CHAPTER 5: SECURING AUSTRALIA’S PLACE IN A CHANGING WORLD

Oceanography: A Global Revolution

Scientists are transforming the defence of Australia’s environment, prosperity and security, writes Robert Woodham.
ON 11 March 2009, the 24000-tonne container ship **Pacific Adventurer** was damaged in heavy seas whipped up by tropical cyclone ‘Hamish’ which had been moving southwards through the Coral Sea over the preceding week.

As the ship floundered off the Queensland coast near Point Lookout, on the north-east corner of North Stradbroke Island, about 270 tonnes of oil spilled into the ocean and 31 shipping containers full of ammonium nitrate were lost overboard.

Not only did the oil pose a major threat to marine life, the ammonium nitrate was explosive. It might also fertilise an environmentally damaging algal bloom. Moreover, the containers themselves posed a shipping hazard.

The Queensland Government, assisted by federal agencies, reacted quickly to the disaster but was faced with two difficult questions: where would the oil slick end up? And where exactly had the containers gone?

Both these questions were answered with the help of an innovative new ocean forecasting system called **BLUElink**, developed by a partnership between the Australian Bureau of Meteorology, CSIRO and the Royal Australian Navy.

The Navy needed the system to provide forecasts of oceanographic conditions that might affect maritime warfare such as hunting for submarines, mine warfare and amphibious operations. But as it despatched its state-of-the-art minehunters, HMA ships **Yarra** and **Norman**, to Point Lookout to help locate the missing containers using their advanced minehunting sonars, Navy oceanographers were busy interpreting the **BLUElink** forecasts for a more peaceful application.

The ships’ crews needed forecasts of the surface and subsurface currents in order to deploy their variable depth sonar and remotely operated vehicles safely and also to understand how the acoustic properties might affect sonar performance.

Meanwhile, Gold Coast oceanographer Brian King was tasked to advise on the likely trajectory of the oil and ammonium nitrate spills. Which beaches were under threat?

Using **BLUElink** ocean forecasts, as well as comparison forecasts from other systems, he identified a stretch of coast between Coolum Beach in the north to Bribie Island in the south, as well as the north-eastern coastline of nearby Moreton Island itself, as the areas most at risk.

Over the following days, the Navy minehunters located all 31 of the missing containers. The spill response, involving around 2500 people, started without delay as the oil came ashore exactly as predicted. **BLUElink** had proved its worth.

So what exactly is an ‘ocean forecast’ and why is there a rapidly growing need for them in the 21st century?

Most people are familiar with the depressions, anticyclones, fronts and trough lines that bring Australia its varied weather, our land “of droughts and flooding rains”. Perhaps not quite so obvious, though, is the fact that Australia’s climate variability is matched by the enormous complexity in the surrounding seas.

The East Australian Current (EAC) flows down the east coast then deflects offshore, shedding warm- and cold-cored eddies into the Tasman Sea, while the Leeuwin Current flows down the west coast on an annual cycle starting in late summer. The Antarctic Circumpolar
Current flows strongly and constantly eastwards to the south of the Australian continent and the Indonesian Throughflow affects waters to the north (See: Figure 1).

In addition, numerous other oceanographic phenomena such as upwelling of cold water to the surface, internal waves and extreme tides are found in various locations around our waters.

These features are defined by their temperature, salinity and current structures, all of which are forecast by the BLUElink system in the same way that the weather is forecast by numerical models that represent the temperature, moisture and winds in the atmosphere.

The motivation for ocean forecasting has grown in recent years, as experts realise the importance of the ocean to the weather systems such as El Niño, the extensive warming of the central and eastern tropical Pacific that leads to a major shift in weather patterns across the Pacific. El Niño events often mean cooler than normal sea surface temperatures in the western Pacific and an increased probability of drier conditions in Australia.

The 1982-83 El Niño was the strongest on record at the time, but despite the havoc it caused around the Pacific Rim, the weather phenomenon was not even detected in the ocean until it was nearly at its peak. This prompted a concerted international effort to improve the poor state of ocean observations.

As a direct result of the 1982-83 El Niño, a fixed array of buoys was installed in the equatorial Pacific Ocean to monitor the three-dimensional temperature structure and, hence, provide warning of future events. Satellite observations of sea surface height that show the locations of oceanic eddies have been improved, along with measurements of sea surface temperature and other oceanographic properties.

