

# ATSE FOCUS

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## HEALTH TECHNOLOGY

### IMPROVING OUR HEALTH USING THE NEW TECHNOLOGY

Contributors discuss national challenges, opportunities and developments now in sight

# ATSE | CLUNIES ROSS AWARDS 2015

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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.

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# CONTENTS

## 3

**Telehealth can add big value to our healthcare**  
By Branko Celler

## 5

**Preventive, personalised healthcare: taking responsibility**  
By Carrie Hillyard

## 9

**Building a medtech industry for Australia**  
By Anna Lavelle



Front cover: A new age in health care.  
PHOTO: iStockphoto



All eyes on the presenter at the 2014 Extreme Science Experience (Page 17).

- 12 The NBN can transform health and aged care
- 15 ATSE takes a lead in health technology
- 16 Perth showcases 2014 ATSE Clunies Ross Awards
- 19 ACOLA report hails innovation as a productivity key
- 20 ATSE suggests alternatives to infrastructure program
- 20 Aligning R&D to optimise mineral resources
- 21 ATSE spotlights SEQ's future water options
- 21 Looking at Tasmania's energy options
- 22 Grant will boost STELR in Australian schools
- 22 WA Eminent Speaker lectures underway
- 38 ATSE in *Focus*

# 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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## What is the API?

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By Branko Celler

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# Telehealth can add big value to our healthcare

Use of telehealth technologies can better manage patient flows, optimise clinicians' time and triage patients, and its benefits in chronic disease management are well documented.

**T**he value that telehealth can add to Australians and the healthcare sector is the power to deliver health services at home by telemonitoring of patients with complex chronic conditions such as congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), diabetes and morbid hypertension.

This is important as chronic illness and aged care accounted for more than 70 per cent of Australia's \$140 billion expenditure during 2011-12.

More than half of the Australian population aged over 65 (61 per cent) have a single chronic condition and 22 per cent have multiple conditions.

Telehealth technologies can be used in general practice, community health centres, community nursing settings and delivery of specialist consultations to better manage patient flows, optimise clinicians' time and triage patients before they see a clinician.

The benefits of telehealth for the management of chronic disease internationally are now well documented. The Whole System Demonstrator (WSD) Program of the UK Department of Health provided the following key findings in 2011:

- 15 per cent reduction in Accident and Emergency visits;
  - 20 per cent reduction in emergency admissions;
  - 14 per cent reduction in elective admissions;
  - 14 per cent reduction in bed days;
  - 8 per cent reduction in tariff costs; and,
  - 45 per cent reduction in mortality rates.
- Other programs and trials around

the world have also provided significant reductions, particularly the Veterans Health Administration (VHA) in the US.

## Home monitoring

CSIRO is undertaking a trial of Home Monitoring of Chronic Disease in Aged

Care, an initiative funded by the Australian Government. The trial is being carried out in six locations in five states and involves 25 test patients and 50 control patients at each site. These sites have different models of care management – from hospital-based disease management with



Monitoring health in the home.

Telehealth is a form of assistive technology based on information and communications technology. Assistive technologies are any devices or systems that can provide assistance with everyday living and range from simple devices such as motion sensors to devices developed using sophisticated technologies such as nanotechnology and advanced manufacturing. In Australia the Government only funds telehealth services as tele-consultations between specialists and patients located either in remote locations or in residential care facilities.

**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.**

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specialist clinicians to general practitioners functioning in community care.

Test patients are supplied with a clinical monitoring unit from Telemedcare, an Australian company, which measures and monitors blood pressure, pulse, glucose levels, heart rate, body temperature and body weight, as well as administering a range of clinical and wellbeing questionnaires. Patients can also message or video conference with their clinical care coordinator.

This project has many unique characteristics that are designed to provide statistically robust evidence to government which can help inform decision-makers and determine future funding models.

As well as reporting on healthcare outcomes, this trial is also studying health-economic outcomes, acceptability of the service to patients and carers as well as clinicians, the impact of workplace cultures and the need for organisational change management.

Although the trial is not complete, preliminary data have been encouraging including:

- exacerbation of patients' conditions have been detected and early intervention either avoided hospitalisation or resulted in a better outcome;
- increasing awareness by patients of their condition, with a greater capacity for self-management; and
- positive attitudes from patients.

### Why not here?

Given the strong international evidence for enhanced self-management of chronic disease and improved healthcare outcomes, why has telehealth not yet become an accepted model of health service delivery in Australia? Possible explanations include the following.

#### 1 Lack of funding models for telemonitoring of patients at home.

Medicare traditionally funds services delivered by clinicians to patients, but only face-to-face. However, some funding for telehealth is available from the government through the Consumer Directed Care (CDC) initiative.

#### 2 Limited support from general practitioners who are often unaware of the international evidence, unsure how they will be remunerated for their participation and have concerns about the disruption to the traditional patient-doctor relationship.

#### 3 Lack of capability or willingness in some local health districts to embrace change and carry out the necessary organisational change management required for introducing new models of health service delivery into long-established service models and workplace cultures.

Health policy surrounding the development and deployment of assistive technologies is fundamental to enhance economic outcomes and financial sustainability for the healthcare

system and ensure quality healthcare is delivered to all Australians as they age.

ATSE has been involved in the area of assistive technologies to enable healthy and independent living for many years. The interest to drive forward this agenda, where technologies provide benefits to individuals and the healthcare system in the long-term, is strengthening.

ATSE Fellows were engaged in focused discussions in April and the following **priority focus areas** were identified that could facilitate change and see improved healthcare delivery and enhanced quality of life based on deployment of assistive technologies:

- recognising that assistive technologies offer tools to reduce long-term care costs by maintaining the aged in the community and reducing the cost of unnecessary hospitalisation;
- developing large-scale educational campaigns to inform citizens and service providers of the range of assistive technologies and financial assistance available;
- building workforce development and capacity to ease the transition of assistive technologies into healthcare delivery models;
- significant increasing funding for research and development (R&D) and innovation in assistive technologies, based on consumer demand; and
- developing ICT infrastructure to cope with the demands of data required to monitor and deliver healthcare remotely, as well as ICT systems that will be interoperable, standardised and coordinated.

## ANALYSING AUSTRALIANS' ATTITUDES TO SCIENCE

Most Australians equate CSIRO with Science, and attitudes in support of CSIRO rise and fall with changes in community attitudes to Science, according to a CSIRO report. While awareness of, and trust in, CSIRO remains high across the wider community, increasingly young people and those with anti-science outlooks are unaware of, or uninterested in, CSIRO and its work, it says. The *Community attitudes towards science and technology in Australia* report is analysis of several attitudinal studies. The report reveals the drivers of different community attitudes and awareness, looking at how individual values impact attitudes; levels of trust and the impact of negative media coverage on trust; people's preferred sources of information; disengagement by young Australians; impacts of science at school on later attitudes to science.

Download the report from the CSIRO Research Publications Repository.



PROFESSOR BRANKO CELLER FTSE is Principal Scientist at the CSIRO Digital Productivity and Services Flagship and has an international reputation as a leader and innovator in the area of physiological modelling and biological signal processing. Over the past 20 years he has undertaken pioneering work in the application of information and communication technology (ICT) in health. He is recognised internationally for his research on telehealth for the management of chronic disease in the home, the community, residential care, and rural and remote areas, and founded a company that is now operating internationally and is recognised for its innovation and excellence in telehealth.



By Carrie Hillyard  
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# Preventive personalised healthcare: taking responsibility

Governments, healthcare regulators, payers and insurers are realising that the cost to budgets of lifestyle-caused diseases is unsustainable and are starting to support and sponsor proactive solutions.

**S**hifting the focus of healthcare towards prevention of disease could significantly reduce the high cost of long-term treatment of chronic disease.

Healthcare systems around the world are faced with rapidly increasing costs and public health challenges – many of which are related to chronic conditions such as obesity, diabetes, mental health and an ageing population.

The Australian National Health and Hospitals Reform Commission (NHHRC) has also identified failures in healthcare service provision, including a lack of adequate response to a changing pattern of disease and treatment, an inadequate focus on preventative health, uncoordinated delivery of necessary patient services and an inappropriate balance or configuration of services.

ATSE's Health Technology Action Statement on preventive and personalised healthcare envisions an improved system where individuals take responsibility for their health and health data and where prevention is a major focus, rather than treating disease that results from poor lifestyle choices.

## Prevention focus

Shifting the focus of healthcare towards prevention of disease could significantly reduce the high cost of long-term treatment of chronic disease. Helping clinicians and end users to understand the use and associated benefits of new technologies will impact on future health outcomes for Australians.

For example, if the number of people needing chronic care for diabetes, cardiovascular disease and obesity could be reduced, it would free up funding and hospital beds. In later stages, diabetes patients have to be treated with drugs,

clinic visits, hospitalisations and often amputations of feet and toes, all of which limit mobility and productivity.

Governments, healthcare regulators, payers and insurers everywhere are now realising that the cost to budgets of lifestyle-caused diseases is unsustainable and are starting to support and sponsor proactive solutions in an effort to transition towards a proactive and preventive primary healthcare framework, coordinated and integrated across the different practitioner modalities and specialities.

Reimbursement and price paid to pharmaceutical companies, in some countries, is being based on efficacy in order to reel in the escalating costs

PHOTO: FITGENES LTD



The new face of healthcare.

of new drugs and the regulators are focusing companies to provide diagnostic tests linked to particular drugs, so that only the patient population which will respond is given the drug.

Currently, the most common response to the healthcare challenges is to focus on acute and episodic care, where patients typically go to their general practitioner for treatment of a condition.

However, there is an emerging reorientation towards the use of allied health practitioners – such as dietitians, nutritionists, naturopaths or chiropractors – for preventive healthcare solutions, as more people become aware of the need to be proactive in caring for their long-term health or see the limitations of mainstream medicine in being able to provide personalised and preventive care.

General practitioners in Australia and overseas are beginning to include these allied practices in their clinics and look at a more proactive approach.

## Wearable devices

Wearable devices are causing a revolution that will affect healthcare and wellness, will allow practitioners to monitor patients' compliance with the solutions they are providing and will interact with smart programs of lifestyle changes, nutrition and exercise.

There is now an emerging convergence of people's expectations for their health and computer technology and this emerging field is called mHealth, since it is based on mobile device technology. Apple and Google are funding wearable

What's powerful about wearable tech is not the gadgetry *per se* but how it will transform our behaviour: how we pay, how work gets done, how we manage our health.

– RACHEL BOTSMAN, AUSTRALIAN FINANCIAL REVIEW, 9 MAY 2014



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medical technologies and Samsung has recently previewed a 'Simband', which will be laden with sensors, including ECG, pulse oximeter and blood pressure monitors. 'Fitbit' and similar devices are taking off exponentially.

However, in order to make use of these new technologies it will be important to link them with software that can integrate the data with genomic and pathology information, family history and health goals.

The first wave of wearable products are changing behaviour, monitoring steps and sleep, and interacting with mobile devices to encourage further activity. In future, one would expect that they will be integral to clothing or other accessories used regularly for exercise.

### Consumer demand

Consumers are now far more informed, rely on the internet to find medical and health information, have higher expectations of what constitutes best practice healthcare and are demanding better health outcomes when they visit their providers. This is leading to a growing demand for proactive health and longevity solutions which, when combined with new genomic science and technologies, is changing the way health services are being delivered.

Personalised healthcare requires information that is specific to the individual. Since the human genome was elucidated in 2001–03, there has been a general expectation that genetic testing would provide the answers to a lot of medical questions. To date, it has largely failed to deliver on this. However, now that the research community has begun to understand what some genes do and how their expression can be modified, there is an opportunity to translate this knowledge into service solutions.

The ability to look at genetic changes is not limited to disease, however, and there is now an increased use of genetic information by allied health practitioners, in particular, to link genomic testing with preventive healthcare solutions. In 'tech' parlance, these are the early adopters.

The medical profession is traditionally slower to adopt new technology or research. One of the biggest hurdles for all practitioners is how to deal with the vast amount of data available from

the genome and other testing and translate it into clinical practice.

Companies are now beginning to emerge that are focused on in-depth, rapid, medical data analysis, and traditional technology investors are moving into funding of these health applications.

### How does it work?

The genome encodes the genetic information required for the production of proteins to control all physiological functions. SNPs (single nucleotide polymorphisms) are naturally occurring variations in genetic sequence resulting from a single nucleotide change. The majority of SNPs occur in regions that are not required for protein production and, in most cases, do not pose any adverse health effect. However, less frequently, a single nucleotide change can occur in a gene coding region or at a control element and a SNP can result in silencing (no protein expressed), decreased or increased protein expression, which can impact upon the body's ability to maintain healthy equilibrium.

However, healthcare and wellness practitioners are still struggling with the science of genomics and their ability to use it in their clinics. The challenge facing the healthcare industry is that point-of-care decision-making is growing in complexity as the number of health diagnostic markers being assessed and correlated per patient increases.

There is also hope that these technologies can be applied to understanding dementias at the personal level, so that remedial strategies can be applied early to reduce the propensity of disease and/or ameliorate the rate of deterioration.

Genetics is the common denominator required to deliver preventive, multidisciplinary and truly personalised healthcare, but practitioners must also be provided with the requisite tools, training and support.

To make it work in a national system also requires a functioning, easy-to-use,

electronic database of patient data that is used by all practitioners and that can be controlled by the patients themselves.

### Further reading

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**DR CARMEL (CARRIE) HILLYARD** FTSE co-founded CM Capital Investments and led its Life Sciences group for more than 10 years, investing in early stage biotechnology and medical device companies. She has commercialised products from laboratory bench to market and is an inventor of a number of patented technologies. She has also mentored entrepreneurs, assisted with commercialisation and licensing and served on a number of government and public and private company boards. Dr Hillyard is Chairman of ATSE's Queensland Division, Fitgenes Ltd and FizzioFit Pty Ltd and Deputy Chairman of the Mater Medical Research Institute. She was awarded a Centenary Medal in 2003.

**We believe the healthcare industry is on the cusp of a third wave of IT adoption, and that now is the time for it to go all in on digital strategies. Understanding what patients want – and what is purely myth – can help pave the way.**

– STEFAN BIESDORF & FLORIAN NIEDERMANN, MCKINSEY&COMPANY, JULY 2014

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By Anna Lavelle  
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# Building a medtech industry for Australia

There are a range of policies impacting Australia's ability to keep its home-grown technologies in the country and to reap the full benefit they have to offer.

**T**he medical technology industry is growing rapidly around the world in both diagnostics and devices.

Australia is a significant global contributor and boasts global success stories such as Cochlear and ResMed and more than 500 companies with products registered with the Therapeutic Goods Administration (TGA).

This is an industry with all the hallmarks for a successful future, but to be sustainable and deliver all the benefits it promises, we need public policy that supports building of critical mass, a complete ecosystem and the workforce to drive it.

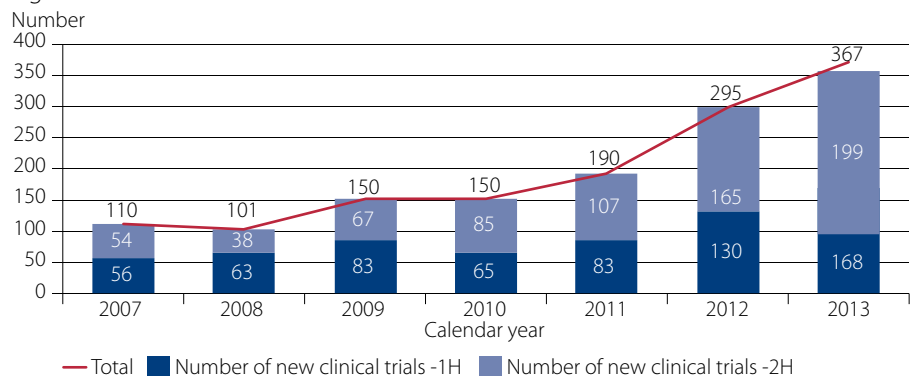
The medical device industry is one of the so-called 'sunrise' industries. It ticks all the boxes of advanced manufacturing, providing high-value-added products, with highly skilled labour and global production chains. It also provides clinical trial activity, intellectual property creation to underpin our much-desired knowledge economy and spillover benefits to our economic prosperity.

The increasing affluence of developed and developing countries, with people living longer and demanding a higher quality of life, is a driving force for this growth around the globe.

The medical technology landscape in Australia, with the exception of a few industry heavyweights such as Cochlear, ResMed and Cook Medical, is typically characterised as young and small, and competing globally with large multinational companies for market share.

The Australian Government's last edition of the Australian Medical Device Industry Data Card reported that there were almost 4000 medical devices companies in Australia, based on Australian Bureau of Statistics figures. Most of these companies (84 per cent) were small to medium enterprises with a turnover of less than \$2 million. Almost

Figure 1 Number of new clinical trials – medical devices.



SOURCE: TGA, JUNE 2014

40 per cent of them do not employ (yet) and 60 per cent employ approximately 17,500 people, with about 12,000 of those employed in the manufacturing sector.

The industry is advancing rapidly into new fields of science and engineering, with nanotechnology and other research developments facilitating new innovations in the biomedical sphere, and an increasing convergence of physical and biological technology platforms.

## Clinical trials

TGA data shows the fast-growing number of medical device trials conducted in Australia has increased by around 234 per cent since 2007 (Figure 1). The steady upward trend is good news for Australia on three counts:

- it's a sign of a healthy and growing medical device industry;
- a larger number of trials means that more patients can get access to cutting-edge treatments sooner; and
- clinical trials contribute significantly to the Australian economy via the highly skilled jobs and intellectual property creation that flows from them.

## Public policy settings

Medical technology companies seeking to

commercialise technologies are vulnerable to public policy settings, partly due to their size and lack of collected wealth, which usually buffers companies from tough times, and partly due to the youth of the ecosystem in which they are seeking to grow.

There are a range of policies impacting Australia's ability to keep its home-grown technologies in the country and to reap the full benefit they have to offer.

Australia does an outstanding job of innovating, especially in the early research phase, only to leave a public policy gap that allows our technologies to leave our shores just as we are set to reap the greatest benefits from them. There are some key issues.

## 1 TAX REFORM

AusBiotech is leading the industry's call for further tax reform in Australia to provide incentives for innovative companies and high-tech manufacturing to support Australia's future and keep us internationally competitive by attracting and retaining business, and the resulting jobs and exports.

