Australia’s Place in Space: Historical Constraints and Future Opportunities

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Australia occupies an unusual place in the story of human activity in space. Australia’s approach to space has been and remains intensely pragmatic and collaborative, leading to outcomes that have puzzled many observers and commentators over the years. Principles of necessity and sufficiency have been dominant. Grand plans for space exploration and space industry development have failed to attract sustained interest or investment from any quarter, public or private.

This article outlines the drivers for the situation that exists today, and suggests some possibilities for the future. There are four principal drivers for the approach of successive Australian governments to space:
Strategic Geography
Alliance Relationships
Broader International Obligations under the Outer Space Treaty
Cost and Risk.

The first three have been and remain enduring drivers. The fourth addresses a perception, strongly held by many Australian politicians and officials, that space investments entail high technical and financial risks for uncertain returns or for returns for which broader community benefit is difficult to quantify in terms of jobs and votes. Successive governments have reasoned that Australia’s essential national security interests with respect to space have been met through the extended deterrence offered by allies in return for their use of Australian soil to pursue their national interests. Ergo, substantial and sustained investment in a local space industry has simply not been a policy or investment priority.

Above all, space has been dealt with by Australian governments as a strategic and national security question within the context of alliance relationships. Investments, activities and interests have been largely driven by this perspective, and much of what has occurred has been and remains highly classified, and thus well beyond the view of many politicians, public servants and the broader population.

The Impact of Geography

A former representative of the US National Aeronautics and Space Administration (NASA) to Australia, Dr Neal Newman, used to describe Australia as being “there, bare and fair.” This epithet neatly captured the essence of NASA’s interest in Australia and, for that matter, the essence of the interest of others as well. From the perspective of support to space activities, each of the points warrants brief expansion.

There

Australia, in terms of longitude is more or less equidistant from Europe and the United States. This means that satellites, no matter where they are relative to the Earth’s surface, are likely to be in view of a ground station in North America or Europe or Australia, making continuous monitoring and downloading of data possible. Satellites in geo-synchronous orbits which are located above the Equator from the western

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3 Dr Neal Newman was NASA’s Representative in Australia from 2002 to 2006.
Pacific to the mid Indian Ocean can be seen from ground stations in Australia. Australia, in short, fills the coverage gap between North America and Europe.

Bare

Continental Australia is roughly the same size as the continental United States but with a much smaller population (22 million as opposed to 360 million) which is largely confined to the coasts, and the south-eastern corner of the continent. The continent is, therefore radio quiet, and ideal for hosting satellite ground stations and radio telescopes.

Fair

Australia is a liberal democracy and an ally of the United States, and although less important today, the United Kingdom as well.

When these factors are combined they provide attributes not available anywhere else in the world.

The Joint Defence Facility at Pine Gap near Alice Springs, in the middle of the Australian continent, was located there as a direct consequence of geography. The site was radio quiet and likely to stay that way for a long time. It was far from the coasts and international waters in
which the electronic intelligence collectors of the Soviet Union operated during the Cold War. This was vitally important because the first generation of satellites supported by Pine Gap are reported to have had an unencrypted communications link, and the United States was very keen to protect the strategic advantage obtained by having these satellites in orbit.4

The Impact of Alliances

Since the mid 1940s, Australian space activity has been bifurcated. On the one hand Australia has been a staunch supporter of the space ambitions of “our great and powerful friends,” to use the phrase coined by Robert Menzies, Australia’s longest serving Prime Minister.5 In the 1940s and 1950s this “friend” was the United Kingdom. Since the 1960s it has been the United States. Only a handful of senior Ministers, the members of the National Security Committee of Cabinet, are comprehensively briefed about the functions and capabilities of the so-called “joint facilities” which have been established by the United States on Australian soil, and which are jointly staffed and managed by Australian and American personnel. This means that junior Ministers, backbench Members of Parliament, and the wider Australian public have been forced to depend on sometimes scant, incomplete, and even incorrect information in their efforts to appreciate the importance of these facilities to national, regional and global security. Key decisions about alliance relationships have been made by senior Ministers, including the Prime Minister, the Attorney General, the Treasurer and the Ministers for Defense and Foreign Affairs.

On the other hand, responsibility for investment in space science and a domestic Australian space industry, especially in launchers and satellites, has been the preserve of junior Ministers who, although well-meaning, have failed to win the support of their more senior colleagues for enduring and systematic investment in space activities. The efforts of junior Ministers have lacked direction and focus, have been constrained by lack of funds, and characterized by opportunism not connected to Australia’s implicit approach to space in which alliance relationships and international civil collaboration have been and remain central pillars.

A consequence of bifurcation is that Australia has not developed a coherent national space narrative that makes sense to politicians and to the

5 Menzies, R.G., The Measure of the Years, Cassell, Melbourne, 1970, p 44.
wider community. Indeed, serious discussion about the role Australia might and should play in space is hindered by ignorance on the one hand, and an unfortunate “giggle factor” on the other. There is also a well-entrenched economic rationalist view that governments have no business in investing in a domestic space program, any more for example, than they should invest in the creation of a biotechnology industry. Politicians and senior officials have come to approach space matters with considerable caution and skepticism, and there is a widely held view “space is expensive and run by geeks.”⁶ The sector has a major image problem when questions deserving of serious and informed debate arise, although there is evidence that this may be changing, which is discussed in the latter sections of this chapter.

Many commentators both in and beyond Australia express puzzlement and even dismay at Australia’s apparent lack of interest and involvement in space matters. Most fail to understand the bifurcation that has occurred since the late 1940s, and its influence and implications.

Australia’s core strategic interests in space have been met through alliance relationships. Since the 1960s, the United States has underwritten Australia’s security in return for Australia hosting satellite ground stations, which were essential elements in the global Cold War intelligence and surveillance system developed by that superpower. These facilities remain as important today, if not more so, than they did when they were established.

Core operational level interests, especially access to Earth observation data for numerous applications including meteorology, mineral exploration, environmental monitoring, vegetation mapping, land use planning and ocean monitoring, has been achieved largely through access to public good data made available through international collaborations. With regard to the sciences of space, astronomy has been favored over space science (the latter taken to include planetary geology, solar physics and space weather), except where space science has been relevant to national security, such as ionospheric physics, which makes an essential contribution to the operations of Australia’s Jindalee Over the horizon Radar Network (JORN). The JORN system is arguably the most advanced high frequency sky-wave radar in the world, providing wide area coverage of Australia’s northern approaches, monitoring aircraft and shipping

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⁶ This phrase was used by a now retired Minister from the Government of South Australia in a private conversation with the author in March 2011.
movements.\(^7\)

Turning the clock back to the dawn of the space age, before World War II had ended, the United Kingdom was considering what it needed to do to acquire atomic weapons and the missiles to deliver them. By this time, there was no dispute or doubt that Australia was an independent sovereign state within the British Empire.\(^8\) The ties of Empire, however, were strong, certainly strong enough for Australia to enter into a “Joint Project” with the United Kingdom to use remote and sparsely populated areas of the Australian outback to develop and test these weapons. This led to the creation of the Woomera Test Range, 650 km northwest of Adelaide, and later sites as well, notably the Monte Bello Islands off the coast of Western Australia and Maralinga near the border between Western and South Australia, for the testing of nuclear devices.\(^9\)

**Woomera**

Woomera was a very active place in the 1950s and into the early 60s as the Joint Project progressed. However, when the United Kingdom recognized it could no longer afford the costs of Empire, and in the face of increasingly persistent anti-colonial movements, it abandoned its ambitions to be a self-reliant nuclear power, which was the death knell of the Joint Project. The European Launcher Development Organisation (ELDO) was active at Woomera for a time, but the French, partly in response to the British change in policy, and determined to develop an independent launch and nuclear capability of their own, left Woomera as well. ELDO was eventually absorbed into the European Space Agency (ESA), and the launch program was moved by the French to Karou in French Guinea where it provided the basis for the successful Ariane family of launch vehicles.

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7 For a brief description of the JORN project see: http://www.defence.gov.au/dmo/esd/jp2025/jp2025.cfm
8 The relationship between Australia and the United Kingdom is frequently misunderstood by foreign observers due to the fact that the Queen of England is also, formally, the Head of State of the Commonwealth of Australia. This is an artefact of history. Any doubt as to Australia’s sovereign independence was removed with the passage of the Statute of Westminster Adoption Act by the Australian Parliament in 1942.