More recently, there have been various initiatives to improve measurements in the ocean. One such initiative is the ‘Argo’ program, which has put in place a global fleet of over 3500 floats to observe ocean temperature, salinity and currents.

Argo floats loiter in the deep ocean, but every 10 days they are programmed to rise to the surface, measuring temperature and salinity as they go. At the surface the buoys transmit their data over a satellite link to shore-based data centres where it is shared around the world. Australia has been a particularly strong supporter of Argo, contributing around 50 floats a year, some of which have been deployed from Navy ships.

Now the ocean is being observed much more comprehensively, the large volume of data collected each day can be used to create a snapshot of ocean conditions. This snapshot is used as a starting point for the ocean-forecasting models now being set up in centres around the world. Although this revolution in so-called operational oceanography is just getting going, Australia is at the forefront, notably through the BLUElink project.

The RAN has not been slow to see the opportunities offered by operational oceanography, particularly in view of the complex waters in our region. These are waters in which the navy may one day have to fight – hence its involvement in BLUElink. As a result, the Navy is in the very top rank of world navies in terms of oceanographic capability.

The Navy is interested in various types of oceanographic forecasts. Sound speed in the ocean varies according to temperature, salinity and pressure, and these variations cause sound to bend or ‘refract’. This can help submarines to camouflage the sound that might give them away.

For example, a submarine might hide in the shadow zones caused by refraction beneath the

The 1982-83 El Niño was the strongest on record at the time, but despite the havoc it caused around the Pacific Rim, the weather phenomenon was not even detected in the ocean until it was nearly at its peak.
mixed surface layer or close to an eddy boundary. In contrast, a surface ship or maritime patrol aircraft might try to exploit a sound channel, where refraction concentrates sound energy, in order to detect a submarine at long range.

Oceanographic forecasts are also useful inshore. That’s because mine warfare specialists and amphibious forces need to know about the currents, acoustic properties, swell and surf conditions, longshore currents and rips. Ocean currents, at and below the surface, can also be exploited by surface ships and submarines to increase their speed over the ground.

The case of the Pacific Adventurer illustrates a peaceful application of oceanographic forecasts, but there are many others. For instance, BLUElink data guided the search for HMAS Sydney II and the German cruiser Kormoran, which sank after a sea battle in 1941, and also for AHS Centaur, torpedoed off the coast of Queensland in 1943. All these wreck sites were located by international shipwreck hunter David Mearns and his team, helped by BLUElink.

In addition to improving management of the seagoing disasters and assisting underwater explorers, BLUElink data can improve the handling of oil spills. The system, for example, was used to plan the response to a major oil spill in the Timor Sea from the ‘Montara’ oil platform after a well-head blowout in August 2009.

The applications of BLUElink and systems like it keep growing. The data they provide is invaluable to university and research institution scientists, seeking to understand a wide range of ocean phenomena. Ocean engineers in the oil and gas industry also exploit such data to plan ocean renewable-energy projects.

National weather agencies are interested in using ocean forecasts to increase the skill and range of weather forecasts by modelling interactions between the ocean and the atmosphere. The Marine Nation 2025 report, published in March 2013 by the Oceans Policy Science Advisory Group, points out that the ocean contributes approximately $44 billion per annum to our economy through a range of marine industries. This is expected to increase to $100 billion by 2025, as these industries expand,
and new initiatives in offshore oil and gas, ocean renewable energy and fisheries come on line. This growth will drive an increasing demand for oceanographic data.

Clearly, a global revolution in operational oceanography is in full swing. This international scientific transformation is driven by an increased awareness of the effects of the ocean on our climate, as well as increasing economic activities at sea and the international sensitivities posed by competing interests.

Australia is very much at the forefront and little wonder. The oceanography around our island nation is complex and provides scientists with an enticing ocean laboratory. The BLUElink ocean forecasts offer a decisive edge to the Navy’s fighting ability, and are starting to reveal some of the mysteries and complexities of our ocean environment. They will also help mitigate future environmental threats, such as the Pacific Adventurer disaster.

