



# **Inquiry into The Current State of Australia's Space Science & Industry Sector**

SUBMISSION FOR THE INQUIRY INTO SPACE

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# 1. Overview

The data captured by satellites is spatial information. It is an important part of that broad body of spatial information collected from space, on land, and below the oceans and the earth. Spatial information is the lifeblood of the rapidly growing number of Australian businesses operating in the spatial information industry; the sector that contributes \$12.5 billion to GDP each year; and the sector represented by ASIBA.

Space touches people's lives on earth on a daily basis in four main areas. These are:

- 1) **Satellite communications**, providing telephone and data networks to many parts of the world along with television and radio broadcasting.
- 2) **Global Satellite Navigation Systems (GNSS)**, via constellations of satellites transmitting timing and location information allowing receivers on earth to calculate their position quickly and precisely. The most widely used of these navigation constellations is the Global Positioning System (GPS) launched by the US Government and now in its 3<sup>rd</sup> generation of satellites. The Russian (GLONASS) system is projected to come back on line within the next 12 months, with GALILEO (European Union) scheduled for operations sometime after 2010. China and India have both flagged their intentions to launch their own navigation satellite constellations. This technology was developed by the military for aircraft and weapons guidance systems but has become so integral to the civilian world that US President Bill Clinton signed an executive order guaranteeing civilian access. This technology impacts the daily lives of every Australian from the legal survey of our properties to summoning an ambulance, sending a package around the globe, in-car navigation systems or ordering a pizza. Commercial innovation and development of this technology has given birth to an enormous consumer goods market in the areas of vehicle navigation, marine navigation and chart displays, and products for bushwalkers and adventurers. In the near future GPS technology will be considered a "standard" feature of all new cars rather than a "luxury item". The annual commercial value of this technology to the Australian economy is measured in the billions and growing.
- 3) **Earth Observation**, the placement of satellites in specific orbits to observe the earth, by using either optical or RADAR based sensors. Earth observation satellites fall into two main categories: 1) weather satellites and 2) land and water monitoring satellites. Weather satellites are capable of observing thousands of kilometres with a single image while some land observation satellites can resolve objects down to a resolution of 0.5m. While most Australians are familiar with the images taken by weather satellites few of us stop to consider how important they are in providing information that goes into predicting tomorrow's weather or whether we can expect a higher than normal rainfall this summer. Land and water observing satellites are even less well known by the average Australian. Google Earth, and other internet applications, are adding a "spatial component" to our lives that has always existed but is only now being recognized by the general public. Earth observing satellites support exploring for minerals, fighting bushfires, predicting agricultural crop yields, monitoring for illegal land clearing or monitoring the environment quality of our natural landscape both on land and in the oceans. The value of this information is only now emerging as Australia recognizes that our landscape is fragile and some of our historical land practises are leading to irreparable damage.

- 4) **Space Exploration**, the use of spacecraft to explore the moon, the solar system and beyond. In recent years the space-faring nations have begun coordinating plans to return humans to the moon to establish a sustainable presence. While this endeavour holds as much fascination for Australians as other nations it should not be a national priority. Our priorities lie closer to earth in a reality with increasing demands on scarce Government funding.

## **2. In which markets should Australia invest?**

ASIBA's, and we would argue Australia's, main interest in space is driven by economic, public safety and environmental considerations, communications, navigation and earth observation. In the following paragraphs we consider where government resources would have the greatest impact.

### **2.1 Communications**

Communications using satellite assets falls within the domain of classified military activities and commercial telecommunications services. The former will not be discussed here by ASIBA. The latter is part of a vibrant commercial industry where market forces will decide whether Australia needs to purchase a telecommunication satellite or lease transponders on other vendors' satellites. Our current participation in the ITU spectrum allocation and international regulatory bodies on telecommunications issues is the extent to which Australia's government should limit its involvement.