AusBiotech advocates making tax incentives an asset for innovation and business, with four pillars (Figure 2):

- retain the Research & Development

(R&D) Tax Incentive, which is a top priority for the life sciences industry;

- introduce the Australian Innovation & Manufacturing (AIM) Incentive, a 'patent-box'-style incentive to keep home-grown intellectual property (IP) once it reaches commercialisation, as well as associated manufacturing, in Australia;
- introduce fiscal incentives for investors in pre-revenue and start-up companies; and
- restore the Employee Share Scheme to its pre-2009 form.

The AIM Incentive would reward innovative Australian businesses (or Australian entities for tax purposes) that make profits from qualifying IP. Its purpose is to encourage the commercialisation phase of innovation by providing an incentive to locate high-value jobs associated with the development, manufacture and exploitation patents in the country with the incentive.

The AIM incentive could also be used to attract overseas IP and

associated benefits (such as jobs, skills, manufacturing) to Australia. While R&D incentives are designed to encourage activities that will result in innovation, the AIM Incentive is aimed at commercial activities, by providing tax relief on profit from qualifying IP.

Ten nations (nine in Europe, plus China) have enacted patent-box-style regimes, the most recent in the UK (April 2013). IP is highly mobile and can be easily separated from the jurisdiction where it was developed and migrated to low-tax jurisdictions or where there are ongoing in

Australia already supports the R&D phase of innovation via the R&D Tax Incentive, but the support phases out at the commercialisation phase of innovation. As support phases out, Australian IP is vulnerable to being sold or manufactured overseas and the resulting community and economic benefits going with it.

It's imperative that Australia takes action to remain competitive and relevant on the world stage, especially, when other economies including the UK or

Singapore are already reaping the benefits of their tax regimes and some Australian companies are moving operations to these nations to develop our IP. Maximising Australian innovation and reinvigorating the manufacturing sector in Australia largely depends on the existing R&D Tax Incentive being complemented with a tax regime that can secure Australia's competitiveness for the future.

As R&D and patent-box incentives become more commonplace around the world, a number of governments have demonstrated that to stay ahead, it is necessary to offer a competing environment.

## 2 SUPPORT FOR COMMERCIALISATION

A number of measures announced in the May Federal Budget removed support for commercialisation and potentially may seriously damage Australia's hard-won momentum in innovation. Australia already has a recognised problem in translating our world-class research into cures and treatment, products and services. With the

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support for commercialisation that was removed in this Budget (Commercialisation Australia and the Innovation Investment Fund to cease), the level of difficulty in translating research help that reaches patients just got a whole lot harder.

Also announced in the Budget was the establishment of the Medical Research Future Fund (MRFF). Should it be passed by the Parliament, it would be the biggest medical research fund of its kind in the world and is welcomed as a great nation-building investment for Australia. However, the removal in the same Budget of commercialisation support and lack of detail on the MRFF has left the biotech sector wondering if and how the commercialisation of such research would occur.

AusBiotech is urging the Government to consider the dedication of a portion of the MRFF proceeds to the translation of research, in line with the McKeon Review recommendations.

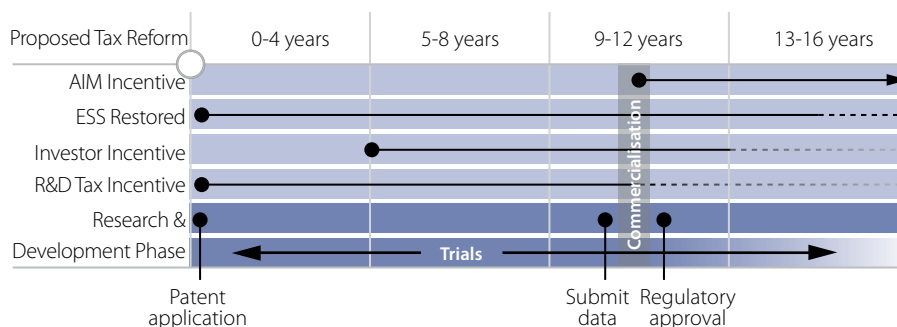
A key element of the report was the strengthening of commercial pathways to ensure the translation of research outcomes into health and economic benefits for the Australian community. It also recommended that funding address the twin 'valleys of death' in commercialising research and called for the establishment a Translational Biotech Fund.

The McKeon review recommendations were made while CA and IIF existed. The removal of the remaining support for commercialisation means there is now an even greater need for the Translational Biotech Fund if we are to see benefits flow from the MRFF to real treatments and cures, as intended in the Treasurer's Budget speech.

### 3 CLINICAL TRIAL HARMONISATION

The Clinical Trials Action Group (CTAG), convened by the Federal Government, made 11 recommendations designed to make the process of initiating and conducting clinical trials in Australia significantly more efficient and cost-effective – and therefore help Australian attract a larger global share. Unfortunately, nearly three years after their release, and despite allocated funding to complete the work, these recommendations have still not been implemented to the extent necessary

Figure 2 Time frames for AusBiotech proposed tax incentives.



(From left) Cameron Boardman, Executive Director – Innovation, Technology and Industry Programs, Department of State Development, Business and Innovation, Victoria, Anna Lavelle and Professor Jeffrey Rosenfeld, Head of Neurosurgery at The Alfred Hospital, at AusMedtech 2014 in Melbourne.

to change the realities on the ground.

The Government should look to implement the recommendations of CTAG and the McKeon Review within the next 12 months.

### 4 WORKFORCE

At the heart of our plans for industry growth and sustainable wealth creation is a highly skilled workforce, particularly with skills in science, technology, engineering and mathematics (STEM), which will underpin an innovative, knowledge-based economy.

Workforce is vital for Australia's future prosperity, but we need to remain globally competitive for the employers and for the skills to remain in Australia. Medical technology is among the industries contributing to the fastest-growing occupations requiring significant STEM skills and knowledge. For this reason, AusBiotech supports

the ATSE Action Statement Advancing STEM Education (September 2013) as the skills shortages will increase, due to demand, if no action is taken.

With the right policy settings, Australia's medical technology industry has the capacity to be major contributor to our economy as well as our lives.

DR ANNA LAVELLE was appointed inaugural CEO of AusBiotech Ltd in June 2005. Previously she was with the Australian Red Cross Blood Service, as Director for Strategic Planning and Business Development and then as Director of Intellectual Capital, responsible for management of the national R&D program, evaluation of emerging technologies, and international and national business development activities. Prior to these roles she was CEO of a public health organisation, industry lobbyist for a membership organisation and a Monash University academic. Dr Lavelle holds a PhD in genetics from the University of Melbourne.

By Jennene Buckley  
jennenebuckley@feroscare.com.au



# The NBN can transform health and aged care

The biggest challenge to wider-scale adoption of telehealth will be the engagement of GPs and health services.

Using the 'My Health Clinic At Home' tablet and vital-signs equipment.



**T**he National Broadband Network (NBN) has the potential to transform health and aged care services, providing more timely access to health services and allowing seniors to learn, strengthen their social connections and to increase their participation in society.

Feros Care's NBN-enabled telehealth pilot – My Health Clinic At Home (MHCAH), is an example of the way telehealth and the NBN are transforming health service delivery and revolutionising home-based healthcare in Australia.

Feros Care's MHCAH pilot is one of nine Australian Government-funded pilots designed to demonstrate the abilities of the nation's new NBN in overcoming particular challenges in regional areas. The program aims to showcase how the NBN can help provide innovative and accessible health services, reducing health-related transport and hospital care, and improve communication between consumers, carers

and health service providers to improve quality of care and health outcomes.

Reports evaluating the nine national pilots will be published over the next six months.

The biggest challenge to wider-scale adoption of telehealth will be the engagement of GPs and health services.

Even if the government sets the right financial incentives in place, the change management process will be significant, fighting for buy-in by general practitioners, one GP at a time.

Seniors, however, are enthusiastic participants of telehealth and their acceptance of the technology and the virtual environment is fantastic. It will be the seniors who truly drive the demand for emerging technologies in a consumer directed market.

The NBN has proven to be a tremendous experience for our organisation and our clients, and has set Feros Care on a path for service transformation.

Technology is evolving faster than our current consumer internet is allowing and the faster and more reliable our internet, the better we can future-proof a sustainable telehealth experience for all clients.

Pilots such as the MHCAH are showing how the NBN – delivering superfast, medical-grade internet connections to nearly every home – is helping provide a 21st century solution to healthcare, social isolation and in-home care and support to older people.

Feros has facilitated more than 5000 video conferencing sessions over the life of the pilot, with the NBN proving to be the most consistent and stable video connection we have experienced, allowing high-quality, multi-party video streaming. ADSL2+ 4G connections, in comparison, have proven to have had issues around cost, reliability and lower quality video.

After experiencing the quality of and reliability of FTTP (fibre to the premises), it would simply make sense for this to be the preferred way forward if we are going to invest in infrastructure to set us up for the 21st century and beyond.

The MHCAH pilot based in Coff's Harbour, NSW, provided an easy-to-use touchscreen tablet, vital-signs monitoring equipment, the NBN connection and a simple-to-use touch screen interface to

## CLIENT COMMENT

**I love it! It has given me another chance in life. I can tell what the body is telling me to do and I act accordingly. My wife and I were on the telehealth program and were impressed with being able to monitor ourselves, as well as having our telehealth nurses keeping an eye on our readings and contacting us when necessary.**



enable seniors with chronic conditions to have their vital signs monitored daily by a telehealth nurse. Large touch-screen icons were set up on the MHCAH technology to enable one-on-one or group virtual calls/consultations with the telehealth nurse, GP, case manager, other health professional or significant other in their lives, to help reduce their social isolation.

The pilot program targeted seniors living at home with health conditions – including chronic obstructive pulmonary disease, unstable blood pressure, diabetes and/or chronic heart failure – and resulted in many clients not only gaining a better understanding of their chronic condition, but being better able to manage their symptoms. The clients were much less anxious knowing they had a telehealth registered nurse monitoring their condition and they felt less isolated, with the ability to video call their family and friends at the press of a button.

Another big challenge for the MHCAH pilot was the short pilot timeframe (12 months from when the first participant was referred) and the delay in the rollout of the NBN live zones. With the pilot milestones based on participant numbers, the recruitment of participants was an overwhelming focus for most of the pilot. Similar to one of the earlier NBN pilots in Kiama, NSW, we had to engage the community for direct referral, which involved information stands at shopping centres, clubs and community groups.

Although not the traditional way of receiving referrals, it was a surprise to see how many seniors were willing to participate in the trial and learn more about their health and chronic condition. Feros received almost double the referrals needed to fill the pilot requirement of 200 participants.

Unfortunately the clinical outcome of the pilot was not as strong as it might have been, as participants were not in a high-risk category for hospitalisation.

Finding GPs to participate in the trial – with only half a dozen health

#### HEALTH SERVICE COMMENT

**Our clients said it was great to see the connecting care nurses rather than just the voice. They had never seen us before. Telehealth is a great triaging tool, you can connect the dots better that way and can help prioritise the next steps and get clients the most appropriate services quicker.**

professionals actively participating in referrals and virtual consultations/video calls – provided another obstacle.

Non-participating GPs said their reluctance to get involved was due to the short timeframe of the pilot, time constraints and the fact that after the pilot finished, there was no financial incentive through the MBS scheme for GPs to undertake virtual consultations from their surgery to a client's home.

This is an important issue which is going to have to be addressed by the government if we are to see any increase in the scale of telehealth nationally.



Feros Care's Mick O'Regan in a chat club session.

But participating health professionals provided some very encouraging comments about the value of the NBN enabled telehealth services.

While this Telehealth trial might seem purely about health management, it's actually equally about exploring the best ways people can remain connected to their family, friends and society as long as possible. All participants were encouraged to use the video conferencing feature on the MHCAH to boost their social connections from their living room, with the goal of linking them virtually to two to four stakeholders in their life.

Participants were able to link through Feros Care's video conferencing bridge for one-on-one interaction with their family, friends, telehealth nurse, case manager or GP. They could also link to group multi-party sessions such as online bingo (linking nursing home residents and seniors in the community into a virtual bingo game), group chat clubs and health literacy classes.

The usage of video conferencing increased to almost 600 sessions a month by the end of the pilot. This has inspired Feros to explore broader mainstream initiatives and programs using the internet and technologies to reduce social isolation.

An unexpected benefit of the MHCAH pilot has been the potential for the technology to transform our case management support models in the community. The ability to turn a portion

#### DOCTOR'S COMMENT

**MHCAH gives patients alternative access to GPs if they are not able to physically come into the practice. The vital-signs monitoring allows the GP to see the dip in their signs. We suspected this would become a benefit but it is now a reality. Yes, the clients were more informed and have asked more questions. This more timely, effective follow-up prevents mortality.**

## 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)**

of our home visits into virtual visits, could produce an estimated saving for community case managers of up to approximately 8000 kilometres and 160 hours of travel time annually. This could allow them to support almost double the number of clients over the course of the year.

On the strength of the Coffs Harbour pilot, Feros Care has been able to embark on a number of new services. Feros Care, with assistance from government funding under the Home Support Scheme has launched My Health Clinic At Home in Sydney's south-east to 200 seniors over 65 who have chronic health conditions. The program has presented a new service

model under HACC nursing services.

Feros Care was also awarded funding by the Department of Health via the Better Health Care Connections program to integrate MHCAH technologies to pilot a new multidisciplinary care model for seniors living in three of our residential aged care villages in far northern NSW. This has included the installation of gigabite wireless networks in all three villages to facilitate high-speed video connection.

Our video conferencing infrastructure and the MHCAH is giving us opportunities to explore a range of programs including virtual

volunteer visitors and the virtual senior centre concept we have seen working at Selfcare in New York.

How much of an impact telehealth and the NBN are expected to have on home-based healthcare in Australia is yet to be seen, but if our MHCAH is any indication, signs certainly look promising.

**MS JENNENE BUCKLEY** has worked in the health and aged care sector for 20 years, including for the past 13 years as the CEO of Feros Care, which has grown from a single-locality residential provider to one of the fastest-growing aged and community care services on the east coast of Australia. She is a CPA Fellow and has recently completed an Executive Leadership Program through the London Business School. Ms Buckley was a finalist in the 2008 Telstra Business Women of the Year Awards. She has a passion for aged care and is seen as an industry leader in innovative practice.

#### CLIENT COMMENT

I think that the best thing is to keep active and alive and this is what the chat club does because we get to talk to other people and be inspired.



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## Inspiring education in Western Australia

BHP Billiton partners with outstanding organisations to deliver an extensive range of education programs that support students from early childhood, through to career pathways.

**BHP Billiton, proudly supporting education in Western Australia.**

# ATSE takes a lead in health technology

The ATSE Health Technology Forum has recently produced four papers – a Position Statement and three Action Statements – on health issues where technology can provide solutions for a healthier Australia.

These are in line with the ATSE 2013-2017 Strategy Plan, which sets out the priorities and approaches the Academy will take to enhance Australia's prosperity through technological innovation.

The Health Technology Position Statement – **Advanced Technological Solutions for a Healthy Australia** – calls for the development and deployment of advanced technological solutions for a healthy Australia.

It notes that Australia's expenditure on healthcare has increased 41 per cent over the past decade to address increases in chronic diseases and conditions such as many cancers, cardiovascular disease and dementias, and the increased rates of obesity and diabetes.

It notes this high expenditure is not economically sustainable, and technologies can play a major role in reducing healthcare costs when they are socially accepted and widely adopted. Health technologies also address the increased patient demand for greater self-management and quality of care.

ATSE believes there are enormous opportunities to enhance the effectiveness of the healthcare system. These can be through technologies such as genetic diagnostic testing for personalised medicine, cloud computing, robotics, assistive health technologies, mobile (mHealth) and electronic (eHealth) health technologies – and effective and interoperable information communications technologies (ICT) systems that act as a platform for various technologies and integration of data.

The Action Statement – **Deploy Assistive Technologies for the Aged and People with Disability to Improve Quality of Life** – says that large-scale deployment of assistive technologies is essential to enable the aged and people with disabilities to manage their own health,

remain independent and at home longer and to contain growing healthcare costs.

Assistive technologies, encompassing telecare and telehealth services that are delivered at home through ICT have been demonstrated to deliver cost-effective, timely and improved access to quality care. This form of healthcare delivery is one way to address the challenges that accompany Australia's ageing population, which places great stress on healthcare services, by shifting the management of chronic disease to home and community settings to reduce the burden on the current hospital-centric healthcare system.

Very little policy work has been undertaken in Australia in deploying telecare and telehealth in the home, regardless of demonstrated benefits. ATSE believes that policies and funding models are needed and this requires better coordination of State and Federal Government agencies, better funding and reimbursement models and creation of new public and private sector markets including the participation of aged care and not-for-profit sectors.

The Action Statement – **Develop Technologies for Personalised and Preventive Healthcare** – supports the role that technology plays in providing personalised healthcare to consumers and in shifting the focus towards prevention of disease.

Individuals are becoming more proactive about their health and demanding greater health outcomes. This is driving the development for personalised and preventive health technologies that are targeted and tailored to individual needs. These technologies will have greater prevention power when individuals are better informed of the effect that personal lifestyle choices have on their health.

Personalised healthcare has the potential to improve health outcomes and provides mechanisms to prevent diseases and conditions that are contributing to the escalating healthcare costs, such as cardiovascular disease, obesity and diabetes. Individual genetic testing/profiling for

disease prediction can drive personalised nutrition and lifestyle programs to improve health and wellness over time.

The Action Statement – **Grow and Promote a Globally Competitive Medical Device Industry in Australia** – recognises that Australia has a medical device industry with an excellent research and development base, a highly skilled workforce and can draw on engineering and manufacturing capabilities to provide greater global impact.

Medical device products are diverse and wide-ranging and can be complex and sophisticated, such as magnetic resonance imaging (MRI) scanners, or simpler devices such as syringes and bandages. Increases in life expectancy and increases in a number of diseases and conditions have attributed to the rapid growth of the industry globally and in Australia to address these challenges.

A robust Australian medical device industry has the potential for national economic and social benefits through job creation, export growth and improved healthcare. Australian medical device revenue is estimated at around \$10 billion and the industry is dominated by a large number of small and medium-sized enterprises. More than half of Australian medical device companies have grown from start-ups.

All four Statements are on the ATSE website at Publications/Policy-and-Technical and accompany this edition of ATSE Focus.





# ATSE IN ACTION

## Perth showcases 2014 ATSE Clunies

The 2014 ATSE Clunies Ross Awards were presented at a gala dinner at the Perth Convention Centre in May attended by more than 370 eminent entrepreneurs, decision-makers, government officials, researchers, academics and business leaders.

