

UNSW

ISSUE 1 2017

magazine

Rocket man

The scientist launching
Australia's next-generation
space program



Banning killer robots

Toby Walsh versus
autonomous weapons

Cultural warrior

The secret of Carriageworks'
artistic success

Love thy neighbour

Hugh Mackay's strategy
for national renewal

UNSW congratulates Madeline Gleeson

Madeline's book *Offshore: Behind the wire on Manus and Nauru* has won the Non-Fiction Prize in the Victorian Premier's Literary Awards



Photo: Quentin Jones

Offshore is published by NewSouth

Keep up to date with UNSW's Grand Challenge on Refugees & Migrants
at newsroom.unsw.edu.au

From the Vice-Chancellor



Welcome to the first edition of UNSW Magazine for 2017.

I'm sure that, like me, when you look into the heavens at night, the last thing you think of is space junk, but our cover story is full of it. As well as cluttering the planet with our leftovers, humanity is also littering the universe, mainly for useful causes. There are thousands of metal fragments up there, remains of old spacecraft, causing headaches for space programs, and UNSW Canberra Space is involved in building new debris-tracking systems to make space exploration less risky for future ventures.

The visionary team lead by Professor Russell Boyce is plunging ever-deeper into the unknown, developing the biggest space capability of any university in Australia. They're determined to help expand Australia's presence in the space industry, and to contribute to the global space business through collaborations with the Defence Department and other agencies.

The edition continues the science and technology theme with a fascinating but chilling article on autonomous weapons, commonly known as 'killer robots'. I get extremely edgy thinking about weapons that have 'minds' of their own. Toby Walsh is passionate about banning them, and warns that if we don't stop making them, we'll face a new *Terminator*-style arms race.

We also highlight the work in biosecurity of Professor Raina MacIntyre, Head of the School of Public Health and Community Medicine at UNSW. Raina is one of our first PLuS Alliance Fellows. And finally, we revisit the 2017 UNSW Gandhi Oration by social researcher Hugh Mackay, whose talk on community resonated strongly.

These encounters show UNSW at work in areas of crucial importance to the planet's future. I highly recommend them.

Professor Ian Jacobs

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Photo: Prudence Upton

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Cover image: Andrew Taylor

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One+One



“Dad focused on capital theory. I was interested in labour theory.”

Photo: Grant Turner/MediaKoo

Tim Harcourt, JW Nevile Fellow in the School of Economics, has written about doing business in Asia and brought economics into the everyday world. His father, **Geoff Harcourt**, is an internationally renowned economist and is Honorary Professor in the same school. They spoke to *Michael Visontay*.

Tim Harcourt was politicised early in life through his parents’ involvement with the union movement and politics. His father opposed the Vietnam War and the family house was often filled with unionists. His mother stood as an ALP candidate in South Australia in 1968.

When he came to choosing a field of study, his father’s eminence in economics – Harcourt senior had established himself as a major figure in left-wing economics at Cambridge through his 1972 book *Some Cambridge Controversies in the Theory of Capital* – shaped the son’s intellectual outlook. After graduating from the University of Adelaide with a Bachelor of Economics, Tim soon found himself working as a research officer and advocate at the ACTU.

There was one major theoretical difference between us, says Tim. “Dad focused on capital theory (means of production); I was interested in labour theory and markets.”

That platform guided Tim towards the area of trade. “When I was at the ACTU, then Secretary Bill Kelty asked me what I was interested in apart from my day job.” It was a period after Hawke and Keating had reformed the economy and the spotlight was turning to trade, with the creation of the World Trade Organization in 1995.

“I said: ‘Aboriginal affairs and international trade.’ He gave me responsibilities for both.” Trade soon became his main interest.

In 2000, after Tim had moved from the ACTU to chief economist at Austrade, he undertook research into global trade which found that exporters were more

unionised, paid higher wages, and provided better health, safety and equal employment opportunity conditions. His two areas of interest, trade and working conditions, had found common ground, just as his father had earlier with his books on capitalism and academia.

Harcourt senior says his career path was more accidental than his son’s. “I was bad at physics and chemistry, and did economics as a fill-in subject,” he says. Between an aptitude for the fill-in subject and some inspirational teachers, he gained excellent results that set him on a path to Melbourne University, then Cambridge and later Adelaide University.

He recalls his time at Cambridge with fondness, working with many leading economic thinkers, such as Joan Robinson. At Cambridge he was supervised by Ronald Henderson (who later came to Australia and wrote a landmark report into poverty in 1973, that created the ‘Henderson Poverty Line’).

After returning from Cambridge, Geoff was made an Emeritus Fellow at UNSW, where he continued to research and write. Such is his standing that in 2011, the *Cambridge Journal of Economics* held a conference in honour of his 80th birthday.

That same year, Tim moved from the public sector into academia with his appointment at UNSW. Father and son were finally united, academically. Tim says: “When I got my first job, as an economist at the Reserve Bank in the 1980s, Dad said: ‘It’s okay but it’s not academia,’ and it was the same when I worked for the ACTU and Austrade.”

In his current role as JW Nevile Fellow in the School of Economics, Tim is now in demand as a commentator on everything from politics to trade, and also enjoys engaging with the public on a popular level. His book *The Airport Economist* (2008), which was an informal companion for Australian businesses on developing new markets, has since been turned into a television show on Sky News and fittingly enough (for an airport economist) Qantas.



Left to right:
Judith Neilson;
Dean of Art & Design
Ross Harley, and
Emeritus Professor
Alec Tzannes

Generous gift establishes new research Chair

Philanthropist Judith Neilson has donated \$6 million to endow a Chair in Contemporary Art.

Philanthropist and White Rabbit Gallery founder Judith Neilson AM has made her second major donation to UNSW with the announcement of the Judith Neilson Chair in Contemporary Art.

The Professorial Chair will work between UNSW Art & Design and Sydney's internationally recognised White Rabbit Gallery to lead rigorous scholarly research.

White Rabbit Gallery is home to one of the world's most significant collections of Chinese contemporary art and UNSW Art & Design is ranked in the top 30 art and design schools in the QS

World University Rankings.

With privileged access to the White Rabbit collection, the Judith Neilson Chair in Contemporary Art will develop new knowledge and a better understanding of the global significance of China's art and culture.

UNSW Art & Design Dean, Professor Ross Harley, described the funding of the Chair in Contemporary Art, which also includes the appointment of a postdoctoral fellow, as a "transformative act of philanthropy" and a timely contribution to cultural scholarship.

"It is imperative that UNSW and Australia contribute to research and dialogue in contemporary Chinese culture internationally. Judith's visionary and generous gift ensures UNSW Art & Design students, staff and wider

communities can participate in these important conversations," Harley says. "The emergence of contemporary Chinese art over recent decades has shifted visual culture internationally and will continue to shape and transform China as a global cultural, social and economic power."

As founder and director of White Rabbit Gallery, Ms Neilson said she was motivated to make the major investment to expand the study of contemporary Chinese art in a global and historic context.

"Chinese contemporary art reflects the history and transformation of China and is a mirror on the world beyond. It is alive with ideas and energy, vibrant, often humorous, imaginative, technically superb and utterly compelling," Neilson says.

"We must give the work, the artists, and the distinctive and

shared traditions the rigorous critical attention they deserve."

Neilson has now donated \$16 million to the University. In January 2015, UNSW announced a \$10 million Judith Neilson Chair in Architecture to research the design of affordable housing for people displaced by natural disasters, geopolitical conflicts, and economic and environmental factors.

UNSW President and Vice-Chancellor Professor Ian Jacobs acknowledged Neilson's extraordinary generosity and vision. "This new Professorial Chair and Judith's gift will strengthen the growing cultural and artistic bonds between China and Australia on the world stage. UNSW is committed to building enduring and reciprocal partnerships between China and Australia encompassing culture, education, research and innovation."



Photo: Shutterstock

BRIEFS

SMART SENSING NETWORK

- Futuristic sensing technologies to tackle major challenges in agriculture, health, security, the environment and industry have been showcased at the launch of the NSW Smart Sensing Network by UNSW and the University of Sydney. Researchers announced work on smart technologies ranging from mobile phone-enabled air and water sensors to skin patches for monitoring sun exposure and techniques for audio recognition of koala mating calls.

LAW ADMISSION CHANGES

- A wider range of students will study law at UNSW this year following an overhaul of the admission process. About 300 people received an offer to the undergraduate dual law degree program based on their ATAR and their result in the new Law Admission Test (LAT). The LAT, an Australian first for undergraduate law, was designed to provide a more rounded view of applicants' skills.

POLITICAL DONATIONS ANALYSIS

- The most recent financial disclosures issued by the Australian Electoral Commission (AEC) highlight the lack of transparency around political donations, according to Dr Belinda Edwards, from the School of Humanities and Social Sciences at UNSW Canberra. Dr Edwards analysed the AEC database to identify how much party income was unaccounted for, and found that "only about 13% of the Liberal and 21% of Labor's income is transparently attributed to political donors".

UNSW has been named as one of the world's most international universities, ranked 14th by Times Higher Education (THE) in a table that assesses universities on their outward-looking characteristics.

The ranking is drawn largely from the "international outlook" pillar of the THE World University Rankings 2016–17, which covers international staff, students and co-authors. However, it also includes a measure of universities' international reputations, taken from the THE's annual Academic Reputation Survey.

UNSW's ranking in the world's top 20 puts it in the company of globally focused universities such as ETH Zurich – Swiss Federal Institute of Technology Zurich, the University of Hong Kong, King's College London, the universities of Oxford and Cambridge, and the London School of Economics.

UNSW RANKED IN TOP 20 MOST INTERNATIONAL UNIVERSITIES

At 14th, UNSW is ranked second in Australia behind the ANU, and ahead of all other Go8 universities.

