



**SPACE INNOVATION  
AND GROWTH  
STRATEGY  
(SOUTH AUSTRALIA)**

**ACTION PLAN  
2016-2020**



*"QUOD INVENIAS EXPLORANS SPATIUM  
PROGRESSUS EST HUMANITATIS"*

"HUMAN PROGRESS IS IN SPACE EXPLORATION"

# FOREWORD

In recent years, the global space sector has undergone a significant evolution in technological development, knowledge dissemination and overall size. Between 1998 and 2015, space-sector growth was about three times the annual growth rate of the world's GDP.

South Australia is now claiming its role as a key player in that global arena. Our state is becoming a hub of innovation, and our space sector is leading the way in the development of a space economy for our nation as a whole.

The spectrum of possible civil applications of space-related innovations is larger than ever. It ranges from agriculture to energy, communications to telemedicine, and distance learning to national security. Commercial revenue has largely eclipsed government revenue from space activity, while nanosatellites offer new and exciting opportunities at constantly decreasing costs.

South Australia is extremely well positioned to benefit from the latest technological developments because it has:

- significant capabilities across a range of space-related activities, including ground infrastructure and the processing of spatial information; and
- a vibrant, innovative space ecosystem that includes a thriving hub of private enterprise, university and research organisations.

In order to maximise benefits for our state, we must further develop our technical knowledge and infrastructure to pave the way for innovative opportunities, and to become a prominent player in an extremely competitive global arena.

If it is, indeed, true that *Quod invenias explorans spatium progressus est humanitatis* ('human progress is in space exploration'), we have a responsibility to current and future generations to ensure we continue to build a robust economy.

Through space activity in South Australia, we can continue to:

- amass a high-end skills base and world-class competency;
- promote and encourage space-related science, technology, engineering and mathematics (STEM) activities;
- foster technological advancement;
- promote industrial growth and employment opportunities; and
- generate widespread socioeconomic development.

## A SPACE-ENABLED ECONOMY

We are pleased to present the *Space Innovation and Growth Strategy (South Australia) Action Plan 2016-2020*. This document represents the beginning of an exciting journey towards a strong space industry for South Australia.

Our Government recognises that the civil and defence applications of space-related innovations are crucial for South Australia and, more broadly, for the nation, where long distances separate people. Space technologies will help us bridge the gaps of distance, connecting people more closely than ever before.

The strategy was developed by the Government of South Australia in collaboration with a number of businesses, industrial associations, private consultancies and research organisations. It identifies the key direction, mission and actions that will help us develop a space-enabled economy in South Australia. It also articulates how we will cultivate an innovative and open space ecosystem. The strategy aligns with *South Australia's Economic Priorities*, which include fostering innovation, commercialising research, and forming international connections.

This strategy will foster collaboration and best practice in the space industry and, through this approach, we will create wealth, jobs and opportunities for South Australians.



Jay Weatherill

Hon Jay Weatherill MP

Premier of South Australia



Hon Martin Hamilton-Smith MP

Minister for Defence Industries



ACM Sir Angus Houston AK AFC

Chairman, Defence SA Advisory Board



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# 1. EXECUTIVE SUMMARY

In recent years the space economy has experienced exponential global growth. Revenue from space-related activities in 2015 was about US\$323 billion, growing at a compound annual growth rate of 9.52 per cent from 1998 to 2015. This is more than three times the annual growth rate of world GDP, which was 2.87 per cent for the same period.

In April 2016 we established the *SA Space Industry and R&D Collaborations* office, located in Defence SA, which aims to support space industry growth and to increase collaboration in research and development (R&D) in the space industry in South Australia.

The new office will:

- increase awareness of the strategic importance of space applications to South Australia and Australia, including their relevance to a range of industries (for example, national security, advanced manufacturing, telecommunications, agribusiness, position navigation and timing, and environment)
- develop a plan to build a 'national hub of space industry, research and development' in South Australia where high-tech enterprises, universities and research organisations are actively involved in developing a vibrant innovation ecosystem
- strengthen international cooperation in high-tech industry and R&D in South Australia to enhance high-quality knowledge and stimulate the commercialisation of research results.

In this *Space Innovation and Growth Strategy (South Australia) Action Plan 2016-2020* we identify the key direction, mission and actions needed to create a 'space-enabled economy' in South Australia. This action plan provides the structure to support this important area of growth, with a view to promoting an increased market share in areas that have not traditionally been linked to space, and giving rise to job creation and skill development.

The *Space Innovation and Growth Strategy (South Australia) Action Plan 2016-2020* has three interconnected pillars:

- growing South Australia's economy through space activity
- invigorating South Australia's space innovation ecosystem
- engaging international cooperation with lead countries.

GROWING THE ECONOMY THROUGH SPACE ACTIVITY	INVIGORATING SOUTH AUSTRALIA'S SPACE INNOVATION ECOSYSTEM	ENGAGING INTERNATIONAL COOPERATION WITH LEAD COUNTRIES
<i>Space industry – an opportunity to stimulate South Australia's economy</i>	<i>Consolidate and stimulate the capabilities and expertise, and strengthen the commercialisation of research results, in the space industry</i>	<i>Develop a network of strategic partnerships in the space sector</i>
<p><b>Space Hub</b></p> <p>To promote the space economy by increasing awareness of the innovative possibilities within the space sector.</p> <p>To encourage investment and collaboration within the industry.</p>	<p><b>Space Capability Directory</b></p> <p>Map capabilities and expertise in South Australia.</p> <hr/> <p><b>Space Hub</b></p> <p>To promote STEM activity in the South Australian education system.</p>	<p><b>Missions &amp; Overseas Delegations</b></p> <p>To promote State Missions led by Ministers or the Premier to countries that have notable space activity with the aim of facilitating international partnerships, agreements and joint activities.</p>
<p><b>SA Space Council</b></p> <p>To represent research organisations, universities, private enterprise and government to provide a forum to discuss innovative ideas and new approaches.</p>	<p><b>Space Hub</b></p> <p>To spur collaboration among South Australian researchers and entrepreneurs in the areas of applied research and commercialisation of research results.</p>	<p><b>International Astronautical Congress - Adelaide 2017</b></p> <p>To promote and facilitate the involvement of South Australian stakeholders on the global stage.</p>

## GROWING SOUTH AUSTRALIA'S ECONOMY THROUGH SPACE ACTIVITY

This growth is crucial for a variety of sectors, including:

- communication
- entertainment
- environment
- mapping and movement.

The space industry contributes at a strategic level to the development of other priority sectors for South Australia, such as:

- national security
- agriculture
- mining and tourism
- services for the community, such as health and education, particularly in remote applications (for example, telemedicine and distance learning).

### Actions include:

- promoting the space economy through increasing awareness of the innovative possibilities within the space sector and encouraging investment and collaboration within the industry
- forming a 'SA Space Council' to represent all organisations operating within the sector, including private enterprises, universities, research organisations and government.

## INVIGORATING SOUTH AUSTRALIA'S SPACE INNOVATION ECOSYSTEM

By improving the relationship between industry, university and research sectors, our goal is to foster endogenous growth in South Australia.

We will promote and support an active innovation ecosystem, where the space industry acts as one of the key drivers of innovation. This will provide an environment that encourages the enhancement of the skills of our best researchers and engineers.

