

The economic contribution of Australia's space sector in 2018-19



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alphaBeta
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Contents

Infographic	4
Glossary.....	5
Executive summary	7
1 The global space industry is growing rapidly, creating significant opportunities for Australia ..	9
1.1 Australia has a small but important space sector with significant room to grow	9
1.2 The space sector is experiencing a global transformation, driven by new technology and investments from private and public sectors	11
1.3 The space sector will create new jobs and economic benefits as it grows	15
2 Australia's space sector is expanding quickly and developing distinctive capabilities.....	19
2.1 The Australian space sector is worth \$4.8 billion and growing more quickly than its peers.	19
2.2 Australia's space sector is dominated by the applications segment of the value chain that provides services such as mobile communications, weather forecasting and GPS.....	23
2.3 A further 4,000 firms are in space-adjacent sectors and could extend their capabilities into space	33
3 Government will continue to play a central role in stimulating and supporting the increasingly commercial space sector.....	37
3.1 Major infrastructure projects and government facilitation can drive local innovation and developing supplier capabilities.....	37
3.2 Government is working to encourage innovation through creating a safe and certain regulatory environment.....	39
3.3 Regular and robust measurements will improve sector visibility, which could help support and encourage investors	39
3.4 Conclusion	40
4 Appendices	41
4.1 Appendix A: Australian Space Agency definition of the Australian Space Sector	41
4.2 Appendix B: Measuring the space sector.....	41

Infographic

Australia's space sector is growing rapidly



\$4.8 billion
of revenue in 2018-19,
accounting for 0.25% of GDP



9,000 – 10,000
total jobs in the space
sector in 2018-19

The sector is composed of four key segments



Manufacturing (4%)

The **manufacture of spacecraft**, satellites, payloads, launch vehicles & products to be used in space as well as **of ground facilities** and **equipment** including launch facilities



Operations (7%)

The operation & **management** of **satellites** & other objects in space, as well as activities in space and astronautics



Enablers (9%)

Services that support space activities including **research & development, policy** and **regulation, infrastructure & professional services**



Applications (80%)

Services that enable downstream and consumer applications of space-related activities such as **satellite television**, satellite broadband, mobile communications and earth observation

Government supports space sector growth in three ways



Acting as a partner and facilitator, including supporting **major infrastructure projects** to drive innovation and build capabilities



Reducing barriers to entry for domestic and international activity by creating a **safe and effective regulatory landscape**



Conducting **regular and robust measurements** of the sector to improve sector visibility and attract investors

Glossary

ABN: Australian Business Number

ABS: Australian Bureau of Statistics

ACT: Australian Capital Territory

ANU: Australian National University

ANZSIC: Australia and New Zealand Standard Industrial Classification

The Agency: Australian Space Agency

Capability: A firm's capability is its ability to provide a product or service relevant to a major space supply chain. The capability is not the product or service itself or the skills required to perform the capability. It could be specialised within the space industry or it could be more generalised to other industries

CSIRO: Commonwealth Scientific and Industrial Research Organisation

EOS: Electro Optic Systems

ESA: European Space Agency

FY: Financial Year

GDP: Gross Domestic Product

GNSS: Global Navigation Satellite Systems

NASA: National Aeronautics and Space Administration is an independent agency of the United States Federal Government

Non-space firm: Firms that are not currently participating in the space sector

OECD: Organisation for Economic Co-operation and Development

R&D: Research and Development

SAS: Sky and Space Global

SBIR: Small Business Innovation Research

SES: SES Space Hub

SMEs: Small and medium-sized enterprises

SpaceX: Space Exploration Technologies

SSA: Space Situational Awareness

SKA: Square Kilometre Array

STEM: Science, technology, engineering, and mathematics

UK: United Kingdom

UN: United Nations

UNSW: University of New South Wales

WRESAT: Weapons Research Establishment Satellite

Executive summary

The space sector is experiencing a global transformation. New technology, increasing demand for satellite and geospatial services, and upcoming landmark exploration missions are driving sector growth. This new wave of space innovation represents an important opportunity for Australia to develop local space capabilities, drive innovation, train skilled workers, and reap the benefits of new space-related technological breakthroughs, potentially boosting other sectors such as disaster management and advanced manufacturing.