Professor Ian Jacobs, UNSW President and Vice-Chancellor, welcomed the result. "You can tell a great university by the company it

keeps, and UNSW is among outstanding company in these listings," Jacobs says. "To be ranked as 14th most international university in the world reflects the commitment to global engagement in our 2025 Strategy. We aspire to be Australia's global university through pursuit of academic excellence, social engagement and global impact.

"The fact Australia scored five universities in the Top 25 most international indicates higher education in Australia is increasingly taking on the global outlook essential for the country's future prosperity."

– Steve Offner

Vice-Chancellor warns against Trump order

Professor Ian Jacobs has responded to US President Donald Trump's immigration executive order, saying higher education and research are bulwarks against ignorance.

He was among a group of university vice-chancellors in Australia who warned that President Trump's order – which temporarily bans people from seven countries

from entering the US – will threaten the global academic community.

"How can it be that the US, which has countless Nobel Prize winners and top universities, might

bar the world's best from entry, or re-entry, into its classrooms?"

asked Jacobs. "The world badly needs collaborative university research between nations."



Set the bar high and students will jump it

UNSW quantum physicist Michelle Simmons has urged young people to tackle life's hardest tasks and to strive to be the best they can be, in the 2017 Australia Day address for NSW.

Scientia Professor Simmons, the first female scientist to deliver the address in its 20-year history, said intellectual independence, innate optimism and a willingness to "give it a go" made Australia the best country in the world to do research.

But the UK-born scientist, who is leading the world in the race to build a prototype quantum computer, warned that Australia's educators were jeopardising the future by lowering student expectations.

"Great teachers with high expectations challenge their students to be the best they can be," Simmons said. "However,

equally important are the curricula they teach. "One of the few things that horrified me when I arrived in Australia was to discover that several years ago the high school physics curriculum was 'feminised'. To make it more appealing to girls, our curricula designers substituted formulae with essays.

"I see little evidence that this has made any difference and indeed I see many students complaining that the physics curriculum has left them ill-equipped for university.

"When we reduce the quality of education that anyone receives, we reduce the expectations we have of them. If we want young people to be the best they can be, we must set the bar high and tell them we expect them to jump over it."

Simmons delivered the address to an audience at the Sydney Conservatorium of Music.

Need to Know



NHMRC GRANTS SUCCESS

● Clinical trials for childhood cancer, studies into pain medicine addiction and teenagers with OCD are among UNSW projects backed by the NHMRC in the latest funding round. Executive Director of the Children's Cancer Institute and UNSW Conjoint Professor Michelle Haber (above) received a program grant for UNSW, to conduct clinical trials to treat childhood cancer neuroblastoma. It was among 11 UNSW projects that received a total of \$8.7 million.

FUTURE LEADERS

● Two young researchers working to reduce carbon emissions and to promote the design of sustainable and livable cities have been named UNSW winners of the 2017 Westpac Future Leaders Scholarships. Gurinder Nagra (below) and Elise Wood were among 22 young Australians to receive the prestigious scholarships from the Westpac Bicentennial Foundation. The \$22 million program is designed to support exceptional graduates with the potential to shape Australia's future.



AGSM RANK CLIMBS

● The Financial Times Global MBA Rankings has again recognised the AGSM as one of the top MBAs, ranked 54th in the world, up 12 places from 2016. It is one of only three Australian business schools included in the prestigious FT Ranking. The QS report also ranked the AGSM among its "global elite", placing it among the top 45 global business schools.

CLIMATE HEALTH IMPACT IGNORED

● Australia has neglected to fund research investigating the impact of climate change on human health despite the area being pinpointed by government as a priority 25 years ago, says Dr Donna Green (below) from the UNSW Climate Change Research Centre, the lead author of a paper published in *Nature Climate Change*. The paper is co-authored by Nobel Prize winner Professor Peter Doherty and former Australian of the Year Professor Fiona Stanley.



GEORGE INSTITUTE COLLABORATION

● The George Institute for Global Health and UNSW have announced their intention to collaborate on medical research. The initial focus is expected to include non-communicable diseases; clinical trials; epidemiology and biostatistics; health systems and services; and "big healthcare data". Other areas include the health of women, girls and Aboriginal and Torres Strait Islander communities.

Great aspirations

UNSW's outreach initiative ASPIRE has secured funding to roll out new regional programs. Myles Gough reports.

ASPIRE, UNSW's premier outreach program that introduces disadvantaged students to university, will roll out new projects in regional NSW after receiving \$800,000 from the federal government.

One of the projects to benefit from the National Priority Pool funds is *Uni in a Ute* which aims to offer regional Year 11 students everything they need to get them 'on the road' to the world of higher education.

"With this funding we can build on our work to date and target specific areas of need, including, coding and computer literacies for teachers and students, and online reading mentors for younger children," says Dr Ann Jardine, ASPIRE's director.

"We have been working with our regional partner schools in NSW since 2010 and have seen a steady increase in the number of students receiving offers to university," Jardine says, referring to Universities Admissions Centre data that shows a 120% increase in university offers to students from ASPIRE partner schools over six years (1,076 in 2016, up from 488 in 2010).

"Students in regional schools should not be held back from pursuing a university education because of where they live or their financial situation," she says.

Built on an evidence-based approach that emphasises an early engagement with students, ASPIRE encourages students from low SES backgrounds to interact with the university environment through multiple workshops and visits to campus. To date the program has reached nearly 50,000 students, and is now involved with 56 schools in regional and metropolitan areas.

Its unique character was recognised last year with an Australian Rural Education Award, its second national honour. In 2012, the program won a prestigious Office for Learning and Teaching Award for its

contribution to helping students from disadvantaged communities.

This year, a further \$4.5 million committed by UNSW to its AimHigh Unit for initiatives to widen access to university, will allow many more students to benefit.

These will include students like 21-year-old Winton Wu, who was first acquainted with ASPIRE while at Canterbury Boys High School in Sydney's south-west. He wanted to become a medical researcher but knew very little about how to make his dream a reality.

"ASPIRE was really invaluable for me," says Wu. "I had a misconception that I needed to study medicine to be a medical researcher. By talking to the ASPIRE ambassadors, I learned

"It's very important to break down the stigmas that stop people from low SES backgrounds achieving their dreams."

I could do a science degree. There were also events where we got to go to the university and see what students and researchers do."

Wu recently finished an advanced science degree at UNSW, specialising in molecular cell biology and microbiology. He plans to eventually complete a PhD. During his time at UNSW, he was one of 200 ASPIRE student ambassadors who collectively give more than 2,000 volunteer hours annually.

"We try to work with students to inspire them to pursue their own career aspirations. It's very important to break down the stigmas that stop people from low SES backgrounds achieving their dreams," Wu says.

Neal Reed, principal of Gilgandra High School in western NSW, agrees. He says the school's partnership with ASPIRE, which started in 2010, has been "absolutely invaluable". "It exposes rural students to ideas and experiences they might not have otherwise had," he says. "It forces them to challenge their own expectations, and gives them an opportunity to interact with education, locally and globally."

He says regional communities also benefit from having students "come back with the skills to be community-minded leaders". "From a public education perspective, this is what it's all about, enriching the lives of young people to contribute to society. This is a platform that may well be life changing."



Canterbury Boys High School students with ASPIRE ambassador Winton Wu (centre).

Photo: ASPIRE

Inequality: the challenge of our time

Photo: Michael F. Hiatt / Shutterstock.com



Professors Ros Dixon and Richard Holden will lead UNSW's newest Grand Challenge, Inequality. *Clare Morgan reports.*

As UNSW Law Professor Ros Dixon sees it, inequality is the challenge of our time. Rising inequality was a big contributor to the Brexit vote and the rise of Donald Trump, Dixon says, and she is bracing for more upheaval this year.

"Some of the most important achievements of the post-World War II era – multilateral institutions, free trade, quasi-open borders – are all under threat because people feel that their fundamental economic needs aren't being addressed," Dixon says.

"If we're going to preserve a world of mutual ties and connections, we have to think harder in democratic societies about addressing people's legitimate sense of feeling left behind and being excluded."

Dixon and Economics Professor Richard Holden, a PLuS Alliance Fellow, have been appointed to lead UNSW's latest Grand Challenge, Inequality. It joins other Grand Challenges on Climate Change (led by Scientia Professor Matthew England) and Refugees & Migration (led by Scientia Professor Jane McAdam).

Dixon says the Inequality Grand Challenge will focus on conversations about poverty, economic disadvantage and inequality, and connecting to broader trends in democratic politics. There are plans to hold two conferences this year: one on economic inequality and one on cities and inequality, "looking at the design of, and access to, urban and public spaces, schooling, housing affordability and social uses".



Top: Ros Dixon. Photo: Prudence Upton
Below: Richard Holden. Photo: Aran Anderson

Holden says: "As an economist, when I hear the word 'inequality' I instinctively think of income inequality. But it is much broader than that, and people all across UNSW work on different and important aspects of the broad concept."

They are undaunted by the huge scope of their topic. "The Grand Challenge program is meant to be a platform for all the existing excellent research that's being done within the university so it's about connecting people across faculties and giving a more public platform for ideas that are already being generated, and showcasing to public policymakers and other broader community stakeholders just how much there is going on," Dixon says.

Conduits for those ideas will include conferences and regular meet-ups, and what Dixon and Holden are calling a forum of embryonic ideas, which will "encourage academics to turn existing research ideas into policy-relevant proposals for action".

"We do this now on a large scale with [ARC] linkage grants scheme but this is about incubating ideas at an earlier and smaller stage," she says.

Any ideas will have to have a reasonable chance of implementation, Dixon says. "What that means is being realistic about the need for at least one political party to support the ideas, if not both. And ideas will need to be relatively budget neutral."

Even if ideas don't get up, just having the discussion will be a result. "Sometimes you can shift the politics simply by putting the issue on the agenda. If we helped shine a sharper light on the issue so that there were more actions taken in the public space, that would be success," Dixon says.