Our aspiration is to inspire and support the next generation to develop skills that will push forward the frontiers of scientific knowledge.

### Actions include:

- mapping capability in our state (the Space Capability Directory)
- promoting and encouraging space-related science, technology, engineering and mathematics (STEM) activities within our education system
- fostering knowledge transfer among researchers and entrepreneurs in the area of applied research and commercialisation of research outcomes.

## ENGAGING INTERNATIONAL COOPERATION WITH LEAD COUNTRIES

Enhancing our competitive edge in export markets and targeting market-led investments in leading-edge technology will encourage foreign investment, as well as attracting entrepreneurs, talent, researchers and students.

### Actions include:

- promoting international collaboration, including state missions led by Ministers or the Premier
- supporting and promoting the International Astronautical Congress to be held in Adelaide in September 2017.

## 2. SOUTH AUSTRALIA'S 10 ECONOMIC PRIORITIES

### STRONG BUSINESS, STRONG GOVERNMENT AND STRONG COMMUNITY

The South Australian economy is transitioning from a traditional manufacturing economy to an 'innovation leader', capable of adding value to our rich natural resources and strengthening our knowledge-based society. South Australia is becoming increasingly competitive in global markets.

Our innovative ecosystem is growing and opening the door for South Australia to attract more investment, build industry, increase our export potential and drive more R&D-led breakthroughs.

R&D, commercialisation of research results and high-tech industries are major priority areas for the sustainable growth of the state. The South Australian Government is promoting the development of innovative space industry companies with new cutting-edge products and services, crucial for building a robust economy for the future.

The *Space Innovation and Growth Strategy (South Australia) Action Plan 2016-2020* aims to grow local space industry and increase R&D collaboration in the space sector. Our action plan reinforces the Premier's message that "South Australia is the place where people and business thrive".

In 2014, the Premier launched 10 economic priorities and actions that underpin the State's vision of "partnerships between strong business, strong government and strong community"; these connections are at the heart of our economic development strategy.

The implementation of the *Space Innovation and Growth Strategy (South Australia) Action Plan 2016-2020* will contribute to:

- Priority 4 – The knowledge state – attracting a diverse student body and commercialising our research
- Priority 6 - Growth through Innovation
- Priority 9 - Promoting South Australia's international connections and engagement
- Priority 10 - South Australia's small businesses have access to capital and global markets.

### INCREASE AWARENESS, COLLABORATION AND INTERNATIONAL ENGAGEMENT

By attracting R&D-oriented companies to South Australia, or by identifying R&D opportunities in lead countries for companies, organisations and universities located in our state, we will strengthen South Australia's position as a 'knowledge state' in strategic areas such as:

- resources, energy and renewable assets
- premium food and wine
- health and ageing.

This activity aligns to economic priorities 1, 2 and 3; attracting international private enterprise and experts aligns to economic priorities 5, 7 and 8.

The State Government's 10 Economic Priorities serve as a foundation for our space strategy. Growing space and sustainable defence industries in South Australia will enable Defence SA to contribute more broadly to economic growth, jobs, investment, population, sustainability, innovation and training targets contained within *South Australia's Strategic Plan*.

# 3. VISION AND MISSION

## A SPACE-ENABLED ECONOMY

Defence SA is South Australia's lead government agency for all defence-related matters. It leads the state's defence and space industry development efforts, offering focused and responsive service to this innovative space industry to drive the sector's growth in South Australia and deliver key projects and facilities.

The knowledge, experience and infrastructure of Defence SA are essential for maximising the economic impact of an inclusive space policy, encompassing sectors that may not necessarily be related to defence.

Defence SA is implementing South Australia's space sector strategy to grow the local industry and increase R&D collaboration. We will connect to other sectors of the Australian and global economy that can potentially benefit from space applications, data and services.

The overarching vision of the space strategy is to create a 'space-enabled economy' where the space sector in South Australia provides new advances that lead to growth, new jobs and an increased market share in areas not traditionally linked to space.

The Defence SA Advisory Board provides high level strategic and policy advice to support Defence SA in promoting the growth of space and defence industries and facilities. These will be competitive and sustainable, in accordance with *South Australia's Strategic Plan* targets and South Australia's 10 Economic Priorities.

The growth of space and sustainable defence industries in South Australia plays a key role in the state's socioeconomic development. Within this mission, the main pillars of this space strategy are:

- growing South Australia's economy through space activity
- invigorating South Australia's space innovation ecosystem
- engaging international cooperation with lead countries.

In pursuing this strategy, Defence SA will act as the pivotal node of a broader network involving universities, research organisations, private enterprise, industrial associations, private consultancies and government agencies – using a 'triple helix' approach to encourage the growth of the local economic system.

## GROWING SOUTH AUSTRALIA'S ECONOMY THROUGH SPACE ACTIVITY

- supporting space activity in South Australia that is crucial for different sectors, including communication, entertainment, environment, mapping and movement
- contributing strategically to the development of other priority sectors in South Australia such as national security, agriculture, mining and tourism, as well as services for the community including health and education, particularly in remote applications (for example telemedicine and distance learning).

## INVIGORATING SOUTH AUSTRALIA'S INNOVATION ECOSYSTEM

- growing intrinsically innovative companies in the space sector, and improving the relationship between South Australian industry and research organisations, including universities, Cooperative Research Centres and the Defence Science and Technology Group
- promoting an active network among the main stakeholders involved in the state's innovation ecosystem to foster endogenous growth
- increasing awareness of the importance of high-tech industries, such as the space industry, to enhance the innovative skills of our best researchers and engineers
- inspiring and supporting our young people to develop the skills to advance the frontiers of scientific knowledge.

## ENGAGING INTERNATIONAL COOPERATION WITH LEAD COUNTRIES

- enhancing our competitive edge in export markets and targeting market-led investments in leading-edge technology, our export industry will expand, and we will attract new interest and investment from foreign investors, entrepreneurs, talent, researchers and students.

## 4. KEY STAKEHOLDERS

Defence SA has many key stakeholders specific to the space industry. We are committed to meeting the needs of the following groups in particular:

- State and Commonwealth Government Departments and Ministers as appropriate
- space industry (local, national and international) including industrial associations and private consultants
- universities and research organisations (local, national and international).

Defence SA will work with a broad range of partners and stakeholders as it strives to achieve the right climate for space industry growth, across a broad range of areas:

- workforce skills development
- research and development
- innovation
- export
- investment
- migration.

# 5. STRATEGIC CONTEXT – GROWING THE SPACE ECONOMY IN SOUTH AUSTRALIA

## BACKGROUND

The space industry is based on disruptive technologies that allow the development of new products and services, causing a change in the habits of our daily lives. Through our constantly increasing and evolving use of space systems and apparatus (e.g. smart phone, GPS navigation, tablets, TV, internet) day by day new markets are creating amazing opportunities.

The South Australian innovation ecosystem can capitalise on these opportunities by becoming a driver of new technologies. This will have the added benefit of increasing our attractiveness to leading entrepreneurs, students, talent and researchers.

Established as a dedicated separate entity in 2007, Defence SA remains the only stand-alone state-based defence agency in Australia, and is highly valued by defence and space stakeholders.

Defence SA acknowledges that it is industry rather than the State Government that delivers goods and services to the defence and space industry sectors. Our role is to facilitate programs and services that drive further growth of the space sector in South Australia, as well as fostering sustainable industry.

