

GOVERNMENT OF SOUTH AUSTRALIA

**SUBMISSION TO THE
SENATE ECONOMICS COMMITTEE INQUIRY INTO THE CURRENT STATE OF
AUSTRALIA'S SPACE SCIENCE & INDUSTRY SECTOR**

April 2008



**Government
of South Australia**

Introduction

The Government of South Australia is pleased to contribute to a timely and important inquiry into the current state of Australia's space science and industry sector.

Recognising that South Australia has a long and illustrious history as the natural home of Australia's space effort, the Government is keen to contribute to the rigorous review of this crucial element of national capability. South Australia recognises that proper management of space policy and strategy at the federal level is essential to the security of the nation and applauds this well overdue initiative of the Commonwealth Government. Furthermore, South Australia is prepared to support a broad spectrum of skills attraction and development programs that will complement its world class space infrastructure, make an important contribution to international space efforts and enhance Australia's security posture.

South Australia's submission addresses the key elements identified in the Inquiry's Terms of Reference, particularly noting their application and relevance in South Australia. These topics are:

- the current state of Australia's space science and industry sector
- options to strengthen and expand Australia's position in fields that strongly align with space science and industry
- consideration of national strategic coordination requirements, and
- findings and policy options of the National Innovation System Review.

South Australia's submission in particular addresses:

- Australia's capabilities in space science, industry and education, including:
 - existing Australian activity of world-class standard, and
 - areas in which there is currently little or no activity but that are within the technical and intellectual capacity of the country
- Arguments for and against expanded Australian activity in space science and industry, including:
 - an assessment of the risks to Australia's national interest of Australia's dependence on foreign-owned and operated satellites
 - the potential benefits that could accrue to Australia through further development of our space capability
 - economic, social, environmental, national security and other needs that are not being met or are in danger of not being met by Australia's existing space resources or access to foreign resources
 - impediments to strengthening and expanding space science and industry in Australia including limiting factors relating to spatial information and global positioning systems, including but not limited to ground infrastructures, intergovernmental arrangements, legislative arrangements and government/industry coordination
 - the goals of any strengthening and expansion of Australia's space capability both in the private sector and across government, and
 - realistic policy options that facilitate effective solutions to cross-sector technological and organisational challenges, opportunity capture and development imperatives that align with national need and in consideration of existing world-class capability.

Status of South Australia's Space Science and Industry Sector

South Australia's involvement in space began in 1947 with the establishment of the Woomera Test Range to support testing of British and Australian missiles. Extensive military trials were conducted at various range launch sites within the Woomera Test Range; notable amongst these was the long range intercontinental missile, 'Blue Streak' and the suborbital re-entry test missiles, the 'Black Knight' and the 'Redstone' rockets. Numerous space-related programs have since been undertaken at Woomera including support of the Mercury manned space flight missions and establishment of NASA's deep space Instrumentation Facility at Island Lagoon. Woomera's satellite experience includes launching of the Australian WRESAT and the British Prospero satellite.

With the development of Woomera in 1947, there was a steady growth of space related technologies and corporate knowledge in the design, development and deployment of space platforms. Several South Australian companies grew skills and capabilities in space vehicles and systems, satellite communications and global positioning system, earth resources management and deep space astronomy. Industry, the Defence Science and Technology Organisation (DSTO) and South Australian universities collaborated to consolidate this very real space intellectual capital.

Existing South Australian Space Activity and Capabilities

Space communications particularly the ground segment and service providers providing fixed and mobile communications access via satellite remain the major space capability in South Australia, and no doubt Australia wide. This submission then will not address that segment per se but identify South Australian capabilities relevant to the space segment, an area in which the state has had a major role since the 1940s.

South Australian industry and universities remain involved to various extents in space related research and business activities although the overall capability has diminished as space program funding has reduced in recent decades. Strong capabilities remain in satellite communications in both industry and universities and fundamental technologies in communications and sensing applicable to space applications remain strong and currently applied in the commercial and defence markets. The majority of these companies are small to medium enterprises which continue to develop and sell niche technologies and products to the world market.

South Australia has an increasing aerospace components manufacturing capability supplying aircraft components in to the world's leading military and civilian aircraft manufacturers. This capability is highly relevant to the space sector and could support the production of space vehicles and systems.