The Space Treaties

In the 1960s, Australia was an active participant in the international dialogue concerning the regulation of outer space. Australia has signed and ratified all of the five main space treaties including the Moon Treaty, unlike most other countries in the world, and places high value on being regarded as a good international citizen where the regulation of space is concerned. During the Cold War, Australians chaired the S&T Committee of the United Nations Conference on the Peaceful Uses of Outer Space (COPUOS) continuously for 33 years from 1962 – 1995. However, Australian official commitment and interest in the international governance of space waned following the retirement of Professor John Carver from this and other positions in 1995. As will be discussed below, there are signs this may be changing and that Australia, once more, is beginning to take an active interest in space governance.

The US Alliance and the Joint Facilities

From the earliest days of the US civil, military and classified space programs, the Australian Government has hosted a number of ground stations to support these activities. Some, notably the Defence Surveillance Program (DSP) ground station at Nurrungar near Woomera (operated from 1970–1999), and the Joint Defence Facility at Pine Gap (JDFPG) near Alice Springs in Central Australia (1970–present), have been at times contentious and at the forefront of political arguments and debate in the context of Australia’s alliance with the United States, and the extent to which Australian sovereignty was impugned or diminished by the bases being located on Australian soil.

This was especially the case at the start and finish of the Whitlam Labor Government in the 1970s. When the Australian Labor Party (ALP), led by Gough Whitlam was elected to office in December 1972, ending 23 years of conservative rule, deep concerns were held in the US that the incoming government might compromise the security of the joint facilities, or possibly move to shut them down. In fact this did not happen, and the Whitlam Government, although harbouring reservations about the levels of secrecy applied by the United States, supported their continued operations. At the very end of the Whitlam Government’s tenure, which closed in controversial circumstances when the Governor General removed the Prime Minister’s commission in order to break a parliamentary deadlock, the joint facilities were again at the fore.

A conspiracy theory gained credence to the effect that the Secretary of the Department of Defence, Sir Arthur Tange, possibly assisted by the Chief Defence Scientist of the day, John Farrands, had, in effect tipped off the Governor-General just days before he dismissed the Whitlam Government, that the United States held grave concerns for the security of the joint facilities if a Labor Government were to remain in office. This theory persisted for more than a decade although no compelling evidence has ever been produced. What these events do point to is the exceptional care taken by the United States and those Australians who are briefed about the joint facilities not to reveal, or have revealed by others, the technical capabilities (and limitations) of the space-based surveillance and intelligence gathering systems of which the Australian hosted facilities are

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an important part.

There was a strongly held belief in some sections of the community, and also by some parliamentary members of the ALP as well as Left leaning politicians and commentators, that these facilities would be nuclear targets in the event of war between the Union of Soviet Socialist Republics (USSR) and the United States. This possibility, although remote, was explicitly acknowledged in the 1980s, including in the 1987 Defence White Paper.\textsuperscript{13} Although critics of the joint facilities remain, the concerns and reservations that are expressed today are generally more restrained than in the past, a consequence of the passage of time and the end of the Cold War.

In 1985 Professor Paul Dibb reviewed Australia’s defense capabilities, and his report, published in March 1986, provided the basis for the Defence White Paper published a year later, March 1987 (DOA 87). Both documents refer to the need for the Australian Defence Force to embrace satellite communications, and both emphasize the importance of the joint facilities. Dibb wrote, in this instance by inference to the joint facilities, in the following terms:

"We have access to United States intelligence resources, which can provide technical military intelligence coverage beyond the comprehension of previous generations of military planners. These resources contribute not only to our capacity for strategic analysis, but also to the potential effectiveness of our forces in circumstances of combat. They could not be duplicated from national resources."\textsuperscript{14}

Both documents were silent, in any explicit way, about outer space. Dibb summarized Australia’s principal national security interests under six headings, of which space was not one.\textsuperscript{15} DOA 87 summarized Australia’s principal national defense interests as being:

- The defense of Australian territory and society from threat of military attack;
- The protection of Australian interests in the surrounding maritime areas, our island territories, and our proximate ocean areas and focal points;
- The avoidance of global conflict;
- The maintenance of a strong defense relationship with the United States;

\textsuperscript{14} Government of Australia, Department of Defence, Review of Australia’s defence capabilities, Canberra, March 1986 (the Dibb Report), p 46.
\textsuperscript{15} Dibb Report, p 37.
The maintenance of a strong defense relationship with New Zealand;

The furtherance of a favorable strategic situation in South-East Asia and the South-West Pacific;

The promotion of a sense of strategic community between Australia and its neighbors in our area of primary strategic interest;

The maintenance of the provisions of the Antarctic Treaty, which ensures that continent remains demilitarized.16

Both Dibb and DOA 87 also placed considerable emphasis on the concept of ‘self-reliance.’ Dibb called self-reliance a “slogan” until it was “related to credible and practicable situations.”17 Kim Beazley, the Minister for Defence at the time, in his introduction to DOA 87, explained the implications of self-reliance, writing that self-reliance aimed to achieve the four fundamental objectives of Australia’s national and international defence policy:

1. capacity for the independent defence of Australia and its interests;
2. promotion of regional stability and security;
3. strengthened ability to meet mutual obligations especially with main allies (the United States and New Zealand; and
4. enhanced ability to contribute to strategic stability at the global level.18

He also cautioned that self-reliance does not mean self-sufficiency.19

Nowhere is there any direct reference to outer space as being relevant to Australia’s strategic circumstances, or as an area in which Australia should seek some capacity at all, let alone self-reliance or, even more ambitiously, self sufficiency. It simply did not rate.

A turning point with regard to broad acceptance of the joint facilities came in 1988 when Bob Hawke, the Labor Prime Minister of the day, announced in Parliament that the agreements covering the joint facilities with the United States had been extended for a further 10 years. His statement contained the most fulsome official explanation of the purposes of both Nurrungar and Pine Gap provided before or since. Hawke said:

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16 DOA 87, para 2.69, p 22.
18 DOA 87 p ix.
19 DOA 87 p x.
"Nurrungar is a ground station used for controlling satellite (sic) in the United States defense support program (DSP). The DSP satellites provide ballistic missile early warning and other information related to missile launches, surveillance and the detonation of nuclear weapons. Few if any elements of the strategic systems of either superpower make such a decisive and unambiguous contribution to keeping the peace as the defense support program.

"Pine Gap is a satellite ground station whose function is to collect intelligence data which supports the national security of both Australia and the United States. Intelligence collected at Pine Gap contributes importantly to the verification of arms control and disarmament agreements.\(^{20}\)

The Pine Gap complex near Alice Springs.

Other ground stations, including the NASA Deep Space Tracking Station at Tidbinbilla, and the European Space Agency (ESA) stations in Western Australia, manifestly support space exploration and space science, and are an integral part of the Australian space landscape. They are

unobtrusive, do good work, provide a small number of jobs into local communities, are the source of occasional good news stories, demonstrate Australia’s bona fides as an international partner, and cost the Australian Government and taxpayer almost nothing. “Why invest when this is the sort of deal the nation has been able to negotiate in the past?” is a question that few critics and commentators have sought to ask.

**Australian Satellites**

Three satellites have been designed and built (mostly) in Australia. The first was WRESAT in 1967, making Australia the fourth country to launch a satellite made in its own territory from that territory. The second was Oscar Australis 5 in 1970, and the third was FEDSAT in 2002. All were one-off projects, and none led to the follow-on activity which was essential if industry was to have the confidence to invest.

**Civil Developments**

In 1985 the Hawke Labor Government established an Australian Space Office (ASO) following a seminal review of Australia’s performance in space, which was conducted at the request of the government by the Australian Academy of Technological Science and Engineering. The review was headed by a distinguished mining company executive, Sir Russel Madigan. Madigan recommended that modest funds ($100 million over five years) be provided to promote space science and to assist space industry developments, including private initiatives to establish launch facilities on the Cape York peninsula in northern Australia and also at Woomera. Successive governments never came close to the investment levels recommended, and none of the industry initiatives materialized.

Madigan recommended that the work of the ASO be overseen by a Space Council comprising worthy and experienced people who would guide the ASO and keep the Minister informed as to progress. The Council was initially an advisory group, which reported to the responsible Minister. Eventually it was established under its own Act of Parliament in 1994. The functions of the Council were outlined in S6 of the Act:

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21 Australian Academy of Technological Sciences, A Space Policy for Australia, Melbourne, June 1985 (The Madigan Report).