### **2.2 Navigation**

With as many as four satellite navigation constellations planned in the wake of the immensely successful GPS program it is difficult to argue that Australia should develop its own constellation of navigation satellites, given the deployment cost of several tens of billion dollars. Given the enormous economic value-added market for uses of GPS technology the challenge for the Australian Government is to ensure continued access to this technology through strategic alliances with the countries deploying the systems. With guaranteed access to GPS and other communications signals the commercial market will expand the use of this technology into new and innovative markets. The economic benefits to Australian industry are obvious and will help maintain our strong position within the global economy without further need for government investment.

GNSS augmentation from ground stations is important to accurate positioning systems (better than 6 metres). Augmentation systems are provided by both the private and the public sector. The Australian government is investing in a major augmentation network as part of the NCRIS program segment AuScope. These activities add value to un-augmented GNSS such as GPS. Consultation between augmentation providers and GNSS providers is important to insure that Australia obtains maximum benefit from these systems.

### **2.3 Earth Observation**

While we are taught in school that Australia is geologically a very old continent, it is only in the last few years that Australians as a population have recognized the fragility of this ancient landscape and discovered their "green conscience". Locally we have experienced the impact of water restrictions and the allocation of irrigation waters within the Murray Darling Basin for conflicting agricultural and environmental purposes has made the front pages of the national media and on to the political agenda.

There is little doubt that human activity is changing the nature and quality of the Australian landscape. Leaving out the politics we can all agree that some of these changes are irreversible and could potentially leave future Australians with less capacity to feed themselves or maintain sustainable levels of biodiversity. At the same time the Australian climate is changing, exposing widely dispersed communities to greater risk from fire, flood and coastal inundation. Earth observation satellites are our best means of tracking and understanding the extraordinary changes occurring on our land and

waterways. A relatively small but skilful group of Australian scientists, image analysts and Geographic Information System (GIS) specialists process this data with great skill, often in real time. Innovative Australian businesses develop world-class products from this expertise. While we benefit greatly from data collected from a host of satellites flown by other countries we are passive recipients of these data with no real control over the source or influence in its design and applicability to Australian-specific issues, not even the ones vital to weather prediction and measurement of our precious water resources. The question is then: shouldn't Australia play a more active role in maintaining its ability to collect, analyse and apply this critical information?

Because of its similarity to Australia, in terms of size to population ratio and per capita GDP and the absence of serious military commitments, Canada provides a good example of how a strategic investment in civilian space activities can benefit economic and industrial development. Canada has, since the mid-1980's, successfully applied remote sensing technologies to managing the country's primary industries and natural resources and environmentally sensitive areas, while developing Radarsat, an earth observing satellite attuned to the national needs of a country at its latitude and weather conditions.

The messages are there to be read but perhaps the only way Australia will truly appreciate the value of these technologies to our national interest is to have them denied to us.

### 3. Current Situation in Global Space investment

Many countries placed below Australia on the OECD GDP per capita index have space programs. In most cases these are not military programs but rather have a strong focus on earth observation for disaster assessment, environmental monitoring and agricultural security. The leading space programs include:

Space Agency	Annual Budget (US\$)	Remarks
NASA	\$16 Billion	Budget includes a substantial proportion to space exploration
European Space Agency	\$3.8 Billion	
JAXA (Japan Space Agency)	\$2.1 Billion	
Russian Federal Space Agency	\$1.3 Billion	
Brazilian Space Agency	\$1.2 Billion	Brazil is working closely with China and Russia so their leveraged combined expenditure is substantial
Indian Space Research Organisation	\$815 million	
China National Space Administration	\$500 million	Official published figure, actual expenditure likely to be 3-4 times higher
Canadian Space Agency	\$300m	
Thailand Space Agency	\$300m	Recently launched their first Earth Observation Satellite

Other countries with dedicated space programs include:

- Malaysia
- South Africa
- Vietnam
- South Korea
- Taiwan
- Many of the members of the European Space Agency also have their own national space programs including; France, Germany, UK, Italy, Spain and Sweden.