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FURTHER READING


Latest data from the Tropical Atmosphere Ocean (TAO) array, which monitors the Pacific Ocean for the prediction of the El Niño/Southern Oscillation, http://www.pmel.noaa.gov/tao/

Information on Argo profiling floats, http://www.argo.ucsd.edu


The structure of some of the ocean currents around Australia, as revealed by BLUElink forecasts of sea surface temperature and sea surface height, for 1 June 2013.
COMPUTER CRIME IS ON THE RISE

Cybersecurity is an issue for everybody, from individuals to nations, writes Alastair MacGibbon
I received the same email five times in as many weeks informing me of an $18.60 refund following a ‘billing error’ with a ‘mobile phone provider’. Not a huge sum, but believable.

I don’t have a mobile phone with this company, so I ignored it the first time, and the second. But by the third email I had started to wonder: did someone else in my family have a phone with this company? And by the fifth email it took considerable strength not to click on the attachment. After 15 years policing experience and more than 10 years addressing cybercrime, I was tempted. Scary. What if it was a legitimate email communication?

I checked the full email header, rather than the summary from/to/date header we see by default, and noticed the email originated in the United States, not Australia. This and a visit to a scam alert website that noted this particular email restored faith in my initial gut judgement, allowing me to rest easy knowing that I wasn’t missing out on the big bucks.

The emails were nothing more than spam. Determined, simple spam. Had I filled out the attachment I’d have entered personal information, including financial, so the ‘refund’ could be paid.

Had my credit card details been successfully obtained to use fraudulently, I would be reimbursed by my bank under the terms of the e-Payments Code. So, no real loss. Or is there? Unsurprisingly, the banks don’t take one for the team in the online economy.

Their moment as the ‘white knight’ sees them demand reimbursement from the online merchants where stolen credit card details were misused. ‘Card not present’ – internet and phone – transactions are at the merchant’s risk. In turn, merchants build that loss into the cost of goods and services legitimate customers buy. So everyone loses out, bar the criminal.

Back to my original series of spam scam emails: the criminal also could have embedded a ‘malicious payload’ of computer code in the attachment known as ‘malware’. A ‘key logger’ may have been installed, sending every stroke I type – including passwords – back to the criminal. My contacts and files may have been plundered and abused by the criminal then resold to other criminals via well-developed criminal online black markets.

My computer – now made a ‘zombie’ by the malware – could be drafted with other compromised computers into a ‘botnet army’ and used to carry out denial-of-service attacks against business and government websites, causing them to crash. My computer may also have been used for breaking, or hacking, into other computers with all roads leading back to me if the matter was investigated. My computer could store and share illegal material such as child
pornography and could be used to send more spam just like the one that caused all my trouble. Maybe all of the above, over time. A tempting $18.60 would have reaped significant individual loss, while contributing to a burgeoning criminal economy and supporting infrastructure. This scenario is played out in an automated, relentless fashion every second we’re awake and asleep.

And the increasing use of mobile and tablet devices, combined with a steady growth in online activities, multiplies the threats. For instance, what if the compromised computer, phone or tablet device I use for my personal life is also used for work? The corporate system could also be at risk, exposing company intellectual property, client information, finances and more.

Ultimately, what was first a damaging individual incident – when aggregated with potentially thousands or indeed millions of other individual incidents – could have national security implications, threatening Australia’s economic interests, the wellbeing of the Australian public and the integrity of Australian Government information and systems.

The sheer scope of cyber vulnerabilities alone helps make a compelling case for national security concern. In a recent example, a seemingly benign hacker nicknamed Carna compromised 420,000 internet-connected devices, mainly routers and servers, to create his own botnet. While Carna claimed to have

**WORRISOME WORMS**

In 1999 the ‘Melissa’ worm, and then in 2000 the ‘ILOVEYOU’ worm, provided early warnings of the speed with which malicious codes can spread across connected computers. These worms – a form of malicious computer code that spreads across networks – were particularly significant because they impacted business, government and consumer systems. Fortunately, while both were annoying and caused some harm to targeted computers they were reasonably harmless.

Ten years later, when security researchers learned of the ‘Stuxnet’ worm, the world of large-scale computer malware had changed. Stuxnet – widely believed to have been developed by the US intelligence community in cooperation with Israel – was originally designed to target Siemens supervisory control and data-acquisition systems used in Iran’s uranium-enrichment program. The code caused centrifuges to spin out of control, damaging the country’s nuclear efforts. Although specifically targeted, Stuxnet spread and was later altered and used for other malicious activity.