6. (1) The Council's functions are:

- To inquire into, and report to the Minister on, such matters affecting the application of space-related science and technology by the Australian public and private sectors as are referred to the Council by the Minister; and
- To recommend to the Minister a national space policy (the "National Space Program") that encourages the application of space-related science and technology by the Australian public and private sectors; and
- To co-ordinate the involvement of representatives of the Australian public and private sectors in developing, and reviewing, the National Space Program; and
- To keep under review, and report to the Minister on, the outcomes of the National Space Program; and
- To consult and co-operate with persons, organisations and bodies in relation to matters affecting the National Space Program; and
- Such other functions as are conferred on the Council by this Act or any other Act.

(2) In performing its functions, the Council must comply with any directions given by the Minister [under section 8.]

(3) The Council may perform its functions in or out of Australia.

The Council produced reports in 1994 and 1995. Emphasis was on launch and focussed on the establishment of a space launch facility on Cape York, which was described in the second report as a “Project of National Significance.”

In 1996, when the Liberal Coalition Government led by John Howard came to power, the Space Office, was scrapped together with the Space Council and their lofty ambitions. Investment in space development activities and space science funding ceased to have any special status in Cabinet, in research funding, or in any other claims to government attention.

Some years later a further attempt to establish a space launch

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capability on Australian territory was made by the Asia Pacific Space Centre (APSC), which planned to launch satellites from Christmas Island beginning in 2004. Christmas Island is a small Australian island territory south of the Indonesian island of Java and located at 10.5 degrees South, is close to the Equator and well-placed to support heavy lift payloads into geo-stationary (GEO) orbits. APSC planned to use Russian launch vehicles and had an aggressive and optimistic launch schedule. The Australian government offered considerable assistance to APSC, mainly in the form of infrastructure upgrades at Christmas Island. However, the launch market dried up, the investors needed to bring the spaceport to life walked away, and the project failed.

An enduring legacy of these failed launch initiatives is the Australian Space Activities Act, No 123 of 1998. This Act and its associated regulations is one of the more comprehensive pieces of domestic space legislation in existence anywhere in the world. Perhaps most importantly it defines a lower, if arbitrary, limit of outer space for the purposes of the Act as being 100km.25

In 1979, the Australian Government established a new communications company called AUSSAT the purpose of which was to acquire and operate a small number of capable satellites to considerably improve communications services to regional and remote areas of Australia. The satellites were acquired from the Hughes Corporation and launched in 1985 and ‘86. Shortly afterwards, AUSSAT was sold to a commercial company, Cable and Wireless Optus, which was later purchased by the Singapore based Singtel corporation. Optus is currently the ninth largest communications satellite company in the world.26 Although a wholly owned subsidiary of Singtel, Optus is an Australian company and the Australian government has imposed strict licensing conditions to ensure Australia’s sovereign interests are adequately protected.

In 2000, the Howard Government released the first Defence White Paper since the one published by the Hawke Government in 1987.27 Most importantly, the Cold War had ended and alliances and other relationships around the world had been re-shaped. The 2000 document, not unlike its predecessor, was virtually silent on space matters. The word ‘space’ in the context of outer space does not appear once, and the word ‘satellite’ is

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26 Space Foundation, Space Report, 2010, Exhibit 3k, USA, p 79.
mentioned only twice – once in the context of high-resolution imagery, and once in the context of communications satellites. There is no direct reference to the joint facilities, only higher-level phrases about intelligence cooperation and privileged Australian access to a range of US technologies.

In 2001 the Howard Government established an International Space Advisory Group (ISAG), chaired by the first person born in Australia to fly in space, Dr Paul Scully-Power. The ISAG, according to the media release, was an ambitious undertaking. Among other things, it was to:

- Lay the foundations for the development of a strategy for Australia's engagement in key international space programs,
- Identify opportunities for Australian involvement in the International Space Station (ISS) and other international space programs, and
- Assess the potential scientific and commercial benefits in pursuing such opportunities.

The responsible Parliamentary Secretary of the day, Warren Entsch, was quoted in the same media release as saying, “This could include such things as Australia taking a direct role in testing and providing landing sites for NASA's new X-38 International Space Station crew rescue vessel, right through to possible collaboration in the development of habitation modules for the International Space Station and space based research in the life sciences.”

No such activities eventuated. The legacy of the ISAG, which reported in 2002, is that it created an inventory of civil and commercial space activities with which Australia and Australians were involved. Its principal recommendation was that Australia should develop a ‘demand’ driven strategy for space engagements. And contrary to the hyperbole of Mr Entsch, the report also concluded that:

"Australia should not sign onto international space programs, including the International Space Station, before determining its own national priorities for space engagement through a demand driven strategy.”

The ISAG report set the scene for the Howard Government’s Australian Government Space Engagement: Policy Framework and

\[\text{28 Media release, Australian International Space Advisory Group Meets in Canberra, Office of Warren Entsch, MP, Parliamentary Secretary to the Minister for Industry, Science and Resources, Canberra, dated 5 June 2001.}\]
\[\text{30 ISAG Report, p i.}\]
Overview. It would seem to have reinforced the view of Government that space was not an area which called for any special consideration where investment or intervention was concerned.

The apparent lack of interest and investment in space activities in Australia for 25 years from 1980 – 2005 has been a source of conjecture at home and abroad. One paper, describing and lamenting this state of affairs, uses the phrase “punching below its weight” to describe Australia’s seemingly passive and confused approach to involvement and investment in space activities.

Some writers point to Canada and wonder why Australia did not choose a similar path and develop a niche, local space industry. Both nations, after all, have vast geographies for which satellites present obvious practical solutions. There are two answers to this question. The first is that the Canadian space industry, for all intents and purposes, is an integral component of the US space industry. Canadian companies supply niche components to the major US satellite manufacturers in a single market. Perhaps more importantly, the drivers of the alliance relationships with regard to space between Canada and the United States and Australia and the United States are quite different. During the Cold War Canada and the United States had common cause in the air and missile defense of North America. They faced a common threat. Canadian servicemen and women served alongside their US counterparts in the organizations that were established to conduct nuclear war with the Soviet Union, such as the North American Aerospace Defense Command (NORAD). This was for Canada a survival imperative, but not so in Australia. Although the joint facilities may have been targets in the unlikely event of global nuclear war, they were in remote locations well away from major population centers. A different risk calculus leading to different investment priorities applied.

Changing Times

From the mid 2000s a series of events and activities have occurred in and beyond government that have started to develop the narrative about space that was previously absent. At the same time, the political and physical

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circumstances of space have changed substantially, and finally, and perhaps most importantly, there is increasing awareness, certainly by governments, of the increasing reliance that the economy, and social life more generally, has on assured and secure access to space-based services, including position, timing and navigation, communications, and Earth observation.

The closest the Howard Government came to enunciating a national space policy was a document called Australian Government Space Engagement: Policy Framework and Overview. This document, first released in 2003, following the ISAG review, was considered by some critics to be a policy not to have a policy. Its central tenet, that Government saw no special need to provide favored treatment to the space sector over any other sector of the economy in organizational terms, or in support for industry development and research, was roundly condemned by small but vocal space science and space advocacy groups. Space Engagement stated:

“There is no strategic, economic or social reason for the Australian Government to pursue self-sufficiency in space.”

Few would have disagreed with this statement. However critics of this policy, such as Jeff Kingwell, made the point that there were opportunities in space science and space industry development, short of self-sufficiency, which, if pursued, offered benefits. Unfortunately, papers such Kingwell’s failed to comprehend the impact of the US alliance relationship on space-related discussions in government. Comparisons with countries including Mexico, Venezuela, Egypt and others simply cut no ice with Australian governments because none of those nations had a relationship with any superpower which bore any resemblance to that which existed (and exists) between Australia and the United States, and at the core of which are space capabilities.

In 2005 Senator Grant Chapman, a Liberal Senator from South Australia, established a Space Policy Advisory Group (SPAG), which drafted a report, Space: A Priority for Australia, that the Senator forwarded to the Prime Minister in November. This report noted the growing dependence of many sectors of the Australian economy and social fabric on space-based services and argued that the Government did not have a clear view either of these dependencies or their associated vulnerabilities. The report argued that space-based services were, in effect, part of the nation’s

33 Space Engagement Framework.
34 Kingwell, p 161.
critical infrastructure, and recommended that the Government take a series of steps to allow it to better understand and mitigate the vulnerabilities which were emerging. The Chapman Report, as it became known, led to a formal review of the Space Engagement document, and a revised version was released in early 2007.