It was opened by Hon Colin Barnett MLA, Premier of Western Australia, followed by a keynote address from Professor Ian Chubb AC, Chief Scientist of Australia.

The following day the winners joined nearly 300 students and teachers from across Western Australia in the Extreme Science Experience with hands-on activities to excite students about science and technology.

It was the first time the ATSE Clunies Ross Awards dinner and Extreme Science Experience were held in Perth and the combined events were again an outstanding success.

The awardees are recognised as Australia's pre-eminent innovative scientists and technologists for persisting with their ideas, often against the odds, to the point that their innovations have provided broad economic, social or environmental benefits.



The winners and sponsors.

### The 2014 ATSE Clunies Ross Award winners were:



John Nutt receives his award from Alan Finkel.



Tanya Monro thanks the guests.



San Thang and his wife Louisa at the dinner.



Chief Scientist Ian Chubb addresses the dinner.

# ATSE IN ACTION

## Ross Awards



Deep concentration in the ESE.

**Dr John Nutt AM FTSE** (Lifetime Achievement Award) for his ongoing contribution to the engineering profession and commitment to the advancement of the industry over the past 50 years. **Professor Kevin Galvin FTSE** from the University of Newcastle for his work in mineral processing and the development of innovative, cost-saving

and effective minerals industry technology. **Dr Ezio Rizzardo FRS FAA FTSE**, **Dr Graeme Moad FAA** and **Dr San Thang FTSE** for their work in developing better ways of making polymers and plastics. **Mr Ravi Ravitharan**, **Mr Peter Mutton** and **Mr Graham Tew** for their significant technical



Nobel Laureate Barry Marshall at the ESE podium.



Orica engineer Catherine Hart works the equipment at ESE.



Eugene Ivanov works with ESE students.

innovations in railway engineering. **Winthrop Professors Eugene Ivanov** and **Michael Tobar FAA FTSE** for their invention of the world's lowest-noise oscillators, with multiple applications in fundamental research, high-tech communications and defence.

The 2015 Clunies Ross Awards Dinner will be held at Brisbane City Hall on Thursday 28 May. The organising committee is chaired by Professor Mike Hood and is working to raise sponsorship funds and sell event tickets to the Brisbane audience.

The following day will feature a new style of student event, with the Extreme Science Experience being presented as the Wonder of Extreme Science, featuring key aspects of both the national STELR program and the Queensland Wonder of Science initiative.



ESE MC Sarah Lau gets the day underway.



# ATSE IN ACTION

## CAETS looks at engineering and the future of mankind

The 20th Convocation of CAETS (the International Council of Academies of Engineering and Technological Sciences), held in Beijing in June, focused on Engineering and the Future of Mankind.

Fellows Professor Ted Brown AC FREng FTSE, Professor Aibing Yu FAA FTSE, Professor German Spangenberg FTSE and Foreign Fellow Professor Liang-Shih Fan gave keynote presentations at the Convocation.

ATSE President, Dr Alan Finkel, Academy Director and International Engagement Strategy Group Chair, Professor Kaye Basford, and past ATSE President Professor Robin Batterham chaired several of the parallel sessions, with ATSE Senior Advisor Dr Vaughan Beck attending and contributing to these and other bilateral meetings.

The opening address by the Chinese President, Xi Jinping, emphasised the importance of innovation and engineering at the forefront of Chinese development.

Professor Kaye Basford, who met President Xi in Beijing, was impressed by his address.



Kaye Basford meets the Chinese President.

"President Xi clearly articulated the very strong role that engineering must take in building China's future.

"The visionary plans that China has for its advancement mean that engineering and technology developments will be key drivers for the future progress and prosperity of China," she said.

Professor Basford said that ATSE looked forward to further developing and promoting its collaboration with China to address many of the critical issues that face both countries.

"ATSE highly values its relationship with the Chinese Academy of Engineering. Both academies have demonstrated a strong spirit of international collaboration through various joint workshops and exchanges," she said.

**The 2015 CAETS Convocation will be held in New Delhi, 13-14 October 2015. The focus of the meeting will be Pathways to Sustainability: Energy, Mobility, and Health Care Technologies.**

## Board launches two new Forums

**The Academy Board has approved formation of two new Forums.**

The **ATSE Agriculture Forum** will be a critical engagement vehicle to facilitate delivery of the Academy's objectives relating to its National Technology Challenges, which identifies agricultural productivity as a key technology issue for Australia. Dr Kate Fairley-Grenot will be its interim Chair.

The **ATSE Industry and Innovation Forum** is proposed as a critical vehicle to facilitate delivery of the Academy's objectives relating to innovation policy which is identified by the Academy as another key technology challenge for the nation. It will initially be chaired by Academy Vice President Professor Peter Gray.

The **agricultural sector** is of high importance in ATSE's vision of technological sciences, engineering and innovation contributing significantly to Australia's social, economic and environmental wellbeing. The

ATSE Strategy Plan 2013-17 identifies agriculture as a key priority focus area.

ATSE has a strong history in providing evidence-based policy advice to government on a number of agricultural issues in Australia, most recently through the ATSE Agriculture Position Statement Enabling Growth in Agriculture, publication of a major report *Food and Fibre: Australia's Opportunities*, and contributing to the government's Agricultural Competitiveness White Paper process.

ATSE's database shows that there are some 95 Fellows with primary qualifications and/or expertise in agricultural sciences. The Agriculture Forum also offers a mechanism to further strengthen ATSE linkages with the expertise and networks of the Crawford Fund.

ATSE sees **technological innovation** as critical to build and maintain competitiveness in Australian industry, where innovation is a key driver of productivity growth necessary for Australia's prosperity, economic growth, and

social wellbeing.

ATSE also has a strong history in providing evidence-based policy advice to government on a number of innovation and industry related issues in Australia – most recently through the ATSE Innovation and Productivity Action Statement (Translating research into economic benefit).

Key issues that the new Forum will address are:

- 1** Reduce regulatory barriers to technology commercialisation.
- 2** Optimise translation to practice of publicly funded research.
- 3** Adopt disruptive technologies to make Australia's industries more competitive.

The key objectives of ATSE Forums are to produce outputs that will contribute to public debate and policy development; and provide a platform for internal discussion, debate and wide engagement in areas of common interest for the Fellowship.



# ATSE IN ACTION

## ACOLA report hails innovation as a productivity key

Expert Working Group Chair and co-author Dr John Bell FTSE launched the ACOLA Report *The role of science, research and technology in lifting Australian productivity* in a televised address to the National Press Club in June.

The report confirms the importance of innovation, science and research to Australia as critical drivers of productivity and the building of future industries. It includes 25 key findings about Australia's current performance and outlines opportunities to boost innovation-driven productivity.

The report finds that there is an urgent need for Australia to increase innovation to lift productivity growth and build future industries and draws three major conclusions.

**1** Adopting technological innovation to develop high-value products and services for global markets is key to building Australia's future industries.

**2** Innovation and productivity can be significantly enhanced by improving international and domestic collaboration, both between businesses and between business and publicly funded research.

**3** An innovative workforce that combines technical and non-technical disciplines, and improved business management, is essential to underpin the competitive advantage of Australian industries.

"There is an urgent need for Australia to look at measures to increase innovation. Current measures are inadequate and Australia is lagging behind key international competitors, many of whom are rapidly growing their investment in research and innovation," Dr Bell said.

"Australia has an opportunity to utilise elements of international best practice in providing research and innovation support to improve productivity. For example, unlike the majority of our competitors, Australia has a history of frequent changes to innovation support measures for small to medium businesses. This erodes confidence and makes it difficult for businesses to plan."

The report found that the success of Australia's future manufacturing industries will depend on technological innovation, a



John Bell addresses the National Press Club.

shift to advanced manufacturing, integration with services, international connectedness and enhanced participation in global value chains.

"We seem to regard funds spent on research and building business capability as an expense, rather than an investment in Australia's future," Dr Bell said.

"Such investments are not a case of living beyond our means. They're necessary to create jobs for future generations of Australians. Underlying the recent Budget announcements is a serious lack of understanding of the need for government measures to create the sort of economy that will ensure our competitiveness in the 21st century, and it won't happen without government help.

"Other countries recognise this and we need to do so too. To be competitive in the 21st century, we need an effective innovation system and financing it is not something that can wait until the Federal Budget gets back into surplus. The UK and the US have both faced budget deficits and it hasn't stopped them continuing to invest in innovation and it shouldn't stop us.

"If it does, we'll find ourselves getting left behind. In our region, we already lag China, Japan, Singapore, Korea and Taiwan in a number of key indicators of innovation. We need to be concerned about generating productivity growth if we're going to maintain our standard of living and our report shows innovation is an important driver of productivity growth and underpins the creation of future industries."

Three ATSE Fellows – Dr Bell, Dr Bob Frater AO FAA FTSE and Professor Tom Spurling FTSE – were among the eight members of the Expert Working Group that produced the report. Many other Fellows contributed to the report by participating in workshops and meetings.

*The report forms part of the Securing Australia's Future Program which delivers a series of strategic research projects to the Chief Scientist and Prime Minister's Science, Engineering and Innovation Council.*

**The report, *The role of science, research and technology in lifting Australian productivity*, is on the ACOLA website.**

# ATSE IN ACTION

## ATSE suggests alternatives to infrastructure program

The Academy's submission to the Australian Government's Entrepreneurs' Infrastructure Program (EIP) suggested an alternate approach to the discussion paper circulated for comment.

ATSE noted that the proposed structure of the EIP outlined in the Discussion Paper preserved some elements of recently terminated programs (for example, Enterprise Connect and Commercialisation Australia), but appeared to offer no options for new approaches and read as a *fait accompli*.

ATSE responded with some general comments and suggested an alternate approach, as the lack of information on how the \$484.2 million commitment would be allocated over four years raised some concern for ATSE.

The submission said that, given the amount per annum was not large, it would be important to appropriately distribute the funding across the program elements discussed in the discussion paper.

ATSE said it believed the Business Management component should not be the core component of the program, rather as a later element that offered business advice to innovative organisations and companies that

had been successful in receiving government funding.

This would better benefit innovative companies at crucial points in the research translation–innovation–commercialisation continuum. ATSE noted its view that **business management support** did not work through a website, but was optimally delivered by direct contact with experts and noted its concern on the reliance of advisers to provide advice on business matters.

ATSE said it presumed the proposed **commercialising ideas service** would provide introductions, advisors to help businesses evaluate their programs, and a website to link markets to investors, but noted that much of this information was already readily available to businesses large and small, through private sector consultants, and though a plethora of publicly available databases.

ATSE welcomed the creation of the **research connections** element, as financing was a major stumbling block for innovation success and driving business productivity in Australia. But ATSE suggested that the grants, at \$50,000 each, were much too small to change the investment or development plans of a company, even a small one, especially if it

required matching funding. It noted there were examples where a small grant scheme could be effective but these were at the pre-competitive stage of commercialisation.

ATSE said it believed that the questions raised in the Discussion Paper had been substantially addressed in the recent report by the Australian Council of Learned Academies (ACOLA), *The role of science research and technology in lifting Australian productivity*.

The ACOLA Report, commissioned by the Chief Scientist for the Prime Minister's Science, Engineering and Innovation Council (PMSEIC), had three major conclusions:

- building Australia's future industries will depend on adopting technological innovation to develop high-value products and services for a global market;
- improving collaboration in Australia, between businesses and between business and publicly funded research, will significantly enhance innovation. International collaboration is also critically important. Both domestic and international collaboration improves the productivity and competitiveness of Australian technology-based firms; and
- an innovative workforce that combines technical and non-technical disciplines, and enables good business management, is essential to underpin the competitive advantage of Australian industries and realise opportunities to lift productivity.

## Aligning R&D to optimise mineral resources

The Academy held the third in its 2014 series of ATSE Public Lectures at the Science Exchange in Adelaide in June, which dealt with aligning R&D to optimise the potential of our minerals industry.

Delegates were told that computer modelling, sensing and data analysis – often at massive scale – are at the heart of future exploration and processing strategies in minerals and energy.

Given the greater role of technology and engineering in this future, Australia's research institutions and industry must become better aligned if they are to better serve the nation.

Science and industry experts presenting at the event discussed technology trends in minerals processing and shale gas and provided case studies – including sorting a

million tonnes of copper ore, and real-time analyses for gold and other precious metals – that had resulted from successful alignment of research and industry.

The speakers were:

- Dr Craig Mudge FTSE, CSIRO Minerals Down Under Flagship;
- Professor Magnus Nyden, Director, Wark Institute, University of South Australia;
- Dr James Tickner, CSIRO Process Science and Engineering; and
- Dr Mary McGowen, Chemicals and Compliance Advisor, Halliburton.

The Science Exchange streamed this meeting live from its website.



Adelaide lecture speakers (from left) Mary McGowen, Craig Mudge, Magnus Nyden and James Tickner.

# ATSE IN ACTION

## ATSE spotlights SEQ's future water options



The audience locked in on Queensland water issues.

Drinking water options for South-East Queensland went under the spotlight in June at a Brisbane seminar, hosted by the Academy's Queensland Division, The Australian Water Recycling Centre of Excellence and the UQ Advanced Water Management Centre.

The public lecture, at the Queensland State Library, heard experts discuss several questions.

- What role do different water sources play in securing a sustainable, long-term water supply across a rapidly growing region such as SE Queensland?
- Is the infrastructure in a state where it could be rapidly deployed if needed?
- Should recycled water play a greater role in our water supply?

The lecture was a further leveraging of the Academy's *Drinking water through recycling report*, released in October 2013. This report, funded by the Australian Water Recycling Centre of Excellence, discussed the benefits and costs of supplying recycled water directly to the drinking water distribution system.

The expert speakers, who later engaged with the audience in a facilitated panel discussion, were:

- Ms Leith Bouilly, Commissioner with the National Water Commission, and Chairman of Healthy Waterways Ltd, the Australian Centre of Excellence for Water Recycling and the Great Barrier Reef Marine Park Authority's Catchment and Coastal Reef Advisory Committee;
- Professor Jurg Keller FTSE, Director of the Advanced Water Management Centre at the University of Queensland and Member of the Steering Committee for the ATSE report;
- Associate Professor Stuart Khan, lead author of the ATSE report and Associate Professor in the School of Civil and Environmental Engineering, University of New South Wales; and
- Ms Monica Bradley (Facilitator), strategic adviser and problem solver who helps businesses, communities and individuals understand the future and design innovative strategies to grow and succeed.

Attendees were reminded that the whole of Queensland, including the highly populated

## TASMANIA'S ENERGY OPTIONS

The Academy and the Royal Society of Tasmania (RST) held two public lectures in Hobart in June and July, titled *Power Options for the Future*.

The first lecture, chaired by Dr Alan Finkel AO FTSE, President of ATSE and Chancellor, Monash University, addressed three energy options – wind, coal and nuclear – and attracted an audience of more than 100.

Mr Barry Waining, Tasmanian coal power and heavy engineering expert, spoke on coal issues; Mr Andrew Halley, Principal Operations Engineer, Transend Networks (owner and operator of the electricity transmission system in Tasmania) addressed wind power options; and Dr John Soderbaum FTSE, Deputy Chair, ATSE Energy Forum, outlined nuclear energy options.

The second lecture addressed solar, hydro and shale gas and attracted an audience of more than 200.

ATSE Energy Forum Chair Dr Bruce Godfrey covered solar options; ATSE Senior Advisor Dr Vaughan Beck FTSE spoke on shale gas options; and Dr Marian Piekutowski, Chief Engineer System Integration at Hydro Tasmania, addressed hydro-electric power.

The lectures were supported by Inspiring Australia, The University of Tasmania and the Tasmanian Department of Economic Development, Tourism and the Arts and hosted by Professor Ross Large, President of RST and ATSE Tasmanian Division Chair.

south-east corner, had suffered severe droughts and floods in the past decade, which had put the water supply at risk and – even without extreme weather events – population growth in the region was creating an increasing demand for water.

In response to these challenges governments had made an unprecedented infrastructure investment into the urban water system. But because SE Queensland was currently between extreme weather events this infrastructure had not yet been fully deployed.



# ATSE IN ACTION

## Grant will boost STELR in Australian schools

Academy President Dr Alan Finkel and Education Minister Christopher Pyne (right) watch students at Prince Alfred College, Adelaide, working with STELR equipment.



The Academy's STELR initiative, already taking innovative science education to nearly 400 secondary schools around Australia, will be a key element of a new \$1.6 million, two-year collaborative program to encourage student participation in maths and science in Years 11 and 12.

The Inspiring Science & Mathematics Education (ISME) project is a collaboration between Southern Cross University, the University of Wollongong, Charles Darwin University and the Academy.

The consortium received \$996,500 through the Australian Maths and Science Partnerships Program Competitive Grant Round, announced by Education Minister Christopher Pyne. The consortium participants will provide the balance of the project funding in cash or kind.

ISME will enhance teaching and learning of the science and maths

curriculum in Years 7 to 10 and involves the development of at least five multidisciplinary classroom modules, which use cutting-edge science and engineering contexts and the latest educational theory from the partner universities and other research institutions to excite and engage students.

ISME modules will be delivered through a web-based platform and are designed to increase both the enthusiasm and engagement of secondary school students for STEM subjects and careers and to increase the number of students choosing maths and science courses at tertiary level.

ISME will use the expertise of university science, engineering and education faculties and other research institutions to develop multidisciplinary modules that engage secondary students through relevant contexts. The modules will involve hands-on, inquiry-based science and mathematics activities supported by background information and

career profiles of recent graduates working in the relevant industries.

All Australian schools will ultimately benefit. The modules will be trialled at schools nominated by each university. They will be evaluated, rewritten where necessary and then published through ATSE's STELR website.

Teachers will be supported through the provision of comprehensive multidisciplinary modules that include student activities and worksheets, and teacher resources. Professional learning workshops will be delivered by the partner universities for all teachers in the ISME program.

### All ISME modules will:

- be aligned with the Australian Curriculum;
- be modelled on ATSE's highly successful STELR program that is currently being used in nearly 400 schools across Australia;
- be taught within the school curriculum so

# ATSE IN ACTION

that all students, not just the science 'whiz kids', will develop their science literacy and life-long active learning skills;

- be written with the inexperienced teacher, or the teacher teaching out of field, in mind;
- be flexible to allow each school to individualise its science programs as well as provide an effective tool for teacher support, regardless of their existing skill set;
- appeal to boys and girls equally;
- appeal to Indigenous and non-Indigenous students alike;
- be available to students and teachers regardless of location (rural, metropolitan, remote) or sector (government, independent, Catholic);
- make the nationally field-tested, highly successful STELR Renewable Energy Program available to more Australian secondary schools; and
- expand the range of STELR curriculum modules to more broadly cover the science curricula across school Years 7 to 10.