Australia has neither an identifiable civilian space agency nor a long-term vision for the strategic use of currently available space resources and assets. Visiting officials from space agencies in the US, the European Union, Japan and China are ushered confusingly around Canberra to a host of agencies such as CSIRO, the Bureau of Meteorology and Geoscience Australia; none of which has the authority or funds required to accept generous offers to fly Australian-designed instruments on their next satellites. The European Space Agency (ESA) has, on several occasions, offered Australia *associate membership* for the commensurate financial contribution, which we declined.

Australia's current expenditure in environmental space related technologies could be said to be the \$3.5million per annum spent on the operations of ACRES (The Australian Centre for Remote Sensing, under Geoscience Australia). However, ACRES is not a space office, does not set policy or strategy and only operates as a ground receiving station for non-Australian Government publicly funded earth observation satellites. For over 25 years ACRES has efficiently received satellite data from a number

of countries orbiting earth observation satellites. The reception of data from the US Landsat 5 and Landsat 7 has formed the bulk of their activity and ACRES has amassed a large continuous archive of this US satellite data. This heavily biased collection highlights Australia's lack of strategic direction in earth observation.

In October 2007 Landsat 5 suffered a severe problem with its power supply, hardly a surprise for a 20 year old satellite. The delay in restarting the satellite (till March 2008) has meant that Australia lacks data over a whole summer period. Landsat 7 has had technical problems for a number of years, which makes it suboptimal to use as a backup system. Landsat satellites have been measuring vital details of Australia's vegetation, crop production and carbon stocks for a considerable period. In fact, Australia has depended upon Landsat to the extent that it has been said that *Australian users wake up each morning and expect Landsat to fly over before lunch*. For 25 years this has been the case but we have come to treat this privilege as a *birth right*. The latest problems with Landsat has finally forced a realization that the tool we consider "essential" for monitoring Australia's fragile and degrading landscape could actually be denied to us.

**NASA has no clear plan for continuing or updating the Landsat program.** Landsat 8 is projected to be launched in 2011 – 2012 and most users are expecting a *data gap* as the older Landsat satellites go offline. The lack of a space program with an adequate budget has meant that ACRES has had to purchase data from other sources that have not demonstrated sufficient reliability for routine use and cannot provide a long term guarantee of service availability.

NASA's funds have been diverted from Earth Observation to a US Government initiative to revisit the moon and other planets. With NASA's focus elsewhere, Europe, Japan, India, South Korea and China are filling the gap with a new generation of earth observation satellites. The space baton has clearly been handed from the US to a myriad of other countries. Where in this new reality will Australia's strategic interests be met?

Before Australia's *free ride* ends completely, we need to recognize and quantify the value of this technology stream to our strategic national interests and then take up the most applicable of the offers from the world's space agencies Australia needs to participate financially and collaborate in their missions and deploy sensors that are purpose-designed for Australian issues on their next-generation satellites. Many of these satellites will be *polar orbiting*. They fly over Australia just as often as they fly over the launching countries such as Japan, France and China, and could collect data of vital interest to Australian industries and for safety and scientific purposes. Participation in a space program would also attract back many of our brightest aerospace engineers and scientists, who have left Australia to further their interests and careers in the space sciences.

Both France and Canada have offered Australia the opportunity to be a part of their existing space program; to place engineers as observers in the construction of current satellites. Such opportunities will provide Australia with invaluable knowledge on the science and economics of satellite systems. ASIBA is not advocating that Australia build or launch satellites in the next decade.

However, collaboration with strategic partners will boost our knowledge, build capacity and make Australia a smarter buyer when we look to purchase our own systems or invest in other systems in the near future. All of these activities should be undertaken within a coherent national space program that

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can evaluate which earth observation technologies are needed to best meet our strategic goals. Our strategic goals must recognise and engage the private sector of both the space and spatial industries to ensure that opportunities for business are not hindered or overlooked.

Interestingly, South Africa has recently released an extensive Earth Observation policy and established a Space Office and budget. A policy such as this was developed after much consultation and deliberation, using a combination of local and international leaders to develop it. Australia must do the same.