The 2008 Senate Inquiry

In November 2007 the ALP led by Kevin Rudd won a clear victory at the general election. John Howard, the incumbent Prime Minister, even lost his seat. The new Prime Minister, who had been a diplomat and had an abiding interest in foreign affairs set a frenetic pace, (which ultimately led to his undoing in June 2009). Shortly after the election, three Senators, all from South Australia (Grant Chapman, Liberal; Natasha Stott-Despoja, Democrat; and Annette Hurley, ALP) worked in concert to persuade the Senate, through its Standing Committee on Economics, to conduct an inquiry into Australia’s space sector. This was the first time either House of the Australian Parliament had deliberately inquired into Australia’s performance in space.

The Committee received 88 written submissions and held six public hearings. It produced an interim report in June 2008 and a final report in November 2008. Its six recommendations were cautious but directed towards much better coordination of space activity in Australia, notably in the civil and commercial sector. The report viewed the creation of an Australian space agency as a goal to pursue and recommended that an Advisory Council be established which would:

- Conduct an audit of Australia's current space activities within six months of the establishment of the Council;
- Analyze the strengths, weaknesses opportunities and threats to Australia's emerging space industry;
- Focus on the key “workhorse” space applications of Earth observation, satellite communications and navigation as the most practical and beneficial initial priorities;
- Systematically evaluate the medium/long-term priorities for a space agency, including the national benefit of defense related

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36 Senate Standing Committee on Economics, Lost in Space? Setting a new direction for Australia’s space science and industry sector, Canberra, November 2008 (Senate Report).
activities, Earth observation, environmental, land management, exploration, national disaster prevention and management, treaty monitoring, e-commerce, and telemedicine;

- Examine the benefits to Australia of improved international collaboration, including membership in international space groups;
- Develop a draft strategic plan for the establishment of a space agency and the most appropriate form of that agency, including public/private funding, budget and staffing priorities; and
- Identify critical performance areas such as research, technological development, development of the skill base, effective partnerships, delivery of new services, and financial management.  

The Government formally responded to the Senate recommendations in November 2009, well after the May 2009 budget, which allowed the Government to record considerable progress against the Senate report’s recommendations. The 2009 events are discussed later in this chapter.

Other Factors

There were also other factors at work.

First, the Global Financial Crisis of 2008 prompted the Australian Government to devise an economic stimulus package in order to protect jobs and to help the Australian economy ride the storm that engulfed stock markets and the economies of North America, Europe and elsewhere. The stimulus package provided an unexpected source of income, some of which was used to fund some of the space development activities recommended in the Senate Report.

Second, Prime Minister Rudd made the first ever national security statement to the Parliament on 4 December 2008. This wide-ranging document was completely silent about space, except by inference when discussing the importance to Australia of the US alliance. Perhaps the authors of the document did not know quite what to say. Certainly, in late 2008 and extending into 2009, the Prime Minister’s own department conducted a review of Australia’s space activities, which was intended as

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37 Senate Report, Recommendation 5.
the basis of a briefing to the Prime Minister in April 2009.\textsuperscript{39} The outcomes of this review may well have helped to inform decisions announced in the May 2009 budget about civil and science investment in space. It may also have influenced the focus on space in the 2009 Defence White Paper, which was also released ahead of the May 2009 budget.

Third, the global strategic environment, of which space forms an integral element, was rapidly changing with the rise of China and the relative diminution of status of the United States. What Australia, as a middle power, might, could and should do to influence the developing relationship between China and the United States may well become the defining question for Australian foreign policy over the next 50 years, and as the regulation, use of and behaviour in space may become one of the most contentious areas with which China and the United States will have to deal in this century, Australia finds itself precisely in the middle of the equation.

The Australian Space Industry

Since it was formed in mid 2009, the Space Policy Unit has commissioned two surveys of the Australian space industry in an effort to gather data about its size and wider contribution to the Australian economy. The second report, which was an update of the first, concluded:

It [the report] reveals that Australian space activities are substantial in their own right in terms of the number of organizations involved (631), the number of people employed (8,418), and the revenue generated ($1 billion - $2.2 billion).\textsuperscript{40}

Leaving aside questions about methodology, the word “substantial” hardly seems warranted to describe a collection of companies and research groups in universities and government agencies which contribute directly somewhere between 0.1 and 0.2\% of Australia’s GDP (which, in aggregate, is approaching one trillion dollars annually). No matter how these numbers are cut, they point to a sector populated by small, even tiny companies and research groups which, using simple arithmetic, employ 13-14 people each. This is not to denigrate the efforts of those involved, far from it. Rather it

\textsuperscript{39} The author of this paper was an invited participant at one of the workshops held as part of the review.

is intended to put some realistic measures around the industry, at least as defined by the surveys.

Only one Australian company, Silanna, is known to produce components (radiation hardened computer chips) that fly in space.\textsuperscript{41} The industry overall is dispersed, and most participants self-identify with other sectors of the economy, such as communications, remote sensing or surveying, rather than with space per se. Their space business often comprises a very small element of their business overall.

**Satellite Communications**

In Australia, satellite communications is a mature, commercially viable market. The Australian government, as noted earlier in this chapter, invested in two communications satellites in the 1980s through AUSSAT, which was the forerunner to OPTUS. The Australian Government, through the National Broadband Network (NBN) initiative has recently announced its intention to purchase two more highly advanced broadband satellites to deliver high capacity communications services primarily to Australia’s remote and regional areas.

The Australian Department of Defence has purchased satellite communications in ways that are innovative and could well serve as a model for others to follow. Defence has used five approaches:

1. A shared satellite approach on the OPTUS C1 satellite, where the one satellite bus is shared by a commercial payload operated by Optus and a military payload operated by Defence and the satellite is jointly owned;
2. A constellation approach, evident in Australia’s investment in the US Wideband Global System (WGS), whereby Australia has paid for one satellite in a constellation of six satellites which is operated by the USAF and, in return, has gained access to the capabilities of the entire constellation;
3. A hosted payload approach, adopted for an agreement reached with INTELSAT, whereby Australia has paid INTELSAT to place an additional military communications payload onto an otherwise commercial satellite (IS-22, launched on 25 Mar 2012);
4. Negotiated access to allied communications satellites to support specified activities; and

\textsuperscript{41} Silanna: see http://www.silanna.com/
5. Ordinary commercial leases.

The key point to note is that Australian Governments and military planners have judged that the risks of accepting considerable and growing dependence on space-based services, and over which the nation has little or no direct control, are worth taking. Assured and secure access to the space environment on a sustained and continuous basis has been assumed or taken as a given. A corollary has been that the mere possession of satellites that bear the Australian flag is unlikely to alter the extent of Australia’s influence in international conversations around the security and stability of the space environment. The attitude seems to have been that if the United States is prepared to take the risk, then why would Australia not follow suit? The Australian Government has made substantial investments, in both space and ground segments, via the approaches outlined above; a point not always acknowledged by those who argue for more active and explicit space engagement by Australia.

Australia’s direct investments in space communications have been achieved in such a way that up-front capital exposures have been shared or minimized and access has been gained, in the case of WGS especially, to a global constellation for the cost of investing in only one part of it. Operationally, providing that the nation remains confident in the strength and endurance of the alliance, this seems like a very good deal. Strategically, such dependencies may become limiting because Australia’s options for independent action could be reduced at some point in the future. There is every reason to be confident that the Australian Government is aware of these risks, which partly explains why commercial leases with various providers are also in place. Defence would seem to be making considerable effort to ensure path diversity thereby avoiding single points of failure in satellite communications systems which could have adverse strategic, operational and tactical consequences, especially for deployed elements of the Australian Defence Force.

Timing and Navigation

 Australians, like most other peoples on Earth, are reliant on the US Global Positioning System (GPS) for precision timing and navigation that supports myriad applications. GPS has become a global utility funded by the US taxpayer, and life without access to GPS is difficult to imagine. Many economic and social systems that are highly integrated and tightly coupled would stop. Others might slow to a crawl until alternative methods for determining time and location were established. Several nations,
including Russia, China, Europe (as a whole), Japan and India have developed or are developing their own precision timing and navigation systems which are independent of GPS. All of these systems converge in Asia including across the northern parts of Australia, forming what some have called the Global Navigation Satellite System (GNSS) Hotspot.

