

Research Note

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Abstract

This paper provides a background on Australia's space industry, the relevant public and private organisations, and the legislative framework governing it.

It also examines the opportunities and challenges the industry currently faces, with respect to regulation and competition from overseas counterparts.

Space Technology in Australia

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What falls under space technology?

Space technology is a broad category of technologies, many of which are used by people daily. They include, but are not limited to:

- Satellite communications (e.g. the internet, broadcasting);
- Position navigation (e.g. GPS, mapping);
- Earth observation (regular observations of the planet's physical, chemical and biological systems over large geographic areas and extended periods of time).

Australia's role in the space industry

Australia has been involved in developing space technology and related policy as early as the 1940s, when it played a significant role in the then-new field of radio astronomy (CSIRO website).

More recently in 2017, the local space industry is estimated to have generated \$3-4 billion in revenue and sustained a workforce of 10,000 across 388 start-ups and private sector companies (CSIRO, 2018). By 2030, it is estimated this could grow to 20,000 workers and an industry value of \$12 billion (NT Government, 2019).



Figure 1: A map of Australia listing various space-related businesses, government agencies and educational institutions. Source: ACIL Allen (2017). Click on the image for an interactive web version.

The Victorian Department of Jobs, Precincts and Regions (2021) estimates 2,300 Victorians are employed across 250 space-related businesses. These include multinational companies such as Lockheed Martin, Thales, Boeing and BAE Systems, in addition to local businesses. DJPR estimates the state generates \$400 million in annual revenue through space-related activities.

The Victorian Government manages a network of Global Navigation Satellite System ground stations, which are used to enhance positioning systems used for agriculture, construction, transport, mining and more industries. The Department of Environment, Land, Water and Planning uses space technology to monitor the environment and respond to natural disasters.

Other government agencies involved with space technology in various forms include the Australian Communications and Media Authority, Bureau of Meteorology, Department of Defence, Department of Home Affairs, Department of Infrastructure, Transport, Regional Development and Communications, and Geoscience Australia.

According to the Australian Space Agency (2020), the nation's largest contribution to space 'has traditionally been in communications technologies and services; for example, with the NASA Agreement with CSIRO to manage the [Canberra Deep Space Communication Complex] as well as private sector investment in satellite based television and internet services' (p. 36).

Relevant legislation and agreements

At an international level, Australia has ratified the five United Nations treaties that govern space activity and was a founding member of the UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS) in 1958. The five treaties are:

- *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies* (the ‘Outer Space Treaty’);
- *Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space* (the ‘Rescue Agreement’);
- *Convention on International Liability for Damage Caused by Space Objects* (the ‘Liability Convention’);
- *Convention on Registration of Objects Launched into Outer Space* (the ‘Registration Convention’);
- *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies* (the ‘Moon Agreement’).

In addition, Australia has signed on to the Artemis Accords. The international agreement relates to the Artemis Program, a NASA-led mission to return astronauts to the moon by 2025 (Grush, 2021) and establish the first long-term presence on its surface.

Domestically, Australian space activity is governed by the *Space (Launches and Returns) Act 2018*. The Act is supported by three sets of rules:

- *Space (Launches and Returns) (General) Rules 2019*;
- *Space (Launches and Returns) (High Power Rocket) Rules 2019*;
- *Space (Launches and Returns) (Insurance) Rules 2019*.

Current activity

Prior to the 2022 federal election, the Morrison Government made several space-related announcements and financial commitments.

In January 2022, former Minister for Defence Peter Dutton established the Defence Space Command, sitting under the Royal Australian Air Force (RAAF). The unit was formed with the aims of developing space-related priorities across Whole of Government, industry and partners, and carrying out strategic space planning and policy (RAAF, 2022).

A month later, \$65 million was announced for the national space sector. This included a co-investment of \$32 million for the development of three new or existing spaceports or launch sites (Morrison, 2022).

In April 2022, the Australian Space Agency launched its G’Day Moon campaign to raise awareness for the nation’s first mission to the moon. It follows an agreement with NASA in October 2021 for an Australian-made rover to be part of a future mission to the moon. The launch is expected to take place no earlier than 2026 (DISR, 2022).

In June 2022, NASA launched the first of three rockets from the Arnhem Space Centre in the Northern Territory, marking the agency’s first launch from a commercial spaceport outside of the US (AAP, 2022). Two more rockets were launched between early and mid-July 2022 (Garrick, 2022a; Garrick 2022b).

Opportunities for growth

Government agency reports have identified multiple areas for potential investment and growth. The following areas have been highlighted by the CSIRO's 2018 Space Roadmap and the *Australian Civil Space Strategy 2019–2028*.

Space-derived services

Space-derived services are services such as earth observation and satellite communication. These are extensive categories of technology that encompass satellite imagery, mapping, autonomous navigation, TV and radio broadcasting, and broadband.

Development in this area could have flow-on effects to the agriculture, finance, telecommunications and rural health sectors, among others. CSIRO estimates the annual value from Australian satellite imagery-enabled precision farming for broad acre cropping could increase from \$17 million in 2015 to \$221 million in 2025 (2018, p. 7).

Space object tracking

Space object tracking is technology that tracks spacecraft, debris and other objects in orbit. Deploying infrastructure into space carries the risk of colliding with another object or contributing to space debris.

Australia's geographic location means it can monitor parts of the sky that cannot be monitored from the northern hemisphere. This has already been of use during collaborations on the European Space Agency's New Norcia Deep Space Antenna, US C-Band Space Surveillance Radar System, and the Canberra Deep Space Communication Complex with NASA, mentioned above.