The modules will be delivered using iSTELR, the web-based version of STELR that uses the Stile delivery system. Modules will have embedded videos and animations where practical. Stile operates on all platforms including Windows, Apple, iPad, Android tablets and smartphones.

The program aims to address concerns that:

- secondary school science and maths participation rates have declined over the past two decades and have settled at a low level;
- students do not see the relevance of science to their lives; and
- too many science and mathematics teachers are teaching out of field.

ISME will develop modules using contexts that will show students that science and maths are highly relevant to their lives. Career profiles and case studies will show study pathways that lead to careers in the relevant industries. Hands-on, inquiry-based activities are proven to engage students. Support materials will be produced that support teachers teaching out of field.

ATSE will lead the development of ISME, including management of new curriculum development, management of the digital content development, equipment production and delivery, and coordinate teacher professional training. ATSE will provide the secretariat services to the Consortium and

day- to-day project management. ATSE brings the existing STELR curriculum and STELR equipment supply chain, a network of existing STELR schools, the Stile partnership, expertise and experience in developing and delivering ISME-like programs, corporate sponsors, private benefactors, and the networks and support of the 800 ATSE Fellows.

Southern Cross University is the lead university and will be accountable for delivery of the overall project. The university participants will:

- develop curriculum into new areas/ disciplines/subjects according to their areas of research and teaching expertise;
- develop course content and classroom practical/experiment activities based on the latest scientific research methods;
- provide advice on development of new classroom equipment;

- develop teacher professional training for schools in their region; and
- develop the model and help provide undergraduate students mentors to schools.

Southern Cross University will also provide capability and expertise on sustainability education and environmental geochemistry within the context of water and food security.

Charles Darwin University will provide capability and expertise in online course delivery, including rural/remote areas. CDU will adapt materials for use in Indigenous communities.

The University of Wollongong will provide expertise in the modules on sustainable housing, human health issues and mathematics curriculum content.

## WA EMINENT SPEAKER LECTURES UNDERWAY

ATSE's WA Division is collaborating with Scitech, Curtin University, The University of Western Australia (Institute of Advanced Studies) and Edith Cowan University to present its 2014 series of Eminent Speaker lectures.

This year's Eminent Speaker is Dr Rob Hough of CSIRO.

Dr Hough is theme leader of 'Discovering Australia's mineral resources' in the CSIRO Minerals Down Under Flagship. A geologist, he worked as a Postdoctoral Research Fellow in Planetary Sciences at The Open University in the UK before he came to Australia to work as a Royal Society research fellow for the Western Australian Museum. In 2004 he joined CSIRO as a Postdoctoral Research Fellow, before becoming a research scientist in 2005. In 2004 Dr Hough received the WA Premier's Award for Early Career Achievement in Science.

ATSE is delighted that two of the lectures, targeting at senior school students, will be held in two key WA regional centres – Bunbury on 28 August and Kalgoorlie on 4 September. The Perth lectures have been staged at Edith Cowan, Curtin and UWA.

## ATSE HAS NEW EVENTS MANAGER

Ms Sue Wickham has joined ATSE as the new Events Manager.

Sue comes to us with a strong background in events having spent five years as the Membership and Events Manager of Cricket Ireland. This involved managing events both on and off the field, including International Cricket matches held in both the north and south of Ireland.

Since Sue's return to Australia at the end of 2011 she has worked on contract with Victoria Legal Aid in the administration of staff training programs and more recently with the Australasian College of Sports Physicians, a specialist medical college, managing the pre-training entry examination and Fellowship examination processes across Australia and New Zealand.

In her role as Events Manager, Sue will be responsible for managing the logistics of all divisional, national and international ATSE events. She will be joined shortly by a new Events Coordinator who will assist her with running all events to the high standard that has been established.



## Exhibition showcases finest innovations

A new exhibition launched at the Questacon Technology Learning Centre in Canberra in July showcases some of Australia's finest innovations and inventions and the people behind them.

Questacon's Enterprising Australians exhibition tells the story of 35 products, processes and materials – from the Cochlear implant to a new barley for healthier breakfast cereal – and explores the journey each inventor took in developing their idea into a marketable, useful product.

Enterprising Australians features video stories on innovations from a range of fields including mining, agriculture, medicine and the automotive industry, amongst others. These explore the industrial design, development and testing phases of less well-known Australian innovations such as the Safe'n'Sound baby capsule and Safescape laddertube for mines.

Two interactive stations give an up-close view of other innovations. Visitors can test their alertness with the Driver State Sensor System, which detects driver fatigue with face-reading software and cameras. Fitted to mining vehicles, this system is now improving mine safety in 11 countries.

A digital microscope lets visitors zoom in on samples of work from CSIRO and other research organisations, including pest-resistant cotton, improved prawn breeds and sustainable prawn feed.

The exhibition displays some of Australia's most cutting-edge, multidisciplinary research into electromaterials and nanobionics, with fibres that may in the future be woven into wearable health monitor devices, internal drug-delivery implants and even implanted into damaged nerves and muscles to stimulate tissue regeneration.

## A CALL TO BETTER PROTECT ANTARCTICA

Antarctica's ice-free land needs better protection from human activities, according to environmental scientists.

Antarctica has more than 40,000 visitors a year, and with more and more research facilities being built in the continent's tiny ice-free area, the 'last wilderness on Earth' is one of the planet's least-protected regions, say Dr Justine Shaw and Professor Hugh Possingham of the National Environmental Research Program's (NERP) Environmental Decisions Hub.

In a new study, 'Antarctica's protected areas are inadequate, unrepresentative and at risk' (by Justine D. Shaw, Aleks Terauds, Martin J. Riddle, Hugh P. Possingham and Steven L. Chown), published in *PLoS Biology*, Dr Shaw and her colleagues found that all 55 areas designated for protection of land-based biodiversity lie close to sites of human activity, seven are at high risk for biological invasions, and five of the distinct ice-free ecoregions have no protected areas.

"Most of Antarctica is covered in ice, with less than one per cent permanently ice-free. Only 1.5 per cent of this ice-free area belongs to Antarctic Specially Protected Areas under the Antarctic Treaty System, yet ice-free land is where the majority of biodiversity occurs," Dr Shaw says.

"We need to establish protected areas that are representative of Antarctic biodiversity to protect a diverse suite of native insects, plants and seabirds, many of which occur nowhere else in the world," she says. "We also need to ensure that Antarctic protected areas are not going to be impacted by increasing human activities, such as pollution, trampling or invasive species."

## Women strong in agriculture awards

Women researchers won six of the 11 awards in the 2014

Science and Innovation Awards for Young People in Agriculture, coordinated by the Australian Bureau of Agricultural and Resource Economics and Sciences.

- Sandra Corbett (Australian Meat Processor Corporation Award) is doing a PhD at Murdoch University, studying the effects of glycogen (the muscle's energy store) and pH on meat quality.
- Jane Kelley (Dairy Australia Award), is based at the Centre for AgriBioscience at La Trobe University, where she is studying the most widespread vector-borne parasitic disease in the world – the liver fluke – and its effect on dairy cattle in Victoria.
- Dr Alison McCarthy (Cotton Research and Development Corporation Award) is based at the National Centre for Engineering in Agriculture (NCEA) at the University of Southern Queensland, where she is developing a computer program that analyses photos of cotton plants taken with a camera or smartphone and calculates the plants' water needs.
- Rhiannon Moore (Rural Industries Research and Development Corporation Award), who studies at Charles Darwin University and works at the Centre for Crocodile Research, is working to understand the structure of crocodile skins and what causes tiny blemishes that result in the skin being rejected by luxury handbag manufacturers such as Hermès, Louis Vuitton and Gucci.

Alison McCarthy at work.



- Kelly Porter (CSIRO Biosecurity Flagship Award) is a veterinarian with the Victorian Department of Environment and Primary Industries, is an anthrax researcher who plans to test the blood of more than 2000 livestock and about 60 introduced carnivores in the Goulburn Valley, the location of the last three Victorian anthrax outbreaks.
- Megan Verdon (Australian Pork Ltd Award) is now one of the key welfare and animal housing researchers in the Australian pork industry and is studying the effects that socialisation of pre-weaning piglets has on aggression and welfare later in life.



# WOMEN IN TSE

## Health innovator wins ICT award

Innovative research on health technologies has won UNSW's Professor Johanna Westbrook the title of ICT Professional of the Year at the NSW iAwards and takes her through to the national iAwards to be held in Melbourne on 29 August.

Professor Westbrook heads Australia's largest health informatics evaluation research team, the Centre for Health Systems and Safety Research at the Australian Institute of Health Innovation.

Her work focuses on communication and technology in healthcare, and includes more than 200 publications on issues as diverse as electronic medication records management and the impact of interruptions and multitasking on medical practice.

## MINING SCHOLARSHIPS AWARDED TO SIX

Six women have won scholarships to boost the participation of young female engineers and train the female board members of the future.

Holly Kiely and Annette Au are the 2014-15 winners of the BHP Billiton–Minerals Council of Australia Women in Engineering Scholarship.

Holly is studying Mining Engineering at Curtin University and Annette is studying Mining Engineering at UNSW. Both winners have excellent academic records and a wide involvement in extracurricular activities, both on-campus and off-campus.

The BHP Billiton–MCA partnership is helping identify the next generation of talented female engineers. Now in its seventh year, the award is open to all female undergraduate engineering students studying in Australia and provides \$8000 per annum for the final two years of study. It aims to advance the role of women in the resources sector.

Holly and Annette led a field of 96 applicants for the scholarship, indicating a deep talent pool of women studying engineering disciplines.

The remaining four scholarships were awarded to women for board studies, in conjunction with BHP Billiton and Downer Mining.

The scholarships have been awarded to women working in the mining industry to enable them to complete the Australian Institute of Company Directors (AICD) Company Directors' Course during 2014. The scholarship program follows the success of last year's program which saw three women complete the Company Directors' Course in 2013.

These scholarship winners are:

- Andrea Maxey – VP Corporate Affairs and HR, AngloGold Ashanti Australia Ltd;
- Jacqui McGill – Asset President, BHP Billiton Mitsui Coal;
- Julie Shuttleworth – General Manager, FMG Cloudbreak Mine; and
- Miriam Stanborough – Project Manager, Iluka Resources Ltd.

The scholarships, each worth \$9200, are an MCA initiative to encourage more female participation in mining company boards and attracted 46 applications.

The MCA has also decided to award High Commendations and assist another seven women to complete a board readiness e-learning module offered by the AICD. They are:

- Deanna Lomas (MMG Ltd);
- Janette Hewson (Peabody Energy);
- Jo Barron-Perry (BHP Billiton);
- Lynn Olssen (Snowden);
- Helen Anderson (Seabed Geosolutions);
- Michelle Keegan (Incitec Pivot); and
- Andrea Marsland-Smith (Heathgate Resources).

## WOMEN WIN THREE NEW COLOMBO PLAN FELLOWSHIPS

Young women have been awarded three of the four New Colombo Plan Fellowships for 2014, as the highest-ranked student in each pilot location.

They were among 40 students awarded New Colombo Plan Scholarships to live, study and gain work experience in Indonesia, Japan, Singapore or Hong Kong in 2014.

The New Colombo Plan Scholarship Fellows are:

- Emma Roberts, an Australian National University (ANU) Asia-Pacific Studies and Law student, is the inaugural Yudhoyono Fellow to Indonesia and will study at Indonesia's Gadjah Mada University and the Parahyangan Catholic University and undertake an internship;
- Jason Emanuelle, a student of languages at Monash University, is the inaugural Kishi Fellow to Japan and will join a linguistics and immersion program at Osaka University; he also plans to undertake an internship in Japan;
- Rebecca Wardell, a Philosophy in Science undergraduate at ANU, is the inaugural Singapore Fellow and will study immunology and public health at the National University of Singapore and intern at the Saw Swee Hock School of Public Health; and
- Sarah Mitchell, currently undertaking a Bachelor of Arts at the University of Adelaide, is the inaugural Hong Kong Fellow and will study linguistics and history at the Chinese University of Hong Kong and undertake an internship.

The Fellowships were awarded by the Governor-General – and New Colombo Plan Patron – Sir Peter Cosgrove AK MC and the Minister for Foreign Affairs, Julie Bishop.



The NCP Fellows with Sir Peter Cosgrove and Ms Julie Bishop.

By Alan Finkel  
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# We need a better measure of impact

One way to incentivise universities and individual researchers to seek external collaborations or work for a while in industry would be to allocate 'citation equivalents' to various activities.



ILLUSTRATION: ISTOCK

Working together for better productivity.

**A**ustralian publicly funded researchers face considerable pressure to generate academic papers. Arguably, Australian taxpayers would prefer to see a higher level of commercial and social benefits arising from their investment in research.

The focus on publications means there is a misalignment of university research with industry and other end-user needs. In 2010, industry in Australia spent 70 per cent of its R&D in engineering and ICT, while universities only spent 13 per cent in these areas. Engineering and IT departments are driven by

evaluation schemes that favour employing researchers for their ability to generate papers rather than their ability to deliver practical solutions to pressing problems.

Academics who participate in industry programs such as the successful Cooperative Research Centres (CRC) struggle if their project obligations limit their ability to publish extensively. Similar issues dog researchers within organisations such as CSIRO.

The problem is exacerbated by research training and peer pressure for postgraduates being slanted towards pursuing a career in academia. This leads

to nearly 70 per cent of Australian PhD graduates working in public research institutes, unlike the US and Germany, where the majority work in industry.

At the national level, the Excellence in Research Australia (ERA) assessment exercise through which the Federal Government evaluates universities is weighted towards academic publications. It has provision to evaluate other achievements such as plant breeder's rights, patents, research commercialisation income and non-academic publications such as government reports or registered designs but there is little evidence that these have

## MATHS RANKING DOWN SHARPLY

Australia's international position in key school mathematics indicators has declined sharply, according to a confronting report by the Australian Mathematical Sciences Institute (AMSI).

The *Discipline Profile of the Mathematical Sciences 2014* report highlights strategic trends in school education, higher education, research and research training, and career prospects for graduates.

AMSI has identified three areas of critical concern.

**1** Within Australian schools around 40 per cent of Year 7 to 10 maths classes are taught without a qualified mathematics teacher.

This figure is roughly three times the international average and twice the estimated rate for Year 7 to 10 science classes, with students in

regional and low SES areas bearing the brunt. It comes at a time when 54 per cent of adult Australians have only basic numeracy skills.

**2** At the senior level, Year 12 enrolments in intermediate and advanced mathematics subjects have dropped 34 per cent over the past 18 years.

These subjects are the gateway to the quantitative professions – finance, engineering, internet security and biotechnology, as well as the mathematical sciences themselves. The steady decline has already had an impact on our future teacher workforce with many schools ceasing to offer advanced maths altogether.

**3** Women are under-represented in mathematics in schools, higher education and the workforce.

Low enrolment by girls in Year 11 and 12 mathematics continue to drive down the participation of women in the quantitative professions. At university level, female students make up only 30 per cent of

featured heavily in assessments to date.

Every department, faculty and university wants to be judged as meeting or exceeding world class in the ERA assessment, so they vigorously pursue publications almost to the exclusion of other activities. The world university rankings do not help, given their emphasis on research publications. Not surprisingly, these evaluation programs drive behaviour.

Where evaluation is applied to individuals there is concern about lost promotion opportunities if too much time is spent on activities other than generating academic papers. When considering the appointment of an academic who has spent some years in industry, universities and research institutes legitimately worry that the applicant's grant-winning ability might be compromised. Even the most successful Australian universities have very small endowments, thus they cannot afford to carry unfunded researchers no matter how brilliant they might be.

These problems impede engagement with industry and contribute to poor mobility between academia and industry, with a result that Australia rated very poorly in the recent OECD ranking of university-industry collaborations.

One way to incentivise both universities and individual researchers to seek external collaborations or work for a while in industry would be to allocate 'citation equivalents' to various activities, in the same way that the environmental impacts of greenhouse gases

such as methane and water vapour are measured based on their carbon dioxide equivalent tonnage. The fundamental purpose of citation equivalents would be to measure non-academic impact.

Citation equivalents earned could be counted in the same way as normal citations, even contributing to higher order measures such as the H-index or institutional-level evaluations such as the ERA.

In sciences and technology, citation equivalents could be calculated for issued patents, commercial contracts, licence fees, cost savings and other industry-engagement activities.

More broadly, citation equivalents could be calculated for books, opinion pieces, government submissions, community projects, time spent engaging with alumni, PhD student supervision, development of new approaches to teaching practices or establishing novel training courses.

Weighting factors would have to be agreed. For example, a national patent would only be worth a fraction of the value attributed to an issued triadic patent (US, Europe and Japan) and patents taken up and used would be rated more highly than ones that lie dormant.

A system such as this, aiming to provide impact measures for individual effort, would not be well served by labour-intensive proposals applicable to institution-level impact measurement such as case studies or expert evaluation

panels. These take a long-term view, in some cases a decade or more. The proposed citation equivalents would measure near-term achievements that would provide a lead indicator of impact.

To be successful, citation equivalents would have to be embraced not only by research institutes and universities, but by national granting agencies and ideally, international evaluation programs and databases such as Scopus, Google Scholar and Web of Science.

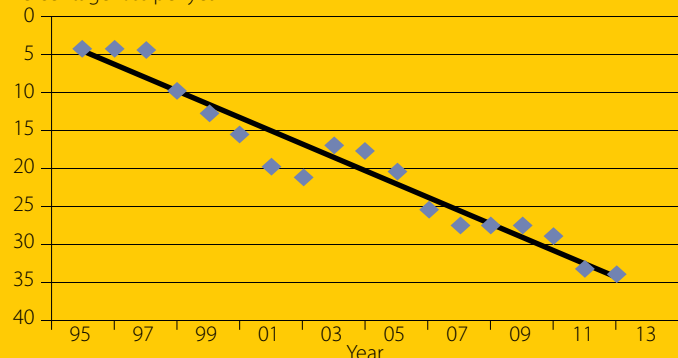
Citation equivalents could be tested at small scale and rolled out as experience is gained. With a little funding and some determination we could broaden the existing publications-focused metrics to achieve a better balance in acknowledging the highest quality basic research and the highest quality impact research.