Defence capabilities resident in DSTO and the Royal Australian Air Force's Aerospace Operational Support Group, which manages the Woomera Test Range, also provide a sound foundation for space research and space vehicle launch activity in South Australia.

Woomera

The Woomera Test Facility and associated Prohibited Area remains an active space launch site for hypersonic vehicles. Under a collaborative agreement, referred to as HyCAUSE, between DSTO and United States Defence Advanced Research Project Agency, hypersonic vehicle testing was undertaken in 2005 and more recently in June 2007. The hypersonic vehicle reached a height of 530kms; an altitude suitable for low earth orbit satellites. As part of its continuing commitment to a research program in hypersonics, in November 2006, DSTO signed a \$74m Hypersonics International Flight Research Experimentation (HiFIRE) Agreement with the US Air Force. Up to ten hypersonic flight experiments are planned to occur at Woomera over the next five years under the agreement. This research to date has provided DSTO with scientific contributions in computer modelling of the combustion processes, non-linear mechanics, guidance and control and trajectory analysis.

More recently, the Japanese Aerospace Exploration Agency has also conducted test flights of its scaled experimental Supersonic Transport in 2002 and 2005 under its Research and Development of Next Generation Supersonic Transport program. Further flights are planned for 2010. A launch facility has been established by JAXA at Woomera and remains available for further experimentation purposes.

Due to its vast and largely uninhabited area, the Woomera Test Range remains a world leading range for space activity. However, the range facilities for launching space vehicles have been decommissioned and range tracking capabilities are antiquated by any modern standard.

Defence Science and Technology

DSTO believes the hypersonic research described above has the potential to put numerous defence and civilian aerospace applications within our reach in the next two decades. Future defence applications include long-range critical missions, with civilian applications including low-cost satellite launching and high speed aircraft.

DSTO also maintains research in technologies highly relevant to satellite applications, including communications, electro-optics, radar and electronic warfare. DSTO is also funding research by local universities in energetic materials which have application, amongst other applications, in rocket motors.

Aerospace Operational Support Group

The RAAF's Aerospace Operational Support Group (AOSG) has responsibility on behalf of the Commonwealth for management of the Woomera Test Facility and associated support infrastructure. AOSG is responsible for day-to-day coordination of range activities, management of range safety and liaison with the local community and other groups on range activities. AOSG has a broad range of test and evaluation expertise and maintains a suite of fixed and transportable instrumentation to support range tests. Other services provided encompass assistance with the approval, planning and conduct of trials at Woomera Test Facility. AOSG is a key national capability in support of space launch and flight testing.

Jindalee Over the Horizon Radar Network

The Jindalee Operational Radar Network (JORN) is Australia's only nationally owned, wide area surveillance capability providing coverage of our northern approaches. JORN operates entirely in the ionosphere to provide 24-hour surveillance and also serves civilian purposes such as weather forecasting. JORN's operating environment is contiguous with many space operations and further development may support other applications.

South Australian Space Capability

- SME **Apogee Imaging International** was established in 1995 with the aim of supplying imagery and analysis services to business, councils and government agencies world wide. Apogee is the exclusive reseller of the German TerraSAR-X satellite and the Israeli EROS satellite data in the Australasian region, and has contracts to supply satellite imagery to the Department of Defence and to Customs. Apogee has teamed exclusively with this elite group of satellite data suppliers and service providers to ensure high quality imagery, digital elevation models and value added satellite sensing services.

The company specialises in advanced imagery intelligence and supports requirements in agriculture, personnel and asset tracking, disaster insurance, emergency services, maritime surveillance, defence, mapping, utilities, EIS support, resource companies, real estate and tourism.

Apogee provides high to low resolution satellite imagery, optical and radar data and high to medium accuracy digital elevation models.

Apogee has invested heavily in research to develop proprietary software systems including NEXTIMAGE™ which provides an affordable 3-D viewing and analysis environment for emergency services, personnel and asset tracking, security and wild fire management.

- **BAE Systems Australia** holds the Woomera Commercial Support Contract with the Defence Support Group - Woomera to provide service support to Woomera Village including area services, catering and cleaning, warehousing, stores maintenance, transport, aircraft refuelling, ground operations, emergency services including fire, ambulance and rescue, administrative support and trail support to range users. The company has supported the Japanese Aerospace Exploration Agency in its hypersonic vehicles experimentation.