Our state has an active civil and defence space community of industry, universities, research centres and government. This community holds an important position in the Australian aerospace industry, particularly with respect to R&D. We also provide a key location for supply companies in high-tech industries.

## FOCUS ON INNOVATION

The 2016-17 financial year has begun with a revitalised focus on innovation, which has been in the spotlight both federally (with the recently released *National innovation and science agenda and Defence White Paper*) and here in South Australia with initiatives such as the Premier's Research and Industry Fund Research Consortia Program.

Significant changes in space technologies and markets that have occurred in recent years have resulted in opportunities for our state. South Australian companies are maximising the benefits of reduced costs associated with accessing space, and increasing opportunities to gain economic and social benefits through engagement with this sector. From agriculture to energy, communications to routing surveillance, educational institutions and private enterprises are increasingly using satellite signals and imagery in geospatial tools.

This trend is having an impact across the space economy, from R&D and design, to manufacturing and services.

## DAILY BENEFITS OF SPACE-BASED APPLICATIONS

- Increase efficiency in agriculture and fisheries**  
 Satellite-enabled applications improve the mapping of cropland in need of irrigation, harvest forecasts, and fisheries control. This guarantees better food quality and security while safeguarding the environment.
- Help regions access knowledge and information**  
 Telecommunication satellites support communication needs when Earth-based solutions are limited. This reduces regional imbalances by serving communities in remote areas without internet access.
- Improve crisis response**  
 Satellite services help shorten response times in emergencies.  
 Swift damage images and assessment maps contribute to more efficient planning and relief efforts, and help guide rescue services.
- Protect the environment and help tackle climate change**  
 Environment monitoring provides crucial information on vegetation, ocean currents, water quality, natural resources, atmospheric pollutants, greenhouse gases, and the ozone layer.
- Increase security**  
 Satellite positioning, satellite communications, and Earth observation contribute to detecting illegal immigration, preventing cross-border organised crime, and combating piracy at sea.
- Improve the health of our citizens**  
 Space-based applications can significantly improve healthcare and the health education of patients through remote medical support. They also help to prevent or mitigate the outbreak of disease.
- Optimise transport**  
 When combined with enhanced communication capabilities, highly accurate satellite positioning contributes to a modern and reliable transport sector for cars, planes, and ships. It optimises fleet management, vessel traceability, collision prevention, speed control, assistance for shipping manoeuvres, etc.

Source: [http://ec.europa.eu/growth/sectors/space\\_en](http://ec.europa.eu/growth/sectors/space_en)

## ECONOMIC GROWTH

From 1973 to 1998 global space revenue grew at an annual rate of 6.3 per cent from US\$15 billion to US\$68.8 billion. This growth rate is **approximately double GDP growth**, which for that same period had a compound annual growth rate of 2.96 per cent.<sup>1</sup>

In 2015 space revenue was about US\$323 billion<sup>2</sup>, growing at a compound annual rate of 9.52 per cent over the 17-year period from 1998 to 2015. Over that same period, world GDP grew at an annual rate of 2.87 per cent while the space sector economy grew at **more than three times** that rate.

Moreover, an economic trend within the space industry is revealed by comparing global commercial space revenue's recent extraordinary growth to the decreasing proportion of the government revenue rate. In 1973 the government contribution to global space revenue was around 80 per cent and commercial industry accounted for the remaining 20 per cent. In 2015 commercial space revenue was 76 per cent of the global space revenue and the remaining 24 per cent was from government contribution (11 per cent of total space revenue was attributed to defence).

This reversal reveals a remarkably strong commercial annual growth rate, with an increase of 12.28 per cent over the period 1998 to 2015.

## SPACE ECOSYSTEM

Testament to the vibrant space sector ecosystem in our state is the presence of at least 60 organisations with space-related expertise, or the potential to apply their expertise to the space sector.

The Space Industry Association of Australia (SIAA) is a peak Australian space industry body with a strong presence in South Australia. This association assists its members to:

- compete and secure work on the global stage
- share knowledge, improve capabilities and pursue opportunities in the global defence, civil and commercial space sectors
- share best practice and strengthen collaboration to continuously improve products, processes and services to be highly competitive and innovative, and provide value-add solutions.

Other associations representing space companies in our state include the Defence Teaming Centre, the Surveying and Spatial Sciences Institute (SSSI) and the Spatial Industries Business Association (SIBA).

## RESEARCH AND EDUCATION

Complementary to this industry sector, there exists a vibrant research and education sector in South Australia – including three local universities, three international universities and world-renowned national research centres such as the Defence Science and Technology Group (DSTG), which actively contribute to the state's innovation ecosystem.

## CURRENT STATE ANALYSIS

The table overleaf is a 'strengths, weakness, opportunity and threats' (SWOT) analysis of the space ecosystem in our state. The SWOT analysis informs the direction for the strategy.

Space activity growth can support the economy by harnessing opportunities to build an innovative, internationally engaged and tightly connected space sector. This action plan will:

- capitalise on the global space economy's fast upward growth trend, particularly in the civil space and private, non-government led sector
- grow the level of space sector activity to increase supply of services; heighten investment in technology; encourage international partnerships and build the sector's export and skills capability
- stimulate the local space sector community by encouraging increased interaction and connection between interdisciplinary research organisations and by strengthening the commercialisation of research results
- promote the uptake of new collaboration in the high-technology field including new joint ventures between international and local research centres and private companies
- use best practice prototypes to implement an 'innovation environment approach' in building a potential 'space cluster' in South Australia
- promote STEM through space activity, within primary and secondary schools
- leverage off existing space industry connections and events (such as the International Astronautical Conference 2017) to support growth of the local space community
- create synergies and new joint ventures by attracting knowledge-intensive Small Medium Enterprises and Multinational Enterprises to collaborate locally, and enhance competitiveness by attracting talent, know-how and new ideas. Working with the Investment Attraction Agency of South Australia (IAA) we will encourage major international companies to establish a presence in our state.

<sup>1</sup> A Selective Review of Australian Space Capabilities: Growth Opportunities in Global Supply Chains and Space Enabled Services, Asia Pacific Aerospace Consultants Pty Ltd, 2015

<sup>2</sup> The Space Report 2016 – The Authoritative Guide to Global Space Activity, SpaceFoundation.org