The alternative systems to GPS have been developed in part to mitigate concerns that the US may seek national strategic, economic, or military advantage by selectively denying others access to GPS in circumstances of international tension, disagreement or war. But all of these systems nevertheless assume that access to space will remain assured and secure for all.

The key vulnerability may not be aberrant behavior by a nation on Earth, but rather solar activity of such magnitude that much of the near space environment, if not all of it, could be rendered unusable. Satellites, especially those operating beyond the Van Allen belts, including the GPS satellites, may well be damaged or knocked out. Solar storms of sufficient magnitude to damage and possibly disable satellites have been recorded in the past. Advance warning of such solar activity is short, and although operators can take actions to mitigate the adverse effects of solar storms and cosmic radiation, a situation can be envisaged where the sheer intensity of a storm could be expected to overwhelm the defenses of many satellites,
leading to reduced performance and, in extremis, destruction.

Certainly the possibility of such an event is remote, but the possibility is greater than zero, and the global community would do well to consider the impact of a world without GPS or, at best, with severely degraded GPS for an extended period of time. Australia is well-placed to frame this discussion for the space disadvantaged nations and to develop realistic mitigation strategies.

The Australian GNSS community, following the lead of space science and Earth observation communities, has recently published a strategic plan for precision location for Australia looking towards 2030 and beyond. This report places dollar values on the economic benefit to be gained by systematic investment in Continuously Operating Reference Systems (CORS) and related capabilities that provide precision timing and location data to all parts of the nation and all sectors of the economy.

**Earth Observation**

Australia is a sophisticated user of Earth observation data especially for climate modeling, weather prediction, and mineral exploration. This status has been achieved without the nation having had to invest, to this point, in satellites of its own. Australia, through international agreements and investments in ground reception stations, data processing infrastructure, appropriately trained and qualified people, and modest but capable research infrastructure, has developed a critical mass of capability which is unique among non-spacefaring nations.

A substantial component of Australia’s foreign aid program is allocated to the provision of meteorological and related service, from data derived from satellites, to nations in SE Asia and the SW Pacific. Success and sophistication notwithstanding, there are shortcomings and there is considerable room for improvement.

There are several reasons why Australia has not embraced satellite remote sensing in a more fulsome way than might otherwise have been the case.

**Good weather**

Australia’s skies, except north of the Tropic of Capricorn during the monsoon season, are mostly clear of clouds, which means that airborne

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remote sensing is a well-established industry. Users, both government and private, are familiar with the products and understand their strengths and limitations. Users control and, in some instances, own and operate these aircraft and their sensors. “Why fix a system that is not perceived to be broken?” is a pervasive attitude. Those who seek to persuade Australia to invest in Earth observation satellites rarely acknowledge the efficacy of existing arrangements and fall into a trap of assuming that, almost by definition, a satellite-based solution is in some way superior to anything that might have gone before.

**Technology Push versus User Pull**

Many companies and government funded agencies from spacefaring nations have come to Australia to demonstrate advanced and seductive satellite-based remote sensing technologies which are assumed to fill pressing information gaps or deficiencies. Invariably these organizations have sought to raise capital or to sell data on an ongoing basis. But few have bothered to learn about the scope, scale and structure of the Australian market. For example, Australian fire and emergency management organizations are favored targets even though the amounts of money to which they have access is small, and is held by the States and territories. Until recently there has been no single buying authority for satellite data in Australia. None of the relevant State and Territory authorities have access to the (usually) multiple millions of dollars sought by proponents of satellite-sourced data. More importantly for responder organizations such as fire fighting agencies, their organizational culture seeks to keep to an absolute minimum any investment that is not directed towards response assets. Somewhat simplistically, fire trucks, not information systems, put out fires, and firemen do not want to be satellite operators. This point is often not well-appreciated or sufficiently acknowledged by satellite data vendors and others seeking to collaborate with Australian users.

An additional dimension is that partnership and vendor proposals are often couched in terms of what a particular sensor can ‘see’ – based on experimental data, much of which has been gathered outside Australia. Invariably, the marketing focus has been placed on the sensor and not the overall system – to include revisit rates, satellite replacement and upgrade plans, calibration and verification, validation and assurance (VV&A) schemes. How the inclusion of satellite data into risk assessments and decision making might allow end users to achieve substantially better

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43 Available data indicates that the mean is in the order of 3.2/8 or 3.2 octas. See http://www.bom.gov.au/climate/change/cloud.shtml
operational outcomes is rarely discussed. This involves changing long-established business processes and building trust and confidence in new and unfamiliar sources of data.

There is a tendency for proponents of satellite-derived data to assume that potential customers in Australia will grasp the benefits, essentially by definition, due to the brilliance of the technology. Such attitudes are arrogant, disrespectful and indicate that little or no market analysis has been done ahead of the technology being exposed. Invariably organizations that assume or assert that Australian agencies will derive benefit from access to systems and data on offer leave disappointed and disillusioned. This cycle of disappointment is unlikely to change unless and until vendors seriously invest in understanding and developing the Australian market. This is a long-term effort that is not capable of being met by fly-in/fly-out sales and marketing efforts, which is the usual approach.

In summary, vendors reinforce quite strongly held attitudes by politicians and officials that many involved in space endeavours are self-serving, obsessed with technology for its own sake, and not focused on providing end user benefit. Until they and potential collaborators come to Australia to listen, rather than to tell, they are not likely to succeed in selling their own products and services or building the relationships they seek to build.

Poor industry behavior and Politicians

Australian politicians have long been wary of proposals to invest in space capabilities. The failed commercial launch proposals of the 1980s and 1990s followed by a succession of ill-conceived, from a business perspective, remote sensing projects have left many politicians skeptical of all things space. Once again, the “giggle factor” comes to the fore and needs to be overcome through evidence and a narrative that emphasizes individual and community end-user benefit.

This evidence, especially with respect to the economic value of satellite based remote sensing, is starting to accumulate, and a defensible narrative, told in terms of end-user benefit, is beginning to emerge. In 2008, the Cooperative Research Centre for Spatial Information (CRCSI), commissioned a report on the value of spatial information to the Australian economy. The report concluded that:

“. . . industry revenue in 2006-07 could have been of the order of $1.37 billion annually and industry gross value added around $682 million.”
The economic footprint of the spatial information industry is considered to be larger than this. Spatial information is increasingly being used in most sectors of the economy where it is having a direct impact on productivity.

The study found that in 2006-07 the accumulated impact contributed to a cumulative gain of between $6.43 billion and $12.57 billion in Gross Domestic Product (GDP) – equivalent to 0.6% and 1.2% of GDP respectively.\(^ {44}\)

Geoscience Australia commissioned a second report by ACIL Tasman in 2010. This found that Earth observation from space contributed at least $3.3 billion to Australian GDP in 2008-2009, with prospects for significant growth. The report also concluded that if Australia were even partially denied access to data from Earth observation satellites there would be a significant negative impact on the Australian economy.\(^ {45}\)

2009: A Tipping Point

2009 may well come to be regarded as a “tipping point” in Australia’s involvement in space. For the first time, domestic developments and investments were spoken about by Government as being important factors in Australia’s commitment to space. An inference is that relatively passive and acquiescent reliance on the United States is no longer considered to be necessary or sufficient policy position to meet Australia’s sovereign needs and interests in space.

The 2009 Defence White Paper

Unlike its predecessors, the 2009 Defence White Paper placed considerable emphasis on space, and on cyberspace.\(^ {46}\) With respect to space, it proposed the acquisition of a Synthetic Aperture Radar (SAR) Earth observation satellite, nominated Space Situational Awareness a “priority” for Australia, indicated that Australia may need to consider “hedging strategies” in Ballistic Missile Defence (BMD) to counter emerging threats, and also proposed to establish a dedicated cadre of space

\(^ {44}\) ACIL Tasman, The Value of Spatial Information: The impact of modern spatial information technologies on the Australian economy, Melbourne, 2008.

\(^ {45}\) ACIL Tasman, The economic value of earth observation from space: A review of the value to Australia of Earth observation from space, Melbourne, 2010, p vi.

specialists within Defence. The dependence of the ADF on satellite-based services was underlined.

A simple metric illustrates the increased awareness of the importance of space to Defence and to national security more generally. The word “space” appears 32 times in the 2009 White Paper. In its predecessor released in 2000, the word does not appear at all. Similarly, the word “satellite” appears 14 times in the 2009 document and only twice in its predecessor.