In previous years, BAE Systems Australia has designed and developed earth resource measurement subsystems for its UK parent company. Similarly, BAE Systems Australia has manufactured and delivered satellite transponders to Hughes Aerospace. The transponders were fitted to satellite systems used by Australian communications companies.

BAE Systems Australia combines key skills in engineering and systems integration and is a leading provider of communications, electronic warfare systems, military air support, air defence, mission support systems, and intelligence, surveillance and reconnaissance.

- SME **DSPACE** Pty Ltd was recently acquired by EMS Technologies, a US-based company, because of its advanced capabilities in developing satellite communications technology. EMS Technologies will retain the strong elements of DSPACE's satellite communications signal processing expertise, package its baseband modem technology, and develop satellite communication products. EMS SATCOM is a source of excellent, innovative satellite communications solutions when it comes to connecting mobile users around the globe.
- SME **Vipac** Pty Ltd was a core member of the former Co-Operative Research Centre for Satellite Systems (CRCSS). Vipac had a pivotal role in the FedSat Project with overall responsibility for the FedSat platform. This responsibility included the development of the bus system, definition of the payload/structure interfaces, system level responsibility for mechanical and structural systems, assembly and integration and test of the platform.

This was an aggressive program requiring constant coordination with other CRC members and international suppliers. The payload included instrumentation to measure the Earth's magnetic field and to demonstrate the use of high-speed computers in space environments.

Universities

- **The University of Adelaide** has a number of world class research centres including:
 - **Centre of Expertise in Phased Array and Microwave Radar Systems** underpins efforts by DSTO and Australian industry to tackle practical engineering problems associated with the design, development and integration of the next generation of phased array systems with application to radar, electronic warfare and satellite navigation.
 - **Centre of Expertise in Photonics (CoEP):** Founded in early 2005, the Centre is a joint venture with DSTO, and supported by the South Australian Government. CoEP works closely with DSTO to develop new classes of optical fibre for applications in communications, radar and electronic warfare. Its depth is world class and its defence relevance is significant.
 - **Sensor Signal Processing Group** is a small group conducting multi-faceted research in sensor signal processing including world class work on GPS anti-jam technologies for The Technical Cooperative Program and joint MOU contributions in this area.

The University also provides education and training in key space areas including **Aerospace Engineering** which is a growing field with applications in areas as diverse as aircraft, satellites, rockets, space stations and hot air balloons, and **Aerospace Navigation and Guidance** focussing on inertial navigation, satellite navigation technologies such as GPS navigation systems.

The University's School of Chemistry and Physics hosts the Australian Research Council Special Research Centre for the Subatomic Structure of Matter and the National Institute for Theoretical Physics which is actively involved in a number of space related research projects (eg a Japanese/Australian gamma-ray astronomy project called Cangaroo based at Woomera, founding member of the Pierre Auger Observatory for cosmic ray research and a range of cosmic ray projects).

In 2002 the University hosted the *1st World Space Environment Forum* and also housed the World Institute for Space Environment Research (WISER) and continues to remain involved in atmospheric research that also includes the ionosphere and space environment which, contributes to space weather measurement.

The University's Special Research Centre for Subatomic Structure of Matter researches mathematical applications for space weather processes and supports WISER as a centre for education and research into space weather.

- **University of South Australia**

Space related research is concentrated mainly within Division of Information Technology, Engineering and the Environment. External to that Division, but within the University's Research and Innovation portfolio, the Institute of Telecommunications Research is highly space relevant. To this can be added research from the Ian Wark Research Institute in material sciences.

- **Defence and Systems Institute** was established at the University's Mawson Lakes campus in 2007 to recognise the growth and importance of Defence and systems work. It aims to become a leading international centre of excellence for research and education in the area of complex systems which is highly relevant to space systems.