Disability deaths could have been avoided

A total of 732 Australian adults with an intellectual disability died in NSW over six years, many from causes or conditions that could have been avoided with more appropriate health care and monitoring.

That is the conclusion of the largest study yet conducted in Australia into the cause of death for adults with an intellectual disability (ID). The study, conducted by researchers at UNSW and published in journal *BMJ Open*, found potentially avoidable deaths at more than

Photo: Shutterstock



twice the rate of the general population.

The research also revealed many deaths were incorrectly attributed to an individual's disability, using a flawed classification system that masks the actual cause of death or health condition that may have

contributed to the death.

Study lead author and UNSW Chair in Intellectual Disability Mental Health Professor Julian Trollor says the research highlights the lack of substantial progress in addressing health inequalities experienced by adults with ID, since the initial

publication of mortality data in this group more than a decade ago.

"In a wealthy society such as ours, such a high death rate and high proportion of potentially avoidable deaths is unacceptable. We must invest more into improving the health of this group who are among our most vulnerable," Trollor says.

The study reviewed deaths among all adults aged over 20 with ID who received disability services in NSW during 2005–11 (19,362 adults). The researchers found 732 deaths at an average age of 54 years old, revealing a life expectancy 26 years shorter than the general Australian population. The deaths were then compared with a general NSW population group, using Australian Bureau of Statistics data.

– Dan Wheelahan

Brain study identifies bipolar marker

People with the highest risk of developing bipolar disorder exhibit weak connections in the emotional areas of the brain, a world-first Australian study shows.

Researchers hope the findings will lead to new tools to identify those at risk to help reduce the impact of the disorder. The study, published in the prestigious *Nature* journal *Molecular Psychiatry*, was the result of collaboration between researchers from QIMR Berghofer Medical Research Institute in Brisbane and UNSW in Sydney.

Bipolar disorder is a debilitating illness affecting about one in 70 Australians. It typically involves unstable mood swings between manic 'highs' and depressive 'lows'. The age of onset is usually between 18 and 30 years.

The teams conducted MRI scans on the brains of three groups: people who had been diagnosed with bipolar disorder; people

who had a first-degree relative (parent, sibling or child) with bipolar and who were at high genetic risk themselves; and people unaffected by bipolar disorder.

They found networks of weaker connections between different brain

“Changes in brain wiring patterns will impact upon a person’s capacity to perform key emotional and cognitive functions.”

regions in both the bipolar and high-risk subjects and disturbances in the connections responsible for regulating emotional and cognitive processes.

“We know that changes in these brain wiring patterns will impact upon a person’s capacity to perform key emotional and

cognitive functions,” says study author, Scientia Professor Philip Mitchell from UNSW’s School of Psychiatry.

“Each year we will be following up with participants who are at high genetic risk of developing bipolar disorder, to see if the brain changes identified in MRI scans reveal who will develop episodes of mania.”

Professor Michael Breakspear, from QIMR Berghofer and Brisbane’s Metro North Hospital and Health Service, says the research team hopes to use the findings to develop a way of identifying those at risk of bipolar before the onset of the disorder.

“Many people are incorrectly diagnosed with depression or other disorders. This delays the start of proper treatment with medications that are specific to bipolar, which has the highest suicide rate of any mental illness. So it’s crucial that we diagnose people correctly straight away.”

– Siobhan Barry and Dan Wheelahan

Impotence and optimism: the life of a cancer scientist

It is impossible to describe the deep frustration – impotence even – that comes with watching someone close die from a disease you have spent years researching.

It doesn't come close to the fear and turmoil of those facing their own mortality. But staring such a personal emblem of failure in the face is a special kind of torture.

A simple, entirely reasonable question from my young daughter crystallised this uncomfortable insight for me. Why couldn't I just go to the lab and make some medicine to cure her grandmother of the lung cancer slowly killing her? Yet here was their beloved Nonna dying, and there was nothing I could do.

Add to this emotional turmoil the erosion of funding, public rejection of expertise and a political climate unfriendly to science and you can see how even the most enthusiastic scientist might be sapped of motivation. What keeps us going in this climate? Medical research can be exhausting. I've seen countless colleagues sacrifice family, relationships and mental health on the dais of scientific success. We forgo time with our own families so that others less fortunate get to spend more time with theirs.

Survival rates for many cancers have been steadily increasing for years – a direct outcome of huge research efforts. The years

A medical researcher's career is one of frustration and melancholy. What keeps us going, asks *Darren Saunders*.



Photo: Shutterstock

of human life represented by those statistics is something of which we are collectively proud.

But those broad improvements aren't always reflected at the individual level, particularly for diseases like lung cancer and pancreatic cancer. When medicine runs out of answers, as it did in my family, it creates fertile ground for paleo prophets of false hope.

At the hospital with my kids' Nonna, I bit my tongue as well-meaning visitors tried to help. Who was I to criticise? As a symbol of the failure of modern medicine, my opinions no longer held any weight. Science just can't offer the same narrative of hope. A growing frustration

started to cloud my motivation with anger, impatience and sadness. I became impatient with a system that has me spending months every year writing mostly fruitless applications for research funding, wasting hours filling out useless paperwork.

Each year, Australian medical researchers spend an estimated 550 working hours applying to our federal funding scheme. This system is so stretched that less than 15 % of applications were approved in 2015.

Friends and colleagues, long frustrated by having more ideas than funding, are leaving in droves. In the past year alone, at least six colleagues have either left research or moved overseas.

How has the value of science in Australia been so undermined? The benefits aren't always immediately visible and predicting future risks is difficult. So in some ways the problem is one of near-term thinking.

Still, there is no quick fix. More funding would help but it is not the only solution. We need to convince voters and politicians to see research funding as an investment, not a cost.

Scientists have a responsibility here, too. Politicians will fund us if there are votes in it. We have to engage people with the impact of our work to reverse the erosion of confidence.

So how did I navigate my way out of the distracting, corrosive fog of introspection? Triggered by the revelations of two friends with serious illness, I found a way to harness the melancholy and anger for motivation to work harder and smarter.

And spending some time in the mountains reminded me of an important mental discipline: When skiing or riding through a forest, your body follows your mental focus – you have to train yourself to focus on the gaps, not the trees. Bouncing off trees is painful, and it stops you getting down the mountain. I realised that neither were helping me, or the people I care about.

Dr Darren Saunders is a senior lecturer in medicine at UNSW whose latest research into pancreatic cancer was published in *Cancer and Metabolism*. World Cancer Day was 4 February. A longer version of this piece first ran on ABC's *The Drum*.

Steve Meacham meets Raina MacIntyre, the professor on the front line of the fight against bio-threats.

First responder



Photo: Lee Henderson

Alex, head of disease control and bioterrorism at the Counter Terrorism Unit, is having a terrible day. An infectious disease is killing hundreds across the city, with experts insisting it is flu. Yet Alex knows it is too early in the season for the virus and wonders if it is a genetically engineered strain of avian flu?

His boss is sceptical. “What if I promise to wash my hands and cover my mouth when I cough?” the boss sneers dismissively.

This is a scene from *Pandemic*, the five-part bioterrorism drama shortlisted for four awards in Melbourne’s 2016 Web Film Festival. And note the credit line on the final episode: Story by Raina MacIntyre, David Heslop and David Muscatello.

“I already had the story for *Pandemic* in my head,” explains Professor MacIntyre, UNSW’s School of Public Health and Community Medicine head.

The Professor of Infectious Disease Epidemiology is an international leader in emerging infections and biosecurity. She

conceived the series as a teaching aid for her online course on Bioterrorism and Health Intelligence, which launched in 2015. It’s part of a new suite of programs offered by the PLuS Alliance, a formidable partnership between three of the world’s top universities – Arizona State University (ASU), King’s College London (KCL) and UNSW.

Pandemic may be a dramatisation, but its threats are real. And MacIntyre understands their magnitude. Biosecurity is at the heart of many of her 280 peer-reviewed papers.

Around 2014, she began using the phrase “biological winter” to refer to “a world full of man-made infections happening too fast to be controlled by drugs or vaccines”. It was a warning that biosecurity breaches could be just as catastrophic as nuclear war.

MacIntyre devised a risk-priority scoring system for the most severe (category A) bioterrorism agents, which won her the 2007 Sir Henry Wellcome Medal and Prize from the Association of Military Surgeons of the United States. It was a rare honour for a non-

US citizen, or military member.

Her interest in bioterrorism stems from concerns around dual-use research that is done “with the intent of helping humanity, but which can also harm – either by deliberate misuse or by accident”.

The issue exploded on the international stage in 2011 when two research groups wanted to publish their findings on how to modify an avian influenza virus so it could be transmitted between people. The researchers claimed this might enable the development of vaccines and drugs.

“That really split the scientific community,” recalls MacIntyre, who has a stance on the matter. “The risk is too great. Firstly it’s not that helpful for developing new drugs and vaccines. Second, the track record in biosafety in laboratories is not good.

“We have biological technology now that is mind-blowing in its capability. We have gene-editing that is accessible. You can engineer humans, animals, plants or pathogens or create a virus in a lab.” What’s more worrying

is governments are struggling to keep pace. “Our systems, legislation and mechanisms for dealing with these advances are stuck in the last century,” she says.

When we meet at UNSW’s Sydney campus, MacIntyre has just returned from a conference of PLS Alliance Fellows in Phoenix, where ASU is based. She was presenting the details of a new project investigating H5N1 avian influenza, and the risk factors for human-to-human forms of the highly pathogenic virus.

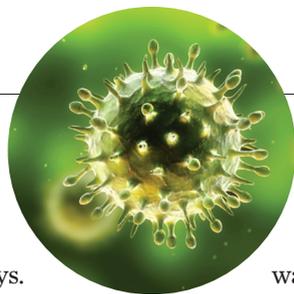
It’s among the first PLS Alliance projects to be given seed funding and is led by Matthew Scotch, an associate professor in ASU’s Department of Biomedical Informatics. MacIntyre and Dr Kathleen Steinhöfel from KCL are also collaborators.