This report aims to describe the economic contribution of the local civil space sector in Australia and the role of industry, government, researchers, and educators in fostering the local space ecosystem. It is one of the most comprehensive assessments of the sector since the establishment of Australian Space Agency in 2018, and uses a combination of economic data, survey data, and insights from researchers and industry leaders to analyse the sector's progress between 2016-17 and 2018-19.

By understanding the economic impact of the sector, Government and industry can identify and assess how Australia can best seize opportunities in the future.

AlphaBeta has estimated the space sector in Australia generated approximately \$4.8 billion in revenue in 2018-19 and employed approximately between 9,000–10,000 workers. The Australian space sector is at an earlier stage of growth compared to international peers. Space sector revenue in Australia is equivalent to 0.25 per cent of national GDP and 1.3 per cent of global space revenue. According to a recent survey by the Nous group of 128 firms (80 per cent of whom were SMEs), space firm revenue in Australia grew 17 per cent a year in two years to FY2018-19, which is 3.5 times faster than the overall economy.¹

Employment in the space sector is stable at around 9,000–10,000 space workers, although the mix of jobs within the sector has shifted over the past two years. Employment in high-value SMEs in space manufacturing and research and development has grown strongly, while jobs in more mature sectors like pay television and telecommunications have declined.² Such sector dynamics are evident overseas too: Canada's space economy is similar structured to Australia's and has grown in revenue whilst losing jobs between 2014 and 2018.

While the ongoing COVID-19 pandemic has disrupted employment and investment throughout the global economy, at the time of writing its effect on the Australian space sector so far has been minimal in comparison to other global space sectors. Market research from the United States shows that private sector investment in the global space sector declined substantially in the June quarter, although investment in the applications segment of the space value chain, which contributes most of Australian space sector revenue, remained strong.³ Australian space sector work has continued to progress throughout the crisis, with the Australian Government committing \$11 million of industry grants and \$7 billion of defence funding to the sector. According to Minister for Industry, Science and

¹ Nous Group (2020), Australian space sector survey, June 2020.

² Ibid.

³ Space Capital (2020), Space Investment Quarterly: Q2 2020.

Technology Karen Andrews: “The space industry is a key growth sector that will form an important part of our economic recovery and help us emerge from the COVID-19 crisis stronger than ever.”⁴

The space value chain can be split into four key components: manufacturing (ground and space), operations, enablers and applications. The applications segment is the most established segment in Australia, with \$3.8 billion in revenue last year (80 per cent of total sector revenue). Australia is also developing distinctive capabilities in the operation of satellites and in downstream applications that rely on space-based technology to deliver services. The operations segment of the value chain is a potential competitive advantage for Australia, and currently contributes to a higher proportion of Australian GDP compared to the global average (0.02 per cent versus 0.01 per cent). Australia also has niche areas of capability in sectors adjacent to space manufacturing which can form the foundation of future involvement in the segment. Space manufacturing is the largest segment of the global space sector, constituting over a third (36 per cent) of total value.

The Australian Government’s ambition is for Australia to become an even more prominent participant in the global space economy. By 2030, the Government aims to triple sector revenue and employ an additional 20,000 workers in the local space sector through following the path outlined in the Australian Civil Space Strategy. The Strategy is built on four Strategic Space Pillars: “open the door internationally; develop national capability in areas of competitive advantage; ensure safety and national interest are addressed; and inspire and improve the lives of all Australians”.⁵

Developing new commercial opportunities for the local sector is a priority for Government, including investment in national infrastructure, capabilities in space data gathering, analysis and services. This will be built on cooperative partnerships with international space agencies, states and territories, and industry. The Government is also focusing on lifting Australia’s manufacturing capability, and has committed \$1.5 billion to support the Modern Manufacturing Strategy⁶ which identifies space as one of six manufacturing priority areas.

Measures of success include stimulating at least \$1 billion pipeline in inward capital investment between 2019 and 2028, achieving year-on-year growth of at least 8.5 per cent, and increasing awareness of space activities and the impact on the Australian economy, reaching at least 10 million Australians per year.

⁴ The Hon. Karen Andrews MP (2020), Media release: \$11m space grants to boost businesses and local jobs.