- **Institute for Telecommunications Research (ITR)** is one of Australia's foremost research organisations, specialising in technology for digital wireless communications, including both fixed and mobile satellite and terrestrial radio services. ITR maintains a research engineering capability to support implementation of demonstrators and prototypes, a clear indication of a propensity for the higher technology readiness levels. Its research quality and reputation ranges from well established to world class.
- **Telecommunication Networks & Services Group** has a major focus on satellite and mobile data systems. It provides all the resources for research in the CRC for Satellite Systems B.2 Program, and group members are the major contributors to industrial contracts with several national and international telecommunications companies. The group has a wide variety of projects including the high-rate WLANs, the FedSat Communications Payload, three generations of the earth resource satellite demodulators (ERSDEMs), a fast acquisition IF demodulator (FAID), a VSAT burst modem, CDMA modem testbed, and various mobile satellite modems.
- **Engineering Projects Group** was established in 2004, to further strengthen and improve ITR engineering skills. It specialises in satellite and wireless systems engineering, with a commitment to the commercialisation of research outcomes. It has a strong focus on the application of knowledge in collaboration with industry partners.
- **Cooperative Research Centre for Satellite Systems (CRCSS)** was established in 1998, as a part of a major government initiative to develop skills for space based industries. Its mission was to deliver a new, sustainable advantage for those Australian industries and government agencies that are involved in services based on the applications of future generations of small satellites.

ITR was a core participant of the CRCSS, in partnership with CSIRO, Auspace, Queensland University of Technology and Vipac Engineers and Scientists. ITR led the communications node of the CRCSS.

CRCSS carried out research and development, education, training, operations and commercial activities relating to space technologies, particularly in the field of low-cost satellite missions. Its first major project was the scientific and engineering satellite FedSat, launched in 2002.

However, CRCSS ceased operations in 2005, after funding was not renewed in the 2004 CRC selection round. Recognising the value to Australia of such an important piece of scientific infrastructure, an agreement was reached with the CRCSS for the Department of Defence to assume responsibility for the FedSat satellite.

- **Ian Wark Research Institute:** Founded in 1994, the institute is one of the key research concentrations in the University of South Australia. It holds a unique position in the Australian research scene as the government-sponsored Australian Research Council Special Research Centre for Particle and Material Interfaces. Its application is in materials sciences and advanced manufacturing.

German Aerospace Center

In 2007, South Australia signed a memorandum of understanding with the German Aerospace Center (DLR) relating to scientific and technical cooperation and for the coordination of mutual activities for the earth observation bushfire monitoring and management system AUSBIRD.

DLR is Germany's national research centre for aeronautics and space. Its extensive research and development work is integrated into national and international cooperative ventures. As Germany's space agency, the German Government has given DLR responsibility for the forward planning and implementation of the German space program as well as international representation of Germany's interests.

The AUSBIRD project aims to provide access, via dedicated satellite, of high resolution infrared imaging and analysis, processed on board and sent to ground stations, in remote areas to fire fighting authorities in near real-time. The technology will also be used in measurement of climate change and subsequent development in the optical systems to include a short wave infra red sensor will provide new applications including water resource measurement, carbon tracking and a range of more detailed bushfire data analyses.

The \$300m investment will see a ground station being established in South Australia and down stream linkages in education and technology being established between DLR and the State's universities. DLR has agreed to fund and launch the first satellite in 2010 to start the establishment of the AUSBIRD constellation. Australia is seen as the launch customer for a system that has international applicability.

Areas of little activity but within the capacity of South Australia

South Australia has a strong science and industry base in systems integration, computing, communications and sensing technologies which could be applied to the development of space payloads. Much of this capability is currently applied in the defence sector but could be applied equally in a reasonable timeframe to the space sector.

Similarly, South Australia has a world-class aerospace components and advanced manufacturing capability, which delivers aircraft components to the world's leading aerospace manufacturers such as Lockheed Martin Corporation, for new generation military and civilian aircraft. Advanced manufacturing of aluminium and particularly titanium components provides a sound base for space platforms and systems.

Options to Strengthen and Expand South Australia's Position

The space sector provides many opportunities for creating profitable goods and services and for more than 40 years has provided technological breakthroughs that have broad application in our everyday life. Capitalising on space is driven by socioeconomic issues such as the political will and financial ability by government to fund space research and development.

Space is not a large economic activity worldwide and is unlikely to be so in Australia but its national significance can not be overstated. This suggests that Australia's 'space industry' will be a small group of research organisations and companies to provide space capabilities of national interest but from which other commercial return may be gained through international collaboration and export.