Subsequent incidents have occurred, either carried out by or in support of nation states, utilising malicious code. As well, successful criminal malware enterprises such as ‘Zeus’ have targeted banking information.
no malicious intentions the incident illustrates the potential size of internet security issues.

Malicious botnets like Waladec and Rustock – successfully crippled by Microsoft’s Digital Crimes Unit in 2011 – and the more recent Bamital botnet are examples of highly malicious criminal enterprises that affected hundreds of thousands of people worldwide.

Cyber vulnerabilities at a small business, corporate and government level mean that valuable intellectual property and traditional national security secrets can be targeted, as can computer systems running critical infrastructure supporting the economy: power, water, transport, food distribution, telecommunications and banking.

And in some instances that targeting may have found its mark via, say, a scam mobile phone refund email.

To date, we’ve failed to grasp the enormity of the misuse of technology and, as a result, have not viewed the problem as a societal one. The $18.60 refund scenario highlights how cybercrime is both an individual and national security issue. Cybercrime can be so interlinked that, theoretically, my $18.60 click could be part of a larger, orchestrated attack on critical infrastructure. It’s essential to recognise that no matter how benign a scam may seem it is potentially malignant and can definitely metastasise.

When addressing these issues, blame is usually attributed to end users or government agencies, particularly security services and police. There are few calls for internet service providers, online retailers, social network operators, software and hardware manufacturers and businesses in general to shoulder greater responsibility in providing safer services and educating end users.

True, end users and governments must scale up their efforts. But what’s needed most is a national approach addressing cybersecurity like a public health concern: with measurable baseline data, broad strategies and a relentless long-term commitment to tackle the problem.

Scientists, engineers and mathematicians can and should play a central role. Instead, a handful of public officials and information technology (IT) security professionals dominate the debate.

In the age of the internet, the once-dominant ‘three Rs’ of reading, writing and arithmetic have been replaced by the ‘three Cs’: coding, computation and communication. Consequently, Australia requires more
The ePayments Code covers electronic transactions, including ATM, EFTPOS, credit card transactions and internet banking.


**Thomson, I.** 2013, ‘Researcher sets up illegal 420 000-node botnet for IPv4 internet map’, *The Register*, http://www.theregister.co.uk/2013/03/19/carna_botnet_ipv4_internet_map/.

**Smith, G.** 2013, ‘Microsoft takedown busts up global botnet cybercrime ring’, *Huffington Post*, http://www.huffingtonpost.com/2013/02/06/microsoft-botnet_n_2632616.html.

**ALASTAIR MACGIBBON** specialises in internet fraud, consumer victimisation and internet security. He is managing partner of Surete Group, a director of the Centre for Internet Safety at the University of Canberra and CEO of the not-for-profit ‘white hat’ hacker-certification body, the Council of Registered Ethical Security Testers. Previously, he headed Trust & Safety at eBay Australia and later eBay Asia Pacific, was the founding director of the Australian High Tech Crime Centre, and a federal agent with the Australian Federal Police.

**DIGITAL IMMUNE SYSTEMS**

Over the past 20 years, teams of US cyber specialists have worked on an innovative approach to cybersecurity originally proposed in 1992 by scientists at the University of New Mexico and the Los Alamos National Laboratory. Drawing inspiration from human immune systems, the goal is to create digital immune systems and healthy computer ecosystems able to defend against cyber threats.

Computer viruses are similar to biological viruses. They disrupt healthy systems and exploit their hosts in order to replicate. While mimicking human immunity makes sense, the human immune system is incredibly complex. So too is the digital task.

The first step is building software able to recognise malicious traffic. One approach is to develop a program that creates digital ‘antibodies’ that attach to anything suspicious or unusual.

Suspicious files are automatically sent to a central location for analysis and scrutiny. For malicious traffic there are two outcomes – the virus signature is identified for future detection, and an antidote is created to counteract it. Then, the signature and antidote are spread around the network, ready for use when other computers are attacked.

engineers, programmers and mathematicians to work on cryptography, to write secure computer code and crime-fighting software, to create safer machines.