Scotch says in MacIntyre he has found someone “who truly complements my work in the historic and geographic distribution of viruses and public health informatics”.

Part of the allure is her research impact across four areas: biosecurity, responses to emerging infectious diseases, vaccinology and personal protective equipment (PPE) for frontline health workers. “Most researchers work on one, or maybe two, of these scientific areas,” Scotch says. “Raina focuses on all four and has tremendous impact.”

Scotch and MacIntyre are among the first scholars to be named PLS Alliance Fellows. There are now around 120, drawn equally from the three universities. Fellows are encouraged to form research and education partnerships, meet frequently, and take advantage of the cross-pollination of ideas and information that comes from the partnership.

Born in Sri Lanka in 1964, MacIntyre moved with her family to Sydney, at age nine, sponsored by her uncle who was an associate professor at UNSW. At 15, she wanted to be a police officer. At 16, a chemical engineer. At 17 she wanted to be an artist. But with school’s end looming MacIntyre doubted she



could make a living creatively, so enrolled in medicine at the University of Sydney.

From her first year, MacIntyre was drawn to public health: “I was interested in whole populations. But I also wanted to do my physician training.” After graduating in 1988, MacIntyre did 10 years’ training and practice with the aim of becoming a cardiologist. But that ambition was sidelined by a fascination with epidemiology and infectious diseases, which led to a research position at the National Centre for Immunisation Research and Surveillance (NCIRS) at the Children’s Hospital in Westmead.

Europe and the US by travellers and first-responder doctors and nurses – an otherwise ambivalent world took notice.

MacIntyre was astonished that as late as 2009 there had been no clinical trials to test the efficacy of the equipment given to medical staff.

There was a huge discrepancy between the paper and cloth masks issued to staff in hospitals and field clinics, and the full-mask respirators worn by laboratory researchers. She embarked on her own study.

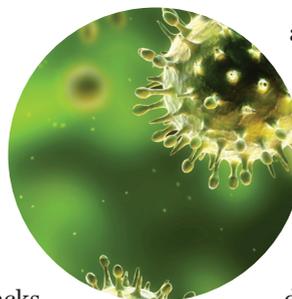
The findings, from four published clinical trials, changed conventional clinical practice and hospital guidelines: Paper masks offered minimal protection from the respiratory

“We have biological technology that is mind-blowing in its capability. You can engineer humans, animals, plants or pathogens or create a virus from scratch in a lab.”

During her 15 years with the NCIRS, she focused on vaccines and vaccine trials. She also developed a special interest in vaccination of the frail and elderly, culminating in a 2013 study that demonstrated the protective effect of the flu vaccine on preventing heart attacks.

MacIntyre has written about “the disconnect” between academia and public health practice and wants to bridge that gap. “What you are doing academically has to be relevant to ... improving the health of people.”

Perhaps surprisingly, MacIntyre’s most controversial research concerns the protective equipment worn by frontline health workers dealing with infectious diseases. When Ebola re-emerged in West Africa in 2014 the world was unprepared, and hospitals paid a heavy price – with about 60% of patients and one in 10 medical staff succumbing. When the virus began turning up outside Africa – carried to the UK,



aspects of infectious disease compared with fully sealed respirators worn in labs. Even more worrying, the research showed cloth masks could increase the risk of infection.

The findings raised eyebrows because they challenge long-held dogma. But in late 2014 during

the Ebola epidemic, the Atlanta-based Centers for Disease Control and Prevention changed its guidelines to recommend respirators rather than masks.

MacIntyre is now focused on cross-disciplinary problems in the new centre she leads on Epidemic Response. One of these is lack of adequate PPE for paramedics and law enforcement officers.

“If police do a raid on a property these days ... they should also be thinking about [the presence of] biological agents. We’ve made small inroads into raising awareness of biosecurity among first responders. But there’s a long way to go.”

Space is filling up with junk. “It’s not like there’s a storm of metal and if you venture into space you’re going to get clobbered,” says Professor Russell Boyce, Chair of Space Engineering at UNSW Canberra. “But the risk of collisions is increasing.”

The US Air Force Space Command currently tracks more than 20,000 pieces of debris larger than 10 centimetres wide. As sensors improve, Boyce suspects that number could reach more than half a million.

The remnants of old satellites and spacecraft, these metal fragments career blindly in orbit at a blistering 7.5 kilometres per second. Impacts at these hypervelocity speeds would not only render vital space assets irreparably damaged, they could trigger a domino effect of destruction referred to as the Kessler syndrome.

In this scenario, each collision would create more debris, causing ever more collisions until the space environment becomes akin to a minefield, off limits to human activity for decades or longer.

To avoid this catastrophe, researchers around the world are working to improve our abilities in space situational awareness (SSA). That is, the capability to view and accurately predict the behaviour of objects orbiting Earth.

UNSW Canberra has made a \$10 million investment over five years to establish the foundations of a next-generation Australian space program. Boyce is its leader and says the program is already reversing the brain drain in space R&D that has plagued Australia for decades.

The program recently has secured \$562,500 from the ACT government under the Key Capability Area Funding Program to build new infrastructure; is on the cusp of signing a \$10 million contract with the Department of Defence; and is quickly developing the capability to design, build and fly small satellites with “disruptive” payloads. Each will meet strategic national priorities and have specific objectives that meet national needs – ranging from climate change monitoring to secure quantum communications and SSA.

Despite international efforts to track debris, there are still sizeable gaps in our

understanding of how these objects behave in space. Depending on an object’s size or shape, tracking systems might only have “eyes” on it for seconds at a time, says Boyce. The job is to then predict the orbit and re-acquire the object down the track.

“But the uncertainties in predicting the orbits are significant. Objects can drift sideways and up and down by kilometres each day,” he says. In the rarefied atmosphere of low Earth orbit – altitudes between about 300 kilometres and 2,000 kilometres – space objects slam into various molecules, atoms and ions, with the effect building up to cause significant course deviations.

“The scientific community predicts the influence of these impacts quite badly,” says Boyce, and the result is that orbits and possible collisions are also predicted badly. This is when debris poses the greatest risk, as surveyors are unable to warn satellite operators with any certainty if their spacecraft are in the firing line.

Boyce and his team want to remove the guesswork. They have built a code to model the forces that charged ions exert on space objects. “The normal assumption is that charged particles have exactly the same effect as neutral particles such as atoms and molecules in causing drag,” says Boyce. “But that’s not true at all.

“We’re starting to open up a new field of flow physics, and to show some of the possible sources of anomalous behaviour that nobody has been able to explain before.” With a fleet of small spacecraft soon under its command, the team will be able to get “real validation data in orbit”.

THE OWNERSHIP STAKES

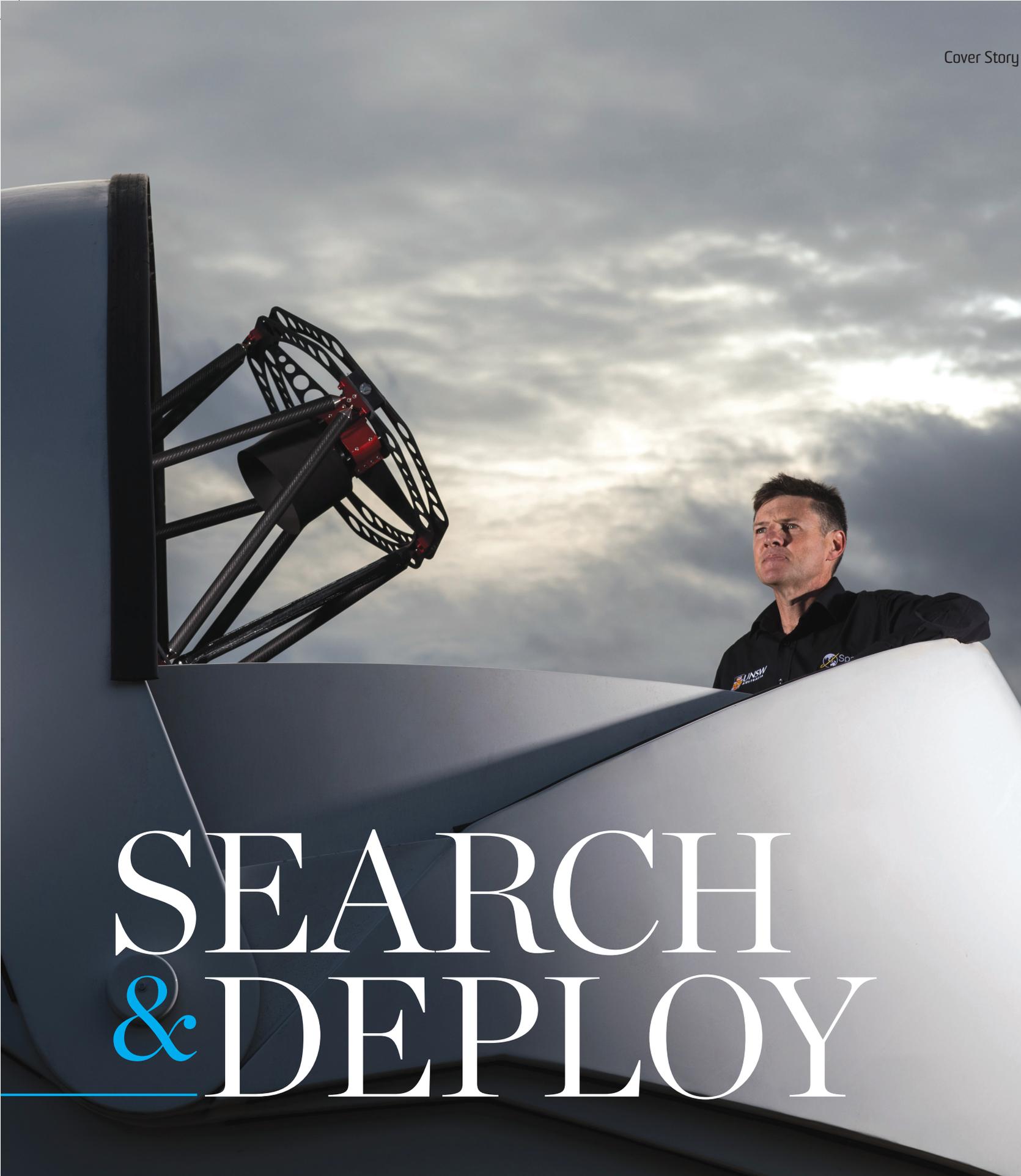
Australia relies critically on space-derived data, for everything from national security and disaster management, to environmental monitoring and resource mapping, yet it does not have sovereignty over obtaining that data, says Boyce.