South Australia has established a new framework, referred to as *Constellation SA*, to strengthen collaboration between researchers, within and across disciplines, and to improve the interface between the research community and end-users so that applied research is more effectively translated into practical solutions; an essential element in delivering space capability. The framework consists of three key elements, namely:

- *Strategic Research Capabilities* – expertise comprising high quality research infrastructure and research teams within publicly-funded research organisations
- *Alliances and Clusters* – representing the State Government's priority sectors (alliances) and underpinning applied research concentrations (clusters) to strengthen collaboration within the research community and improve the uptake of knowledge by end-users (ie industry, community and government), and
- *Precincts* – focal points for concentrating research and translating research into innovation.

South Australia has identified seven alliances, one of which is Defence and Advanced Manufacturing. Space would be a logical cluster to form under this alliance as it could leverage off the workforce, skills and technology many of the universities and industry have established to service the defence sector but with appropriate tailoring to meet the specific demands of space.

The formation of a space cluster in South Australia need not be purely a regional capability but could be the basis for a national space capability based on a hub and spoke model involving select universities and industry from other states as well. The cluster would also provide a mechanism for international collaboration in space technologies. This type of model is not unique but would provide a focus and simple mechanism for government funding for space research, programs, education and training, and infrastructure.

Australia is already investing in hypersonic vehicle research which could provide a suitable launch vehicle for small payloads for commercial and defence use. Funding in further development of the space vehicle should continue whether by Australia itself or in collaboration with an international partner. In parallel, a program of investment in the local development of innovative payloads such as micro-satellites with communications, electro-optic, electronic warfare or other sensors tailored to meet Australia's interests would provide a sound technology innovation program. Moreover, both programs will have spin-offs into supporting technologies and services as well.

The use of the Woomera Test Facility for space launches is expanding through hypersonic research programs. There is potential to increase the use of Woomera for space activity although to do so will require investment to make Woomera a world class facility to attract other international space operators. In particular, current instrumentation is antiquated by international space launch site standards and should be upgraded in the near future.

The Woomera site remains a favourite location for not only scientific research but for the establishment of a space base for space tourism. Companies like Virgin Galactic and Space Adventures have expressed interest in locating a base in the Asia Pacific region and Australia remains under consideration as a preferred location.

Virgin Galactic is establishing its first 'Space Base' and headquarters in New Mexico and Space Adventures is currently flying space 'tourists' from Baikonur to the International Space Station. This industry is only just starting to develop and Virgin Galactic with its successful Spaceship One is leading the way. The expectation is that commercial interests would be interested and encouraged to invest in new launch infrastructure at Woomera (or some other suitable site).

National Space Issues

Despite Australia's long history with space and involvement in international fora, Australia maintains a minor role in what is a field of global significance. The impact is that Australia, in other than astronomical terms, is a light weight in the international space community when in other international fields where Australia has direct involvement it punches well above its weight. Previous investments in space activities starting with launch activities in the 1940s, 1950s and 1960s and more recently Australian designed communications satellites have diminished to a point where technological and industry capabilities are limited.

Successive federal governments have committed fewer funds to space programs over the years to the extent that direct funding to space programs ceased in 1996. Subsequently, research and industry capability has withered. The absence of a clear national space policy has resulted, not unreasonably, in an ad-hoc approach by research organisations and industry alike leading to an underdeveloped national space capability.

The ubiquity of space and its vital importance to the economy and security means that it is a national responsibility and, therefore, clearly falls on the responsibility of the Australian Government. The absence of a cogent space policy and strategy has a ripple effect down to state government level and beyond due to the uncertainty associated with a lack of guidance and commitment at the national level. State governments are reluctant to invest in state-based research and development, workforce and skills, and infrastructure to support local research organisations and industry when there is little national support for the space sector. While some companies have invested in space activities, this investment is primarily associated with local space-based communications service demand.

Dependency on Foreign Governments and Companies

Australia is heavily reliant on space services including communications, remote sensing, positioning, navigation and timing provided by foreign companies subject to foreign government control. These services are derived from the US, European Union, Russia, Japan and Israel. In the future, India and China could also provide space services to Australia. Space services provided from some nations (eg Israel in remote sensing) are provided through third party nations which hosts the regional earth station for those satellites.