⁵ Australian Space Agency (2019), *Advancing Space: Australian Civil Space Strategy 2019 – 2028*.

⁶ Department of Industry, Science, Energy and Resources (2020), [Modern Manufacturing Initiative and National Manufacturing Priorities](#).

1 The global space industry is growing rapidly, creating significant opportunities for Australia

Australia's space sector has significant room to grow in an expanding global market. Increased international space activity is driving global demand for space services, both from commercial and public actors. As a result, private and public investment is growing quickly. This investment can boost commercial revenues and employment in Australia, while also improving productivity and efficiency, social welfare and cost saving across the broader economy.

1.1 Australia has a small but important space sector with significant room to grow

Australia has made significant contributions to space exploration in the past. It was one of the earliest countries to orbit a national satellite, with the launch of WRESAT from Woomera, South Australia, in 1967.

Australia's involvement with space tracking reaches back to the very beginnings of the Space Age. Locally managed NASA tracking stations have supported the exploration of the solar system, pioneer applications satellites and human space exploration. Australia played a crucial role in the Apollo Moon landing program, especially receiving and broadcasting to the world the television signals showing Neil Armstrong setting foot on the Moon. The nation has also provided support to the space missions of the European Space Agency (ESA) since 1979.

Today, the Canberra Deep Space Communication Complex and ESA's New Norcia facility in Western Australia, continue the space tracking tradition, supporting deep space missions from many nations, including NASA's Perseverance Rover and the UAE Hope mission, which began their journeys to Mars in July 2020.

Australia also has a proud history as a pioneer in radioastronomy. CSIRO's Parkes Radio Telescope has been at the forefront of radio astronomy research for 60 years, in addition to assisting NASA and ESA with space tracking. The country's relative abundance of open, radio-quiet spaces make it suited to major radioastronomy projects. In 2012, Western Australia was selected as one of two locations globally for the massive, multinational Square Kilometre Array (SKA) radio telescope, to be built in the coming decade. In 2019, the CSIRO completed the Australian SKA Pathfinder (ASKAP), which was built as a precursor to the SKA and is currently the fastest survey radio telescope in the world.

The Australian space sector is growing but is still only half the size of global leaders

Despite these significant contributions to advances in astronomy and international space endeavours, the Australian local space sector is young, compared with global peers. The sector generated approximately \$4.8 billion in 2018-19, which is equivalent to 0.25 per cent of Australia's GDP, up from an estimated \$3.8 billion in 2015.⁷ By comparison, the revenue of the space sector in Canada is equivalent to 0.4 per cent of GDP, and globally space sector revenue is equivalent to 0.5 per cent of

⁷ Asia Pacific Aerospace Consultants Pty Ltd (APAC) (2015), A Selective Review of Australian Space Capabilities: Growth Opportunities in Global Supply Chains and Space Enabled Services.

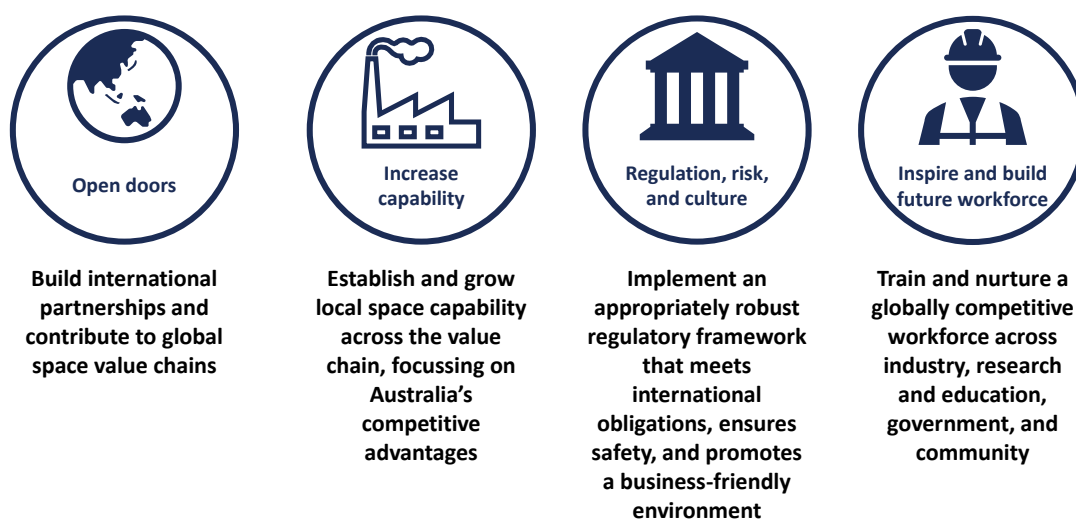
GDP. In leading space nations, it is higher. Space sector revenue in the United States is equivalent to 1.0 per cent of GDP, while the UK space sector's revenue is equivalent to 0.7 per cent of GDP.