Governments must also ensure that it fosters a sustainable private sector in the space and spatial industries within Australia. This is necessary to sustain a strong business case for a national space program and to build capacity and export capability.

The spatial information and technology sector is an important part of the business model and must be developed around a coherent national policy framework that removes impediments to growth. Similarly, a space private sector must also be supported by a policy framework that requires a *buy Australian* approach to encourage investment in space and spatial systems and technologies. Competition between government and the private sector is unproductive and will inhibit growth and stifle investment in new technologies and innovation.

## 4. Recommended Actions

Now is the time to set up a modest **Australian Space, Spatial and Simulation Agency or Office**, with a primary focus on earth observation remote-sensing and the business drivers around spatial information. Such a body would not require a large and expensive bureaucracy. Clearly Australia already has capacity for a strategic Office/Agency housed within a key portfolio with a mandate to develop a suite of Australian-owned instruments, which protect our vital interests while developing appropriate policies to ensure wider commercial and public benefits. An appropriate agency should be staffed by people with a broad understanding of both space and spatial issues, who possess experience in dealing with overseas agencies and have a strong commitment to working effectively with the private sector.

Australia is already an educated consumer of earth observation technologies. We need now to become an educated purchaser of the technologies that provide strategic data streams. Australia must step up and accept appropriate offers from space-capable countries to gain further knowledge and skills.

### 4.1 Space Science Recommendations

1. The Australian Government must make a modest investment to place its leading engineers in active satellite construction programs overseas, which would build our engineering technology capacity.
2. The Australian Government must acknowledge the national strategic importance of earth observation. It should discontinue the practice of seeking out the cheapest data streams that meet our short term needs - but have little long term security of data continuity - so that we can slowly develop greater control over the delivery of this information to Australian users both public and private in the long term.
3. The Australian Government must invest in partial ownership of new earth observation satellite systems to ensure our needs are not “denied” for reasons beyond our control.
4. Ultimately, the Australian Government must purchase or build its own satellite systems with instruments optimized to collect the earth observation information Australia needs to meet its strategic requirements for environmental management, agriculture, water resource management, public safety and national security.

By observing the development of space technology in other nations, it is clear that the notion that this can be carried out totally by private industry is unrealistic. These are basic, non-commercial data sets all Australians need, as surely as we need our weather predictions - free and for the common good. There is also the need for basic framework and infrastructure to be established where there is no short or medium term commercial return on investment that typically constrains private investment. The most appropriate model should be developed in consultation with private sector interests as this will form part of the business case for private sector innovation and investment.

Possession of our own earth observation assets, including a suite of home-grown instruments, and thus our own secure data sources, will lead to opportunities to grow our local space industries and value-add spatial-information businesses.

We must act now before the volume of satellite data applicable to Australia's national strategic interests either diminishes or is potentially denied to us. The latest generation of satellites all have the capability to encode their data, either for security or to ensure a steady income stream for the nations that own them. We cannot afford to be blinded by the denial of our 'eyes in the sky' over Australia.

#### 4.2 Spatial Science Recommendations

There is clearly a strong correlation between the need for spatial data and the drive for Australia to be actively involved in the space arena. The question is one of business drivers. The recent economic study (refer to attachment 'A') of the spatial information industry by ACIL Tasman demonstrates the value proposition for Australia to be engaged in a targeted space program.

This is an opportunity for government to develop a policy program for space that includes the largest and most valuable market for that industry/science. By expanding the use of spatial information in defence, transport (including carbon emissions management), environment, water, climate change and carbon trading schemes, emergency management, health, location based services, asset management, planning and development, logistics, to name but a few areas of potential and existing demand, we can justify the investment in a space program.

1. The spatial information industry's economic study (refer to attachment 'A') proves that the value to GDP of space acquired information and management tools will substantially increase as awareness accelerates. It is also important to recognise and remove potential barriers to the use of spatial information arising out of a national space program, in particular: restrictive pricing and access arrangements, and government competition with the private sector while also adopting a *buy Australian* approach to ensure the viability of significant Australian investment (such as is done in the USA, Canada and the EU amongst others).