The paragraph from the 2009 White Paper, which discusses the SAR satellite, is worth quoting in full.

"As a significant new measure, the Government places a high priority on assured access to high-quality space-based imagery to meet Defence's needs for mapping, charting, navigation and targeting data. It has decided to improve Australia's intelligence collection capabilities by acquiring a satellite with a remote sensing capability, most likely to be based on a high-resolution, cloud-penetrating, synthetic aperture radar. This important capability will add to Australia's standing as a contributing partner within our alliance framework with the United States, which will be given access to the imagery collected by this system."

The paragraph underscores the importance of the US alliance and the concept of self-reliance. Unusual for a white paper, this paragraph is quite specific and prescriptive. A not unreasonable assumption is that the SAR satellite may well represent the beginning of an enduring national Earth observation program for Australia which includes a space element as part of the overall capability. No mention is made of the ‘dual use’ possibilities of the system, but the choice of sensor (SAR) and the explicit link to the United States may imply that this satellite, if ever built and brought into operation, will be optimized to cover Australia’s northern approaches and may not be well-suited, or readily available to meet civilian needs across the Australian continent and surrounding oceans.

Developments in the Civil Domain

In the non-defense domain, the 2009 Budget provided funds to establish a Space Policy Unit within the Department of Innovation, Industry Science and Research (DIISR) and to establish a modest Australian Space Research

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47 Defence White Paper, 2009, para 9.80, p 82.
for the Development of Space

A Space Industry Innovation Council was also established to provide high level advice to the Minister. Perhaps most importantly, the Prime Minister of the day, Kevin Rudd, invited the Minister for Innovation, Industry, Science and Research (DIISR), Senator the Hon. Kim Carr, to develop and bring forward to Cabinet a proposed national space policy, to include defense and national security equities as well as civil, commercial and research requirements as well.

A two-step process was adopted by the Space Policy Unit. The first and most difficult step was to draft and gain acceptance across Government of a series of principles that would guide the development of the actual policy. The real purpose of the principles document, which was released by Minister Carr in September 2011, was to provide a basis for discussion within and between departments and Ministers, about the increasing dependence on space based utilities of virtually all areas of government. Seven principles are enunciated in the document:

1. Focus on space applications of national significance
2. Assure access to space capability
3. Strengthen and increase international cooperation
4. Contribute to a stable space environment
5. Improve domestic coordination
6. Support innovation, science and skills development

The principles document fulfilled, in its drafting, an educative role. At the 11th hour, and this point reinforces that made earlier about the “giggle factor,” the word “industry” was inserted into the title of the document. Concerns were raised in senior levels of Government that in a period of fiscal constraint any unqualified reference to a national space policy may well cause media and wider public speculation that the Australian Government was about to embark on some speculative space adventure which could be represented as profligate and out of step with broader economic realities.

The national space policy, hopefully with the “industry” qualification removed, is due for release in the latter part of 2012.

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49 Department of Innovation, Industry, Science and Research, Principles for a National Space Industry Policy, Canberra, September 2011. Available at www.space.gov.au
The Australian Space Research Program (ASRP)

The ASRP, announced in the May 2009 budget, has achieved considerable success. Fourteen projects, four with an emphasis on education and 10 focusing on industry development outcomes, have been funded. The initial funding for all projects is due to end on 30 June 2013 and follow-on funding remains uncertain. However, several of the projects have already identified sources of continuing support independent of the Commonwealth, and others are working to achieve a similar outcome. The ASRP sought to achieve two principal outcomes: enhanced national CAPABILITY and CAPACITY in space science and engineering which would strengthen Australia’s international CREDIBILITY in space matters. The principal means of achieving this was through a program that emphasised COLLABORATION between Australian and international participants in the ASRP.50

Such practical support has been essential to the building of confidence and credibility around the national space policy development process.

Issues and Opportunities

Space Science and Astronomy

Australia has a rich heritage in astronomy, and indeed European settlement on the east coast of the continent followed the discovery and charting of the coast by Captain James Cook following his voyage to the South Seas (Tahiti) to observe the transit of Venus across the face of the sun in 1769.

Australia is especially well-suited to host radio telescopes, being large, flat and, above all, radio quiet. Irrespective of whether the Square Kilometre Array telescope is built in Australia or in southern Africa, Australia, almost certainly, will continue to invest in radio astronomy as a national research strength.

In the context of this chapter, the important point to make is that astronomy is considered by politicians and funding agencies to be an integral part of Australia’s space narrative. Funding for space science other than astronomy generally competes directly for funding that astronomers

50 A summary of the ASRP program together with fact sheets on the funded projects may be found at www.space.gov.au
seek to support their research. The Australian astronomy community is well-organized, reasonably coherent and, over many years, has persuaded governments to invest in telescopes both in Australia and overseas. In contrast, the space science community, which covers many diverse disciplines from human performance in minimal gravity environments to planetary geology to ionospheric physics is dispersed and disorganized. Individual researchers, within their own disciplines, have tended to form their own bilateral links with international collaborators and agencies including NASA, ESA and JAXA.

In September 2010, following a long gestation, the National Committee for Space Science of the Australian Academy of Science, released an inaugural Decadal Plan for Australian Space Science. Aspects of the plan were and remain contentious, notably its recommendations to establish a coordinating body seemingly distinct from the fledgling Space Policy Unit, its proposals to collaborate with China on...

51 An exception to this general principle was made for the Australian Space Research Program (ASRP), a program that was funded in the May 2009 Budget from Economic Stimulus funds. Astronomy projects were expressly excluded from competing for ASRP funds.

aspects of ionospheric research and its plans for relatively large investments to support solar research when more immediate priorities to do with water management especially, across the Australian continent, remain to be properly addressed. However, the plan is a stake in the ground that did not exist previously, and it has provided a focal point for disparate research groups with diverse space research interests across Australia.

**Developments in Earth Observation**

In parallel with development of the 2009 Defence White Paper, the Defence Imagery and Geospatial Organisation (DIGO) and Geoscience Australia (GA), which is Australia’s principal civil geo-spatial agency, have worked increasingly closely to avoid unnecessary duplication, and to formalize their relationship in a way that has been unprecedented. Evidence for this cooperation includes the establishment of a government panel to rationalize purchases of data and services from commercial providers. Called the Optical, Geospatial, Radar and Elevation (OGRE) data and services procurement panel, the aim is to streamline and improve the way the Australian Government acquires Earth Observation imagery and services by using open frameworks and a cooperative approach.\(^{53}\)

Also, and alongside the independent reports prepared by ACIL Tasman referred to earlier in this chapter, the Earth observation community produced a strategic plan in 2009\(^{54}\) and a more narrowly focused policy document in 2010.\(^{55}\) These reports strengthened the evidence base from which the Space Policy Unit and others have been able to explain to Government that Australia’s remote sensing capability, across all elements of capability (people, organizations, sustainment, training, equipment and documented processes) is fragile and, without new investment, will be unlikely to satisfy national requirements with any degree of certainty beyond the short term (the next five or so years).

In 2011, Geoscience Australia released a report called Continuity of Earth Observation Data for Australia: Operational Requirements to 2015 for Lands, Coasts and Oceans (CEODA).\(^{56}\) The report, based on published

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54 Australian Academy of Science (AAS) and the Australian Academy of Technological Sciences and Engineering (ATSE), An Australian Strategic Plan for Earth Observations from Space, Canberra, 2009.


56 Geoscience Australia, Continuity of Earth Observation Data for Australia: Operational Requirements to 2015 for Lands, Coasts and Oceans, Canberra, 2011. (CEODA)
worst-case data about when Earth observation satellites on which Australia currently depends are scheduled to cease operation, painted a grim picture. The report made eleven key points, which are reproduced in full below.