We need properly qualified citizens who can be security cleared and called on to help the Australian government. To this end the government should introduce a scholarship scheme to encourage a step change in the number of young Australians studying science, technology, engineering and mathematics.

And we need more women. In an increasingly digitised future we run the risk of seeing a professional and educational chasm re-open between men and women – who are already under-represented in this sector. Anecdotal evidence suggests girls, generally, need more persuading to engage in the three Cs. If we are to increase the number of women focusing on cyber technologies at tertiary institutions and in the workforce – bringing a balance and skill set desperately required in the future – this must be addressed at primary and secondary levels.

Not only will such efforts lead to a safer and more secure Australia – and world – but an expanded Australian IT-security industry would be good for the economy in what is a fast growing multi-billion-dollar market. It makes dollars and sense.
Science, coupled with innovation, has the potential to help develop solutions to the world's challenges.
Innovation is a difficult journey from the lab to the real world, writes Craig Cormick.

Innovation works something like this: a research scientist develops something brilliant, which is then developed into a product, is commercialised, the general public loves it and buys lots of it, so the developers become wealthy and the public find their lives greatly improved.

Sorry, we’ll start that again.

Innovation works something like this: a research scientist develops something brilliant and goes through an extremely difficult process to develop it into a product, and after finally getting it to market the public are aghast/afraid/suspicious of the technology, so commercialisation fails and nobody is happy and few lives are improved.

To understand that the experience of turning brilliant science into successful and innovative products lies somewhere between these two scenarios, let’s look at innovation before looking at the science.

There are numerous definitions of innovation. To save writing an essay, let’s just call it doing clever stuff in a more clever way to get a good outcome. It can be a product, a process, a service. Its impact can be grand or incremental. And it can, like many things with multiple definitions, mean different things to different people.

For some, innovation offers a certain path to economic growth and social betterment; it leads to new industries or new goods and services, produced more efficiently, that people want to buy. What right-thinking person wouldn’t love that, right?

In many instances this is true. Think smart phones, wi-fi, tablets, organic light-emitting-diode televisions, e-medicine, robotics. Brilliant science led to brilliant products that have huge consumer demand. Almost everyone is happier and better off.

But, of course, this isn’t the way things always work out. That’s a pity, of course, since planet-wide changes – growing population, expanding and shifting economy, changing climate and lifestyle expectations – create unique challenges to which we need new solutions. And science, coupled with innovation, has the potential to lead to the development of such solutions.

But only if we get the innovation thing right.
ADVANCE AUSTRALIA
It is becoming increasingly clear that the way Australia has traditionally managed innovation is unlikely to maintain national health, wealth and wellbeing in a rapidly changing global economy. Australia has dug up mineral resources and sold them overseas for many years, but that threatens to be less profitable in the future. Farmers have watched sheep graze and fatten up and then exported them. More than ever, agricultural production is subject to the vagaries of climate and competition. Meanwhile, we have seen the manufacturing sector contract, close down and move off-shore.

“There’s no question that at some point our economy is going to have to shift and become substantially different from what it is now and be based on innovation,” says Professor Ian Chubb, Australia’s Chief Scientist.

There is a clear and growing chasm between where we are now and where we need to be. Clearly, the challenge for Australia is to find the best way to cross the chasm and move towards a sustainable economy that is less vulnerable than the one for which we must shrug off sentimental attachment, the one that provided the nation’s prosperity to date.

Australia has certain strengths. We do good science. We are a creative nation – at times – and we know where we’d like to be. But we have a poor record of commercialising good science. We aren’t always creative in the right areas and we have a poor understanding of what innovation is.

Unfortunately for the sentimentalists, 21st century innovation isn’t based on the good fortunes of geography, geology and climate, as was much of our traditional wealth. Today, innovation only happens after careful planning, investment and strategic decision-making.
Even then the science → technology → commercialisation model doesn't always flow as smoothly as predicted. As an example, Europe is a strong performer in the science of photovoltaics. They publish papers at a high level and have a good patent track record. Still, they are not good at successful commercialisation of their research. Although Europe accounts for about 75 per cent of the world’s purchases in photovoltaics, their own manufacturing accounts for only about 3 per cent of it.

This situation was described in 2012 by Christos Tokamanis of the European Commission. “A lot of R&D [research and development] dollars are being invested in Europe, but the question being asked is when we are going to see commercial returns?”