*This article was first written for Nature.*

DR ALAN FINKEL AO FTSE is an engineer, entrepreneur and philanthropist and has served as Chancellor of Monash University since January 2008 and President of ATSE since January 2013. Dr Finkel has a passionate interest in education. He established the Australian Course in Advanced Neuroscience to provide advanced training to young scientists. He also established a secondary school science program named STELR, administered by ATSE, which is currently running in nearly 400 secondary schools around Australia. Dr Finkel currently serves as the Chairman of the Australian Centre of Excellence for All-Sky Astrophysics.

Figure 1 Percentage decline in participation in advanced mathematics at Year 12 level.

Percentage loss per year



SOURCE: FRANK BARRINGTON, YEAR 12 MATHEMATICS PARTICIPATION RATES IN AUSTRALIA, DATA COLLECTION PROVIDED TO AMSI

undergraduate and postgraduate enrolments in mathematics subjects, well below the OECD average. The adult basic numeracy of women is below that of men, around 30 per cent in some age groups.

The annual Discipline profile is accompanied by a policy brief with measures to deal with these three critical problems.

AMSI calls on Australian governments to immediately address the urgent shortage of qualified maths teachers. Measures include upgrading existing qualifications for 'out-of-field' maths teachers and engaging with school and undergraduate students to become qualified maths teachers.

To kickstart long-term improvement AMSI advocates a five-year national campaign for mathematics and statistics – targeting schools, the higher education sector and business groups – to increase participation in advanced mathematics and to address the gender imbalance.



# Hi-tech defence SMEs want better access

The best single accelerator for Australian defence exports, in particular those from innovative high technology SMEs, would be for the Australian Department of Defence to demonstrate its own belief in Australian products by genuinely opening its own procurement channels to such products.

**T**his was the key thrust of a submission by EM Solutions Pty Ltd to the Joint Standing Committee on Foreign Affairs, Defence and Trade's inquiry into Government Support for Australian Defence Industry Exports, made by EM Solutions' Managing Director Dr Rowan Gilmore FTSE. The submission applauded the apparent commitment of the Government and the Department of Defence to the success of a local industry, noting "strong enthusiasm and support" for innovative local manufacturers to succeed.

"However, we lament that the institutional support during the procurement process does not match this enthusiasm," the submission said.

"We have found the tender process to be bureaucratic, stifling of innovation and working against the success of a successful export industry, especially one based on technological innovation and value creation through intellectual property.

"Purchasing from a high technology local company seems to entail more risk than the ADF procurement system can tolerate. How then, can it be expected that other international defence forces will take the first step instead?"

The submission, however, noted several positive programs.

"The Department is unique among all Commonwealth Departments in that it offers (to our knowledge) the only

program comparable to the US SBIR Program, the Capability Technology Demonstrator (CTD) Program. The merits of the US SBIR program are so strong that we are sure the Committee will already be considering them.

"EM Solutions has been a notable beneficiary of the CTD program and it has unquestionably resulted in a new product line for us. Perversely, the abrupt cancellation of the program in 2012 stalled our project and severely impacted our ability to progress with a unique export opportunity at a critical juncture in the market, since it effectively crippled our ability to achieve 'WGS certification' (Wideband Global SATCOM system) and thus sell and export the product we had developed during an earlier phase of the program.

"We also acknowledge that the Global Supply Chain (GSC) program has provided access to key systems integrators overseas, and unique opportunities to learn from them. EM Solutions is able to export products to several European systems integrators as a result of the efforts of our sales channels there, and the added support provided by the GSC program.

"We have also been assisted by the apparent reluctance of European integrators to source components solely from the US."

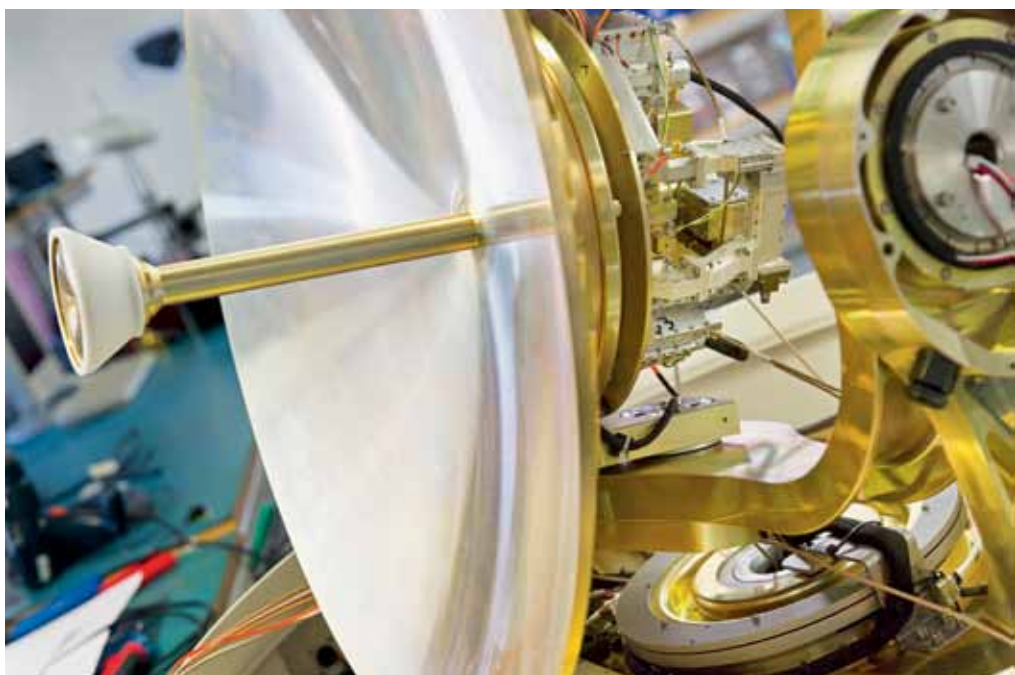
The submission suggested stronger

support for these two programs.

It also suggested new initiatives based on the premise that the easiest way to export is to demonstrate sales to home Forces first. Such initiatives should support simpler engagement between SMEs and DMO, particularly innovative SMEs such as EM Solutions that will always struggle to overcome the DMO threshold of "risk".

## THESE COULD INCLUDE:

- quarantining a portion of the DMO budget for procurement from innovative Australian SMEs;
- introducing special procedures that account for and mitigate the risk introduced when the ADF procures from local SMEs and/or innovative products;
- supporting field trials of innovative products by local SMEs before and during the tender process to overcome the perception of risk;
- allowing for presentation of innovative ideas and submissions as part of the tender process, to help build confidence in potential local suppliers; and
- breaking down into smaller parts large tenders that are typically only accessible by large international prime contractors, so that SMEs can tender sub-components on their own, and be teamed with the successful prime after the prime is chosen.



Satellite communications on-the-move terminal designed and manufactured in Australia by EM Solutions.



By Buddhima Indraratna  
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# New research will mean healthier rail tracks

We urgently need large-scale track process simulation equipment and field instrumentation schemes to understand critical geotechnical issues facing Australia's heavy haul network.



Fibre Bragg Grating sensors being installed in Singleton.



Triaxial Process Simulation Apparatus designed and built at the University of Wollongong.

**R**ailways are a primary mode of transport in Australia for both freight and commuter movement.

For ballasted tracks, the most important issues facing the rail industry include prevention of track degradation by impact and high cyclic loads, mitigation of differential settlements and undrained failure of soft foundations, and the impediments to free-drainage of track caused by the contamination of ballast along coal freight corridors.

The Centre for Geomechanics and Railway Engineering (CGRE) at the University of Wollongong is currently addressing these issues in collaboration with major rail organisations in Australia – Sydney Trains, Aurizon and the Australian Rail Track Corporation (ARTC).

A number of track innovation have evolved in collaboration with industry. For instance, the use of a Triaxial Process Simulation Apparatus (TPSA) with

movable side walls was the first of its kind designed and built in 1995 to model track deformation subjected to heavy loads and high frequencies to simulate high speed rail and freight corridor.

Over the past decade, Fibre Bragg Grating (FBG) sensors have gained increasing attention for structural sensing and health monitoring applications in the field of composites, aerospace, marine and smart structures. Condition-monitoring measures are crucial to ensure safe and cost-effective train operation in the railroad industry. FBGs are strain-measuring devices and provide many advantages over conventional metal foil strain gauges (for example, capacity to measure high strains; small and lightweight to offer negligible interference with surrounding media; and long-term stability).

Considering these benefits, FBGs have been successfully installed and are currently being used during full-scale tests conducted

in the town of Singleton, NSW – the world's first use of FBGs in rail tracks.

Real-time monitoring of transient and permanent strain response under passage of trains is carried out to evaluate the lateral track stability. This approach is verified by extensive field trials, and the preliminary results show that this provides an effective alternative for safe and reliable operating conditions for freight and passenger trains.

The development of simplified software that gives solutions accurate

enough for design is still preferred by practising engineers compared to sophisticated numerical modelling. The salient research outcomes evolved at CGRE over the past two decades have led to the development of computational software named Supplementary Methods of Analysis for Rail Track (SMART). SMART has innovative and integrated design features incorporating the roles of ballast degradation, ballast fouling and track drainage, implications on safe train speeds, potential use of recycled ballast enhanced with geosynthetics, estimation of time-dependent track degradation and the use of sub-ballast filters and artificial inclusions for increased longevity.

This makes SMART unique and more comprehensive for design and analysis than any other track software in the world. This new design software is expected to be commercialised in the near future.

Recently, the Australian Research



Council's Linkage Infrastructure Equipment and Facilities (LIEF) provided \$1.65 million in funding for collaboration between more than a dozen universities and industry to establish the National Facility for Cyclic Testing of High-Speed Rail (FCTHSR). It is the first of its kind in an academic institution. Currently being designed and built in Wollongong, it is expected to be fully operational by mid-2014.

Through extensive physical modelling

and performance monitoring, this unique facility will provide improved safety, speed and passenger comfort, as well as greater efficiency in long-distance freight mobility, to facilitate Australia's future in track modernisation.

**PROFESSOR BUDDHIMA INDRARATNA FTSE** is Professor of Civil Engineering and Founding Director of the Centre for Geomechanics and Railway Engineering at the University of

Wollongong, which is recognised as one of the world's most active and largest railway R&D units. Having pioneered rail track research in Australia in the early 1990s, he received the 2011 Engineers Australia Transport Medal. Professor Indraratna and RailCorp were jointly honoured with the Commonwealth-sponsored BHERT award for Rail Innovation in 2009 for their collaborative R&D work implemented in modern tracks. Professor Indraratna is also a node coordinator for the recently established CRC for Rail Manufacturing.

## Designing for competitive manufacturing

Australian industry is continuing its transformation to build on areas of international advantage and capitalise on new opportunities in advanced manufacturing, according to the Minister for Industry, Mr Ian Macfarlane.

The willingness of companies to embrace innovation and design would be an important part of this process, the Minister said when launching the report *Design for manufacturing competitiveness*.

"High-performing, globally competitive Australian manufacturing firms that apply design principles to all aspects of their work have common attributes – they listen to customers, suppliers and researchers, and then turn their ideas into products and services their customers want," he said.

"The Australian Government is continuing to work with businesses to put in place the new industry infrastructure to tap into Australian innovation and research, and to turn great ideas into great products that reach international markets," Mr Macfarlane said.

The report was developed by Professor Sam Bucolo, who heads the University of Technology Sydney's Design and Innovation Research Centre, and Peter King who leads the CSIRO Future Manufacturing Flagship's Design-Led Innovation initiative.

The research report will be used by the newly formed Australian Design Integration Network to run workshops for companies interested in embracing design-led innovation in 2014.

Ms Catherine Livingstone AO FTSE, a member of the Prime Minister's Business Advisory Council, said she was proud to lend her support to this important report.

"The adoption of design-led innovation must become mainstream if Australia is to

address the challenges of the country's structural economic shifts," Ms Livingstone said.

CSIRO Chief Executive, Dr Megan Clark AC FTSE, said Australian manufacturers have many opportunities to innovate and thrive. "This report, using the voice of industry, is timely and important, in helping Australian manufacturing companies explore new markets and opportunities," she said.



PHOTO: OWEN PEAKE

The Liberator's Pratt & Whitney engine.

## WARTIME B-24 LIBERATOR HERITAGE RECOGNISED

A double dose of Australian wartime heritage was recognised in July at the Werribee Satellite Aerodrome, near Melbourne, when a restored B-24 Liberator aircraft and the 96-foot span timber hangar which houses it, were awarded Engineers Australia Heritage Markers.

"The Liberator aircraft was pivotal in defending Australia against Japanese forces assembled to our north in World War II, and the American-designed hangars represented a solidification of the relationship between newly allied Australian and American forces," said Engineering Heritage Victoria Chair, Mr Owen Peake.

"Both the Liberator and the Werribee Satellite Aerodrome Hangars are last of their kind in Australia and hold historical significance for Australians.

"The B-24 Liberator features the Davis Wing, a breakthrough in aeronautical engineering design at the time. The Davis Wing allowed the B-24 Liberator to carry greater bomb loads, and to fly higher, longer and faster than other bombers of the time.

"This aircraft is the last remaining B-24 aircraft that served in the Royal Australian Air Force during World War II and has been lovingly restored to its former glory by a team of volunteers from B-24 Liberator Memorial Restoration Australia Inc."







Antennas of CSIRO's ASKAP telescope in WA.

## Australian telescope is breaking new ground

**Test results confirm that Australian radio astronomy technology, being developed as a key component of Australia's contribution to the international Square Kilometre Array (SKA) radio telescope, is breaking new ground – even though it won't be operational until next year.**

New images of the sky, made by CSIRO's Australian SKA Pathfinder (ASKAP) telescope in Western Australia, show that this 'precursor' to the much larger SKA telescope is performing superbly. The test involved making an image from nine overlapping regions of the sky captured simultaneously from 'beams' generated by 'phased array' technology. The image area measured was 50 times the size of the full moon.

The novel 'phased array feed' technology used in the ASKAP telescope has enabled it to achieve these new results, placing it well on course to achieve its ambitious science goals.

ASKAP, one of two precursor telescopes at the remote site in mid-west WA, is developing and proving ground-breaking Australian technology, which will eventually be incorporated into the SKA.

"We have broken new ground with innovative technology that will have potential applications extending far beyond radio astronomy," Federal Industry Minister, Mr Ian Macfarlane said.

"The future of radio astronomy has arrived," said Australian SKA Director Professor Brian Boyle. "Since the ASKAP telescope is still going through its commissioning stage, only six of its 36 antennas were used for the test, and only nine of the potential 36 'beams' were generated as part of the tests.

"Even at this early stage, ASKAP is able to make new images twice as fast as any comparable telescope in the southern hemisphere. When completed, ASKAP will be able to survey the sky 25 times faster still, and will be the world's premier survey telescope for centimetre-wavelength radio astronomy."

"ASKAP is now functioning properly as an aperture-synthesis telescope," said CSIRO's Dr David McConnell, who leads the ASKAP Commissioning and Early Science (ACES) team. "We've never had a telescope like this before. We can see that the novel aspects of its design really do work, and that it will outperform a conventional telescope."

The phased array feeds (PAFs) used for these commissioning tests

were so-called first-generation design. Procurement is now underway for second-generation PAFs, which tests have shown will meet their ambitious performance targets. The PAF design last year won awards for innovation from Engineers Australia and the technology is expected to find applications outside radio astronomy.

## AUSTRALIAN INSTRUMENTS REACHING FOR THE STARS

**Australian scientists have won two world-leading contracts to make astronomical instruments, which will further consolidate Australia's reputation for global innovation.**

The Australian National University's Advanced Instrumentation and Technology Centre at Mount Stromlo has been contracted to design one of the first instruments for the Giant Magellan Telescope (GMT), a super-giant Earth-based telescope being built in Chile that is set to revolutionise our view and understanding of the universe.

And EOS Space Systems, with technical support from the centre, has been selected for a commercial \$6.4 million contract from the Korean Astronomy and Space Science Institute for a laser ranging telescope to track space junk.

Launching the Mount Stromlo centre's second stage, Minister for Industry Ian Macfarlane said both contracts demonstrated that Australian astronomy was flying high in global terms.

## NEW SUPERCOMPUTER TO BOOST BoM CAPABILITIES

**The Bureau of Meteorology's new supercomputer, scheduled to begin operation in mid-2016, should provide Australia with enhanced weather forecasting services.**

Environment Minister Greg Hunt said procurement of the new supercomputer, which will ensure the continued and improved delivery of forecast and warning services, would begin before the end of this year.

"The new supercomputer will enable the Bureau to provide more accurate and localised weather information, such as the location and timing of severe thunderstorms and cyclones, improved timing and direction of wind changes in fire weather, and better flood warnings."

## BoM WEATHER GOES SMARTPHONE

**The Bureau of Meteorology has redesigned its website for smartphone users, making it quicker and easier for people to access Australia's official weather forecasts using their mobile device.**

The BoM's website is one of the most popular in Australia: it is the top-ranking government site and the top site for weather information.

"The new mobile-friendly weather website will provide smartphone users with quicker and easier access to current weather information, weather forecasts, warnings and rain radars, helping people make informed decisions and plan their day on the go," said Senator Simon Birmingham, Parliamentary Secretary for the Environment.

"The mobile weather website is the Bureau's first mobile product offering for smartphone users. The Bureau is currently developing weather apps for Microsoft Windows and Apple iOS platforms, which are scheduled to be released later this year."

CSIRO Solar Tower 2 at Newcastle in operation.

## CSIRO sets supercritical solar steam record

CSIRO has used solar energy to generate hot and pressurised 'supercritical' steam, at the highest temperatures ever achieved in the world outside of fossil fuel sources.

The world record, set in May, was at a pressure of 23.5 megapascals (a measure of force per unit area), and temperatures up to 570°C. It is the combination of pressure and temperature demonstrated at scale that makes this such a breakthrough for solar power.

The breakthrough was made at the CSIRO Energy Centre, Newcastle, home to Australia's low- emission and renewable energy research. The centre includes two solar thermal test plants featuring more than 600 mirrors (heliostats) directed at two towers housing solar receivers and turbines.

CSIRO's Energy Director Dr Alex Wonhas says this milestone was a game-changer for the renewable energy industry.

"It's like breaking the sound barrier. This step-change proves solar has the potential to compete with the peak performance capabilities of fossil fuel sources," Dr Wonhas says.

"Instead of relying on burning fossil fuels to produce supercritical steam, this breakthrough demonstrates that the power plants of the future could instead be using the free, zero-emission energy of the sun to achieve the same result."

Supercritical steam is a breakthrough for solar energy and means that one day the sun could be used to drive the most advanced power stations in the world, currently only driven by coal or gas, CSIRO says.