Recognising the rapid growth of the global space industry and its economic potential for Australia, the Australian Government established the Australian Space Agency (the Agency) in July 2018 to support the sector and drive further growth

The Australian Government has released the Australian Civil Space Strategy which aims to nurture a space sector that by 2030 employs an additional 20,000 workers and generates \$12 billion in revenue.⁸ The strategy describes four key actions for growing the sector: building international partnerships; increasing national capabilities; improving regulation, risk and culture; and inspiring and building a future workforce (**Exhibit 1**).

Exhibit 1: Implementation priorities of the Australian Civil Space Strategy, 2019-2028

Scaling the local space sector will require four elements, previously identified by the government: access to international markets, globally desirable capabilities, robust regulations, and a capable workforce.



Sources: Australian Space Agency (2019), Australian Civil Space Strategy 2019 – 2028.

Australia's renewed focus on space has generated significant private and public investment in the civil space sector. The Agency has observed over \$2 billion space-related capital project pipeline for FY2018-2019 to FY2027-2028, including \$775 million from private or foreign investment commitments.⁹ The pipeline also includes investment from the Australian Government and state and territory governments. The Australian Government has invested \$700 million in space since FY2018-2019.

The Government has further committed \$7 billion to developing space capabilities over the next decade to realise its Defence capability goals as part of the 2020 Defence Strategic Update and 2020

⁸ Australian Space Agency (2019), Advancing Space: Australian Civil Space Strategy 2019 – 2028.

⁹ Australian Space Agency (2020), 2018-19 Economic snapshot report of the Australian civil space sector.

Force Structure Plan.¹⁰ This funding will improve Australia's satellite communications, positioning, navigation and timing data, as well as help to grow Australian industry expertise, and Australia's space domain awareness capabilities. Civil sector companies will have opportunities to participate in plans to establish communications satellites and ground control stations.

Additionally, in October 2020, the Australian Government announced a \$1.5 billion Modern Manufacturing Strategy which identifies space as one of six national manufacturing priorities¹¹. The Government has set out that the Modern Manufacturing Strategy will focus on areas of comparative advantage and strategic importance, providing support through four initiatives. For space manufacturing investment, this includes support from initiatives to encourage private investment and leverage transformative investments in manufacturing technologies and processes.

1.2 The space sector is experiencing a global transformation, driven by new technology and investments from private and public sectors

Today's global space industry is radically different to that of the 1960s. While big-ticket, government-funded missions dominated the Apollo era, modern projects are much more diverse. These include satellite-related projects to transmit data, assist with mapping and navigation, and observe and take measurements; as well as launching exploration probes into space. To support these activities, civil firms have developed a similarly broad set of capabilities. Australian space firms are especially capable of remote-sensing and Earth observation; scientific, and engineering support; supplying space-related materials; education, training and astronomy research (**Exhibit 2**).

There are fresh commercial opportunities as space sector technology becomes better and cheaper, and new applications emerge in other sectors such as agriculture, disaster management and advanced manufacturing. For example, scientific consultancy Maitec uses a combination of ground, air and satellite sensors to monitor bushfires and inform Northern Territory emergency services' natural disaster response. Technology provider AgriWebb uses location-based technology from Geoscience Australia to allow farmers to track livestock in real time, while Internet of Things (IoT) business Myriota uses smart sensors and a constellation of nanosatellites to help farmers monitor dam levels and pump operation. The total number of active satellites orbiting the Earth has doubled in the past decade to meet this growing demand.¹²

International space exploration initiatives are further contributing to the demand for space services, with NASA and other government agencies increasingly involving private sector companies in their programs. According to the OECD, public space budgets totalled an estimated US\$75 billion in 2017, the highest since the Apollo era.¹³ Such opportunities have meant that civil space firms are becoming more important to supply chains and the overall space economy. Most notably, firms such as SpaceX and Boeing have developed large-scale partnerships with NASA.