STRENGTHS	WEAKNESSES
<p><b>ACTIVE INTERNATIONAL ENGAGEMENT STRATEGIES WITH LEAD COUNTRIES</b></p> <ul style="list-style-type: none"> <li>➤ existing engagement strategies with China, India and South East Asia, including active executive plans</li> <li>➤ in development engagement strategies with North Atlantic, North East Asia and Middle East and North Africa (MENA) regions</li> <li>➤ the recent decision to build European submarines and frigates in Adelaide allows South Australia to engage with these countries in a broad way, including space activity collaboration</li> </ul> <p><b>BUSINESS ENVIRONMENT</b></p> <ul style="list-style-type: none"> <li>➤ a well-developed aerospace sector (for example companies providing avionic, airframes and precision tooling)</li> <li>➤ a State Government that is facilitating changes to legislation and reducing red tape, which are required to fuel the growth of South Australia's space industry</li> </ul> <p><b>SOUTH AUSTRALIA'S DEFENCE REPUTATION</b></p> <ul style="list-style-type: none"> <li>➤ presence of an established defence-related industrial activity</li> <li>➤ presence of DSTG and the new Centre for Defence Industry Capability (with headquarters in Adelaide)</li> </ul> <p><b>POSITION</b></p> <ul style="list-style-type: none"> <li>➤ liveability</li> <li>➤ gateway to the Asia Pacific</li> </ul>	<p><b>NATIONAL ENVIRONMENT</b></p> <ul style="list-style-type: none"> <li>➤ Australia's space industry is nascent and evolving</li> </ul> <p><b>REPUTATION</b></p> <ul style="list-style-type: none"> <li>➤ low level of attention on the space sector and industry</li> </ul> <p><b>BUSINESS ENVIRONMENT</b></p> <ul style="list-style-type: none"> <li>➤ limited experience in space-related activities</li> <li>➤ low demand for industrial environment</li> <li>➤ limited presence of large companies involved in the space sector</li> </ul> <p><b>R&amp;D COLLABORATION</b></p> <ul style="list-style-type: none"> <li>➤ lack of strong connections in the R&amp;D sector</li> <li>➤ no space-specific hub where supply and demand of innovations can meet</li> </ul>
OPPORTUNITIES	THREATS
<p><b>INNOVATION AND R&amp;D</b></p> <ul style="list-style-type: none"> <li>➤ strong interest from space community to build connections between universities and companies, including the establishment of innovative space-related start-ups and spin-offs, and to establish a vibrant node of the new Cyber Security Industry Growth Centre in Adelaide</li> <li>➤ growing attention on the space industry</li> </ul> <p><b>BUSINESS AND LABOUR ENVIRONMENT</b></p> <ul style="list-style-type: none"> <li>➤ mature business environment, good entrepreneurial spirit</li> <li>➤ quality universities with good scientific background</li> </ul> <p><b>GLOBAL TRENDS</b></p> <ul style="list-style-type: none"> <li>➤ strong growth of space economy</li> <li>➤ cost reduction of satellite design, assembly and launch</li> <li>➤ growing importance of Asia-Pacific region</li> </ul> <p><b>LOCAL OPPORTUNITIES</b></p> <ul style="list-style-type: none"> <li>➤ 68th International Astronautical Congress to be held in Adelaide in September 2017</li> </ul>	<p><b>INTERNATIONAL COMPETITIVENESS</b></p> <ul style="list-style-type: none"> <li>➤ international competitors have already developed strong capabilities</li> </ul> <p><b>LOCAL COMPETITIVENESS</b></p> <ul style="list-style-type: none"> <li>➤ other national clusters or hubs in the space sector that gain an international reputation able to lead a national strategy, including opportunities for new investments</li> </ul>

# 6. SPACE SA VISION 2020: STIMULATING THE GROWTH OF SOUTH AUSTRALIA'S SPACE SECTOR

## PILLAR 1 – GROWING SOUTH AUSTRALIA'S ECONOMY THROUGH SPACE ACTIVITY

### *Space industry – an opportunity to stimulate South Australia's economy*

In 2015, the global space economy grew to a total of US\$323 billion worldwide<sup>3</sup>. This includes:

- 37 per cent commercial infrastructure and support industries (US\$120.09 billion)
- 39 per cent commercial space products and services (US\$126.33 billion)
- 13 per cent US government space budget (US\$44.57 billion, of this amount US\$23.57 billion for national security spending and US\$21.00 billion for civil space spending)
- 10 per cent non-US government space budgets.<sup>4</sup>

Commercial space activities made up more than three-quarters (76 per cent) of the space industry markets, mostly driven by global telecommunication.

In this context, space industry start-ups are also showing interesting growth patterns. Space start-up investment had a compound annual growth rate of 180 per cent during 2012-15 (larger than both bitcoin and photo sharing growth). Start-up space ventures attracted US\$2.3 billion of investment in 2015. Of this amount, US\$1.8 billion came from venture capital, more than the previous 15 years combined.<sup>5</sup>

Space technologies and markets have changed significantly in recent years, reducing the cost of accessing space and increasing opportunities to gain economic and social benefits for South Australia and Australia. These changes include:

- small satellites becoming more attractive in the past five years due to their lower development costs, shorter production lead times and smaller risk. In the past year, 63 per cent of the total satellite launches across the world were small satellites, with increasingly sophisticated payloads<sup>6</sup>
- space-enabling services (such as: Earth observation, satellite communications, and national space-based position navigation and timing) growing to become invaluable to a range of priority sectors in Australia, such as national security, agriculture, health, education, tourism and mining.

These changes represent important opportunities to build the space economy and for associated companies and research centres to provide a key focus for further development.

Annual revenue from the Australian space industry sector is estimated at between \$3-4 billion, consisting of 92 per cent from domestic activity and 8 per cent from export. Employment in the sector is estimated to be between 9 500 and 11 500 full-time equivalent.<sup>7</sup>

Augmented Global Navigation Satellite System (GNSS) services deliver economic benefits to Australian industry through improvements in productivity and more efficient use of resources. Projections are that by 2020 'real GDP could be between \$7.8 billion and \$13.7 billion higher than it would otherwise have been'.<sup>8</sup>

While Australia has been a user of launch services, there is no domestic orbital or sub-orbital launch capability. Most of Australia's capability in launch-related activities involves tracking launched vehicles. This means that multinational (Tier 1 and 2) companies providing design, manufacture and testing of complete spacecraft systems do not currently have a strong presence in Australia. In South Australia, international companies such as BAE Systems Australia, Cobham Aviation Services, Airbus, SpeedCast, SAAB System and Lockheed Martin operate mainly in the aeronautical sector.

<sup>3</sup> *The Space Report 2016 - The Authoritative Guide to Global Space Activity*, SpaceFoundation.org and *State of The Satellite Industry Report, The Tauri Group 2015*

<sup>4</sup> *The Space Report 2016 - The Authoritative Guide to Global Space Activity*, SpaceFoundation.org

<sup>5</sup> *The Space Review – Effects of Changing Economics on Space Architecture and Engineering*, Gary Oleson, May 26, 2016.

<sup>6</sup> *State of the Satellite Industry Report, The Tauri Group, 2015*

<sup>7</sup> *A Selective Review of Australian Space Capabilities: Growth Opportunities in Global Supply Chains and Space Enabled Services*, Asia Pacific Aerospace Consultants Pty Ltd, 2015

<sup>8</sup> *The Value of Augmented GNSS in Australia*, Acil Allen Consulting, 2013

In Australia, there is a significant presence in the field of smaller Tier 3 or 4 companies specialising in the production of specific electric, electronic and mechanical components/materials or in software and services. These companies are mainly small and medium sized enterprises operating in downstream segments of the space industry. In addition, there are many small and medium local enterprises that are very well connected with South Australian universities.

According to a recent survey, defence is a major industry sector for space companies – 72 per cent of the companies interviewed listed Defence as a client, with mining the next most important sector.<sup>9</sup>

The table below shows the main high-growth market opportunities in the space sector around the world.

Stakeholder consultation has identified the most relevant priorities for South Australia, which are indicated in **bold**. These are consistent with the general world trends concerning the application of space-related technological innovations in civil sectors.