Exploration and utilisation

Space exploration and utilisation encompass exploration missions and projects that involve low Earth orbit, the Moon and Mars. Missions are likely to first be robotic, then followed by human missions.

The International Space Exploration Coordination Group (ISECG), a coalition of global space agencies, has identified partnerships between public and private organisations as essential to taking advantage of space exploration opportunities. Engaging Australia's diverse range of businesses will help build momentum for our local space economy and assist in elevating businesses to international supply chains (CSIRO, 2018).

Leapfrog research and development

Leapfrogging refers to the process of skipping small, previously established innovations in a field in favour of more contemporary options.

The Australian Space Agency (2019) has listed new rocket technology, space medicine, synthetic biology, quantum communications and optical wireless communication technologies as areas consistent with Australia's economic and security interests, and suggested these fields could be worth leapfrogging into (p. 13).

Robotics and automation on Earth and in space

This pertains to the control, interoperability and delivery of robotic assets including satellites, infrastructure, facilities and robotic platforms.

Foundation services, which include materials handling, transport, asset maintenance and component manufacturing, have also been identified as one of Australia's areas of expertise. These areas have a strong tie-in with the field of robotics, and the Australian Space Agency (2022) has suggested our expertise could be used to 'seize longer-term market possibilities' in the future.

To excel in the robotics and automation area, the Australian Civil Space Strategy lists several objectives including:

- Establishing an Australian Space Automation, Artificial Intelligence and Robotics Control Complex;
- Undertaking resource prospecting and extraction;
- Developing field sites;
- Creating a set of core foundation services that can be offered to the global market.

Access to space

Australia's unique geographic location is an opportunity to 'leverage international space missions and commercial launch activities' (Australian Space Agency, 2019) and support industry growth.

The three rockets launched by NASA in the Northern Territory between June and July 2022 is a clear example. Equatorial Launch Australia, the commercial operator that owns the Arnhem Space Centre, plans to complete more than 50 launches per year by 2024 or 2025 (de Zwart, 2022).

As mentioned earlier, Australia's geographic location also allows for unique space object tracking opportunities.

The benefits of investing in space technology

One of the primary benefits of investing in Australia's space technology industry is the potential to increase its labour force and generate new revenue streams. The Australian Space Agency has a mandate to grow the nation's domestic space industry by up to \$12 billion by 2030, generating 20,000 new Australian jobs in the process (CSIRO, 2018). This will be done by scoping out areas of opportunity, forming strategic partnerships, attracting and providing financial investment and facilitating regulatory reform.

Investing in space technology has flow-on effects for other related industries, including agriculture, mining, defence, environment and water management, and disaster management. For example, the combined powers of earth observation and data analytics technology has improved farmers' abilities to monitor crops over a season (CSIRO, 2018).

Advancements in space technology are often transformed and applied to other industries down the line. For instance, research in radio astronomy, first undertaken in Australia in the 1940s, eventually led to the development of Wi-Fi in the 1990s (CSIRO website). Furthermore, earth observation and other satellite technologies has been integrated into commonly used tools such as smartphones and car navigation systems.

What are the challenges we currently face?

Lack of pre-established industry

Compared to the United States and Europe, Australia is not as supported by a pre-existing aerospace industry. As such, agencies will need to focus on developing industry capability through its domestic businesses and attract overseas partnerships (ASA 2019).

The local industry will also need to develop partnerships with education institutions to ensure students have relevant skills, and incentivise skilled workers from overseas to work in Australia. The pre-existing partnerships between Australian universities and space companies, locally and internationally, have been highlighted as a resource worth taking advantage of (Commonwealth of Australia, 2021, p. 134).

Breaking into the international market

Emerging space businesses in Australia face several barriers to entering international supply chains.

Accessing investment or venture capital is one such example, as well as 'limited information ... available to support investors to evaluate investment decisions in the growing space economy' (ASA 2019, p. 7).

To establish a presence overseas, local businesses will also need to acquire internationally recognised certifications or qualifications for their hardware or processes, ensuring their products meet the necessary requirements.

Regulation

Feedback from stakeholders at a 2021 House of Representatives committee inquiry into Australia's space industry criticised the current legal framework governing domestic space activity.

In one submission, the Adelaide Law School claimed the Space (Launches and Returns) Act 'fails to capture the full life of a space operation, especially the 'operational' phase of a space asset' (2021, p. 3). During a committee hearing, Dean of the Law School, Professor Melissa de Zwart said 'it is vastly expensive to comply with the requirements, such as the need for expert assessment' (2021, p. 29).

Southern Launch, an Adelaide-based space company, agreed. Chief executive Lloyd Damp told the committee that the costs imposed on launch vehicle operators and launch facility providers are 'a very large impediment to Australia being competitive on a global scale, especially when the modern launch vehicles are far smaller, far less complex and far cheaper to operate'.

Sovereign space capabilities

Australia relies on the space technology of other countries in order to conduct business or government affairs, such as the Wideband Global SATCOM satellite network, operated in partnership with the US Department of Defence. These kinds of arrangements have been identified as vulnerabilities to Australia's 'communications sovereignty' (Bergmann, 2019, p. 25) and stakeholders have argued designing, building and maintaining our own space requirements would strengthen national security and stimulate the local industry (House of Representatives Standing Committee on Industry, Innovation, Science and Resources, 2021, p. 45).

The Defence Space Strategy (2022) and the CSIRO's Space Roadmap also highlighted our limited sovereign space capabilities and has listed development in this area as an objective.

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