“Australia is seen increasingly as freeloading in the international sector,” he says. “We get all of our data more or less for free and that has been a happy situation for us. But that is slowly coming to an end.” A domestic space capability, Boyce says,

Russell Boyce at the Falcon space surveillance telescope on the UNSW Canberra campus.

Photos: Andrew Taylor

Professor Russell Boyce is leading Australia’s largest team of space scientists and engineers in a project to harness the opportunities beckoning on the final frontier. *Myles Gough reports.*



SEARCH & DEPLOY

could open opportunities for Australia to capture part of the exploding space market, which generated an estimated US\$300 billion in worldwide revenue in 2014, according to a report by the Space Foundation.

Waking from a period of relative inaction, the federal government – in late 2015 – called for a review of the *Space Activities Act*, and has started removing regulatory hurdles that prevented Australian entities from launching satellites and operating in space. One of the first beneficiaries was a STEM education start-up called Cuberider, co-founded by UNSW engineering student Solange Cunin. In December, it launched the country's first payload to the International Space Station.

“Over the past couple of years, the national conversation in Australia about space has changed completely,” says Professor Michael Frater, UNSW Canberra Rector. “What we're seeing now, throughout government, is an understanding that it is critically important

Pieces of debris can get temporarily lost. This is when they pose the greatest risk as surveyors are unable to warn satellite operators with any certainty if their spacecraft are in the firing line.

for Australia to operate in space, both from a security point of view and economically. We take some credit for that.

“We want Australia to have a really vibrant space industry that includes significant activities in space and we want to have a leading role in making that happen.”

Two years into the five-year plan, the initiative is ahead of schedule. Boyce says: “We now have the biggest space capability of any university in the country, and the biggest space team”, including a handful of homegrown space scientists and engineers brought back from overseas. “I would say it's the most comprehensive collection of space talent in Australia for space missions, development and operation.”

Dr Tony Lindsay, who worked with the Defence Science and Technology (DST)

Group for 28 years and is now the director of Lockheed Martin's STELaRLab, says Boyce and the leadership team at UNSW Canberra have demonstrated they understand the paradigm shift in opportunities for Australia presented by the rise of small satellites.

“Their greatest virtue is they've been decisive. They realised the world was changing, that Australia had a significant level of latent capability in the area, and they've moved rapidly to take a lead position within the community. They collaborated early to take advantage of Defence's existing programs, and demonstrated they could put together a quality team in a short time.”

DISRUPTIVE CAPABILITIES

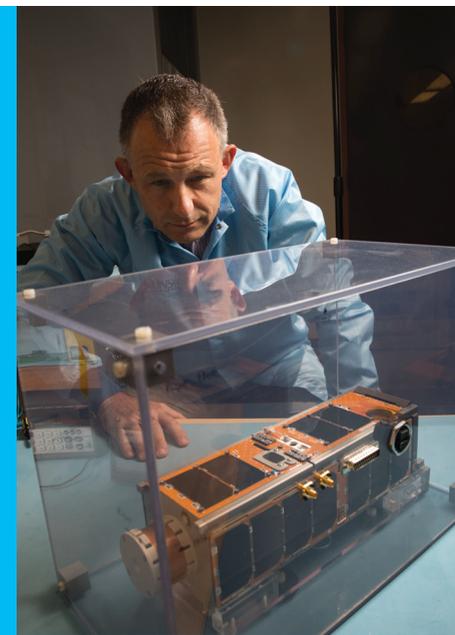
Eight spacecraft are currently planned through UNSW Canberra Space, with five fully funded. The first, set to fly in mid-2017, is part of the Buccaneer Program with the DST Group. In addition to improving SSA capabilities, this small satellite will perform calibration experiments for Australia's world-leading, over-horizon Jindalee Operational Radar Network (JORN) from low Earth orbit.

Three spacecraft are planned with the Royal Australian Air Force (RAAF), and another with the UK's RAL Space that will use special laser sensors to detect methane content in the upper atmosphere, making valuable contributions to climate science.

A development that Boyce and his team are very excited about is their roadmap to launch satellites equipped with Australian-developed quantum technologies. These include cold-atom sensors for ultra-precise measurements of time, positioning, acceleration and gravity, in development at the Australian National University (ANU), and quantum communication technologies, which will relay ultra-secure information via light, either between satellites in space, or between satellites and ground stations.

Stage one is a 'pathfinder project' with the National University of Singapore, which already has space-ready quantum hardware, says Boyce.

“Together we are setting out to be the first to demonstrate in orbit, the exchange of quantum-encrypted information from one spacecraft to another, and to see how



Compelling vision

Exile is not a word you often hear in the context of university education, but that's exactly the tag that space systems engineer Douglas Griffin (above), the spaceflight programs manager at UNSW Canberra, found himself labelled with after his PhD in hypersonics in 1995.

After receiving his doctorate from the University of Queensland, Dr Griffin was told by his supervisor, the eminent Professor Ray Stalker, that if he “wanted to stay in high tech he had to go overseas”.

“He actually used the term ‘self-imposed exile’ – because there was nothing for me in Australia,” Griffin recalls. With his sights set on space, he went to Europe and spent three years in Italy at a government lab and private firm, now owned by Thales.

In 2001 he moved to the Rutherford Appleton Laboratory (RAL Space) in the UK, where he led the development of cameras for the European Space Agency's largest astronomy space telescope, and for the agency's Solar Orbiter, which will get inside the orbits of Mercury and Venus to snap some of the most detailed images of the Sun.

It was something of a career gamble to return to Australia where “space had been non-existent” but he was compelled by “the vision that Boyce painted”.

“These are not just toy missions, done for the sake of building a spacecraft,” he says. “These are real space missions with interesting objectives.”

“Russell is a big picture person – what he does so well is inspire a vision and communicate it to people, and he gets them to buy into it. That's one of his strengths.”



far apart we can get the spacecraft and still maintain that secure link.” Pending the almost-finished feasibility study, and then securing funding, the mission could fly in 2019.

In addition to its planned missions, UNSW Canberra has launched two new degrees, a Master of Space Engineering and a Master of Space Operations. It is developing a ground station for sending and receiving quantum-encrypted communications, and is building a state-of-the-art space mission design facility. This will streamline missions, and serve as a training hub for partners from industry, government and research institutes.

“We’ll be the host of a national facility, at the front end of, hopefully, every space mission that Australia does,” says Boyce. “That puts UNSW in a very strategic position.”

THE ROAD TO CANBERRA

The skies were always beckoning for Boyce. Growing up in Papua New Guinea and Sydney, he dreamt of becoming an RAAF pilot.

When flying fighter jets was out of reach, Boyce took up a Bachelor of Science at ANU, earning the university medal in physics. He stayed on to complete a PhD in hypersonics – the science of air and spacecraft travelling significantly faster than sound, at speeds above Mach 5.

His first academic post was at UNSW Canberra starting in 2001, and he squeezed in some flight training, getting to the point of flying solo. He says the experience gave him “street cred when teaching aerodynamics to the ADFA top gun cohort”.

After nearly seven years at UNSW Canberra, Boyce took up the Chair for Hypersonics at the University of Queensland, where he would eventually become the director of SCRAMSPACE, the university’s \$14 million international program to build and test-fly a hypersonic scramjet engine.

It was a groundbreaking, yet ill-fated project. The scramjet payload launched from a Norwegian rocket range in the Arctic Circle in September 2013. Almost immediately after take-off, Boyce knew something was wrong. The rocket was supposed to carry the scramjet to an altitude of 350 kilometres, where it would begin its descent. But at just 1,500 metres the rocket began wobbling violently, bleeding a spiral of white smoke.

“When I looked up all I could see was this corkscrew pattern, and I instantly knew that was the end of the flight,” says Boyce. Minutes later, the scramjet payload took a nosedive into the frigid sea, only a few kilometres from the launch range.

The team learned in the aftermath that their test flight was hijacked by a faulty motor

in one of the rockets. The scramjet was ready to fly, evidenced by the data it collected, but a stroke of bad luck beyond the team’s control meant it was never able to hit maximum speed.

A few months before the launch, Boyce had attended a workshop as the Chair of the Australian Academy of Science’s National Committee for Space and Radio Science. The keynote speaker was the mission lead for SSA with the US Air Force Research Laboratory.

He posed that the erratic behaviour of space debris was one of the grand challenges facing the use of space, and required people to “step up” to devise a “high-fidelity, physics-based” solution.

“I found myself realising this is exactly what I do with hypersonics – it’s just with higher speeds and higher altitudes,” recalls Boyce, who then applied for the Chair of Space Engineering at UNSW Canberra and was hired to start shortly after SCRAMSPACE.

For Frater, Boyce was an obvious choice: “To direct a program like this, you need someone who is leading in terms of the research they do, but is also able to build the networks required in order to do something big and ambitious,” says Frater. “Russell is the absolute ideal person to lead the team.”