These primary opportunities, when considered in a dynamic and evolving environment, will allow South Australia to identify the space technologies and skills necessary to achieve results in these fields particularly, providing a clear direction and focus for the investment of resources and the development of appropriate educational pathways. It also satisfies the opportunity/capability/capacity equation.

## AREAS OF OPPORTUNITY

### SECURITY, SAFETY AND RESILIENCE

- **Maritime geospatial services**
  - **Maritime surveillance**
  - **Maritime environment monitoring**
- Secure satellite communications
- Galileo PRS
- Polar infrastructures for shipping and exploration
- **Disaster and emergency response**
- **Space robustness services**
  - Removing space debris
  - Space weather
  - **Space situational awareness**

### e-CONNECTIVITY

- Direct-to-home TV
- **Fixed-satellite broadband**
  - **Backhaul (mobile, fixed, broadcast)**
  - **Telemedicine, assisted living**
- Broadband to ship
- Broadband to aircraft
- Ubiquitous m2m
  - Energy use monitoring and management
  - Transport
- Location-based services
  - Gaming/synthetic environments
- **Managing unmanned vehicles (RPVS) and hosted payloads**
- Seamless personal communications

### CLIMATE ENVIRONMENTAL SERVICES

- Insurance and finance
- **Agriculture and food security**
- **Environmental services**
  - **Climate applications**
    - Carbon monitoring and modelling
    - Environmental policy
- **Weather forecasting**

### MORE EFFICIENT PUBLIC SECTOR SERVICES

- **Transport management**
  - Rail transport
  - Air traffic
  - **Road transport**
- **Smart cities/urban services for local governments**
- Energy infrastructure services

### GAME-CHANGING SERVICES

- Low-cost access to space
  - Space tourism and small-payload launch
  - Space planes
  - Low-cost LEO launch vehicles
- Persistent surveillance
- Power from space

<sup>9</sup> A Selective Review of Australian Space Capabilities: Growth Opportunities in Global Supply Chains and Space Enabled Services, Asia Pacific Aerospace Consultants Pty Ltd, 2015

## OPPORTUNITIES

Priority areas for South Australia include:

- agribusiness
- health
- mining
- education
- tourism.

These areas have become increasingly dependent upon evolving space technology.

Defence SA will raise awareness and promote collaboration relating to opportunities such as:

- the National Innovation and Science Agenda, with almost \$1.1 billion funding available in the next four years, representing an opportunity to promote business-based research, development and innovation
- The new Centre for Defence Industry Capability<sup>10</sup> with \$230 million (over the next decade), including the Defence Innovation Portal that will facilitate engagement between Defence and innovation activities
- The Defence Innovation Hub with \$640 million available over the next decade increasing the engagement between industry and Defence sectors.<sup>11</sup>

Additionally, there are State Government programs to encourage innovation, including the following programs managed by the Department of State Development (Industry and Innovation):

- the Innovation Voucher Program
- South Australian Early Commercialisation Fund
- South Australian Venture Capital Fund.

These represent a pool of opportunities, particularly for the South Australian SMEs involved in the state's potential space industry cluster.

## ACTIONS

The global space economy's fast upward growth trend, particularly led by the private sector, is attracting the attention of market-leading venture capital firms and start-up funds. This growth can be attributed to the fact that the space sector is viewed as a lucrative and growing market. It is important to increase awareness of the significance of space applications to South Australia.

South Australia would be wise to harness the opportunity to attract international space sector investment – stimulating local SMEs, spin-off and start-ups, particularly among young researchers and students.

The consideration of South Australia's priority areas can guide the development of a supportive ecosystem, assisting companies, universities and research organisations to take advantage of these highlighted growth opportunities.

The South Australian ecosystem could take into consideration the following activities:

- uptake of space services
- technology investment
- international partnerships and export
- skills.

The actions and efforts of these stakeholders will be coordinated through the implementation of the 'SA Space Council', which will serve as a key tool to represent research organisations, universities, private companies and government. The Council will provide a forum for the discussion of innovative ideas.

### ACTION 1 – INCREASE AWARENESS

- Establish a hub to share information, data and relevant news and documents.
- Promote the South Australian space economy and increase awareness of the space sector as an innovative area to invest and collaborate.
- Facilitate the involvement of South Australian stakeholders in the space sector – organising additional meetings, seminars and information sessions.
- This hub will provide a conduit for South Australian companies to access a range of programs aimed at promoting R&D, commercial development and programs specifically targeted toward company growth (i.e. accelerating commercialisation, CSIRO innovation fund to commercialise early stage innovation, the Biomedical Translation Fund to commercialise promising discoveries).

### ACTION 2 – SA SPACE COUNCIL

- Establish the 'SA Space Council' to represent research organisations, universities, private enterprise, government and relevant stakeholders in the space sector.
- The Council will serve as a primary avenue for the discussion of trends, and for the identification of strategies and actions aimed at assisting Defence SA in supporting growth in the space industry, and in enhancing innovation in the South Australian space sector.

<sup>10</sup> 2016 Defence Industry Policy Statement, Australian Government, Department of Defence, 2016

<sup>11</sup> Ibid

## PILLAR 2 – INVIGORATING SOUTH AUSTRALIA'S SPACE INNOVATION ECOSYSTEM

***Consolidate and stimulate the capabilities and expertise in South Australia and strengthen the commercialisation of research results in the space industry.***

Australia is tackling the same challenges and issues faced by other manufacturing regions, which need to adapt to rapid global economic and social changes, keep up with the new technological advances in space innovation, and be competitive with emerging countries that offer a lower labour cost. Therefore, it is of the utmost importance to seek territorial competitive advantage in the R&D field.

Aligned with South Australia's 10 Economic Priorities, this strategy aims to:

- improve local innovation and R&D competitiveness
- enhance high-value industries
- strengthen connections among universities, industry and government (triple helix model).

Prime examples include the Tonsley Innovation District and the South Australian Health and Medical Research Institute (SAHMRI) where multinational companies including Siemens and Hewlett Packard, high-tech SMEs and universities have clustered in order to leverage interconnections and strengthen networks.

Government policies and effort are directed towards continuous improvement of these linkages. Some local best practice models such as BioSA, Tonsley Park and SAHMRI could be used as best practice prototypes in forming a potential 'space cluster' in South Australia.

An intrinsic part of the South Australian space innovation ecosystem is an active R&D community, including strong and positive relationships with industry stakeholders, moving South Australia towards the new economy.

Space research activity in South Australia is mainly concentrated in the three local universities that have a space focus across a number of schools, centres and institutes. These include satellites, propulsion, communications, legal, science, engineering, sensors and applications.

Other examples are:

- The University of Adelaide's wind tunnel is the second largest wind tunnel in Australia and offers research and testing services for many applications, including aircraft structures, aerospace and aeroacoustics
- Flinders University, which has a flourishing internationally recognised school of Space Archaeology
- The University of South Australia, which has a planetary space science activity focussing on the observation and investigation of terrestrial planets in the solar system, using data from the National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA)
- The headquarters of the Cooperative Research Centre 'Data to Decisions' is located in Adelaide and aims to extract intelligence and make predictions based on big data (including satellite data)
- The Defence Science and Technology Group provides R&D and science and technology advice to the Defence industry with respect to space-based capabilities across Earth observation, satellite communications, and national space-based position, navigation and timing (PNT), which play a crucial role in applied space research. Within Australia the highest concentration of capabilities can be found in these three service domains.<sup>12</sup>

The main higher education activity is similarly spread among the three local universities and three international universities.