1. Earth Observations from space (EOS) data have become pivotal to most environmental monitoring activities being undertaken by federal and state governments in Australia.
2. Australia is totally reliant on foreign satellites for EOS data.
3. Of the 22 EOS sensors currently being used for operational programs in Australia, 19 (89%) are expected to cease functioning by 2015.
4. Australia has not secured access to any future space-based sensors that are relevant to observing the Australian land mass and its coastal regions.
5. Alternate, non satellite-based sources of data do not exist for most types of space-based EOS data, especially those used for environmental monitoring programs.
6. In contrast with the projected rapidly decreasing access to EOS data, Australia’s EOS requirements are expected to increase significantly over the next decade. To support a sample set of 91 operational government programs, the total annual EOS data storage requirements in 2015 were conservatively estimated at 1.2PB per year. This represents a twentyfold increase on current annual EOS data storage. These estimates do not include meteorological applications, research and development activities, or new sensor technologies.
7. Two data types, medium resolution optical and Synthetic Aperture Radar (SAR), are most at risk of data gaps before 2015 for land and marine applications.
8. Data continuity for low and high resolution optical data, and for passive microwave data, is also of concern, but improved access to these data types has a lower priority due to the availability of alternative data sources and/or current levels of data usage in land and coastal applications.
9. Urgent action is needed to ensure that the imminent and potentially damaging EOS data gaps are not realized.
10. Australia’s participation in the Landsat Data Continuity Mission (LDCM) and ESA’s Sentinel missions would significantly reduce the risk of the projected EOS data gaps in the high priority data types and should be the focus of immediate action.
It should also be a priority to encourage an on-going Landsat program.

11. As a matter of priority Australia needs to formalize agreements with several upcoming EOS missions, and formulate a decadal infrastructure plan to safeguard the supply of EOS data.57

This report was a further spur to action by the Australian Government, and in late 2011 work began on two internal reviews, one focused on precision location and the other on Earth observation. The intention is that both documents are considered by Cabinet in the latter part of 2012, possibly in conjunction with the national space policy.

The precision location review is being led by Geoscience Australia, and the Earth observation review by the Bureau of Meteorology. This underscores the critical dependencies that these agencies have on data from satellites to produce timely and accurate products and services on which the broader community places great reliance and trust to support all manner of economic and other activity. The reviews are intended to provide a basis for investment proposals for inclusion in future budgets, with the aim of strengthening Australia’s precision location and Earth observation capabilities. Almost certainly emphasis will be on education and training, and ground processing and dissemination infrastructure in the first instance.

Why no space agency?

A question, often asked, is why Australia does not have a space agency. This is asked both inside Australia and by non-Australian observers as well. The questioners often have in mind a NASA-model, but many of them seem to have no appreciation of the relative sizes of the US or the Australian economies, and still have in mind a launch/manned space flight paradigm as a necessary condition for a space agency. The assumption is that if Australia has a space agency, almost by definition, it would also have launch capabilities and would be involved in programs such as the International Space Station (ISS). This argument is to put the cart before the horse. Successive governments have made abundantly clear by not investing in such activities that neither is considered to be a public policy or spending priority for Australia.

In fact, Australia was invited to join ESA following the withdrawal of the ELDO consortium from Woomera, but in 1983 the government

57 CEODA, p ix.
for the Development of Space

formally notified ESA that it would not be pursuing this option.\(^{58}\) (ESA, however, maintains ground stations in Australia under treaty level agreements with the Australian Government.)

Departmental and agency structures and funding also play a part in the decision not to have a dedicated space agency. The Australian Government, like many around the world, routinely seeks to harvest “efficiency dividends” typically by cutting the funds of ALL departments and agencies by a fixed percentage of their operating costs. Large organizations are much better able to withstand such austerity measures than are smaller, specialist agencies. The latter can rapidly lose critical mass and become unsustainable. The coordinating and other functions presently performed by the Space Policy Unit within the Department of Industry, Innovation, Science, and Tertiary Education (DIISTE), formerly DIISR, are far less exposed than would be the case if these same functions were being carried out by a small, specialized space agency.

In the past decade, with 2009 representing a “tipping point,” Australia’s approach to space matters began to change in response to five factors:

1. The space environment and the radio spectrum needed to support space activities, formerly uncluttered, became congested and contested;
2. The international regulatory regime of space which was established in the 1960s, essentially to meet the needs of the United States and the Soviet Union, showed signs of not being able to cope with the changing environment;
3. The pre-eminent position of the United States in space has come under challenge, especially from China;
4. The Australian Government has started to take a more active role in international space affairs:
   a. At the strategic level to work for a new space regime which protects and advances broadly western interests whilst also meeting ‘common heritage of mankind’ ideals; and
   b. At the operational level to become more self-reliant within the broader settings of the US alliance; and
5. The Australian Government and the wider community has begun to understand its dependence on space-based services, especially the GPS timing signal, and the associated vulnerabilities.

Space: Contested and Congested

The Chinese ASAT antismissile test of January 2007 in which a Chinese satellite was destroyed in orbit, creating a large in-space debris field, was as much a wake-up call in Canberra as it was in many other capitals. The Chinese Ambassador was quickly called in and made formally aware of Australia’s concerns and displeasure. Two inferences may be drawn from this response:

That Canberra and Washington consulted closely on the event itself, its implications for the space environment, and how to respond; and

That within the Australian Government there is a cadre of officials who are well-informed about space matters and who maintain a close watch, in particular from the perspective of Australia’s strategic interests.

The US destruction of a crippled spy satellite in early 2008 followed by the Cosmos/Iridium satellite collision over Siberia in early 2009 reinforced to policy makers the fragility of the space environment and the vulnerability of satellites, especially those operating in low Earth orbits.

With respect to radio spectrum, Australia has been an active member of the International Telecommunication Union (ITU) for more than a century. The nation’s geography compels it to rely, more than many nations, on disciplined use of spectrum to optimize the competing demands of terrestrial and satellite communications systems to ensure assured coverage across the continent and the vast surrounding ocean areas. There is also a need to keep some frequency bands as free as possible for science, notably radio astronomy.

The Regulatory Regime

All spacefaring nations are increasingly aware and concerned about the limitations of the declaratory principles of the Outer Space Treaty and the follow-on treaties and other instruments, which were drafted and came into force in the 1960s and 70s. As more nations develop their own space capabilities, an increasing need is seen for more explicit norms to be developed and embraced by spacefaring nations in order to preserve the space environment itself. The fundamental difficulty with space regulation of any sort and by any name is that the initiative rests with the offense, and the distinction between accidental and deliberate damage can be difficult, if not impossible, to establish. This leads to problems with the concept of proportionality when considering how to respond to an aggressive,
damaging or destructive act.

Not yet evident in discussions about future space regulation is how the voice(s) of nations that are dependent on secure and assured access to space-based services, but which are not spacefaring, will be heard. This writer argues that Australia is well placed by geography and experience to demonstrate leadership as a space dependent but not spacefaring nation in the negotiations to come that will determine the future regulation of human activity in space. In an increasingly connected world in which space-based services play an important and not easily replaced role, mechanisms will be needed by which these people and their governments can be heard as the code of conduct discussions proceed. The “common heritage” principles outlined in the Outer Space Treaty seems worthy of protection, and indeed, of reinforcement.

The United States and China

The 21st Century has been called by some the Pacific Century, as power shifts from Europe and North America to North and South Asia. China and India are emergent great powers and how they will accommodate each other and the United States remains to be seen. Clearly, there will be elements of cooperation and competition, and clearly Australia, by dint of its geography, alliances, and trading relationships, will be both involved in and affected by the ways in which these nations negotiate their future relationships. Space is one of the elephants in the room, with the second being cyberspace.

China is well aware that the US military is dependent on space in a way not yet matched by the People’s Liberation Army, resulting in an asymmetry that at present is favorable to China. As the PLA itself becomes more dependent on space, the temptation for China to act preemptively may be expected to reduce, leading to a situation not dissimilar to the mutually assured destruction achieved in the Cold War when both the United States and the Soviet Union achieved a second strike capability.

There is an active debate among a group of Australian strategic thinkers about the type of role and the extent of any influence that Australia might expect to play in defining the new Asian order. Broadly speaking there are two camps, those who argue for Australia to become even more closely tied to the United States, in anticipation of a serious disagreement with China at some point in the future, and others who argue for a more independent position which acknowledges the importance to Australia of
China in every respect and not simply as a market for Australian raw materials. From a military point of view, the resolution of this debate is fundamentally important because of its implications for force structure. For example, should the Royal Australian Navy be equipped with fast, long endurance submarines, or with slower boats with less range and time at sea before needing to be replenished?

The 2009 Defence White Paper would tend to suggest that its authors and the Government of the day, which approved and released the document, is inclined to the former view. Whether such a position is sustainable and tenable in the longer view remains to be seen.

A More Active Role in International Space Affairs

There is strengthening evidence that Australia is seeking to take a more direct and active role in space affairs in future than has been the case in the past. The cadre of space aware and competent Australian officials is growing in size, capability, and confidence. Australian officials, for example, are becoming more prominent participants in the workings of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) and other multi-lateral forums devoted to space matters. Space security is also being spoken about with increasing frequency by senior Ministers and officials, both within and beyond the context of the US alliance. Each year the Australian and US Governments hold the Australia/US Ministerial talks, known as AUSMIN. These are the peak bilateral talks, which discuss the state of the relationship and the alliance.