IDENTIFYING THE IMPEDEMENTS

So what are the main impediments to successful innovation? If the answer was simple, it would, of course, be similarly simple to remove those impediments. Instead, the impediments are complex and multiple.

The federal government’s 2012 Innovation System Report cites lack of suitable education of management, lack of an innovative culture and an imbalance in government versus private spending on research and development, as reflected in the difficulty crossing the funding ‘Valley of Death’.

The list goes on: lack of R&D growth in key areas; lack of business access to publicly funded research expertise; the large number of Australian patents taken up overseas rather than here; lack of mobility of researchers between academia and business; lack of harmonising intellectual property frameworks across the publicly funded research sector; and lack of a concerted national science, technology and innovation strategy.

There is also an increasing body of research highlighting the need to incorporate consumer needs into successful innovation strategies to ensure that once a new product or service is developed it will be accepted. Think of this as the ‘Vale of Death’: a product is developed that meets all the traditional innovation requirements, but does not align with consumer values or preferences.

PUBLIC ENGAGEMENT

Examples include cases where developers give the public a solution to a problem that most never saw as being their problem; for instance genetically modified (GM) crops as a solution to agricultural productivity. Members of the public may believe research has crossed an ethical divide that some people were unwilling to cross, as in, for example, embryonic stem cell research. Public rejection also occurs with solutions such as nanotechnologies, where the flow of information about the technology is dominated by misinformation on risk and concerns.

BACKING INNOVATION – FROM THE AUSTRALIAN INNOVATION SYSTEM REPORT 2012

Backing innovation is a proven strategy. Australian businesses that innovate are:

- 42 per cent more likely to report increased profitability.
- Three times more likely to export and 18 times more likely to increase the number of export markets targeted.
- Four times more likely to increase the range of goods or services offered.
- More than twice as likely to increase employment.
- Over three times more likely to increase training for employees.
- Over three times more likely to increase social contributions such as community enhancement projects.
And it’s not just a matter of selling the products harder or trying to better explain the science behind them. Having spent a decade having discussions with anti-GM, anti-nanotechnology and anti-vaccination advocates, and even anti-climate change advocates, it is clear to me that their issues are rarely about the science.

Rather, it’s about the personal values the science challenges. These can include issues relating to questions about messing with nature, monopolistic behaviour by agri-conglomerates or ethical fears over the misuse of genetic information. Aligning a product with people’s values, through some form of public engagement to discover what those values are, will increase its chance of having a dream run. Clash with those values though and you could be in trouble.

Good early engagement allows the public to make choices about how they would like to see the research being developed. It also makes good marketing sense to ask the end-users what they want before it is produced. It makes poor sense to assume they will automatically share the developer’s idea of what is needed.

For instance, based on what we have seen in terms of public rejection of large agri-chemical company involvement in GM crops, if the public had been consulted about GM science back in the mid-1990s, it’s a strong bet they would have been against agricultural firms using it to develop broad-acre crops such as soya or corn that are resistant to their own pesticides or herbicides. It’s much more likely they would have preferred to see non-food crops being used to produce pharmaceutical compounds, or healthier niche foods developed.

Some of the contentious innovative research currently in Australian laboratories includes artificial photosynthesis; affordable personal genome sequencing of unborn children; a universal flu vaccine based on mutated viruses; 3D printing of biological materials; and body organs and computer chip brain implants designed to boost memory or intelligence.

The potential benefit to Australian society from such projects is enormous. But for this they will need strong institutional support and community endorsement for their use and regulation, skilled developers to create them and sufficient funds to commercialise them.

These are big expectations. They will require a lot of very clever people working together in new ways to share old wisdom and new ways of thinking. Such next-generation teams must build a bridge that crosses the ‘Prosperity Chasm’, the ‘Valley of Death’ and the ‘Vale of Death’. Building 80 per cent, or even 90 per cent, of a bridge won’t be enough.

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**FURTHER READING**


Engaging other nations in the pursuit of knowledge promotes international relations and national wellbeing, writes Brendan Nelson.
The Jesuits taught me that four virtues are essential to a ‘successful’ life. Unsurprisingly, perhaps, the first was compassion.