South Australia has a world-renowned International Space University Southern Hemisphere Space Studies Program. This five-week program, hosted by the University of South Australia, aims to educate the next generation of space professionals, with participants from across the world studying all aspects of international space activities, including satellite applications, human space exploration and space policy.

The space sector is a high-tech industry requiring a highly educated workforce. A recent report states that two-thirds of the staff employed in these companies hold tertiary qualifications (bachelor degree or higher) and nearly half of the companies interviewed had staff who hold PhDs<sup>13</sup>. It is important that the sector attracts and retains employees with appropriate levels of educational qualifications.

<sup>12</sup> A Selective Review of Australian Space Capabilities: Growth Opportunities in Global Supply Chains and Space Enabled Services, Asia Pacific Aerospace Consultants Pty Ltd, 2015

<sup>13</sup> Ibid

Promotion of the state's science, technology, engineering and mathematics (STEM) skills for the space sector will grow the capability needed to meet workforce needs in the future. This is articulated in the *National Innovation and Science Agenda* and the *2016 Defence Industry Policy Statement*.

## OPPORTUNITIES

Defence SA will promote an active network among key stakeholders involved in the space ecosystem, with a view to sharing information, promoting innovation and improving the relationship between industry and research sectors in South Australia.

We will foster new collaboration in the high-technology field taking into account opportunities such as:

- the *National Innovation and Science Agenda*, which has committed \$1.1 billion in funding over the next four years and provides an opportunity to promote business-based research, development and innovation and investing in STEM
- the Australian Research Council (ARC) funds research under the National Competitive Grants Program through its two main programs:
  - Linkage (\$287 million available in 2015-16)
  - Discovery (\$524 million available in 2015-16)
- key initiatives such as the 'Next Generation Technologies Fund' that provides for \$730 million over the next decade<sup>14</sup> to invest in strategic technologies – with space capability one of the nine priority areas
- the new Premier's Research and Industry Fund Research Consortia Program in South Australia encourages collaboration between researchers and entrepreneurs, and investment in key science and research areas that have the potential to generate significant economic, social and/or environmental benefits for the state
- South Australia Regional Science Hub Grants support the development of STEM programs within regional areas of the state.

## ACTIONS

This vibrant ecosystem which involves industry-building relationships with researchers generates abundant opportunities for new start-ups fuelled by the commercialisation of innovative research results from local universities/institutes and the ingenuity of local South Australian experts within the cluster. These niche capabilities include:

- ICT
- telecommunication
- optoelectronic sensors
- intelligence surveillance and reconnaissance

- development of nanosatellite systems
- environmental controls.

Defence SA will map current capabilities and expertise in South Australia through closely engaging with private companies and research centres. This will enable the development of a resource map (showing existing capability, expertise, knowledge and infrastructure).

Defence SA can facilitate the marketing of our state internationally (attracting new companies and new talent) and stimulate interdisciplinary and inter-laboratory connections within the local space sector community.

### ACTION 3 – SPACE CAPABILITY DIRECTORY

- Develop a survey to share among the main stakeholders in the space sector to map capabilities and expertise existing in South Australia. These results will be instrumental to the development of the first 'South Australian Space Capability Directory'.
- Publish this document periodically (every year for the first two editions and then biennially).

### ACTION 4 – SUPPORT STEM

- Use the space hub as an avenue to support the community that promotes STEM activity by sharing information, including space specific material, contacts and resources.
- Promote STEM in the South Australian community by organising additional meetings, seminars and information sessions.

### ACTION 5 – PROMOTE COLLABORATION

- Promote collaboration among South Australian stakeholders in the space sector, organising additional meetings, seminars and information sessions.
- Use the space hub to stimulate collaboration among South Australian researchers and entrepreneurs in the areas of applied research and the commercialisation of research results.
- The space hub will inform relevant national and international calls to fund R&D projects, share supply and demand of innovative solutions (patents, research results etc.), facilitate new partnerships and stimulate new start-ups and spin-offs. It will also link the space research industry sector with the relevant 'industry growth centres' such as cyber security, advanced manufacturing, mining, food and agribusiness.

<sup>14</sup> 2016 Defence Industry Policy Statement, Australian Government, Department of Defence, 2016

### PILLAR 3 – ENGAGING INTERNATIONAL COOPERATION WITH LEAD COUNTRIES

#### **Grow a network of strategic partnerships in the space sector.**

There is a link between innovation and globalisation – firms need to innovate in order to be able to compete in foreign markets; on the other hand, internationalisation might lead to innovation as a result of the so called ‘learning by export/internationalisation’ effects. The challenge is to create a solid and competitive business environment in order to enable firms of all sizes to perform well.

Strengthening international cooperation in R&D in South Australia is fundamental to generating high-quality knowledge and stimulating the commercialisation of research results.

This enables the creation of first-rate products and services, and allows innovative businesses to prosper. It is a vision that supports the idea of a disruptive economy, where an innovative ecosystem leads to competitiveness through the development of complex products and services involving cutting-edge research in sectors such as space.

There is evidence that North American and European companies are watching the Australian SMEs, research organisations and universities with a view to acquiring space intellectual property and incorporating it into their operations overseas.

Through enhancement of the state’s competitive edge in export markets and targeting of market-led investments in leading edge technology, South Australia’s export share, capabilities and expertise will improve (in Australia export activity for the space industry amounts to a mere 8 per cent of the total revenue<sup>15</sup>). This approach will support the growth of our export industry and attract international companies and highly renowned talent. This activity could receive strategic support through the state’s international engagement strategies (China, India, North Atlantic, South and North East Asia) recently established by the South Australian government.

Moreover, the 68th International Astronautical Congress (IAC2017), to be held in Adelaide on 25-29 September 2017, represents an important opportunity for the South Australian space ecosystem. The international conference will attract more than 3 000 delegates, including heads of the world’s major space agencies (such as ESA and NASA), astronauts, senior space engineers, researchers, policy makers, the innovation leaders from many large aerospace companies (such as Lockheed Martin, Boeing, Airbus, BAE Systems) and approximately 100 additional companies. Some areas featuring in the program include space activity as it relates to biodiversity/ecosystems, climate change, disaster management, global health, global navigation satellite systems, environmental monitoring, natural resource management and satellite communications.

### OPPORTUNITIES

The Department of State Development has a range of new engagement strategies with key international countries and regions in the South Australian Government priority areas. These can be utilised to leverage space-industry linkages and R&D collaboration. Defence SA will foster international collaboration with lead countries, taking into account opportunities such as:

- the new Premier’s Research and Industry Fund Research Consortia Program in South Australia – along with national programs such as Cooperative Research Centres, Australian Research Council Industry Linkage Grants, the Australia-China Science and Research Fund, the Australia-India Strategic Research Fund, and the Australian Astronomical Observatory – can all provide valuable support for international R&D collaboration
- the SA Export Partnership Program, which creates opportunities for the local space industry to be engaged internationally with new markets, increasing the export value of their products and services the Investment Attraction South Australia agency, which aims to encourage investment in South Australia, including attracting investment by high-tech SMEs and MNEs
- IAC2017, which is expected to be the largest congress ever to be held in Adelaide, provides an opportunity for South Australia to invigorate the local space industry and encourage R&D, as well as increase opportunities for international collaboration.