Commercial demand for spatial information is increasing. The use of space acquired imagery has exploded with the advent of Google Earth and Microsoft Virtual Earth. The value of GPS navigation in particular has blossomed in recent times and the value of this location based service has been recognised by mobile phone giant Nokia with its purchase of spatial data company NAVTEQ for some \$9 billion.

2. A logical path for the development of an Australian space capability is to ensure that the links between demand and supply are maintained. That is, there is logic in bringing together in one policy domain the *space, spatial and simulation sciences*. This would ensure that space policy reflected the needs of the spatial and simulation sectors and hence is based on sound business principles. This model would be unique and ensure that there is a definable public and private benefit to a national *space, spatial, simulation* program to justify public and private investment.
3. If Australia is to enter this important scientific field of endeavour then it must start with a sound business case. The linking of space and spatial policy is important to ensure that the value proposition is across portfolios. Therefore, a national *space, spatial, simulation* policy program must be domiciled in an agency with appropriate **cross portfolio responsibility**.

A national *space, spatial, simulation* policy domain would provide a sound basis for Australia to move forward in the space and spatial sciences. It would be in a strong position to look outside the square to ensure that it is able to meet the ever changing demand for space base data capture and control.

## Policy Leadership in Spatial Information

### The issue

- Spatial information industry contributed between \$6 billion and \$12 billion to GDP in 2007.
- Spatial information system will move into mainstream enterprise systems and consumer markets over the coming 5 years
  - deficiencies in spatial data infrastructure and access policies will constrain progress and damage competitive advantage for Australian companies

### The policy imperatives

- Develop Australian Spatial Data Infrastructure in parallel with broad band access
  - fund the next stage of the development of the spatial data
  - involve business in constructing the spatial data infrastructure through a partnership program with government.
- Expand the quality and quantity of fundamental data
  - in consultation with users
- Establish national policy for data access
  - implement the ANZLIC guiding principles for access to fundamental data across all jurisdictions
- A national data pricing policy
  - fundamental data is a public good and should be made available at the cost of supply (free on the internet)
  - jurisdictions to implement the recommendations of the Productivity Commission 2001 report
- Industry policy
  - value added services to be the province of business
  - governments to engage partnership with the business building infrastructure, fostering innovation and developing export opportunities.

### Implementation

- COAG agree to a Geo connections policy reform program.
  - Online and Communications Council to implement
- Commonwealth establish a 10 year program to establish an ASDI
  - Payments to the jurisdictions conditional on policy reform
- Innovation Australia to review adequacy of Spatial Data Infrastructure
- Innovations program to include a Spatial Information Development Initiative linked with Austrade export development programs

Policy context	Principle	Recommendation
<b>Skills</b>	<p>A spatially enabled knowledge economy and society is built both on professional skills and technical occupations, as well as a widespread awareness of the potential benefits to society of spatial information and its applications.</p>	<p>1. Action should be taken under the auspices of COAG to ensure that the initiatives the Spatial Education Advisory Committee is developing on education training and skills demands can be realised.</p>
<b>Innovation</b>	<p>The commercialisation of research and development in spatial information should continue to be supported through ongoing support for the CRC SI and the innovation programs of AusIndustry. An industry/government partnership programme along the lines of the Canadian GeoConnections programme would augment these efforts.</p>	<p>2. The Australian Government should establish a Spatial Information Innovation Development Initiative for a period of five years (using innovation grants administered by AusIndustry) to accelerate commercialising spatial information research and development, taking into account the emerging opportunities in global markets. The initiative should be linked with Austrade’s trade development programmes.</p> <p>3. Governments should maximise opportunities for the spatial information industry to bid for spatial information projects by establishing a government/industry partnership programme with ASIBA.</p>
<b>Fundamental data</b>	<p>Gaps in Australia’s spatial information base should be funded where it is a matter of national priority and international competitiveness. These should be identified on a whole-of-government basis by COAG. In principle, governments should directly fund the costs of</p>	<p>4. COAG should develop and implement policies to expand the quality and quantity of available fundamental spatial information, as well as maintain its currency and accuracy. Consultation with key stakeholders, including ASIBA, should be undertaken as a key element of the</p>

