices.

In the 1970s traction was the standard treatment for many fractures. Only Kuntscher nails were available and Professor Huckstep developed the first interlocking nail – the Huckstep nail – which became widely used in Australia. Later he modified his nail by adding a trunion and created the Huckstep hip.



Ron Huckstep

Professor Huckstep worked at the Prince of Wales for 21 years until his retirement from surgery in 1993.

After his retirement, he continued to teach students at the University of Sydney for another five years.

A prolific author, he wrote *The Simple Guide to Trauma* and later *The Simple Guide to Orthopaedics*, and was a Fellow or Member of many medical societies.

## GRAHAM DAVIES RETURNS TO THE UK

Professor Graham Davies FREng FTSE, Dean of Engineering at the University of NSW from 2008 to 2015, stood down from his role at the end of March 2015 to return to the UK.

Professor Davies led significant change at UNSW and his colleagues say his strategic development of both staff and infrastructure will be his outstanding legacy, with more than \$350 million invested in four new engineering buildings.



Graham Davies

He worked with industrialists and philanthropists the late Sir William Tyree Kt OBE FTSE and Mr Len Ainsworth to ensure that engineering students had top-class facilities.

Through their generous donations, the Tyree Energy Technology Building and the Mechanical and Manufacturing Engineering buildings became beacons of modern teaching and research.

The Faculty has more than 11,000 engineering students – a 62 per cent increase over the period – and 800 staff. It has some of the highest entry requirements in the country.

Since 2013 the Faculty jumped six positions in the QS rankings to 27th in the world. The faculty also features highly in the Shanghai and Times Higher Education tables.

Professor Davies has been named in the Engineers Australia Top 100 Most Influential Engineers for four years, served as Chair of the Go8 Deans of Engineering (2012-15) and led the study of the Top Ten Technologies that will influence the country's wealth and wellbeing (the report is in preparation).

Two key initiatives were the Women in Engineering campaign, which saw the numbers of women enrolling in engineering courses jump by three per cent in two years, and the Primary School Maths Prize.

Returning to the UK for family reasons, he will continue with his research on Micro Electro Mechanical Systems (MEMS) for point-of-care medical devices.

He will work on UNSW alumni relations in the UK and will act as an adviser to InnovateUK, the Business, Innovation and Skills Department of the Ministry of Trade and Industry.

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**dream large**



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# To know that I can impact on people's lives is such a motivating and inspiring feeling

Hosam, UQ PhD student

Under the mentorship of renowned infectious diseases expert Professor David Paterson, Hosam is creating a diagnostic tool to rapidly identify antibiotic-resistant superbugs, to help save lives. The tool has the potential to allow patients to be treated quickly and minimise opportunities for the deadly superbugs to spread. By learning to see the world differently, Hosam is creating change. See Hosam's story at [uq.edu.au/createchange](http://uq.edu.au/createchange)



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Create change