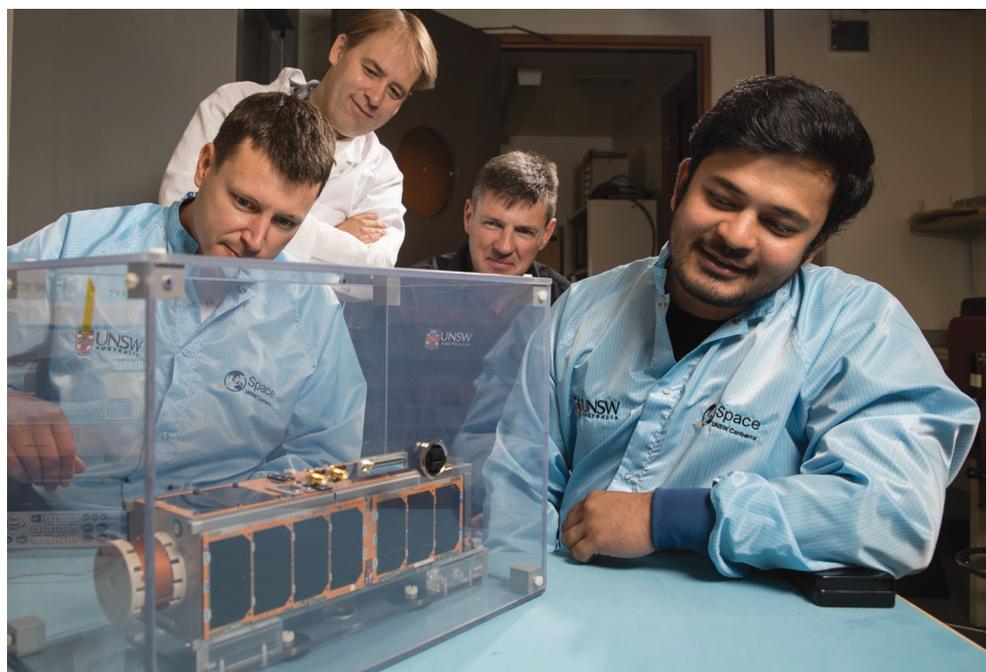
A SUSTAINABLE SPACE INDUSTRY

There is a lot riding on Boyce’s shoulders, but he only has guaranteed funding to 2019. Beyond that, he needs to make sure UNSW Canberra Space is self-sustaining.

The \$10 million windfall from Defence is encouraging, and more contracts could be in the pipeline, but there is a delicate balance to strike. While he is focusing on strategic partnerships, Boyce does not want his team to operate like a consultancy firm and risk losing intellectual property.

“We’re playing more of a long game so we can end up being more equal partners in space missions, rather than feeding from the scraps off the table,” he says. “This is about more than just UNSW Canberra or any one mission,” he says. “It’s about building a sustainable domestic space capability, being able to do it with our own hands, rather than leaving it to others.”

It’s about time.



Left to right:
Igor Dimitrijevic,
Simon Barraclough,
Professor Russell
Boyce and
Arvind Ramana

Why do elephants bellow but whales squeak like a mouse?

The bigger the animal, the deeper the sound they make. But not if they live in the water, write *Kobe Martin* and *Tracey Rogers*.

Have you ever met a really tall man who has a high-pitched voice? Did it seem odd?

We intuitively expect large mammals to have low, booming voices, while small mammals should have high-pitched, squeaky voices. The feathertail glider is a tiny marsupial weighing only as much as three teaspoons of sugar and, as you would expect, it squeaks. At the other extreme a lion prowling the African plains, intimidating his competition, has a deep booming roar.

Other mammals that are intermediate in size, such as the Tasmanian devil, have a suitably intermediate tone to their calls. The frequency of the calls made by animals tends to correlate with their body mass. This is because the larger the animal's

body, the larger their vocal apparatus.

But it is not always that simple. Our research shows aquatic mammals do not produce calls at the frequency we would expect based on their size. Rather than having a deep roar like a tiger, dolphins and toothed whales make high-frequency whistles and squeaks. To put this in perspective, the largest terrestrial mammal, the African elephant, weighs almost 4,000 kilograms and produces calls at frequencies up to 8 kHz. In contrast, the Arnoux beaked whale, which is more than twice the size of an elephant, whistles like a bird at frequencies up to 11 kHz.

It's not only the dolphins and whales that possess this ability to produce such high frequencies for their size.

Leopard seals grow to be the size of a large bull, yet when they sing underwater they produce sounds like a cricket. What is even stranger, rather than having a deeper voice as they get bigger – as most mammals do – the larger seals have a higher-pitched voice.

Previous studies have found that body mass or the environment in which an animal lives tends to influence vocalisation pitch. Recently we set out to find out what causes larger, marine mammals to have higher-pitched voices, and found it's the environment that matters most. Sound travels faster through water than air, and soundwaves attenuate less quickly and are less distorted. This means that higher-frequency sounds are able to travel farther through water than air, without the loss of important information. It is this propagation efficiency that enables aquatic mammals to use

calls of high frequencies.

But mammals also face challenges when it comes to making sound underwater.

You can't breathe and vocalise while underwater. So aquatic mammals have adapted complex respiratory systems to recycle air while vocalising, which means they do not need to surface to get another lungful of air in order to keep singing.

But there is a second problem for mammals that call underwater. When soundwaves travel from air in the vocal tract to water, a large amount of the sound is lost to scattering and attenuation. So, in aquatic mammals, the fatty tissue around the larynx is a similar density to water. High-frequency sounds are produced by recycling air back and forth through organs such as the larynx, which then passes through the fatty tissue and into the surrounding water.

The best-known case is the ability of some dolphin species to echo-locate to navigate and find prey. They have fatty melons on their heads which are very effective at transferring the ultrasonic frequencies into and from the water.

While body size still drives the frequencies produced by terrestrial mammals, bigger doesn't necessarily mean deeper when it comes to aquatic mammals. In fact, you're far more likely to hear a dolphin squeak like a mouse than roar like a lion.

Kobe Martin is a Postgraduate Researcher in Animal Behaviour and Acoustics, UNSW.

Tracey Rogers is an Associate Professor Evolution & Ecology, UNSW.

This article was originally published in *The Conversation*.

Should parents give their children alcohol?

Teenagers and alcohol – it's one of the thorniest dilemmas confronting parents. Marion Downey reports.



Photo: Shutterstock

“There is research indicating the adolescent brain is still developing into the early 20s.”

Children and teens who are given alcohol by their parents are twice as likely to be drinking full serves of alcohol by age 15 or 16, but are much less likely to binge drink, a UNSW study shows.

The four-year study of nearly 2,000 children and their parents found parental supply of alcohol doubled the likelihood the teens would be drinking full serves of alcohol a year later. Getting alcohol from other sources, such as peers or other adults, also doubled the chance of the adolescents going on to drink full serves.

But those children who got alcohol from sources other than their parents were three times more likely to binge drink. As well as being less likely to binge, the adolescents given alcohol by their parents also typically drank less on any drinking occasion than those supplied by their peers or others.

The study was prompted by widespread interest in what is known as the “European model” of introducing children to alcohol – where children are offered sips of alcohol by their parents from a young age.

UNSW Professor Richard Mattick, a lead author of the study published in the British journal *Psychological Medicine*, says

some people believe the European model is protective of later harmful drinking. “There is a body of research indicating the adolescent brain is still developing well into the early 20s and alcohol may interfere with optimum development,” says Mattick, a Principal NHMRC Research Fellow at the National Drug and Alcohol Research Centre.

“But also we know parents want to do the right thing by their children and there has been anecdotal evidence that children introduced to alcohol by their parents, as is common in some European cultures, may be less likely to develop problems with alcohol.”

Mattick and colleagues from universities in Perth and Tasmania recruited 1,927 adolescents from schools in Sydney, Perth and Tasmania and followed them for four years from Year 7.

The team measured the teenagers’ consumption of whole drinks, their binge drinking (more than four drinks on any occasion) and the source of alcohol supply – parent, peers or other adults. One parent of each child was also surveyed annually as part of the study, with the questionnaires being sent separately to avoid bias.

A number of other factors that earlier studies

have found are associated with adolescent drinking (such as family alcohol use, family structure and conflict, and individual personality traits) were taken into account.

Mattick says the results painted a nuanced and complex picture for parents. “On the one hand parents who supply alcohol to their children may be relieved that they are significantly less likely to engage in harmful behaviour, such as binge drinking, compared with those who obtain alcohol from other sources, probably as they are drinking more in front of their parents, so drink less on a given occasion,” he says.

“However, given that children supplied alcohol by their parents were twice as likely to be drinking full serves a year later as their peers who were not given alcohol by their parents, the results suggest that parents who supply alcohol, even with the best intentions, are likely to accelerate their child’s drinking and be laying down the potential for future harms.

“There may be later harms that are not yet obvious, and we are aware that early initiation of drinking is strongly associated with later alcohol use problems in adulthood – delay is the best strategy.”

KILLER ROBOTS

Autonomous weapons have moved from science fiction to become a clear and present danger. But there is still time to stop them, writes Toby Walsh.

In July 2015, thousands of researchers working in artificial intelligence (AI) and robotics united to issue an open letter calling for a pre-emptive ban on such weapons. I was one of the organisers of the letter, and I have spoken several times at the United Nations to reinforce our call for a ban.

The reason I have been motivated to do this is simple. If we don't get a ban in place, there will be an arms race. And the end point of this race will look much like the dystopian future painted by Hollywood movies like *The Terminator*.

In fact, the arms race is already underway, although it is largely undeclared. For example, the US Department of Defense has a US\$18 billion weapons program

in development and most of them are autonomous.

However, there is now considerable international political pressure for such a ban. At least 19 governments, including those of Pakistan, Mexico, Zimbabwe, Cuba and the Vatican, have formally called for a ban, and Human Rights Watch is leading a group of non-government organisations in a "Campaign to Stop Killer Robots".

In December, nine members of the US House of Congress wrote to Secretary of State John Kerry and Defense Secretary Ash Carter calling for the US to vote for a ban at a UN conference on disarmament in Geneva that month. In their letter they said lethal robots "would not simply be another weapon in the world's arsenals, but would

constitute a new method of warfare".