Policy context	Principle	Recommendation
	collecting or capturing fundamental spatial information of national significance, as well as the costs of maintaining the currency and accuracy of the spatial information so that it is fit for purpose by end users.	policy so that priorities are user driven, not “producer” driven.
<b>Spatial data infrastructure</b>	<p>High priority should be given to the development of a fully operational ASDI to ensure that Australian society can realise the benefits from spatial information management systems and Australian industry can maintain and increase its international competitiveness.</p> <ul style="list-style-type: none"> <li>• a national data framework, integrated from federal, state and local sources</li> <li>• common data policies, agreed to by federal, state and local governments and agencies</li> <li>• technical standards, governing web services and interoperable information</li> <li>• enabling architecture, based on open standards and specifications.</li> </ul>	<p>5. The Australian Government should fund the next stage of the development of the spatial data infrastructure at a cost of \$200 million over ten years.</p> <p>6. Business should be actively engaged in constructing the spatial data infrastructure through a partnership programme with government - with funding to be matched with in-kind contributions coordinated through ASIBA.</p>
<b>Access to data</b>	All suppliers and distributors of spatial information should adhere to the ANZLIC guiding principles for access to spatial information as being in the best interests of users of spatial information.	7. Industry and government should collaborate on developing digital rights management architectures appropriate for Australia and publish guidelines on the standards to be adopted.

Policy context	Principle	Recommendation
	<p>In developing the ASDI, work must be done to ensure simple and effective access to spatial information and address the problems in ensuring data quality.</p>	<p>8. The Australian Government should fund a programme to address constraints on information sharing, such as the lack of a whole-of-government approach to licensing.</p>
<p><b>Pricing</b></p>	<p>The market for value-added services should in general be the exclusive domain of the private sector, unless government business enterprises compete on a fair and equitable basis in line with the competitive neutrality principles established by COAG.</p>	<p>9. The Productivity Commission should review the pricing policies for spatial information as they apply to each jurisdiction and, once the findings have been considered, each jurisdiction should address any policy inconsistencies.</p> <p>10. Value-added services should, as a general principle, be the province of the private sector unless public interest considerations dictate otherwise, such as in certain public safety or security matters.</p>
<p><b>Statistics</b></p>	<p>Unless the spatial information industry's contribution to the national economy is measured regularly, policy makers will be unable to assess progress in changes to Australia's international competitiveness and GDP from the national spatial information reform agenda.</p>	<p>11. The ABS should be funded to commission the necessary surveys and population data on which to base an annual satellite account for spatial information within the national accounts framework.</p>
<p><b>Policy leadership</b></p>	<p>The Online and Communications Council should be responsible for coordinating action between governments to progress the national reform agenda. At the Commonwealth level, responsibility for implementing the recommendations should rest within the portfolio of a Minister represented on this Council.</p> <p>A central agency should be given the responsibility for</p>	<p>12. The Online and Communication Council should be the forum for coordinating and implementing the national reform agenda for the spatial industry. A central agency within the portfolio responsibility of the Commonwealth Minister on the Council should be responsible for administering the reform programme and implementing policy at the Commonwealth level.</p>

Policy context	Principle	Recommendation
	<p>administering the programme and implementing policy. This agency should be placed within the portfolio responsibilities of this Minister.</p> <p>Partnership between ASIBA and Government in implementing the reform agenda will be fundamental to success as established in the Action Agenda..</p>	

## **Appendix A Economic Value**

In 2007 the Australian Spatial Information Business Association commissioned an economic study of the value of spatial information to the Australian economy. Leading economics consultancy, ACIL Tasman, conducted the study.

The attached is a copy of Section 5 of the Study, which addresses various aspects of space-based activity and data acquisition. A copy of the full report should be considered by the Review Panel as the value of spatial information and technologies to GDP reflects the importance of space-based information and technologies to this growth sector.