Beyond the spiritual and humane, it’s held me in good stead. In a practical sense, it has meant that I should try to understand how others think – to always ask myself how the person with whom I am dealing thinks and formulates his or her world view. Knowing what others think is one thing, understanding how they think is quite another.

Graeme Davison, in *The Use and Abuse of Australian History*, similarly observed that ethical and responsible citizenship relies on each of us being imbued with the imaginative capacity to see the world through the eyes of others.

As a non-professional diplomat arriving in Brussels early in 2010, it also seemed a sound basis for diplomacy. The European Union (EU), to which I was accredited, had just published its EU2020 vision. Its stated ambition was for a ‘Smart, Sustainable and Inclusive Europe’. One of the seven ways of achieving this was to lift EU investment in research and development (R&D) to 3 per cent of Gross Domestic Product (GDP).

I have found in life that when fronting for a meeting, it’s helpful to have something on the agenda that is also on the other party’s agenda. As I thought about the 15 minutes I would have, first with the president of the European Commission and then the president of the European Council, I asked myself how Australia might advance its own interests by also helping the Europeans meet theirs.

Research co-operation seemed an obvious area for discussion.

At the time, we were also contemplating our bid for the next-generation radio telescope, the Square Kilometre Array (SKA). As Australia’s relationship with the EU had historically been framed by us narrowly around trade conflict in agriculture and market access, I was anxious to broaden the engagement into different areas. Simply saying to the bloc’s leaders that Australia should be awarded the SKA on the basis of its scientific research quality, seemed likely to have negligible impact.

We needed to position ourselves as being helpful to Europe in the field of science and, in doing so, demonstrate the strength of Australia’s research output.

So, when meeting President Barroso to present credentials to the European Commission, I went with four issues. He listened carefully to the first three with the polite, interested air of a seasoned politician with a busy day ahead.

Then I got to science.

I told him I had noted the R&D ambition set out in the EU2020 agenda. While agreeing...
that was one of the key levers the European nation states could pull to lift themselves from the economic crisis engulfing them, I suggested their target was unlikely to be achieved. A number of finance ministers were already publicly stating they could not – and would not – invest more money in research.

I went on to explain that Australia produced 3 per cent of the world’s intellectual output in publications. In some disciplines it’s much higher. I reminded him of our Nobel Prize winners, members of the Royal Society and citation rates, among other things. I told him we realised, however, that to go further, we needed to lift our levels of international collaboration substantially. Further to this, if the EU was to get anywhere near its 3 per cent target, one key device for doing so would also be collaboration.

I had his attention.

I proposed that Australia and the EU could pool some of our research money in support of joint projects. This could be at both the researcher and institutional level. The specific projects to be funded would be selected on a peer-reviewed basis by our respective scientific communities. But together we could nominate areas for joint research collaboration. I proposed water-resource management, agricultural productivity, energy efficiency, renewable energy and human adaptation to new and emerging technologies by way of examples.

I pointed out to President Barroso that if such a model was developed and implemented it would not only deepen co-operation between my country and the EU, it would leverage up our respective research spend. I told him that while Australia’s research budget was small in comparison, such a model applied to similar like-minded countries had the potential to be a ‘win-win’.

He got it, telling me with some enthusiasm that he saw considerable potential in this idea. He said I must see the EU commissioner for research, Máire Geoghegan-Quinn.

Given that EU nations produce 38 per cent of the world’s scientific papers and the European Commission has a budget for research and innovation exceeding 120 billion euros (about AU$170 billion), the potential for Australia was, and remains, significant. Collaborations between Australian and EU scientists exceed those with the US.

When I debriefed staff at the Australian embassy on my meeting and discussion, Dr Martin Gallagher, our then indefatigable science counsellor said, “Brendan, excellent science diplomacy”. I presumed this was an expression thrown around in the science community as part of the jargon used in his world. It was not something I had heard before, even though as science minister in the last decade I had discussed scientific co-operation with my counterparts in a number of countries.

I have since discovered that is far from the case.

Then Prime Minister Gillard came to Brussels some months later and similarly raised and discussed research co-operation with her two key EU interlocutors. The conversation continued when Barroso visited Australia the following year. It was certainly a change from the traditional confrontational nature of dialogue we had experienced in the past, lambasting the Europeans for agriculture and trade policies.