¹⁰ Australian Space Agency (2019), Australian Civil Space Strategy 2019 – 2028; Department of Defence (2020), Strategic Update.

¹¹ Department of Industry, Science, Energy and Resources (2020), Modern Manufacturing Initiative and National Manufacturing Priorities.

¹² In 2018, 114 satellites were launched, which is more than double the number launched in 2004. As of 2019, the number of active satellites is at an all-time high at over 2,514. In 2009, there were just 986 satellites, less than half as many. See Appendix for details.

¹³ OECD (2019), The Space Economy in Figures.

While Australia's space manufacturing sector is relatively small, firms such as Titomic and Silanna Semiconductors have developed advanced components to be used in space. Australia's space sector stands to capitalise from increasing opportunities to enter global supply chains, particularly in National Civil Space Priority Areas such as position, navigation and timing; Earth observation; communications technology and services; space situational awareness and debris monitoring; research and development; robotics and automation; and access to space.¹⁴

¹⁴ Australian Space Agency (2019), Australian Civil Space Strategy 2019 – 2028.

Exhibit 2: Identified capabilities of Australian space firms

Most common capabilities of Australian space firms listed in the SIAA database¹

Firm capabilities		Share that are large organisations ²	Example firms
Education and training	154	35%	
Thought leadership and advocacy	139	22%	
Remote sensing and earth observation	104	29%	
Community engagement	89	11%	
Fundamental and applied research for space systems	81	43%	
Scientific and engineering support	70	29%	
Ground station network	67	49%	
Suppliers of material and components	67	27%	
Astronomy	64	28%	
Logistics and program management	60	33%	

NOTE: The 'Aviation' category has been withheld due to data quality concerns. 1: Organisations are able to self-select into the database so may only be tangentially involved in space. 2: Large organisations as described by the firm. See Appendix for information on how firms were selected.

SOURCE: Space Industry Association of Australia (SIAA) (2020), AlphaBeta space firm database

The private sector accounts for approximately 76 per cent of space investment, and is growing quickly

Private investment accounted for 76 per cent of the global space economy in 2016, concentrated in satellite services, which includes television transmission, consumer navigational equipment, and GPS services.¹⁵ Government space and defence programs make up the remaining quarter. Angel investment and venture capital funding tends to focus on applications development, including on-demand ride sharing and food delivery platforms which rely on satellite-supported navigation and positioning technology.¹⁶

The OECD average public investment into space programs was approximately US\$1.53 billion in 2017.¹⁷ There is a vast difference in the proportion of spending invested by different governments. The majority of countries spend less than 0.05 per cent of GDP on space. Australia is growing its public investment, committing A\$300 million for space-related spending in the 2018-19 Budget, which is equivalent to 0.02 per cent of GDP.¹⁸ Only three OECD countries spend more than 0.1 per cent of GDP on space programs: the US, Russia, and France. The US is the largest public investor in space, with US Government spend on space-related activities equivalent to approximately 0.24 per cent of its GDP.

Both private and public investment in the global space sector is growing quickly. The sector was worth US\$366 billion in 2019, up from US\$345 billion in 2016¹⁹. Analysis undertaken before the COVID-19 pandemic estimated that by 2040, the global sector is predicted to be worth US\$1.1 trillion (**Exhibit 3**). The economic impacts from the COVID-19 pandemic may hamper growth. As described above, approximately a quarter of global space sector is from government. As public finances tighten, reductions in public space programs will impact sector growth. The OECD expects space SMEs to be more exposed to market downturns, potentially leading to greater industry concentration. The OECD recognises SMEs to be important drivers of growth and innovation in the sector and have urged governments to consider the impact of funding changes on SMEs.²⁰

¹⁵ Bryce Space and Technology (2017), Global Space Industry Dynamics (Research Paper for Australian Government, Department of Industry, Innovation and Science).