To give their claim an historical framework, it is important to understand we are contemplating a third revolution in the history of warfare. The first was the invention of gunpowder by the Chinese, the second was the invention of the nuclear bomb, and the third – if we let it happen – will be autonomous weapons. Each is a steep change in the speed and efficiency with which we can kill the other side.

There are many problems. One is we don't know how to build ethical robots. Another is that we don't know how to build robots that can't be hacked. That means such weapons can easily fall into the hands of terrorists and rogue nations. These people will have no qualms about

removing any safeguards, or using them against us.

And it won't simply be robots fighting robots. Conflicts today are asymmetric. It will mostly be robots against humans. Unlike what some proponents might claim, many of those humans will be innocent civilians.

But governments still have time to choose a different future. The world has decided collectively not to weaponise other technologies. We have bans on biological and chemical weapons. Most recently, we banned certain types of blinding lasers and anti-personnel mines.

These bans have not prevented related technologies from being developed. If you go into a hospital today, a 'blinding' laser will actually be used to fix your eyes. But arms companies will not sell you one. And you will not find them on any battlefield.

The same should be true for autonomous weapons. Any ban would not stop the development of the broad technology that has many other positive uses, like in autonomous vehicles.

But if we get a UN ban in place, autonomous weapons will have no place on the battlefield.

Last December in Geneva, 123 nations met for the Fifth Review Conference of the UN Convention on Certain Conventional Weapons and agreed to begin formal discussions on a possible ban of lethal, autonomous weapons. Those talks will begin in April or August, and 88 countries have agreed to attend.

Australia has led the way in many arms control negotiations – the nuclear non-proliferation treaty, and those around biological and chemical weapons. But Australian diplomats are some of the most resistant in the discussions about autonomous weapons. And we don't



“The US Department of Defense has a US\$18 billion weapons program in development and most of them are autonomous.”

have long. If these technologies get a foothold in our militaries, a Pandora's box will be opened and we won't be able to close it.

Our future is full of robots and intelligent machines. We can choose a good path, where these machines will take the sweat and we will be healthier, wealthier and happier. But if we choose another path that allows computers to make decisions that only humans should make, we risk giving up an important part of our humanity.

In his famous novel *2001, A Space Odyssey*, the novelist Arthur C. Clarke delivered one of science fiction's most prescient quotes. When the astronaut orders the onboard computer 'HAL' to disconnect itself, HAL replies: "I'm sorry, Dave. I'm afraid I can't do that." The time has come for humans to assert themselves and say to the computers: "Sorry, I can't let you do that."

Versions of this article have appeared in online publication *IEEE*, and hrw.org.

Toby Walsh is Scientia Professor of Artificial Intelligence at UNSW. Hear him discuss the issue at the Unsomnia conference unsomnia.unsw.edu.au.

HUMAN-FREE ZONE

The legal pitfalls

The difficulty of programming human traits such as reason and judgement into machines means that fully autonomous weapons would likely be unable to comply reliably with international humanitarian law.

They would be unable to make the distinction between lawful and unlawful targets, or exercise judgement about proportionality of action and reaction to the situation at hand.

A further problem is the question of accountability. Who would be held responsible for the actions of autonomous weapons? Insurmountable legal and practical obstacles would prevent holding anyone responsible for unlawful harms caused by fully autonomous weapons.

The moral issues

There is a raft of persuasive moral objections to fully autonomous weapons, most notably related to their lack of judgement and empathy, threat to dignity, and absence of moral agency. They would lack emotions, including compassion and a resistance to killing that can protect civilians and soldiers.

The military arguments

Some critics claim that military advantages would be lost with a pre-emptive ban. They argue that fully autonomous weapons could have many benefits: they could operate with greater precision than other systems, they could replace soldiers in the field and thus protect lives, they could process data and operate at greater speed than those controlled by humans, and they could also operate without a line of communication after deployment.

Finally, fully autonomous weapons could be deployed on a greater scale and at a lower cost than weapons systems requiring human control.

These characteristics, however, are not unique to fully autonomous weapons. Other weapons provide some of the same benefits. For example, semi-autonomous weapons have the potential for precision. They can track targets with comparable technology, but unlike their fully autonomous counterparts, these systems keep a human in the loop on decisions to fire.

In addition, autonomous weapons are likely to destabilise the world order once they become easy to obtain.

“ I wonder what Gandhi would have made of Australia in 2017 – a place many people who live here regard as the best country in the world.

It's true we have a robust parliamentary democracy. We have our spectacular beaches. We have a well-educated population, with unprecedented numbers of students enrolled at our universities. This is a place where we have managed to create a harmonious society out of extraordinary cultural and ethnic diversity, bringing together people from almost 200 birthplaces around the world.

Remarkable. And yet ...

All is clearly not well. We are a society in the grip of epidemics of anxiety, obesity and depression. We are further from egalitarianism than we were 50 years ago. We are showing signs of a disturbing retreat from the values of an open, tolerant society for which we were once famous.

How did this happen? Where did this edgy, anxious, too-violent society come from, this uneasy blend of arrogance and timidity?

Over the years, my research has consistently identified “loss of community” as one of the most common concerns among contemporary Australians. That concern is often expressed as a regret that local neighbourhoods are

Time to *love thy neighbours*

An extract from Hugh Mackay's Gandhi Oration

Hugh Mackay
delivers his
oration



Photo: Meja Baska

not functioning as well as they once did. “We don't know our neighbours” has become a cliché of contemporary urban life. That is never said with pride or pleasure: feeling like a stranger in your own street is bound to fuel your insecurities.

A disturbing piece of research from Edith Cowan University has shown that only 35% of Australians say they trust their neighbours. Clearly, that could not possibly mean 65% of neighbours are untrustworthy – what it must mean is that most

people in our society don't know their neighbours well enough to have learnt to trust them.

I'm not of course suggesting the erosion of our commitment to the community we live in is the sole cause of anxiety, or even the primary cause in many cases. What I am suggesting is that when we lose sight of our role as neighbours, the health of the neighbourhood suffers, and when the health of the neighbourhood suffers, we all suffer.

It's easy to complain about “the state of the nation” and to wish that a leader could make everything right. But as part of the general decline of trust in politics, our esteem for the current crop of leaders has plummeted. (Both Trump and Brexit can be partially interpreted as reactions to similar disenchantment in the US and UK.)

In one way, that might be no bad thing. It might encourage us to look differently at the situation and take matters into our own hands by embracing the idea that the state of the nation actually starts in the street where you live.

We can have a powerful influence on the state of the various communities we belong to – in the neighbourhood, the workplace, the university, the church or other faith community, the sporting association, the book club or other community organisations. How we contribute to the

National renewal starts with a smile

Actions as simple as smiling and saying hello in the supermarket can have a powerful influence on communities, according to social researcher Dr Hugh Mackay. *Clare Morgan* reports.

miniatures of life in our own family, street, suburb or town – will ultimately help to determine the big picture.

We all know how to act like neighbours when there's a crisis – floods, bushfires, storms, or horrific events like the carnage in Melbourne's Bourke Street in January. Why does it so often take a crisis to remind us of our responsibility to the other members of our community?

You think people aren't as friendly as they once were – that, especially in Sydney, avoiding eye contact with strangers has become an art form?

Then be more friendly! Start making eye contact with strangers. No, do better than that, start smiling and saying hello ... at the bus stop, in a lift, in the checkout queue, and especially in the street or apartment block where you live. You don't know your neighbours? Try knocking on the door and introducing yourself. Become the kind of person who is always alert to the possibility that someone needs your help or attention.

If enough of us start living as if this is the kind of society we want it to be, that's the kind of society it will become. As Gandhi put it: "You may never know what results come of your actions, but if you do nothing, there will be no results."

The full Gandhi Oration can be viewed at newsroom.unsw.edu.au.

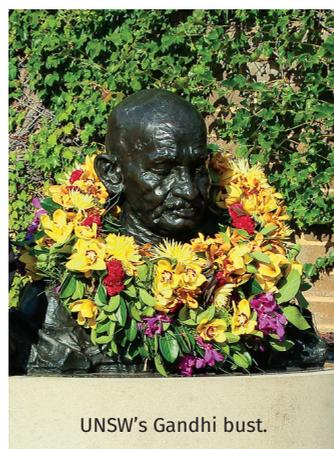
You think people aren't as friendly as they once were... Then, be more friendly," Dr Mackay told the audience in UNSW's Clancy Auditorium for the Gandhi Oration in January.

"Start making eye contact with strangers. No, do better than that, start smiling and saying hello to people at the bus stop, in the lift, in the checkout queue and especially in the street or the apartment block where you live."

The very act of engaging with others, and being alert to the possibility that someone needs your help or attention, would help to determine the big picture, he said.

Sponsored by Tata Consultancy Services, the annual Gandhi Oration commemorates India's Martyrs' Day, the anniversary of Mahatma Gandhi's assassination on 30 January 1948, and is delivered by a person whose life work exemplifies Gandhian ideals. The oration was preceded by a remembrance ceremony before the Gandhi bust on the University's library lawn.

Dr Mackay has had a 60-year career in



UNSW's Gandhi bust.

social research. For 25 years he produced a social research quarterly called *The Mackay Report*. He was a founder of the St James' Ethics Centre and is currently a patron of the Asylum Seekers Centre and an honorary professor at Charles Sturt and Wollongong universities.

Speaking on the topic *The state of the nation starts in your street*, Dr Mackay outlined how Australians are in the grip of anxiety and depression,

concerned about the state of contemporary Australia and feeling powerless in the face of events here and overseas.

Rising income inequality, declining respect for institutions and those who lead them, the rate of technological change, the loneliness born of shrinking households, the scramble for privacy and security in high-rise living, and the isolation wrought by our reliance on electronic communication all exerted great pressure on the stability and cohesiveness of communities, Dr Mackay said. As a result, "we are showing signs of a disturbing retreat from the values we were once famous for".