<sup>15</sup> A Selective Review of Australian Space Capabilities: Growth Opportunities in Global Supply Chains and Space Enabled Services, Asia Pacific Aerospace Consultants Pty Ltd, 2015

## ACTIONS

Defence SA will promote relationships between industry and research sectors in South Australia through enhanced international cooperation.

Countries and regions with which the South Australian Government has an engagement strategy will be considered a priority. Our state can attract knowledge-intensive SMEs and MNEs from leading countries, aiming to create synergies and new joint ventures with local SMEs, which will bring to South Australia talent, know-how and new ideas to enhance our competitiveness.

### ACTION 6 – MISSIONS AND OVERSEAS DELEGATIONS

- Promote, among the space sector's stakeholders in South Australia, state missions led by Ministers or the Premier to countries with notable or significant space activity, to facilitate international partnerships, agreements and joint activities.
- Identify and establish strategic contacts with overseas associates in order to create an environment of interconnectedness between the South Australian space industry, researchers and networks.
- Promote initiatives and facilitate involvement of South Australian stakeholders in the space arena by organising additional meetings, seminars and information sessions.

### ACTION 7 – SUPPORT INTERNATIONAL ASTRONAUTICAL CONGRESS – ADELAIDE 2017

- Organise a series of 'Space Forums' in 2016-17, designed to share information among the South Australian stakeholders in the space arena, to stimulate and encourage the active participation of South Australian researchers and entrepreneurs in IAC2017.
- IAC2017 provides a platform for showcasing South Australian companies, research centres and educational organisations at an international level. This congress provides an ideal environment to identify potential new partnerships and strategic alliances, and to build stronger involvement in upstream and downstream enterprises operating in the space industry global value chain.

## ANNEX 1: SOUTH AUSTRALIAN SPACE CAPABILITY DIRECTORY – ORGANISATION LISTING

TYPE	NAME	WEBSITE	CONTACT PERSON
PRIVATE COMPANIES	Aerometrex	www.aerometrex.com.au	Mark Deuter mark.deuter@aerometrex.com.au +61 8 8362 9911
	Airbus Defense and Space	www.airbusgroupap.com.au www.airbusdefenceandspace.com www.intelligence-airbusds.com	Valentin Merino-Villeneuve valentin.merino@airbus.com +61 421 730 422
	AU Launch Services	www.aulaunchservices.com	Brett Burford brett@aulaunches.com +61 488 662 466
	Auspace Pty Ltd	www.auspace.com.au	Paul Weiss paul.weiss@novasystems.com +61 408 273 654
	BAE Systems Australia	www.baesystems.com	Andrew Sysouphat andrew.sysouphat@baesystems.com +61 8 8480 8729
	Boeing	www.boeing.com.au	Mike de La Chapelle michael.delachapelle@boeing.com +61 466323179
	Cobham Aviation Services	www.cobham.com.au	Anthony Patterson anthony.patterson@cobham.com +61 412 671 610
	Fleet Space Technologies	www.fleet.space.com	Flavia Tata Nardini flavia@fleet.space
	Geoplex	www.geoplex.com.au	Rick Bailey rbailey@geoplex.com.au +61 419 218 458
	Greenhouse Gas Monitor Australia		Andrew Clark andrew.clark@ggma.com.au +61 418 808 387
	Inovor Technologies	www.inovor.com	Matthew Tetlow info@inovor.com +61 412 644 853
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	Lockheed Martin	www.lockheedmartin.com.au	Michelle Scully michelle.m.scully@lmco.com +61 2 6269 0101
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	Nova Systems	www.novasystems.com.au	Peter Nikoloff peter.nikoloff@novadefence.com.au +61 8 8252 7100
	Shoal Engineering	www.shoalgroup.com	Shaun Wilson shaun.wilson@shoalgroup.com +61 2 6239 4288
	Small World Communications	www.sworld.com.au	Steven Pietrobbon steven@sworld.com.au +61 8 8332 0319
SpeedCast	www.speedcast.com	Mike Kenneally mike.kenneally@speedcast.com +61 412 833 613	
Toolcraft Precision Engineering	www.toolcraft.com.au	Peter Timmins peter@toolcraft.com.au +61 8 8265 0044	

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TYPE	NAME	WEBSITE	CONTACT PERSON
INDUSTRIAL ASSOCIATIONS	American Institute of Aeronautics and Astronautics	www.info.aiaa.org/Regions/Int/Adelaide	Mark Ramsey aiaa.adelaide@gmail.com +61 413 665 120
	Defence Teaming Centre	www.dtc.org.au	Les Shearn les.shearn@dtc.org.au +61 434 070 682
	Space Industry Association Australia	www.spaceindustry.com.au	Michael Davis chair@spaceindustry.com.au +61 8 8229 2444
PRIVATE CONSULTANCIES	ACIL Allen Consulting	www.acilallen.com.au	Ray Garrard r.garrard@acilallen.com.au +61 412 089 043
	Coutts communications	www.couttscommunications.com	Professor Reg Coutts reg.coutts@couttscommunications.com +61 414 477 766
	Frazer-Nash Consultancy Australia	www.fncaustralia.com.au	d.farrell@fncaustralia.com.au +61 8 7325 4200
	KasComm Pty Ltd		Jeff Kasparian jeff.kasparian@bigpond.com +61 408 838 660
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	Investment Attraction SA	www.invest.sa.gov.au	Sophie Adlaf sophie.adlaf@sa.gov.au +61 8 8303 2401