¹⁶ Space Capital (2020), Space Investment Quarterly: Q2 2020.

¹⁷ OECD (2019), The Space Economy in Figures. The 49 countries with the largest space programs were estimated to spend US\$1.53 billion in total, based on national budgets.

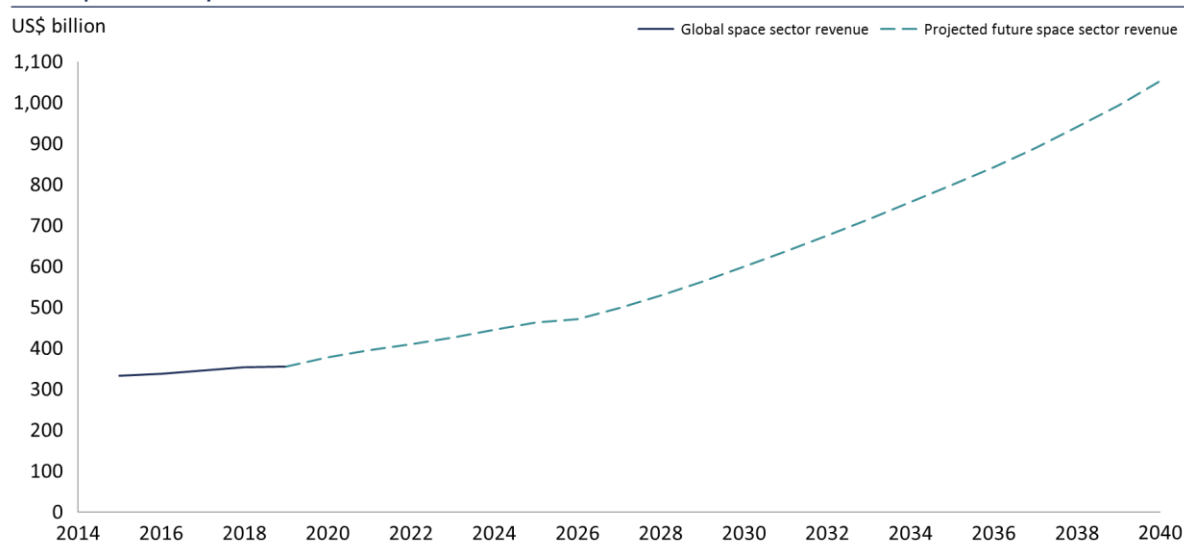
¹⁸ ABS (2020) 1345.0 Key Economic Indicators and ABS (2020) 5206.0 Australian National Accounts. Australian GDP was \$1.887 trillion in 2018-19. Australian Space Agency (2019), Advancing Space: Australian Civil Space Strategy 2019 – 2028.

¹⁹ Bryce Space and Technology (2020), 2019 Global Space Economy at a Glance; Bryce Space and Technology (2017), Global Space Industry Dynamics (Research Paper for Australian Government, Department of Industry, Innovation and Science).

²⁰ OECD (2020) OECD Policy Responses to Coronavirus (COVID-19): the impacts of COVID-19 on the space industry.

Exhibit 3: Estimated global space sector growth to 2040

Global space economy revenue from 2015 to 2040



Notes: 2018 estimates for global space sector turnover is about US\$414 billion.

Sources: Statista 2020; Morgan Stanley; Haver Analytics.

1.3 The space sector will create new jobs and economic benefits as it grows

Governments around the world have recognised the opportunity space presents to drive innovation within their economies, boost growth, and provide a source of high-skilled employment. To enable this, many of Australia's peers have launched ambitious public programs (**Exhibit 5**). The UK, for example, is focused on their ecosystem of civil space firms which also support the broader aerospace and defence sectors. As a result of the UK's Space Innovation and Growth Strategy, launched in 2010, direct employment in the industry increased 6 per cent per annum over four years.²¹ Canada is investing C\$1.9 billion to develop competitive advantages in Artificial Intelligence (AI) and robotic capabilities suitable for space and have committed a further C\$150 million towards NASA's Lunar Gateway program, with the aim of bringing high-value jobs to the country.²²

²¹ London Economics for the UK Space Agency (2016), Summary Report: The Size & Health of the UK Space Industry.