From this early, positive engagement we were able to build a relationship with the EU that was much more constructive. The multiplier effect for increased co-operation in education was an early, positive impact. When the prime minister stood next to the president of the EU in October 2010 and said that we would be working towards closer co-operation in research, its head-turning effect was not confined to the research community.

In education, the EU’s education commissioner and director general both expressed an interest

Neither Australia nor the US has fulfilled their respective, considerable potential in science diplomacy. We should – be it with the Islamic world or the Asia Pacific. Our future depends on it.
The curious country

in exploring further co-operation and linkage of programs. I even found myself invited as ambassador to a small meeting of 10 to read and comment upon the Commission’s draft directive (white paper) for higher education.

So too, as the EU established its own diplomatic service with the European External Action Service, Australia’s relationship reached further into foreign affairs and security.

Similarly, in overseas development assistance, environment, climate change, economic issues and the G20 agenda, I endeavoured to shape our overarching engagement around areas where we might advance a common interest. That interest, wherever possible, would be evidence- and research-based.

I’ve since learnt that science diplomacy is the use of scientific collaboration between and among nations that seeks to meet common challenges. If skilfully applied, it becomes the foundation for constructive international partnerships.

The Obama administration has been particularly enamoured with Joseph Nye’s ‘Soft Power’, as described in his 1990 book, *Bound to Lead: The Changing Nature of American Power*. Greater investments by the US in areas such as science diplomacy are regarded as essential to complement its economic and military power.

President Obama’s 2009 ‘New Beginning’ speech in Cairo, in which he sought to reach out to the Muslim world, argued for a greater engagement by the US through science, technology and innovation. He saw the linking of scientists as a basis for common understanding.

The world has undergone a major transformation in less than a decade, the scale of which is not well appreciated by most Australians. The shifting of political and economic power from North America and Europe to the Asia-Pacific over the past 20 years was rapidly accelerated by the Global Financial Crisis and the world’s response to it.

China’s re-emergence and the critical shape of the template for its relationship with the US are critical to our future. As Henry Kissinger observed, the template for that relationship is being forged now in our region. It is into this global and regional environment that science diplomacy can and should play a pivotal role.
Australia and China have had to deal with a number of ‘irritants’ in the past five years. But there is resilience in the relationship now that gives each country increased confidence in extending its depth and breadth. China’s challenges are immense, among them the need to lift 150 million people out of poverty, create 24 million jobs a year, provide housing to 10 million still homeless, energy security, environmental sustainability and the urgent need to address urban pollution.

Australia has much to offer Chinese researchers and its scientific leaders in expertise relevant to addressing these and other challenges. Irrespective of the diplomatic, trade and economic tensions that ebb and flow between our two countries, China’s political and intellectual leadership can only appreciate research collaboration that helps lift understanding while addressing real issues bearing down on the country. Again, it is imperative that we actively pursue areas of common interest and concern in science as one means of adding substance and ballast to the relationship. Australian researchers actively working with their Chinese counterparts on agricultural productivity and clean energy technology alone will serve our mutual interests.

As China rapidly boosts its investment in research and relentlessly drives the transformation of a handful of its leading universities, the scientists within them will largely shape the direction in which their nation goes. Its challenges – economic, environmental, agricultural, health, social and diplomatic – will all require guidance from science. Researchers in humanities and social sciences will be no less important in this regard. Australia has skilfully managed its relationship with China, balancing its economic needs with concern for human rights and rule of law. We have a program for research co-operation, but there is much more we could do to deepen the ties between men and women whose passion is knowledge. Similarly, those Australian companies that join our political leaders in their visits to countries such as China are themselves, to varying degrees, conduits for science diplomacy where new knowledge is the basis for wealth creation.

While the East Asia Summit, now including the US and Russia, traverses security issues, its agenda is largely in areas where Australian scientists, working with their counterparts, can collaboratively inform reasoned decision-making in key areas ranging from climate change to food production. Neither Australia nor the US has fulfilled their respective, considerable potential in science diplomacy. We should. Our future depends on it; whether it’s the West reaching out to the Islamic world or deepening stable multilateral integration in the Asia Pacific.

The other three Jesuit values for success – commitment, conscience and courage – will all need to be applied to this task. It also requires sustained, whole-of-government political will and resources.

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FURTHER READING