The communiqué for AUSMIN 2010 placed considerable emphasis on space security, notably through improved Space Situational Awareness

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59 Professor Ross Babbage and Mr Mike Pezzullo, are among those whom this writer would place in the first camp. Mr Pezzullo was the principal author of the 2009 Defence White Paper and Professor Babbage was closely involved in the shaping of that document as well. Professor Hugh White is representative of the second camp. He wrote a seminal essay in 2010 which confronts these questions squarely and caused something of a stir at the time. See, White, Hugh, Power Shift: Australia’s Future Between Washington and Beijing, Quarterly Essay, Issue 39, Griffin Press, Melbourne, August 2010.

60 The Kokoda Foundation has published several papers in the past two years which address Australia’s requirement for new submarines. The most recent is Pacey B., Sub Judice: Australia’s Future Submarine, Kokoda Paper No 17, Canberra, 2012. This paper is available for download on the Kokoda Foundation’s website: www.kokodafoundation.org [Declaration of interest: the present author is a director of the Kokoda Foundation.]
(SSA), and under the heading “21st Century Challenges,” stated in part:

“Building upon a long history of defence space cooperation, Australia and the United States signed a Space Situational Awareness Partnership Statement of Principles, which should enable further close cooperation on space surveillance to the benefit of both countries.

“Australia and the United States shared a deep concern about the increasingly interdependent, congested and contested nature of outer space and acknowledged that preventing behaviors that could result in mishaps, misperceptions or mistrust was a high priority. Australia welcomed the US decision, reflected in the June 2010 US National Space Policy, to consider space arms control measures that are equitable, verifiable and in its and its allies’ national interests. Australia intends to work with the United States to progress their shared goal of enhanced space security, with a particular focus on transparency and confidence building measures. The two Governments endorsed a Joint Statement on Space Security highlighting their shared views and resolve to cooperate with like-minded countries to ensure free and safe access to space.”

The SSA Statement of Principles included a commitment by both nations to:

“... investigate the potential for jointly establishing and operating space situational awareness facilities in Australia to support the United States space surveillance network and to support the development of Australia's space situational awareness and mission assurance capability.”

This was an oblique reference to locating, in the first instance, a ground-based SSA radar possibly at North West Cape in Western Australia. Formal announcements about this facility have yet to be made. There has also been comment in the public domain that one of the next generation Space Fence ground-based SSA radars being developed by the US could be located in Australia. Whether this occurs could depend as much on the state of the US defense budget as on operational factors.

In January 2012, the Australian Foreign Minister, the Hon Kevin Rudd, announced that Australia would endorse European efforts to develop a space code of conduct, and Australian officials were active participants in the 2012 meetings of COPUOS in Vienna.62

61 AUSMIN 2010 Communiqué, Nov 2010
Advocacy for Space-Disadvantaged Nations

This writer considers there are 15 nations to which the label spacefaring may be applied. ‘Spacefaring’ is understood to mean demonstrated current capacity within the nation to design build, test, and operate satellites. The reality of global supply chains means that some components will be sourced from outside these countries, including from non spacefaring nations. However, the bulk of design, integration and testing is done within the spacefaring nation itself.

Some spacefaring nations have launch capabilities, while others purchase launch services from a small number of government and commercial providers. The 15 nations are, in alphabetical order: Brazil, Canada, China, France, Germany, India, Israel, Italy, Japan, Russia, South Korea, Taiwan, Ukraine, the United Kingdom, and the United States. Together these nations, which comprise 8% by number of the nations on Earth, represent more than 75% of global GDP and 54% of global population.

The remaining 185 or so nations, their peoples and their economies, also have dependencies on services delivered from space, including precision timing and navigation, remote sensing data and communications.

A question for spacefaring nations is thus how to ensure that space disadvantaged nations have necessary and sufficient access to space-based services to allow them to participate, as effectively as possible, in economic and other activities which are increasingly globalized.

A question for the international community is how to ensure that the legitimate interests of these nations and their peoples, with respect to the safety and security of space-based services, can be articulated and heard. The principle involved is not dissimilar to that which applied during the discussions that occurred in the 1970s in the conferences which eventually produced the Law of the Sea convention. Landlocked states and others with coasts that did not generate significant maritime zones and obligations argued that, in accordance with the principle of the common heritage of mankind, they had some entitlement to a share of the mineral wealth said to be present on and in the deep seabed. These states formed a loose association that became known as the “blocking third.”

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63 Nations that might soon be added to this list include Iran, Malaysia, Mexico, North Korea, and South Africa.

have the numbers to ensure that particular articles were adopted, but they did have the numbers to prevent the inclusion of particular clauses in the convention as it was developed through extraordinary diplomatic effort.

As a middle power, Australia played an active role in the law of the sea negotiations in the 1970s, for reasons that are obvious by glancing at a map. Australia has the third longest coastline of all of the world’s nations, after Canada and Russia. It generates a vast Exclusive Economic Zone and has search and rescue responsibilities for approximately 13% of the Earth’s surface under the Safety of Life at Sea (SOLAS) convention. More than 98% of its exports are carried by ships to markets, mainly in Asia and, in reverse, most imports, which comprise manufactured goods, come from factories, many in China and other countries in Asia, also by sea.

Similarly, this writer sees the possibility of Australia taking a leading role in the international discussions which must occur about the future governance and regulation of space, to ensure that competition between nation states is bounded, that congestion, especially in the Low Earth Orbits (LEO) is managed wisely and fairly, and that the finite resource of spectrum is also allocated optimally, taking account of global, regional, national and commercial interests, and also the potentials for more effective and efficient use and re-use of spectrum which advances in technology may permit. Norms must be developed, defined and agreed upon, and a regulatory regime developed which is sufficiently transparent for satellite owners and operators to comprehend and accept, or mitigate as necessary, investment, commercial and operational risks.

Concluding Remarks

Australia’s space journey is quite different from that of any other nation on Earth, and this has never been well explained or contextualized. The impact of the bifurcation that has occurred between the nation’s strategic and operational goals and interests in space only now is being recognized and its impacts assessed. In 2009 the Australian Government recognized that Australia, like all other nations, had critical dependencies on space-based utilities. It also came to understand that the space environment itself is fragile and easily disturbed, to the detriment of all who depend on space-based services for their work, their safety, their security, and even their leisure. The Government has now taken steps to create a coherent space narrative and to develop a critical mass of space qualified individuals within and beyond the public sector who can provide a necessary and
sufficient mass of talent and expertise capable of lifting the profile of space in Australia and of Australia’s profile in space internationally. This process will take a decade to mature, but evidence of progress since the investments made by Government in 2009 is already evident.

The 21st Century has been described as the Asian Century, and space may be expected to play an important role in how broader relationships between China, the United States, and other Asian nations develop. Australia, due to its location, its alliance with the United States, its trading relationships with China, Japan and Korea, its vital interests along with India in the security of the Indian Ocean, and of the sea lines of communication more generally, has vital national interests at stake. Noting that the space environment is a global commons on which all nations and peoples increasingly depend, Australia standing, as it does, at the cross roads of Asia and the West and of the wealthy North and disadvantaged South, has an opportunity, as a middle power, to provide leadership and be a force for good. In securing its own national interests, Australia is well-placed to ensure that the space disadvantaged nations of the world can also enjoy the benefits of secure and assured access to services from space for national, regional, and global benefit.

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Brett Biddington AM

Brett Biddington owns a Canberra-based consulting company which specializes in space and cyber security matters. Between 2002 and 2009 he was a member of Cisco Systems’ global space team, which developed the Internet Router In Space (IRIS) program and promoted merged space-ground communications systems.

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From 2004-2009, Brett was closely associated with the governance of radio astronomy in Australia. He has also been involved in Australia's commitment to astronomy in Antarctica. In 2002 Brett left the Royal Australian Air Force (RAAF) on completion of almost 23 years of service. He was an intelligence and security specialist before moving into capability development where he sponsored command and control, intelligence, surveillance, reconnaissance and electronic warfare projects including the Jindalee Over the Horizon Radar project and classified and unclassified space initiatives.

In June 2012 he was admitted as a Member of the Order of Australia (AM) for services to the Australian space sector.

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