Supercritical solar steam is water pressurised at enormous force and heated using solar radiation. About 90 per cent of Australia's electricity is generated using fossil fuel, but only a small number of power stations are based on the more advanced supercritical steam.

Commercial solar thermal power plants around the world use subcritical steam, operating at similar temperatures but at lower pressure. If these plants were able to move to supercritical steam, it would increase the efficiency and help to lower the cost of solar electricity.

The \$9.7 million research program is supported by the Australian Renewable Energy Agency (ARENA) and is part of a broader collaboration with Abengoa Solar, the largest supplier of solar thermal electricity in the world.

## NOW IT'S POWER ROOFS FOR AUSTRALIAN HOMES

A clever new renewable energy solution combining COLORBOND® pre-painted steel sheet roofing with cutting-edge, thin-film solar panels is set to provide Australian homes with a streamlined, aesthetically pleasing rooftop energy system that captures the sun's energy as both electricity and heat.

ARENA (Australian Renewable Energy Agency) CEO Ivor Frischknecht joined Parliamentary Secretary to the Minister for Industry, Bob Baldwin, to launch the new technology at a home in Sydney in June.

The \$5 million project was undertaken by the Australian-based global building market supplier BlueScope, with \$2.3 million support from ARENA.

Mr Frischknecht says the company has specifically designed the roofing system for Australia's climate and building environments to ensure the PV systems were durable and robust.

"The old corrugated steel roof on this house in Glebe has been completely replaced with the first integrated photovoltaic (PV) thermal system in Australia, generating reliable renewable energy for the residents. A tile roof in the Illawarra region has also been replaced with the integrated PV system, demonstrating its versatility.

"These first installations are an important step as the technology moves towards commercialisation and cost competitiveness with conventional rooftop PV."

BlueScope is trying to reduce system costs through improved PV modules and roofing designs, reduced packaging and transport, improved building energy efficiency and easy, low-cost installation.

This initiative aims to make Australia a world leader in utilising low-cost solar energy in residential and commercial rooftop design. BlueScope intends the new solar roofing technology to provide a compelling value proposition compared to conventional rooftop PV systems, with a focus on the cost-effectiveness, aesthetics and energy output.

PHOTO: CSIRO

The new solar roof.



## New energy rating app released

**The Australian Government has released a free energy rating app designed to help households and businesses save money on their power bills by choosing energy efficient appliances.**

Minister for Industry Ian Macfarlane MP said the smartphone app was the first of its kind to display power use over the life of an appliance in dollars, rather than kilowatt hours.

The app uses the data from the Energy Rating Label, a joint industry and Australian Government program that has helped people buy energy-efficient appliances for more than 25 years.

To download the free Apple, android and BlackBerry versions of the Energy Rating App or use the web version for other smartphones, visit [www.energyrating.gov.au](http://www.energyrating.gov.au).

## NEW PLASMA RESEARCH FACILITY AT ANU

**The search for star power – fusion – has received a major boost with the July launch of the Australian Plasma Research Facility (APFRF) at the Australian National University. The facility includes Australia's largest fusion experiment, the newly upgraded H1, which will now be able to heat fusion experiments to temperatures hotter than the core of the sun.**

The facility also includes a new machine, MagPIE, which will accelerate research into extreme materials to be used in future experiments involving even higher temperatures and radiation levels.

The fusion of hydrogen into helium powers the Sun and the stars. If harnessed on Earth, it could provide millions of years of greenhouse-gas-free, safe, baseload power.

The H1 experiment uses strong magnetic fields to confine the hot fuel inside a doughnut-shaped vessel. The doughnut design is also the basis for the next-step fusion energy experiment, ITER, which is being built in the south of France by a global consortium of 35 nations.

ITER will have a 10-times-larger volume than any existing magnetic fusion experiment and is planned to produce 500 megawatts of power, on par with a small power station.

"ITER's design hinges on experiments being carried out in experiments around the world, such as the Plasma Fusion Research Facility at ANU," says the Director General of ITER, Osamu Motojima.

"Choice of materials for use in ITER is an active research area, to which MagPIE is already contributing, in collaboration with ANSTO, who part-funded the project," says Dr Adi Paterson FTSE, CEO of ANSTO.

"Power plant fusion plasmas present an extreme materials challenge. This facility helps us to test whether prototype new materials can withstand the heat flux damage inflicted by a fusion plasma," Dr Paterson says.

## UNDERGROUND DAMS CAN PROTECT BASIN

**Underground dams offer a promising way to make Australia's number-one food bowl, the Murray–Darling Basin, more resilient against droughts, a leading water scientist says.**

Professor Tony Jakeman, of the National Centre for Groundwater Research and Training and the Australian National University, says research in the Namoi River region of NSW shows there is good potential to store water underground during time of flood – for use in time of drought.

"It's a chance to turn 'a land of drought and flooding rains' into one that stores and uses its water endowment far more wisely," Professor Jakeman says.

His team's research also indicates it may be cheaper to store water in buried aquifers rather than in surface dams, which suffer from heavy evaporative losses as well as high construction costs.

"The Murray–Darling Basin covers one-seventh of the continent, is the nation's main food bowl, and has nationally and internationally significant natural and cultural assets. Its water resources are under particular pressure due to over-extraction of surface flows in some areas, barriers to connectivity, declines in water quality and the depletion of aquifers," Professor Jakeman says.

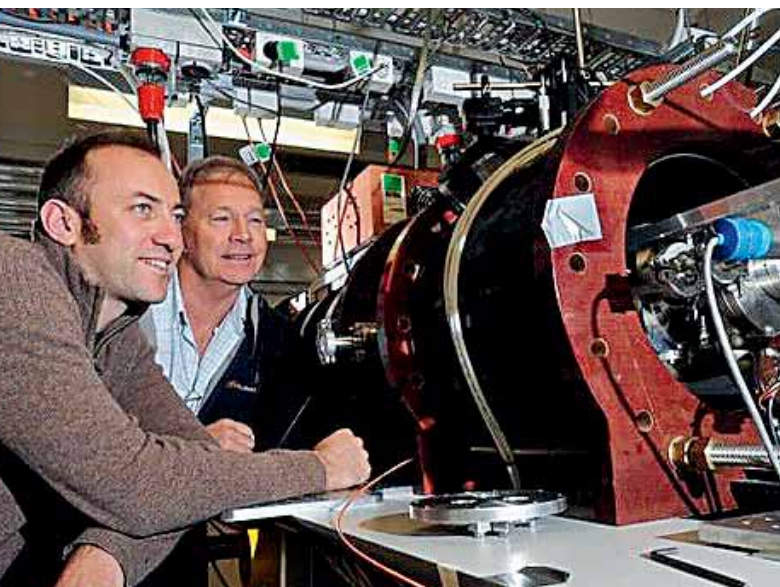
"However, our research indicates there is an opportunity to rectify some of these challenges with the use of managed aquifer recharge (MAR), or 'water banking', as it is sometimes called."

The NCGRT work in the Namoi had shown that managed aquifer recharge may be feasible at farm scale, and potentially at regional scale, that it is cost effective and that the idea of storing water underground enjoys broad community support.

"So long as you have surplus water which you could pull out of streams or rivers when there is plenty – for instance during a flood – and you have suitable aquifers to hold it, as well as suitable conditions on the surface to get it into the aquifer, then water banking should be seriously considered as an option."

Getting the water into the aquifer was usually achieved either by building a 'soak' – a depression built on suitably permeable soils, which holds water until it leaches down into the aquifer – or else by injecting it with a pump (either solar or electrical powered).

Water banking could be adopted at farm scale, in volumes suitable for supplementing irrigation supplies in a dry season, but it could also potentially be used to store water for towns, cities and industrial uses.



APFRF director Professor John Howard (right) with Dr Cormac Corr and the MagPIE.

PHOTO: GRAHAM TIDY



# NWI running for a decade

Australia's National Water Initiative has been running for more than a decade. It was first signed at the Council of Australian Governments (COAG) meeting on 25 June 2004 and represented a significant step by states and territories in addressing our nation's sometimes fragmented and parochial water management practices.



Karlene Maywald

The National Water Initiative set out a blueprint for how our water resources are to be managed and shared to support resilient communities, healthy ecosystems and economic development.

We have come a long way in our efforts. The initiative has forged a national and bipartisan approach to the way we manage, measure, plan for, price and trade water.

By putting a real value on water as a resource, the agreement has delivered sustained productivity gains for rural and urban Australians, according to the National Water Commission Chair Karlene Maywald FTSE.

In an anniversary statement, Ms Maywald said under the NWI all governments collectively agreed to take steps to improve the way we manage the nation's water resources and provide greater certainty for water users.

"So while the coming year will see the demise of the National Water Commission – established to oversee the agreement's reform actions and provide reviews – the National Water Initiative will continue to provide a proven and robust framework for water reform," she said.

"Although the full extent of our aspirations for reform is yet to be realised, as we celebrate the National Water Initiative's 10th anniversary, we should redouble our commitment to its important principles – so that it continues to guide future decisions about how to best manage Australia's valuable water resources."

The National Water Commission has released an e-book to mark the occasion and recognise some of the important water reform achievements of the past decade. The e-book – *10 years of water wins: Australia's National Water Initiative* – incorporates video interviews with the Commission's past and current Chairs as well as with industry, environmental and Indigenous leaders.

The Australian Water Association (AWA) and Water Services Association of Australia (WSAA) also applauded the work done under the National Water Initiative over the past decade. AWA Chief Executive Jonathan McKeown and WSAA Executive Director Adam Lovell said the National Water Initiative continued to provide a national focus on water, one that should not be lost with the closure of the National Water Commission later this year.

## MINING WASTEWATER INTO RAINWATER

A new technology to treat mining wastewater and reduce sludge by up to 90 per cent has been used for the first time at a commercial mine.

The technology, called Virtual Curtain, was used to remove metal contaminants from wastewater at a Queensland mine and the equivalent

of about 20 Olympic swimming pools of rainwater-quality water was safely discharged.

Sludge is a semi-solid byproduct of wastewater treatment and reducing the amount produced has huge environmental and economic benefits.

"Our treatment produced only a fraction of the sludge that a conventional lime-based method would have and allowed the mine water to be treated in a more environmentally sound way," CSIRO scientist Dr Grant Douglas says.

Given the Australian mining industry is estimated to generate hundreds of millions of tonnes of wastewater each year, the technology opens a significant opportunity for companies to improve water management practices and be more sustainable.

"The technology can produce a material high in metal value, which can be reprocessed to increase a miner's overall recovery rate and partially offset treatment costs," Dr Douglas says.

Virtual Curtain utilises hydrotalcites, which are minerals sometimes found in stomach antacids, to simultaneously trap a variety of contaminants – including arsenic, cadmium and iron – in one step. Dr Douglas and his team developed the technology after discovering that hydrotalcites could be formed by adjusting the concentrations of common wastewater contaminants aluminium and magnesium to an ideal ratio and then by increasing the pH.

"If required, the treated water can be purified much more efficiently via reverse osmosis and either released to the environment or recycled back into the plant, so it has huge benefits for mining operators in arid regions such as Australia and Chile.

"It is a more efficient and economic way to treat wastewater and is enabling the global mining industry to reduce its environmental footprint and extract wealth from waste."

The licensed technology, which can be applied to a range of industrial applications, is available through Australian company Virtual Curtain Ltd.



The new treatment in progress to remove a range of metal contaminants.



PHOTO: DARIO GRATTAPACIA, EMPRAVA

Researcher climbing *Eucalyptus* tree BRASUZ1 in Brazil, which provided the genome source for the study.

breakthroughs in engineering aspects of terpene biosynthesis into microbes such as bacteria and yeast.

"This means that in future we could use specially selected *Eucalyptus* genes in bacteria and yeasts, turning them into bio-factories to manufacture advanced biofuels on a large scale. In future, jumbo jets may take off powered by renewable, *Eucalyptus*-based fuel."

## DEAL SECURES RAFT AGENT SUPPLY

The global polymer industry should soon have access to commercial quantities of RAFT agents, following a new licensing arrangement between Boron Molecular and CSIRO, which allows Boron Molecular to manufacture and sell globally the RAFT chain transfer agents, for both R&D and commercial purposes.

CSIRO's reversible addition-fragmentation chain transfer (RAFT) technology allows users to tailor polymer properties with unprecedented control. Up to now companies have only been able to access much smaller 'research' quantities of the agent for R&D evaluation.

With access to commercial volumes of RAFT agents, it is expected that the uptake of the technology in key markets will accelerate significantly, including in the biomedical, personal care, agricultural, industrial and chemical sectors.

Dr Cathy Foley PSM FTSE, Chief of CSIRO Materials Science and Engineering, says she is very pleased to be working with Boron Molecular in the RAFT agent manufacturing space. "We are working closely with the team at Boron Molecular to enable commercial supply of RAFT agents suitable for our industry partners. They are agile and have a track record in delivering bespoke molecules and reagents to industry.

"RAFT has very broad applicability across a range of industry sectors because of the need for new and improved multifunctional polymers for many different applications," Dr Foley says.

## NATIONAL ECOSYSTEM STRATEGY LAUNCHED

The first national strategy for ecosystem science – planned to underpin Australia's future growth, sustainability and prosperity – was launched in Canberra in July by Professor Ian Chubb, the Chief Scientist of Australia.

The plan aims to ensure that Australia's managed and natural ecosystems will be in as good shape in 2035 as they are today – to support industries, native wildlife, landscapes and community wellbeing.

Among its key proposals are:

- a plan to engage the Australian public more closely in studying and protecting ecosystems;
- closer links between science and end users in industry, government and the community;
- a continent-wide monitoring system to report on the condition of Australian ecosystems;
- increased support for long-term research into the ways Australian ecosystems are changing; and
- pooling of national ecosystem research data and stronger cross-disciplinary collaborations.

## *Eucalyptus* genome unlocks new possibilities

The genetic blueprint of Australia's most iconic eucalypt – *Eucalyptus grandis* – has been unravelled, unlocking tremendous potential for this species, which is commercially grown around the world.

The news of the sequencing of the tree was published in *Nature* in June, following work by 80 researchers from 30 institutions across 18 countries over five years to sequence and analyse the 640 million base pair genome.

Professor Zander Myburg, director of the Forest Molecular Genetics Program at the University of Pretoria, was the project leader with partners in the US, Brazil, France and Australia.

"Now that we understand which genes determine specific characteristics in these trees, we can breed trees that grow faster, have higher quality wood, use water more efficiently and will cope better with climate change," Professor Myburg says.

"We can turn well-managed *Eucalyptus* plantations into bio-factories to produce specific kinds of sought-after materials and chemicals. With this new knowledge about the molecular basis for superior growth and specific adaptations in plants, we can apply the same techniques to other woody plants that can be used as feedstock in the bio-economy of the future."

Gum trees are highly adaptable and grow exceptionally fast. While native to Australia, these trees are planted worldwide, mainly for timber, pulp and paper production, but increasingly also for 'chemical cellulose' – a form of pure cellulose that is used in a wide variety of industrial products from textiles to pharmaceuticals.

Team members Dr Carsten Külheim and Professor Bill Foley, at the Australian National University, also found that among sequenced plants to date, *Eucalyptus* showed the highest diversity of genes for specialised metabolites such as terpenes. These hydrocarbons serve as chemical self-defence molecules against pests, as well as providing the familiar aromatic essential oils used in medicinal cough drops and industrial processes.

Among the family of terpene compounds naturally produced in plants and in particularly high abundance in *Eucalyptus* trees, derivatives of sesquiterpenes that contain 15 carbon atoms (diesel fuel typically contains 10 to 24 carbon atoms) may be promising alternatives for petroleum-based fuels. Researchers have already made important

By Ian Rae  
iandrae@bigpond.com



## Poisoned Planet – chemical risks

In this book Julian Cribb FTSE sets out the case that we are all being affected by industrial chemicals and suggests how we can deal with the problem and prevent its recurrence. The book is, he says, a wake-up call and is directed to a broad readership.

The first seven chapters detail the reported and supposed impacts of a range of pesticides, additives and other industrial chemicals. The chapter headings are catchy: Are you a contaminated site?, Diabolical cocktail, Sick society, Getting away with murder, Clean up society (and the Earth).

In good journalistic fashion, each begins with an example of serious harm caused by unwanted exposure to industrial chemicals (including pesticides), retracing Minimata, Seveso, Bhopal and other tragic instances. The distinction between these 'local' impacts and 'global' impacts like those of plasticisers and flame retardants that are discussed in the chapters is not made clear.

In the end, Julian's remedy is the formation of "a global network of people and institutions concerned about cleaning up the Earth to spread awareness, motivate industry to adapt clean production systems and help create citizens to become 'clean consumers'." This, I take it, is the basis for Julian's comment that "although the topic is grim, this is very much an optimistic

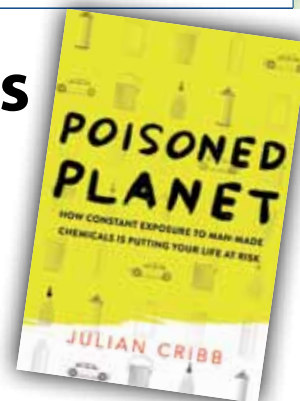
book", although no details are provided about how the masses are to be organised.

Of relevance to educators is his call for the inclusion of toxicology in chemistry courses. There is an interesting analysis of the codes of ethics that the American Chemical Society, the Royal Institute of Chemistry and the Royal Australian Chemical Society impose on their members. Whatever impact these statements might have on chemical innovators would be diluted because only 10 per cent of Australian chemists are members of RACI. The corresponding figure for Britain is 25 per cent.

In any case we could all agree with the recent comment by an American chemical engineer that "product developers need to think harder about the toxicity and biodegradability from the start" lest they keep making the same mistakes.

There is extensive referencing for the instances described in each chapter, often pointing to reviews and opinions rather than research papers, and the text is accessible via the eight-page index, which I found useful for going back for another look at key points.

This is a book of advocacy in which Julian seeks to persuade you that you are being poisoned by chemical substances, many of which are already found in our bodies and described



*Poisoned Planet: How constant exposure to man-made chemicals is putting your life at risk* by Julian Cribb (Allen & Unwin, Crows Nest, NSW, 2014. xii + 276 pp. RRP \$29.99)

evocatively as "body burden".

Advocates build their cases around real issues – and there are real issues about chemicals in the environment – and they augment them with parallel cases (the Amazon effect: people who bought that also bought this), with scare stories from the past, with imagination, exaggeration and irrelevancies. Julian's is a textbook case and it's sometimes hard to identify real risks from the material that has been added for effect.