**ANNEX 2: TIMELINE OF SPACE ACTIVITY IN SOUTH AUSTRALIA**

YEAR	ACTIVITY	DESCRIPTION
1947	Woomera Rocket Range established	The Woomera Rocket Range was established in South Australia as a base for United Kingdom and European (European Launcher Development Organisation (ELDO)) launch activities. The facility would become the second largest launch and tracking facility in the West.
1950's		Woomera was largely used to test UK warheads and delivery mechanisms (sub-orbital rockets), but in 1957, Woomera was the launch site for the first Australian built sounding rocket, the Long Tom. The rocket was used to assist the development of instrumentation at Woomera in preparation for the launch of ballistic research vehicles, and later used to study the upper atmosphere.
1967	WRESAT launched	The Australian-built Weapons Research Establishment Satellite (WRESAT) was successfully launched into orbit from Woomera in 1967 on board a modified US rocket. This made Australia the seventh country to launch a satellite. It also made Australia the third country, after the United States and the Union of Soviet Socialist Republics, to launch a satellite to orbit from its own territory.
1995	EXPRESS Re-entry Capsule Mission	<p>The EXPRESS mission was a collaborative program between Germany and Japan involving the targeted landing of an unmanned re-entry capsule at the Woomera, selected by the German space agency due to the large and safe landing area.</p> <p>The spacecraft, carrying German and Japanese microgravity and re-entry technology experiments, was launched from Kagoshima Space Centre in Japan on 15 January 1995 but did not land at Woomera as expected due to an anomaly. Despite this, Australian support during this mission was highly commended and pioneered the approach for future spacecraft re-entry and landing programs at Woomera.</p>
1996	Kistler Aerospace Corporation approaches Australian Government for permission to use Woomera for its reusable rocket test program	<p>U.S. company, Kistler Aerospace Corporation develops one of the world's first fully reusable launch vehicles, the Kistler K-1. Kistler has a Space Systems/Loral contract for 10 satellite launches from 1998 at over \$150 million.</p> <p>Woomera is chosen over Nevada to be the first site for the test launches and commercial launches as well. The vehicle was to be launched from Woomera, after which the upper stage of the vehicle would return to Earth near the launch site. The Federal Government approved use of Woomera and developed launch licences.</p>
May 1996	Dr Andy Thomas' first flight into space	South Australian-born astronaut Dr Andy Thomas AO flew his first flight into space on Endeavour. He has spent more time in space than many other astronauts of any nationality (a total of 178 days which included five shuttle flights).
1996	Japanese Automatic Landing Flight Experiment (ALFLEX)	<p>ALFLEX entailed testing of a one third scale model of the HOPE spaceplane by the National Aerospace Laboratory (NAL) and the National Space Development Agency of Japan (NASDA) (since merged into the Japanese Aerospace Exploration Agency (JAXA) in 2003). NAL/NASDA conducted 13 automatic landing trials in 1996 over a range of experimental conditions. All trials were spectacularly successful.</p> <p>Selection of Woomera for the ALFLEX program followed a survey by NAL/NASDA of over 100 prospective sites in Japan and overseas.</p>
18 May 2001	NASA grants Kistler US\$136 million to participate in NASA's Space Launch Initiative Program to develop a re-usable successor to the Space Shuttle	Space Exploration Technologies (SpaceX) based in California, and Rocketplane-Kistler of Oklahoma City share up to \$US500 million in NASA seed money to develop their launch vehicles. Rocket Plane Kistler and SpaceX conduct orbital flight tests as well as commercial operations from a spaceport at Woomera, and carry cargo to the ISS. The test results from the K-1 vehicle are used by U.S. National Aeronautics & Space Administration (NASA).
2002-2004	Super Sonic Transport Trials (NEXST) in 2002 to 2004	<p>Following the success of the ALFLEX program, JAXA selected Woomera to conduct the National Experimental Supersonic Transport (NEXST) flight trials.</p> <p>JAXA undertook significant infrastructure upgrades at the Woomera in preparation for the NEXST flights including the installation of a heavy duty launcher and associated air-conditioned moveable shelter, commissioning of a 100 kW radar Upper-Air Wind Profiler and also improvements to various range facilities. Extensive support was provided by AOSG and Adelaide-based aerospace companies.</p>
July-August 2004	International Space University Space Studies Program	<p>The Space Studies Program (SSP) is an intense two-month course for postgraduate students and professionals. The curriculum covers the principal space related fields, both non-technical and technical and ranges from policy and law, business and management and humanities to life sciences, engineering, physical sciences and space applications.</p> <p>Each year the SSP convenes in a different location around the world and was conducted in Adelaide in 2004.</p>

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YEAR	ACTIVITY	DESCRIPTION
13 June 2010	Hayabusa 1 Re-entry Capsule Mission	In 2010, South Australia was the landing site for the remarkable Japanese asteroid-return mission, Hayabusa 1. Hayabusa 1 became the first unmanned spacecraft to return to Earth having collected a sample from the asteroid, Itokawa.  The Hayabusa 1 spacecraft was launched by JAXA's Institute of Space and Astronautical Science (ISAS) on 9 May 2003 from Kagoshima Space Centre. The rendezvous with Itokawa was accomplished with pin-point precision in September 2005 and extensive mapping and sensor measurements were performed. However, problems were encountered following the final manoeuvre, resulting in the landing of the Sample Return Capsule being delayed to mid-2010.
January 2011	International Space University Southern Hemispheres Space Studies Program	Five week intensive summer school program launched jointly with the University of South Australia. The program is held every year in Adelaide attracting more than 40 young space professionals from all over the world.
2014	South Australia wins international bid to host the International Astronautical Congress (IAC) in Adelaide	The Space Industry Association of Australia led the bid over 4 years to host the International Astronautical Congress (IAC) in 2017 in Adelaide and beat bids from Germany, the United States, Ireland and Turkey.
February 2016	\$500 million to \$750 million upgrades to Woomera	The Australian Government via the Defence White Paper announces that \$500 million to \$750 million is allocated for upgrading Woomera within the decade to 2025-26.  In April 2016 American defence contractor Raytheon is awarded a \$297 million contract to revamp Woomera as the world's most advanced military test range and a \$50 million upgrade to obsolete systems is announced in November 2016.
April 2016	Office of Space Industry and R&D Collaborations established by South Australian Government at Defence SA	The South Australian Government establishes the office of Space Industry and R&D Collaborations at Defence SA to grow the space economy by supporting space industries, universities and research organisations and contribute strategically to the development of many other priority sectors such as advanced manufacturing, agriculture, health care, energy, mining, technology and services, national security and education.
27 May 2016	1st South Australia Space Forum Adelaide	Over 110 participants attend the first Space Forum including entrepreneurs, researchers, academics, schools, and government representatives.
June 2016	South Australia Space Capability Directory published	First publication of the <i>South Australian Space Capability Directory</i> which identifies and maps the State's existing expertise and capabilities in space, and promotes them at local and international level. First edition showcases over 40 South Australian based organisations. Annual revisions planned.
September 2016	Space Innovation and Growth Strategy (South Australia): Action Plan 2016-2020 published	The first space strategy of any Australian jurisdiction is published which details the State's vision through three pillars: 1) Knowledge - Grow South Australia's economy through space activity by increasing the awareness of the importance of space technology 2) Industry and Innovation - Invigorate South Australia's space innovation ecosystem by strengthening technological capabilities and expertise and stimulating the commercialisation of research results in the space sector. 3) International partnerships - Engage international cooperation with lead countries by growing a network of strategic partnerships in the space sector
10 November 2016	2nd South Australia Space Forum	About 150 participants attend with a wide range of speakers discussing a variety of space-related topics.
February 2017	South Australian Space Council established	First meeting of the South Australian Space Council to take place.
May 2017	3rd South Australia Space Forum	Third South Australia forum planned.
25-29 September 2017	68th International Astronautical Congress	The IAC is the world's most important annual interdisciplinary meeting for the space industry, expected to attract over 3,000 participants from more than 70 countries, including space professionals, academics, major corporations, government representatives, students and media.

**ANNEX 2: TIMELINE OF SPACE ACTIVITY IN SOUTH AUSTRALIA**

YEAR	ACTIVITY	DESCRIPTION
2020	Planned Hayabusa 2 Re-entry	<p>Hayabusa 2 is an asteroid sample return mission operated by JAXA following on from Hayabusa 1 and addressing weak points learned from that mission.</p> <p>Hayabusa 2 was launched on 3 December 2014. The target is asteroid Ryugu. Hayabusa 2 is expected to arrive at the target in July 2018, survey the asteroid for a year and a half, depart in December 2019, and return to Earth in December 2020.</p> <p>JAXA selected Woomera as the landing site for the capsule which will undertake a high speed re-entry from interplanetary space and descend by parachute in a targeted landing area. Advance trials to simulate the capsule landing and location are planned by JAXA. Approval for the landing has been progressed by Australian government entities, including the Space Licensing and Safety Office and Department of Defence.</p>