GPS services provided by the US and similar services provided by Russia and China are vital to everyday activities in our society. The European Union is also proposing its own alternative system (Galileo) to protect its national interests in the event of service reduction or denial. The impact of a reduction in accuracy in position information has major safety implications particularly in the transport industry where aircraft, ships and land transport systems rely almost solely on GPS for safe navigation and positioning.

In the defence environment, the US plays a particularly important role in the provision of space services including communications, GPS and remote sensing particularly at highly classified levels. In October 2007, the Australian Government announced Australia would join the US Wideband Global Satellite Communications constellation by acquiring a WGS satellite to form a six satellite constellation with the US. This will provide considerable operational benefits for the Australian Defence Force but also exposes Australia to potential US national imperatives and diplomatic tensions should the US engage in military activities in the region requiring greater demand for wideband services.

While Australia can not hope to replicate such services itself in their entirety, suitable alternatives need to be examined. Niche capabilities such as micro-satellites with specialised payloads capable of being launched locally or elsewhere at short notice might provide Australia surety of service, even if somewhat limited in capacity, in some areas such as communications and remote sensing at reasonable cost. In the longer term, matching of this type of satellite capability with hypersonic delivery vehicles based on Australia's current world leading research and launched from the Woomera Test Range could provide a strong national capability which clearly demonstrates to the international community that Australia is an independent and direct player in space.

Australia's capability to establish itself as a world leader in space imagery/data should also be further explored, particularly given the growing relevance of remote sensing technologies to understanding impacts on agricultural and mining, and in managing climate change and water resources.

Weaponisation of Space

In 2007 and early 2008, Australia witnessed the first weapon activities in space with China and then the US demonstrating its ability to destroy space craft with surface launched missiles.. Over the past decade, Australia has engaged the US in Theatre Ballistic Missile Defence (TBMD) research at a low level of activity through DSTO . In the longer term, Australia's new Air Warfare Destroyers could be fitted with SM-3 surface-to-air missiles which are capable of performing the TBMD task. From a national security perspective, Australia's close alignment with the US may place Australia under increasing pressure should this contest continue and with profound implications for Australia in the international community requiring sound policy decisions.

National Strategic Coordination Requirements

The need to develop a coherent national space strategy for Australia is driven by our rapidly growing dependency on space operations for an increasingly diverse range of fundamental inputs to national power. Australia is presently particularly vulnerable to external threats against our space based inputs to capability. The cause stems from a lack of proper analysis of our dependencies and their critical paths, and the lack of development of a defence strategy or risk management plan that could be facilitated by a better understanding of the system.

The dependency explosion we are experiencing is driven by technological advances and a pressing need for the greater efficiencies and economies that are obtainable from effective use of space enabled capabilities. This trend is likely to accelerate in the future, not least in areas as critical as our national air navigation service provision or our modern network enabled defence forces. A national approach is the only plausible way of managing, mitigating or countering the risks that grow with increasing dependency. The question is what form the national approach should take.

It is difficult to envisage how any sort of national space strategy for Australia can be devised and implemented without an initial high level statement of the Australian National Space Policy. The policy must provide a clear statement of the national objectives, priorities and resources to be applied to space capabilities in the national interest. Its initial form should resemble a white paper from which strategic concepts, strategies and implementation plans may be derived.

The white paper should identify those elements of space industry capability that are fundamental to our future security and afford them the highest priority for further development. Secondly, it should aim to build on those elements of space industry production for which we have a comparative advantage, either through history, geography or national characteristics. In developing the white paper, the Australian Government should rely heavily on the 2005 Chapman Report, *Space: a Priority for Australia*, which to date has been inadequately considered.

Development of consequent strategic concepts and subordinate policy should be vested in an organisation with the resources and authority to prosecute its mission. At the governance level, rather than attempting to reinvent the wheel entirely, the *Australian Space Council Act 1994* should be reviewed and used to establish a Space Council tasked to develop a national space policy and program under the guidance of the white paper. An implementing unit should be established within the Department of Prime Minister and Cabinet, responsive to the Space Council, with the responsibility for implementing space policy and initiatives. The National Space Unit should be closely linked to the Prime Minister to underline the critical importance of its work to the security of the nation.