In several places, Julian writes that the industrial chemicals in our bodies are mostly below levels of concern, but he says that not all toxic endpoints have been explored for many chemicals, and that little is known about the impact of mixtures. All true. The effort required to assess properties of new substances,

## CAN WE CONTINUE TO FEED THE WORLD?

The short answer to the question in the subtitle is on page 559. It's a qualified yes: "No calamity is foreseen – but there is no room for complacency, especially of the kind invoked by some advocates of biotechnology". It's all going to be hard grind.

The positive conclusion is based on the authors' estimate that the minimum annual progress in farm yield required to feed the world in 2050 (about 1.1 per cent) can be achieved with produce at prices close to those of 2010. A higher rate such as 1.3 per cent would "better protect against unanticipated shocks".

Dr Tony Fischer AM FTSE is an honorary research fellow at CSIRO Plant Industry, Dr Byerlee an American independent researcher and Dr Edmeades is an independent consultant in New Zealand. They drew on international data and contributions from a range of specialists who

are credited with short biographies in the closing section of the book. The Australian Centre for International Agricultural Research (ACIAR), as publisher, is supported by the Grains Research and Development Corporation (GRDC).

After the introductory material there are major chapters on wheat, rice, maize, soybeans and other crops (including sorghum and sugarcane). The influence of population, climate and culture is evident in the regional nature of cropping: China and India are leading producers of wheat and rice; the US and China lead the maize table; the US, Brazil and Argentina produce most soybeans. Australia's wheat production is 3.2 per cent of the world total, and about the same as Ukraine's.

Some minor crops are increasing rapidly – canola and cassava, for example. Maize production is variable, but the current rate of growth in



not to mention those of the thousands that were introduced under conditions that would be unacceptable today, means that the review process is very slow.

Computational methods are coming into use, and Julian mentions some work at CSIRO, but fails to note that such methods are being used in a major review of the Australian Inventory of Chemical Substances being conducted by the Australian Government agency NICNAS. Similar reviews are under way in Canada, Japan and the US, and there is the massive effort in Europe, REACH, which is mentioned.

Julian casts his chemical net wide enough to include climate change because he rightly guesses that people concerned with the long-term impact of carbon dioxide (an industrial chemical but not part of our body burden) will also buy the chemical argument. Two other recruiting ploys are Julian's view that things would be better if more women were in charge, and his blaming obesity on chemicals rather than on failure to take personal responsibility for consumption and/or irresponsibility by providers of 'fat foods'.

Julian's accounts of consumer reaction, while stopping short of the global army, show how well-informed citizens can have an impact. He mentions the consumer impact on Wal-Mart, Target and Costco in the US, who are no longer selling

products containing certain chemicals.

Some other examples of (admittedly international) consumer action can be observed locally. Most babyware now comes with prominent reassurance that it is 'BPA free' (the chemical BPA (bisphenol-a) is often found in consumer goods) and a stroll through the cookware section of a department store confronts us with 'PFOA free' labels (PFOA is a chemical used to manufacturer nonstick coatings). In these and other cases, manufacturers have responded to consumer concerns and introduced new products. Some Australian efforts are mentioned, but I looked in vain for two of our leading advocacy groups, the National Toxics Network and the Lead Group.

There are some errors that will annoy readers with some knowledge of these matters. Those with a stake in chemical production and those who might already be inclined to dismiss the whole idea will be 'picky'.

An approach that prioritised the problems using Risk = Hazard x Exposure and taking account of dose-response would have provided a more discriminating review and perhaps convinced some of the sceptics. However, people who like this sort of thing will find it's exactly what they like.

PROFESSOR IAN RAE FTSE, an Honorary Professorial Fellow at the University of Melbourne, is a former Technical Director of ATSE. He was President of the Royal Australian Chemical Institute (2006–08) and has served for more than a decade as a technical adviser to the UN Environment Program.

## TELSTRA AND NICTA LINK

**Telstra will partner with Australia's leading research institutions as part of a multi-million-dollar program to explore and collaborate on projects of mutual interest.**

The Telstra Research Partnership Program will see Telstra work with NICTA (National ICT Australia) in areas as diverse as security, privacy, smart network planning and future media delivery, and the telecommunications giant is also looking to work with Deakin University, the University of Technology, Sydney, and the George Institute on a variety of research projects.

Telstra Chief Operations Officer Kate McKenzie says the program is designed to explore opportunities flowing from technology advances and cutting-edge research that could benefit Telstra and its customers.

NICTA CEO Professor Hugh Durrant-Whyte FRS FAA FTSE says: "Innovation in information and communications technology lies at the heart of Australia's future prosperity. The partnership between Telstra and NICTA is an exciting opportunity for driving innovation in Australia and a revolution in communications between individuals, devices, businesses and industry."

The Minister for Communications, Malcolm Turnbull MP, says: "It is great to see first-class organisations like Telstra and NICTA working together to accelerate innovation. If Australia is to retain its competitive position in the global economy and support the growth of advanced, knowledge-intensive industries, partnerships like this are vital."



***Crop yields and global food security: Will yield increase continue to feed the world?* by Tony Fischer, Derek Byerlee and Greg Edmeades (ACIAR Monograph 158, 2014, xxii+ 634pp, \$85)**

wheat, rice and soybeans is only 1.0 per cent a year. Of course, there are regional differences for each of these crops and suggestions for research are directed to catch-ups for laggards.

Later chapters are devoted to techniques for increasing yield, impacts of climate change, resource use efficiency, and policies public and

private. The authors point out that 'yield' is a very complex trait and that trials of genetically engineered crops aimed at increasing yield have been disappointing outside the glasshouse. Their view is "not one of optimism for the role of GE technologies in contributing directly to increases in [yields] in the medium term", stated as 20 years.

Each of the 14 chapters begins with a list of key points and ends with a summary. A generous layout, clear font, and judicious use of shading make the content very accessible. There is no index but the detailed contents list provides pagination for headings and subheading, figures and tables (about 50 of each), boxes, maps and equations. The reference list has about 1000 entries.

This is a masterly assessment of global food security based on what is known and what can reasonably be predicted about crop yields. It is a handbook that will guide policy makers and provide a justification for research for years to come.

– IAN RAE

# ATSE IN FOCUS

## Fellows prominent in 2014 Top 100 Engineers listing

**M**ore than 25 per cent of Australia's "most influential" engineers are Fellows of ATSE, according to Engineers Australia's 2014 Top 100 Engineers listing. Six of the 26 ATSE engineers honoured are women.

Published in *EA Magazine*, the Top 100 lists engineers in 11 categories – Academia/Research, Associations, Community, Contractors/Services, Consulting, Industry, Innovation/Expertise, Manufacturing, Politics, Public Service and Utilities.

Eleven per cent of the group are women, as in 2013, while 43 per cent live in NSW, 18 per cent graduated from the University of NSW and 35 per cent are civil engineers.

ATSE dominated the **Academia/Research** listing, providing nine of the 11 names in the category: Professor John Beynon FTSE, Chair, Global Engineering Deans Council; Professor

Graham Davies FTSE, Chair Go8 Engineering Deans; Professor Hugh Durrant-Whyte FRS FAA FTSE, CEO of NICTA; Professor Peter Lee FTSE, Vice Chancellor of Southern Cross University; Professor Max Lu FTSE, Provost and Senior VP, University of Queensland; Dr Adi Paterson FTSE, CEO of ANSTO; Professor Judy Raper FTSE, Deputy Vice Chancellor Research, University of Wollongong; Professor Ian Young AO FTSE, Vice Chancellor of ANU; and Professor Alex Zelinsky FTSE, Chief Defence Scientist and CEO, DSTO.

ATSE President and Monash University Chancellor Dr Alan Finkel AO FTSE and Dr Bronwyn Evans FTSE, Chair of the Centre of Engineering Leadership and Management, were named in the **Associations** listing and Mr John Grill AO FTSE, Chair of the John Grill Centre for Project Leadership, was named in the **Community** listing.

No Fellows were named in the Contractors/Services or Consulting categories, but half those listed in the **Industry** category were – Mr Peter Coleman FTSE, MD and CEO, Woodside; Dr Bob Every AO FTSE, Chair of Wesfarmers and Boral; Ms Kathryn Fagg FTSE, Reserve Bank Director; Mr James Graham AM FTSE, Group Chief Executive, Gresham Partners; and Mr David Knox FTSE Managing Director and CEO of Santos.

Fellows also comprised half the listings in the **Innovation/Expertise** category: Professor Rose Amal FTSE, Interim Head of School, UNSW School of Chemical Engineering; Professor Kevin Galvin FTSE, Director, Centre for Advanced Particle Processing and Transport, University of Newcastle; Professor Jay Guo FTSE, Research Director, Smart Secure Infrastructure, CSIRO Digital Productivity and Services Flagship; and Professor Stuart Wenham FTSE, Director, ARC Photovoltaics and Photonics Centre of Excellence, UNSW.

ATSE's impact in other sectors was lower – no names in the Politics category and only five among 37 listings in the remaining categories.

Dr Andrew Liveris AO FTSE (Chair, President and CEO, Dow Chemical) and Dr Chris Roberts FTSE (CEO, Cochlear) were named in the 14-strong **Manufacturing** category.

In the **Public Service** listing, two ATSE Fellows were named – Professor Mary O'Kane FTSE (NSW Chief Scientist and Scientific Engineer) and Mr Jim Hallion FTSE (CEO, SA Department of Premier and Cabinet).

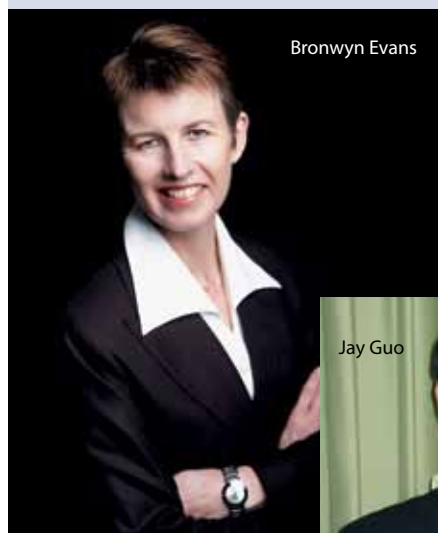
Ms Susan Murphy FTSE (CEO, WA Water Corporation) was ATSE's only name in the **Utilities** category.

Four of the five-strong 2014 selection panel were Fellows:

- Professor Paul Douglas FTSE, former CEO of SKM and Professorial Fellow, University of Melbourne;
- Professor Michael Dureau AM FTSE, Deputy chair of the Warren Centre for Advanced Engineering and an adjunct professor, University of Sydney;
- Air Vice-Marshall Julie Hammer (Retd) AM CSC FTSE, former RAAF electronics engineer and former President of EA; and
- Professor Robin King FTSE, former Chair of EA's Accreditation Board and Chair of ATSE's Education Forum.

### ROBIN BATTERHAM INDUCTED TO CAE

Former Academy president Professor Robin Batterham was inducted as a Foreign Member of the Chinese Academy of Engineering during the CAE Annual Meeting in Beijing in June. He was acknowledged for his "distinguished contributions to chemical engineering and to the promotion of China–Australia exchanges and cooperation in engineering sciences and technology".



Bronwyn Evans



Jay Guo



John Beynon



Kathryn Fagg



Graham Davies

# ATSE IN FOCUS

## Twelve Fellows named in Queen's Birthday honours

**A**cademy Fellows featured strongly in the 2014 Queen's Birthday Honours, headed by Honorary Fellow Professor the Hon Marie Bashir AC CVO FTSE, the Governor of NSW, who was named a Dame in the General Division of the Order Of Australia.

Dr Megan Clark AC FTSE, CEO of CSIRO, and Dr Barry Jones AC FAA FTSE FASSA FAHA, former Minister for Science and President of the Australian Labor Party, were both honoured as Companions in the Order of Australia.

Academy President Dr Alan Finkel AO FTSE, Chancellor of Monash University, Dr Ziggy Switkowski AO FTSE, Chair of NBNCo and Chancellor of RMIT, Professor Edwina Cornish AO FTSE, Provost of Monash University, and Emeritus Professor Ian Ritchie AO FAA FTSE, were all honoured as Officers of the Order of Australia.

Mr Richard Carter AM FTSE, former Chief Executive Officer BHP Minerals, Dr Terence Percival AM FTSE, Director, Broadband and the Digital Economy, NICTA, Professor Michael McLaughlin AM FTSE, CSIRO Fellow, CSIRO Land and Water, and Professor Michael Poole AM FTSE, Honorary Research Fellow and Consultant, CSIRO, were honoured as Members in the General Division of the Order Of Australia.

Mr Ron Spithill OAM FTSE, Director, Vodafone Hutchison Australia and Hutchison Telecommunications (Australia) Ltd, was awarded the Medal of the Order of Australia.

**Dame Marie Bashir** was recognised "for extraordinary and pre-eminent achievement and merit in service to the administration, public life, and people of New South Wales, to medicine, particularly as an advocate for improved mental health outcomes for the young, marginalised and disadvantaged, to international relations, through the promotion of collaborative health programs, and as a leader in tertiary education".

She is a medical graduate of the University of Sydney, a former medical resident officer of St Vincent's Hospital and of The Children's Hospital, and a Fellow of the Royal Australian and New Zealand College of Psychiatrists.

Dame Marie has been NSW Governor



Marie Bashir

since 2001 and will step down later this year. She is a former Chancellor of the University of Sydney (2007–13) and served in senior roles in community and mental health services in Sydney.

Prime Minister Tony Abbott said the honour "recognises a lifetime of achievement for Dame Marie in the fields of psychiatry, tertiary education, Indigenous issues, public administration and as the Governor of New South Wales".

He said she had brought warmth, compassion and grace to Australia's oldest public office.

"She has been an advocate for the disadvantaged and marginalised in the community, particularly those with mental illness. Her contribution has also lifted the quality of health care in the Asia-Pacific region, training and inspiring many medical practitioners to provide life-changing health care to so many. She has given dedicated service as Chancellor of the University of Sydney and is patron to more than 370 organisations."

Dame Marie is currently the longest serving Vice-Regal representative in Australia and has served as Administrator of the Government of the Commonwealth of Australia during absences of the Governor-General.

**Dr Megan Clark** was honoured for "eminent service to scientific research and development through fostering innovation, to science administration through strategic leadership roles, and to the development of public policy for technological sciences".

She has been CEO of CSIRO since 2009 and is a member of the Prime Minister's Science, Engineering and Innovation Council. She was a member of the Prime Minister's Task Force on Manufacturing (2012-13) and a member of the National Research Infrastructure Council (2011-12).

Dr Clark holds many appointments including as a member of the Committee for Measuring Sustainability, World Economic Forum, of the Global Commission of Sustainable Agriculture and Climate Change (2011-12) and of the Advisory Board, Ian Wark Research Institute for Particle Science, University of South Australia (2005-09). She was Vice-President, Health, Safety, Environment and Community, BHP Billiton (2008-09), and Vice-President of Technology (2003-08) and Director (1999-2003), NM Rothschilds and Sons (Australia).

**Dr Barry Jones** was honoured for "eminent service to the community as a leading intellectual in Australian public life, through contributions to scientific, heritage, musical, medical, political and public health organisations, and to the Australian Parliament".

He has been Chairman of Vision 2020 Australia since 2002 and has served as Director of the Australian Stem Cell Centre (2002-08), Board Member, Centre for Eye Research Australia (2000-12), Board Member, CARE Australia (1992-2012), Board Member, Macfarlane Burnet Institute (2000-12),



Megan Clark



# ATSE IN FOCUS

Director, Victorian Opera, (2008–) and Chair, Book Industry Strategy Group (2010–11).

Dr Jones was President, Australian and New Zealand Association for the Advancement of Science (1993) and holds professorial roles at a number of universities. He is the only member of all four Australian Learned Academies and a Fellow of both the Victorian and NSW Royal Societies. A Member of the House of Representatives for Lalor, Parliament of Australia (1977–98), he served as Minister for Science in the Hawke Government (1983–90) and was later National President of the Australian Labor Party (1992–2000 and 2005–06).

**Dr Alan Finkel** was honoured for “distinguished service to science and engineering, and to tertiary education administration, as an advocate for the protection of children, and to philanthropy”.

He has been Chancellor, Monash University, since 2008 and President of the Academy since 2013. He is known for his strategic leadership in computer redevelopment and rationalisation and for philanthropic support for medicine, education and engineering.

He is the champion of the Academy's Science and Technology Education Leveraging Relevance (STELR) program and has played leading roles in the Florey Institute of Neuroscience, the Australian Course in Advanced Neuroscience, ARC Centre for All-Sky Astrophysics and National Centre for the Prevention of Child Abuse.

**Dr Ziggy Switkowski** was honoured for “distinguished service to the community,



Ziggy Switkowski

particularly to tertiary education administration, scientific organisations and the telecommunications sector, to business, and to the arts”.

He has been Chancellor, RMIT University, since 2011 and is Chairman of NBNCo. He was Chairman of ANSTO (2007–10), Chairman, Prime Ministerial Task Force, Review of Uranium Mining Processing and Nuclear Energy in Australia (2006), CEO, Telstra Corporation (1999–2005) and CEO, Optus Communications Pty Ltd (1996–97).

Dr Switkowski was Chairman, Opera Australia (2008–13) and Chairman, Kodak Australasia (1992–96). He has been a Director of Tabcorp Holdings since 2006 and of Oil Search Ltd since 2010, and Chairman, Suncorp-Metway Ltd, since 2010.

**Professor Edwina Cornish** was honoured “for distinguished service to higher education, to advances in biotechnology and horticultural genetic modification, and through fostering of partnerships with government, industry and the community”.

She is Provost, Monash University, and has been Deputy Vice-Chancellor (Research) since 2004. She was Senior Deputy Vice-Chancellor, Monash University (2009–12) and Deputy Vice-Chancellor (Research), University of Adelaide (2000–03).

She was a Member of the National Research Infrastructure Council (2009–12), of Australia's Advisory Council on Intellectual Property (2007–12), of the National Research Priorities Standing Committee (2006–07), of the CSIRO Flagship Program Review Panel (2006) and of the National e-Research Coordinating Committee (2005–06). She served on the Board of the Australian Research Council (2001–04), of the



Edwina Cornish

CRC for Molecular Plant Breeding (2001–03), of Forestry Tasmania (2000–03) and of the CRC for Tissue Growth and Repair (2000–01).

**Professor Ian Ritchie** was honoured for “distinguished service to science in the field of chemistry and hydrometallurgy, as an academic and educator, and to fostering technical innovation in business and industry”.