But rather than relying on leaders, who many have lost faith in and no longer trust, it is up to individuals to engage with the life of the local community and become good neighbours.

"We can have a powerful influence on the communities we belong to," he said. "How we contribute to these miniatures will help to determine the big picture."

"We can have a powerful influence on the communities we belong to. How we contribute to these miniatures will help to determine the big picture."

If you're not scared you're not doing your job," says Lisa Havilah as she stands in one of the cavernous, warehouse spaces at Carriageworks. She glances at her phone which pings constantly and raises her voice above the noise of yet another train barrelling past.

"To me being scared means making sure you're working outside of not just your comfort zone, but your capacity, and continually taking risks."

This daunting work ethic, combined with a love of the unknown, has helped Havilah transform the sprawling Carriageworks near Sydney's Redfern Station – once considered the white elephant of the city's cultural sector – into a thriving contemporary multi-arts centre commissioning and presenting work across music, dance, performance and visual arts.

The building, with its magnificent history and expansive spaces, has been Havilah's workplace for the past five years. Under her direction, an impressive line-up of new and established artists has performed and exhibited in its theatres and galleries.

Björk premiered her virtual reality project *Björk Digital* here, allowing Sydneysiders to

virtually tour the singer's mouth, while French choreographer Olivier Dubois' dramatic Australian premiere of *Tragédie*, involving 18 naked dancers writhing in synchronicity, brought an entirely different energy to the space.

But the big international acts are only one part of Carriageworks' artistic program. Havilah is also committed to making sure the artists selected by the cultural institution reflect the history and the future of the local community.

"This building has an incredible history of inclusion and access," she says, stepping across one of the old railway lines that weave through the building.

"In the late 1800s, 6,000 railway workers were employed here every day, many of whom were migrants, and it was one of the first workplaces in NSW to employ Indigenous Australians on an equal basis. Our artistic program directly reflects that social and cultural diversity, with a focus on engaging new communities."

She says more than 70% of the artists who took part in the 2016 Carriageworks' artistic program were from culturally diverse backgrounds. "It's one of the highest percentages of any

Cultural Warrior

Carriageworks Director Lisa Havilah has turned the historic artspace into one of Australia's most exciting cultural institutions. The UNSW graduate tells *Fran Strachan* about her greatest motivation – fear.

Photos: Nick Cubbin

cultural institution in Australia," she says.

A graduate of UNSW's Master of Arts Administration, Havilah has long been committed to social equity and inclusion. As an emerging visual artist she co-founded Wollongong's Project Contemporary Artspace out of frustration that there was nowhere for local talent to exhibit. She then worked in Sydney's culturally diverse western suburbs for more than a decade as Assistant Director of Casula Powerhouse Arts Centre and then Director of Campbelltown Arts Centre, where she pioneered new approaches to how cultural institutions engage with local communities.

"There's a lot changing across the arts and cultural sector – the historical silos and ways of working have broken down. The public and private are merging and cultural institutions need to become more entrepreneurial. Artists are already beginning to work that way and institutions need to follow suit.

"Connecting artists with local

Clockwise from right: Lisa Havilah; Nick Cave, *HEARD•SYD*, Carriageworks, 2016; Lisa Havilah in *Naya Wa Yugali – We Dance*, NAISDA 40th anniversary, Carriageworks, 2016.

communities to try and reflect the demographic and social issues of the area has always been my priority," she says. "One of the most important things I learned working in western Sydney is that as a curator, you can't just dip in and out of an artist's practice – it has to be ongoing. You need to create a three-way collaboration between the institution, the community and the artist, and the longer you work together the more expansive the outcome."

The word 'collaboration' pops up frequently in conversations with Havilah. She thinks it is critical for arts and cultural institutions to join forces in a sector overwhelmed by funding challenges and reduced government support.





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It is a sentiment Professor Ross Harley, Dean of UNSW Art & Design, agrees with. The faculty is actively forging relationships with many of Sydney’s cultural organisations – including Carriageworks, the Art Gallery of NSW, Artspace, the Australian Design Centre and the Museum of Contemporary Art – to ensure Sydney continues to grow artistically and culturally.

He says Carriageworks sets a strong example of how arts and cultural institutions can support each other. “Lisa is a force to be reckoned with. She has a genuinely collaborative approach and a deep commitment to many different aspects of contemporary culture,” says Harley. “She also has a canny sense of what the next big thing

might be, without being trendy or elitist.”

Carriageworks’ six-year strategy projects that more than two million visitors will engage with its artistic program annually by 2021, making it one of Australia’s busiest cultural institutions. This sort of vision takes ambition.

“You can’t develop without seizing opportunities and being resilient when they go wrong,” Havilah says. “We, the board and the staff, want to make sure Carriageworks continues to grow. We can never assume we have got it all worked out.”

But there are moments among the complexity of running a large cultural institution that Havilah describes as “pure joy”. She says Nick Cave’s *Heard*, billed as a



Photo: Zan Wimberly

“stampede of dancers disguised as colourful raffia horses performing to the tribal beat of eight live drummers”, was one of her favourite performances in last year’s program.

“I never expected *Heard*, which is so beautiful and magical, to have such an emotional

impact on the audience, just because of the sheer beauty of it.

“What I love about this job is watching people engage with contemporary art. I’m lucky to be able to stand in the audience, feel the atmosphere in the room and witness those moments.”

Books



Photo: Grant Turner/Mediakoo

What I'm reading

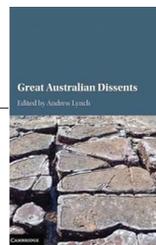
Cathy Sherry

Cathy Sherry is an Associate Professor in UNSW Law and a Scientia Education Academy Fellow.

As we come out of summer holidays, I suppose it's okay to admit that I am reading the last book of Diana Gabaldon's *Outlander* series, *Written in My Own Heart's Blood*. And that the last seven books I have read were *Outlander* books, (with Ian McEwan's *Nutshell* thrown in for good measure). In my defence, I started reading the *Outlander* series on that sad day in November when it became increasingly apparent that Donald Trump was going to win the US presidential election. I desperately needed something to distract me from the unfolding horror.

I tend to read non-fiction, and the *Outlander* books are the first historical romances I have read. They are great stories and the history is fascinating. The later books are set during the American Revolution, which has required a lot of remedial history lessons on Wikipedia. Interestingly, Gabaldon began her career as a scientist at our PLS Alliance partner, Arizona State University.

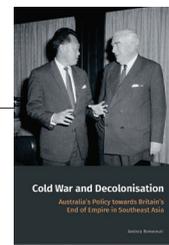
Cathy Sherry's latest book is *Strata Title Property Rights: Private governance of multi-owned properties*.



Great Australian Dissents

Edited by Andrew Lynch, UNSW Law
Cambridge University Press

- When judges disagree, those in the minority write a dissenting opinion. This book considers the great dissents in Australian law through a selection of memorable dissenting opinions. Their worth may derive from numerous factors, including their rhetorical force as a piece of legal reasoning or emotive power as a lament for the "error" of the majority; the general importance of the issue at stake; as a challenge to the orthodoxy; and, sometimes, the subsequent recognition of a dissenting opinion's correctness.

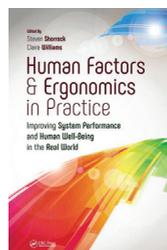


Cold War and Decolonisation

Australia's policy towards Britain's end of empire in Southeast Asia

Andrea Benvenuti,
UNSW Social Sciences
University of Chicago Press

- Benvenuti assesses the impact of Britain's end of empire in Malaya and Singapore on Australia's political and strategic interests in Cold War Southeast Asia. The author argues that although much of the current discourse on Australia's engagement with Asia is critical of the Menzies government, the overall attitude was far from negative.



Human Factors and Ergonomics in Practice

Improving system performance and human well-being in the real world

Edited by Steven Shorrock, UNSW Aviation, and Claire Williams
CRC Press

- This book addresses the way human factors and ergonomics (HF/E) affect a variety of industrial sectors, organisational settings and working contexts. Shorrock and Williams blend academic literature with reflections from experience in areas ranging from health care to agriculture. The book also explores what helps and hinders the core goals of HF/E.



The Long Road

Australia's train, advise and assist missions

Edited by Tom Frame
UNSW Press

- Helping neighbours stabilise their political systems and work towards peace is a core activity for the modern Australian Defence Force (ADF). This book analyses the ADF's "train, advise, assist" missions in Iraq, Afghanistan, PNG and other hot spots. With contributions from media commentators, politicians, academics, aid workers and military personnel, *The Long Road* evaluates the impact of Australia's efforts to help neighbours and partners avoid armed conflict.



Jacqueline Lindeman's *The Kings Cross Commune* is part of a project by UNSW's Master of Architecture – Social Agency students who have redesigned the historic St Canice Church in Sydney's Kings Cross to promote a more friendly and equitable future for the parish community. An exhibition of the students' plans, *What Does the Future Hold for the Modern Church?* is at St Canice's Hall, 28 Roslyn Street, Elizabeth Bay, until the end of March. bit.ly/21B6N5W



EXHIBITION

A Working Model of the World

5 May – 22 July 2017
UNSW Galleries

A Working Model of the World asks how we use models to create and share knowledge. The exhibition presents intriguing objects from all disciplines alongside contemporary artworks. Curated by Dr Lizzie Muller, UNSW Art & Design, and Holly Williams of The Curators' Department. Developed and presented in partnership with UNSW Galleries at UNSW Art & Design, Sydney and the Sheila C. Johnson Design Center, Parsons School of Design, The New School, New York.

If you use interesting models in your teaching or research and would like to be involved in the exhibition, contact lizzie.muller@unsw.edu.au.



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UNSW GALLERIES
SYDNEY

Image: *Money Spinner* by Kenzee Patterson
Courtesy the artist and Darren Knight Gallery, Sydney