The National Space Unit should have a wide remit, but need not be of large size. Its modus operandi should be to coordinate the activities of a number of government departments, authorities and industry organisations into a coherent national strategy. The extent of its authority should be such that it can orchestrate cross government activities if that becomes necessary to achieve the strategic objectives. It should derive much of its day to day authority from a direct link to the Prime Minister through the Space Council. Its remit should cross national and international boundaries and represent the single national point of authority for space policy.

Within the broad space policy there are a number of priority initiatives to which the Space Unit should pay early attention. The most important of these is to research the vulnerabilities of Australian national interests to space based threats, to assess the existing and potential threats and develop and implement a mitigation or risk management plan. In many respects, all other activities are subordinate to this fundamental responsibility of government. However, a number of other important attributes require attention before risk mitigation against security threats can be pervasively effective.

At the most basic level, a program to grow awareness and educational skills in the space realm is vital to Australia maintaining a position of eminence in space knowledge and technology. High school students need to be encouraged to pursue courses and careers in the space sciences sector by programs aimed at raising awareness among the students, parents and teachers. Universities need to be engaged to offer more opportunities to students showing an interest in the space sciences and more research programs to raise Australia's credentials in this area. Given the skills shortages being experienced across Australia and in certain sectors globally, building a sustainable skilled workforce in Australia's space and allied sectors will be a major challenge.

Incentives should be considered for industry to invest in space research, development and manufacture, with particular focus on those disciplines where companies already have expertise that might be further exploited to commercial advantage. Priority should also be given to developing industry capabilities in areas that are critical to Australia in times of security stress but for which we are solely dependent on foreign supply.

Infrastructure to support advanced space programs is in need of systematic review and investment. The Woomera Test Facility in South Australia is unique in the world in terms of its size over land, its remoteness and therefore relative security, its isolation from industrial and electromagnetic pollution and its freedom from encroachment by significant population centres. However, in infrastructure terms it is quite undeveloped and requires the range capability manager (the Royal Australian Air Force) to press ahead more aggressively with its master infrastructure plan and range instrumentation. The potential for Woomera to become a world centre for space research and commercial activity in addition to its primary function as a military test and evaluation range is far from fantastic, save for underinvestment.

Nationally owned and controlled satellite communications and sensing capabilities should be considered as critical national interest infrastructure in much the same way as command and control of our own defence forces is considered fundamental to our defence security. Indeed, the future technology base of the network enabled defence force may well make the two effectively rely on the same space capability. We must therefore be able to provide for satellite capabilities from within our own resources just as we must provide a credible indigenous defence capability. Denial of the space capabilities that we have come to rely on could have an immediate and devastating economic, social and safety impact. The effect is likely to be more widespread, immediate and unexpected than a credible military attack, and it is feasible today.

Having built up a credible national space security, governance and industrial capability, Australia must then resume its rightful place in international space forums to influence international policies and outcomes as it does with other international diplomatic and economic agenda.

National Innovation System Review

South Australia welcomes the Australian Government's current *Review of the National Innovation System*. As space has vital implications for Australia in a global context, an examination of the future possibilities in respect to space innovation would be valuable to focus our innovation efforts over the coming decades.

Conclusion

South Australia welcomes the opportunity to contribute to this timely Inquiry into Australia's Space Science and Industry Sector. South Australia's involvement in space goes back to the inception of space activity in the late 1940s and continues today.

To say that Australia's space science and industry is robust would be a considerable overstatement. Certainly, astronomy is robust and some aspects of space services support a broad industry base in provision of communications and other services to government, business and the community. However, the cessation of Government funding to space research in the past 10 years has caused a dilution of national science and industry capability. The foundations of early space activity remain and could be reinvigorated. Should this be the case, South Australia is a logical base on which to develop a national space capability.

Critical to the reinvigoration of space science and industry, increasing Australia's international standing and securing Australia's national interests is the development of a cogent space policy and strategy by the Federal Government. Further, appropriate mechanisms and funding need to be established at the national level to plan, coordinate and implement the national strategy efficiently and effectively. Once that occurs, state government and industry support will follow.

The Government of South Australia welcomes the opportunity to further contribute to the debate on Australia's space industry.