He was a Foundation Member, WA Premier's Science Council (2001), a Member, Joint Minerals Council Tertiary Education Taskforce and AVCC Committee (1998–99) and a Member, Working Group, WA Minerals and Petroleum Education Research Institute (1997).

Professor Ritchie was the foundation CEO of The Parker Cooperative Research Centre for Integrated Hydrometallurgy Solutions (the Parker Centre) from July 1992, when it first opened its doors for business, until January 2001 and was the driving force behind the Parker Centre's creation.

He graduated from Cambridge University, and obtained his PhD from the University of Melbourne, subsequently lecturing there and also at the University of Western Australia and Murdoch University, where he held the Chair of Chemistry from 1984 to 2002. Professor Ritchie has made many novel discoveries in chemistry spanning an unusually wide range of research areas.

**Mr Richard Carter** was honoured for “significant service to the mining and minerals sector, to professional standards and education, and to the Uniting Church in Australia”.

He held a range of senior management roles with BHP (WA) from 1973 to 1997 including Group General Manager Iron Ore (WA) and Chief Executive Officer BHP Minerals, and Chairman, Pilbara Development Commission (1993–96). He is a former Chairman, Regional Development Council of WA; Vice-President, Victorian Minerals and Energy Council (1999–2004); President, Australasian Institute of Mining and Metallurgy (1998); and Vice-President, Minerals Council of Australia (1997).

Mr Carter has been a Member, Uniting Church in Australia (UCA), since its union in 1977; Chairman, UCA Funds Management, since 2007; Member of the Standing Committee of the Uniting Church in Australia, Synod of Victoria and Tasmania; and Chairman, Board of Prahran Mission (1998–2010).

# ATSE IN FOCUS



Michael McLaughlin

**Professor Michael McLaughlin** was honoured for "significant service to conservation and the environment, particularly through developing public policy on science-based strategies for minimising metals in the environment".

Currently a CSIRO Fellow at CSIRO Land and Water, Adelaide, he was President, Society for Environmental Toxicology and Chemistry World Council (2008–09); President, Asia-Pacific Council (2005–08); and Vice-Chair, International Union of Soil Sciences Commission (2007–10). He is a Member of the Commonwealth Fertiliser Working Group and was a Member, Queensland Water Commission Expert Advisory Panel on Water Recycling (2008–10) and President, Australian Soil Science Society, South Australian Branch (1996–98).

**Dr Terence Percival** was honoured for "significant service to science and technology through landmark developments in broadband and wireless communications".

He has been Director, Broadband and the Digital Economy, at NICTA since 2004 and before that worked at CSIRO (1991–2004), initially as Principal Research Scientist, Division of Radiophysics, and leader of the team that developed Very High Performance Wireless LAN, and co-inventor of patented Wi-Fi technology. In 2001 he led the formation

of the Centre for Networking Technologies, which developed fibre communication and broadband technologies for the delivery of health, education and business services.

**Professor Michael Poole** was honoured for "significant service to environmental science as a leader, researcher and adviser to government".

He has been an Honorary Research Fellow and Consultant at CSIRO since 2007. He was Founding Chair, Centre for Environmental and Life Sciences (1994–2006), Head, Centre for Mediterranean Agricultural Research (1994–2006) and developer, Oaten Hay Industry. He has been Board Director, Future Farm Industries CRC, since 2007.

Professor Poole is Chair of the Swan River Trust. He is a former Board Director of the CRC for Plant-Based Management of Dryland Salinity and the Legumes in Mediterranean Agriculture CRC. He is an Honorary Professorial Fellow, School of Plant Biology and Institute of Agriculture, UWA, and was Executive Director, Division of Plant Industries, Department of Agriculture and Food WA (1991–94). He is past Chair of the Australian Plant Industries Committee, the National Pasture Improvement Coordination Committee and the WA Wheat Advisory Committee.

**Mr Ron Spithill** was honoured for "service to business, particularly to the telecommunications sector".

He is widely known in the communications industry as Director, Vodafone Hutchison Australia, since 2010. He was Director, Telecom Corporation of New Zealand Ltd (Telecom) (2006–11) and Telecom Board Representative, New Zealand Communications Industry Oversight Group (2006–11).

He was Executive Vice-President and Chief Marketing Officer, Alcatel Paris (2003–06), President, Alcatel Asia-Pacific (1995–2005) and Vice-Chairman/Director, Alcatel Shanghai Bell (2003–05). He is a former President, Australian Telecommunications Industry Association; Director, Australian Electrical and Electronic Manufacturers' Association (2001); and Director, Australian Industry Group.

## NICK ARCHIBALD WAS A LEADING GEOSCIENTIST

Dr Nick Archibald, a Fellow since 2006, was recognised internationally as an outstanding geoscientist and entrepreneur who had

built several businesses with global reach.

Dr Archibald died in Perth on 9 June, aged 63.

His nomination citation described him as a "leader, innovator and entrepreneur".

It noted he was "arguably Australia's leading commercialiser of geoscience research" for mineral exploration.

"He and his companies have participated actively in R&D, principally as participants in two successive CRCs. His companies have commercialised key aspects of the research, delivering science services, technology products and innovative business models.

"His companies' technology has been acquired by over 70 companies worldwide. He and his companies have won national and international awards, including the Goldcorp Challenge in North America."

It noted he had established Geoinformatics Exploration and raised more than \$30 million to pursue a highly original exploration business model founded on the core science and technology that he had developed.

Born in Ghana, he studied at James Cook University and the University of Western Australia before working at Monash University as a Research Fellow and then as a consultant to a number of exploration companies.

He worked in increasingly senior roles with Western Mining, Minerals Estates NL, Golden Plateau NL and Jilbadgi Gold Mining Company NL through the 1980s before returning to consulting in the 1990s, when he founded Fractal Graphics Pty Ltd, which he split into Fractal Technologies and Geoinformatics.

Fractal Technologies focused on continued development of leading-edge 3D spatial data integration and management and visualisation technology, while Geoinformatics was an explorer in its own right.

Dr Archibald's technology made its mark on the international mining industry in 2001

when he partnered with another Australian consultant, Dr Vic Wall, to win the Goldcorp Challenge – an international geoscientific competition with a prize of US\$100,000, which they won from more than 100 entrants.



Nick Archibald

# ATSE IN FOCUS

## Kadambot Siddique honoured in Western Australia



Professor Siddique and his wife Almaz at the presentation.

**W**inthrop Professor Kadambot Siddique AM FTSE from The University of Western Australia won the Professions Award in the 2014 Western Australian of the Year awards. He was recognised as an international leader in crop science, dryland agriculture and food production systems.

Professor Siddique has been pivotal in assisting Australian farmers improve their agricultural productivity, and instrumental in establishing the pulse industries in WA and nationally through the development and release of chickpea, lentil and grass pea varieties with superior quality and yield.

His personal research and collaboration with others has helped Australia become one of the major grain-legume-exporting nations in the world.

Director of UWA's Institute for Agriculture, he has published more than 250 scientific papers, review articles and book chapters and is on the editorial board of a number of international scientific journals.

Over 29 years he has worked to set up international collaboration in research and teaching between WA and China, India and countries in the Middle East.

### RON HUI WINS IEEE AWARD

Professor Ron Hui FTSE will be the 2015 recipient of the William E. Newell Power Electronics Award, the Institute of Electrical &

Electronic Engineers' most prestigious award for the field of power electronics.

The citation for Professor Hui's achievement is "for contributions to power electronics applications in planar wireless charging and sustainable lighting technology".

Professor Hui is currently Chair Professor at both the University of Hong Kong and Imperial College London. At HKU, he is the Philip Wong Wilson Wong Professor of Electrical Engineering.

In 2010, Professor Hui received the IEEE Rudolf Chope R&D Award from the IEEE Industrial Electronics Society and the IET Crompton Medal from the Institution of Engineering and Technology, UK.

Professor Hui, elected in 2010, is well known for his highly innovative and visionary research with strong emphasis on energy saving and environmental protection.

His inventions underpin the key dimensions of Qi (the world's first wireless power standard) with free-positioning and local charging features. The Qi standard was launched in 2008 by the Wireless Power Consortium, which now comprises more than 210 company members worldwide.

He is also the pioneer of sustainable lighting technology that emphasises not only high energy efficiency, but also long product lifetime and recyclability. The photo-electro-thermal theory for light-emitting diode (LED) systems that he developed has become the design tool used by the lighting industry.

Professor Hui took degrees at the University of Birmingham and University College London and was on the academic staff at the University of Technology, Sydney, and the University of Sydney in the 1990s.

### GRAHAM SCHAFER MOVES TO LA TROBE

Professor Graham Schaffer FTSE will be the inaugural Pro Vice-Chancellor for the College of Science, Health and Engineering (SHE) at La Trobe University, commencing 1 October, the day the new College is planned to come into existence.

Professor Schaffer, who will head one of La Trobe's two new colleges, said he was excited by the opportunity to contribute to an ambitious university.

"I am attracted to La Trobe by the university's commitment to the local communities it serves and to educating students who can compete globally. I look forward to being part of a college where staff and students succeed, and where together we contribute to a distinctive university that we are all proud of," Professor Schaffer said.

Professor Schaffer is currently Professor of Materials and Design in the School of Mechanical and Mining Engineering at The University of Queensland, where he was Executive Dean, Faculty of Engineering, Architecture and Information Technology from 2009 to 2013.

Since 1991 Professor Schaffer has held a variety of leadership roles at UQ, primarily in the School of Engineering and the Faculty of Engineering, Physical Sciences and Architecture. Prior to this he was a Postdoctoral Fellow and Lecturer at The University of Western Australia.

Professor Schaffer is an internationally renowned expert in alloy design and the development of new materials. He is a Fellow of ATSE, Engineers Australia and the American Powder Metallurgy Institute.

In 2012 Professor Schaffer prepared a report – *Engineering Queensland: A proposal to build Queensland as a global centre of excellence for specialised engineering services* – in consultation with leading engineering, academic and government and industry authorities (see *Focus* 174).

The report, initiated by the Queensland Chief Scientist, Dr Geoff Garrett AO FTSE, and commissioned by the government, proposed a vision and a plan to sustain and further develop engineering in Queensland.



Graham Schaffer



# ATSE IN FOCUS

## Geoffrey Cook led major power bodies

**M**r Geoffrey Cook, a Fellow since 1989 and a former chairman of both the Snowy Mountains Engineering Corporation

and the State Electricity Commission of Victoria, was one of Australia's leading engineers.

He was Managing Director of John Holland Constructions, then Chief Executive of John Holland Holdings from 1971–86, when he became Chairman of both SMEC and SEC Victoria.

Mr Cook, who died in Melbourne on 10 June, aged 86, graduated in civil engineering from the University of Melbourne in 1949 and qualified as a licensed surveyor in 1951.

His nomination citation noted that, in his roles at John Holland, Mr Cook for many years led "a team of engineers who were at the forefront of technological development" in the construction industry.

He was a Fellow of the Institution of Engineers (Australia), the Institution of Civil Engineers (London) and the American Society of Civil Engineers. He was an associate of the Institute of Arbitrators, Australia, and a emeritus Trustee of the Committee of Economic Development of Australia (CEDA). He was also a Director of the Victorian State Opera, President of the National Council of YMCAs and President of the Australian Federation of Construction Contractors.

He worked briefly with a contract firm, Dowsett Engineering, before spending the majority of his working life with John Holland, starting as a Project Manager in 1955.

Under his leadership, the John Holland Group was widely respected as being at the forefront of development of new technologies for construction and design – bridges, dams, tunnels, power stations, offshore and mining works, and major buildings – for which it received many awards.



Geoffrey Cook

## GORDON LONG PIONEERED AERONAUTICS AND COMPOSITES

Dr Gordon Long FTSE, the former foundation Director of the CRC for Advanced Composite Structures, had a distinguished career in both aeronautical engineering and composite structures.

He worked in structural dynamics and aeroelasticity, unsteady aerodynamics, wind tunnel testing, fatigue testing and composite structures.

He spent 30 years in the Australian Defence Science and Technology Organisation (DSTO) – including nine years as Chief of the Structures Division, Aeronautical Research Laboratory. He spent two years at the then Royal Aircraft Establishment (RAE) in Farnborough, UK, and the last seven years of his full-time career as the Director of the CRC-ACS.

Dr Long died in Melbourne on 10 July, aged 77. He was elected a Fellow in 1994.

His Fellowship citation noted his work had a very practical focus, had been widely adopted in Australia and had saved the

Australian Defence Force "many hundreds of millions of dollars".

He worked in a wide range of disciplines encompassing most aspects of structural analysis, design and performance and "demonstrated outstanding leadership".

The AGM Michell Medal 2008 winner, Dr Long was the former President of the Australian Composite Structures Society. He was awarded the Paul Anderson Memorial prize by the Institution of Engineers London, the Walter Atkinson Memorial Prize by the Royal Institute of Naval Architects, the Lawrence Hargrave Medal by the Royal Aeronautical Society, Australian Division (RAeS) and the L.P. Coombes Medal by the Institution of Engineers, Australia.

His peers acknowledged Dr Long for his exemplary achievements in the areas of aeronautics and composite structures, with a "wonderful combination of technical excellence, local and overseas recognition of his



Gordon Long

abilities, technical foresight and leadership".

Dr Long had a first-class honours degree in Engineering (Thermodynamics) and a PhD from Queens University, Belfast.

## CHEMISTRY PIONEER HEADS AAS

Professor Andrew Holmes AM FRS FAA FTSE, an Academy Fellow since 2006 who was a pioneer in organic electronics, is the Australian Academy of Science's new President.

Professor Holmes has been recognised for his ground-breaking work on light-emitting polymers. These polymers play an important role in the newly emerging field of flexible electronics and have applications in flat-screen televisions and solar cells.

He has also been the recipient of a long list of awards including the Royal Society's Royal Medal and the Descartes Prize.

He is currently a Melbourne Laureate Professor Emeritus at the Bio21 Institute in the University of Melbourne and a CSIRO Fellow at CSIRO Materials Science and Engineering.

Professor Andrew Holmes took over from Professor Suzanne Cory at the Academy's annual general meeting in Canberra in May.

Professor Holmes became the 18th president of the AAS. Past presidents have included Sir Gus Nossal AC CBE FRS FAA FTSE.

Andrew Holmes



# ATSE IN FOCUS

## Jagadish wins Boas Medal

**P**rofessor Chennupati Jagadish FAA FTSE, Distinguished Professor and Australian Laureate Fellow from the Department of Electronic Materials Engineering in the Research School of Physics and Engineering at the Australian National University, has been awarded the Australian Institute of Physics's 2013 Boas Medal for contributions to the fields of compound semiconductor optoelectronics and nanotechnology.

His citation noted his "seminal research work in areas such as innovative materials growth, exploitation of new physics in these new materials, novel semiconductor processing to the fabrication of state-of-the-art optoelectronic devices are truly world-leading, as demonstrated by his outstanding publication record in highly prestigious international journals."



Chennupati Jagadish

avenue to recognise outstanding scientists and raise the profile of science in society.

Previous inductees into the WA Science Hall of Fame include Professor Fiona Stanley and Nobel Laureates Professor Barry Marshall and Dr Robin Warren, as well as Professor Stephen Hopper AC FTSE (2012) and Dr Bernard Bowen AM FTSE (2011), the two most recent inductees before Professor Beazley.

## LYN BEAZLEY UNVEILED

Fellow and former WA Chief Scientist Professor Lyn Beazley was officially inducted into the Western Australian Science Hall of Fame at Scitech in Perth in May when the WA Premier and Science Minister Colin Barnett unveiled her induction citation.

Mr Barnett acknowledged Professor Beazley's services to the state, including her dedication to the role of Chief Scientist of WA from 2006–13.

"Professor Beazley's ability to connect people in the science community is well recognised," he said. "She has been a passionate ambassador for Western Australian science and I thank her for her tremendous commitment to the advancement of the field in this state."

The Premier said the Hall of Fame was an important



Lyn Beazley

## PAUL ZIMMET HONOURED BY TEL AVIV UNIVERSITY

Director Emeritus of the Baker IDI Heart and Diabetes Institute, Melbourne, Professor Paul Zimmet AO FTSE, was awarded an Honorary Doctor of Philosophy by Tel Aviv University in May for his "groundbreaking, lifelong devotion to research, education and treatment of diabetes".

As well as his pioneering research in the national and international diabetes arena, Professor Zimmet has been a long-time supporter of Tel

Aviv University – he and his wife Vivien established the first diabetes research scholarships there and he has helped to foster important collaborations with Israeli researchers.

The Honorary Doctorate also recognises Professor Zimmet's leadership role in the

first national diabetes and obesity study in Australia; his research on other populations around the world providing new insights into genetics; his publications, which include more than 800 scientific papers and reviews; his acclaim throughout the world through prestigious accolades, international and national awards; and his work identifying many new genes involved in metabolic, nutritional and inflammatory pathways.

Professor Zimmet has received international recognition in raising the awareness of diabetes as an international public health emergency and that recognition has had helped to enhance the understanding of diabetes as well as improving care and prevention in many nations around the world. He has recently been appointed by the Australian Government to co-chair the Advisory Group to develop the National Diabetes Strategy.



Paul Zimmet



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**dream large**







# UQ TELEHEALTH REDUCING STRESS FOR REGIONAL FAMILIES

**UQ's Centre for Online Health is at the forefront of designing, trialling and delivering health services to regional communities.**

In partnership with Brisbane's Royal Children's Hospital, the Centre established the Queensland Telepaediatric Service (QTS), connecting Brisbane medical specialists with sick children in regional Queensland via virtual consultations. This has resulted in thousands of rural families avoiding the physical and financial burden of a trip from rural Queensland to Brisbane to see a medical specialist.

The QTS has recently reached its 20,000th consultation and is one of the largest reported services of its kind worldwide. A range of communication techniques are used to provide consultation to patients, including email, telephone and videoconferencing.

UQ's Centre for Online Health has been recognised internationally for its work in the telemedicine, telehealth

and e-healthcare fields. Combining elements of clinically focussed research, clinical service delivery and education and training, the Centre aims to produce evidence to support the development of new and sustainable health care delivery models.

The Federal Government's 2012 Excellence in Research for Australia exercise confirmed The University of Queensland as one of the nation's top two universities, measured by the quality of its comprehensive range of specialised research fields. ERA reported that research at UQ is well above world standard in more specialised fields than at any other Australian university: this reflects UQ's leading global role in many areas of discovery. UQ's outstanding critical mass offers researchers significant interdisciplinary capability.

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