²² Minister of Innovation, Science and Economic Development (2019), Exploration Imagination Innovation: A New Space Strategy for Canada.

Exhibit 4: Examples of national space sector initiatives around the world

Canada

- Canada's Space Advisory Board and Canadian Space Agency advises government on sector development strategy, regulation, and education programs
- Government aims to develop competitive advantages in robotics, AI, and biomedical space capabilities through a \$1.9 billion investment in AI-driven space robotics
- Collaboration with the US on landmark lunar exploration projects, including \$150 million in government funding to develop a smart robotic arm ('Canadarm 3') for these missions

United Kingdom

- Space Leadership Council and UK Space Agency created in 2010 to champion the sector and advise on policy and strategies, with a £250 million budget to help realise goals
- £35 million National Space Technology Programme that provides short- to long-term funding to support industry development and R&D
- Government aims to capture 10 per cent of the global commercial space sector by 2030
- National Space Academy to support Higher Apprenticeships in Space Engineering

Australia

- Establishment of the Australian Space Agency in 2018 (supported by \$41 million of funding) and the launch of an Australian Civil Space Strategy to nurture the space sector and improve capability
- Government has committed over \$15 million to foster international partnerships and \$19.5 million to its Space Infrastructure Fund
- \$6 million to support a Space Discovery Centre to improve public outreach and education
- \$150 Moon to Mars initiative will showcase Australian knowledge and capabilities and support NASA's Moon to Mars program.

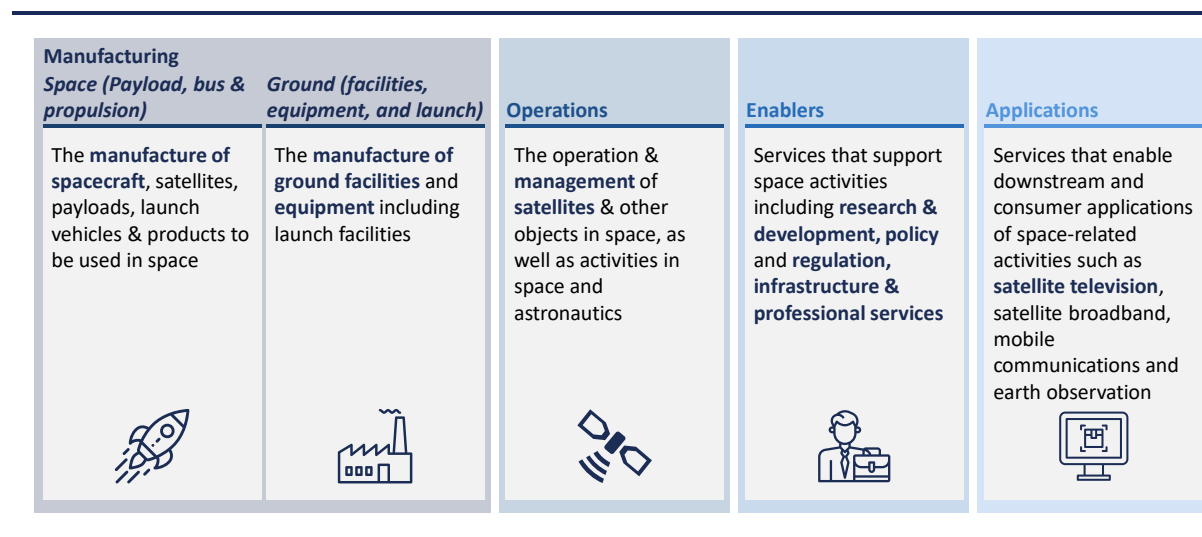
New Zealand

- NZ Space Agency supports strategic commercial partnerships
- Bilateral industry partnerships with the European Space Agency and US Government
- Host to world's first fully private orbital launch facility
- Internships for tertiary students with NASA

Sources: UK Space Agency (2014), Space Growth Action Plan 2014-2030; London Economics for the UK Space Agency (2019), Size and Health of the UK Space Industry 2018; MBI NZ and Deloitte Access (2019), New Zealand Space Sector; Canadian Space Agency (2019), Canada's Space Strategy.

Economic benefits – in the form of revenue and employment – result from the diverse range of activities along the space value chain. The value chain has four segments: manufacturing, operations, enablers, and applications (**Exhibit 5**).²³ These categories have been aligned to the Australian Space Agency’s recently released definition of the sector.²⁴ Large firms hold substantial market share of each segment; for example Airbus, Mitsubishi, and Thales are global leaders in manufacturing. Foxtel and Optus are notable Australian firms which supply broadcasting and telecommunications services in the applications segment.

Exhibit 5: The space value chain



Additional economic advantages often spill over to the broader economy, such as social welfare improvement and productivity and efficiency gains that drive cost savings both within and beyond the sector.²⁵ The OECD estimates that 57 per cent of cost savings are realised outside of the space sector, for example, when space technologies or higher quality data improve operations in other fields. These benefits are easily transferred with many firms working ‘horizontally’ across elements of the value chain and the space and non-space sectors.

The following chapters of the report look at the economic opportunity for Australia in developing its local civil space sector, across the four pillars of the Australian Civil Space Strategy and the sector value chain segments, as well as the critical role Government continues to play in developing a domestic space market.

²³ There are several ways to define the space economy, but consensus is coalescing around the OECD’s definition that it encompasses the full range of activities and the use of resources that create and provide value and benefits to human beings in the course of exploring, understanding, managing and utilising space, with the Australian, New Zealand, and British governments adopting it. The space sector is a part of the space economy. The firms that serve the sector includes a ‘vertical’ set of firms that focus wholly on space-related activities and also a ‘horizontal’ of firms that performs both space and non-space activities.

²⁴ Australian Space Agency (2020), Defining the Australian space sector.

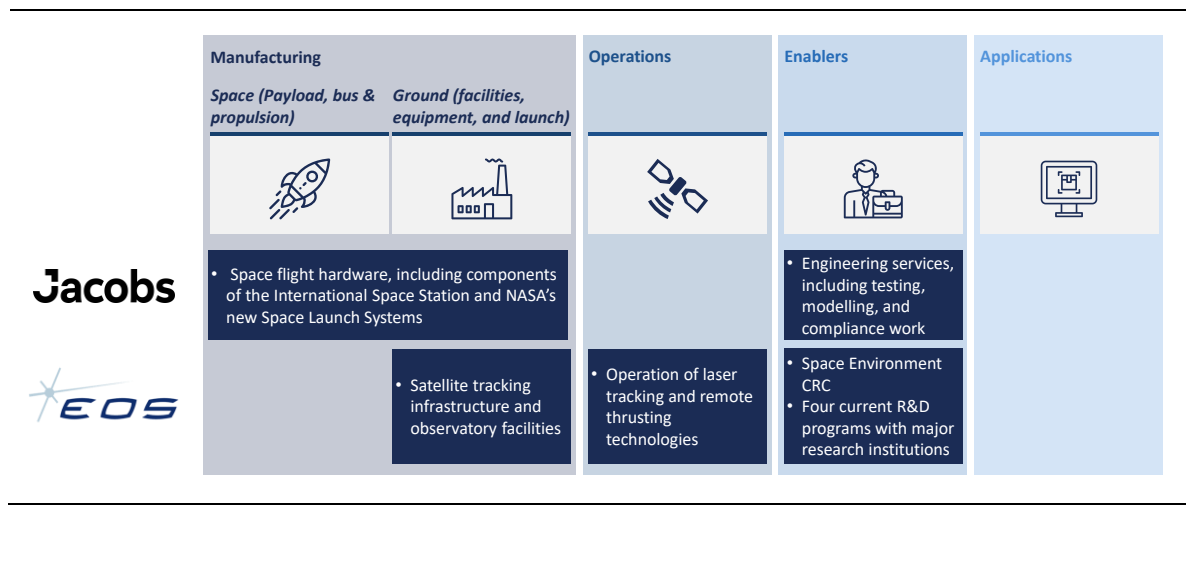
²⁵ OECD (2019), The Space Economy In Figures: How Space Contributes To The Global Economy.

Box 1: Prominent global and local firms operating across the value chain

Looking across the value chain, Jacobs (a US firm) employs engineers, technicians, and scientists focused on manufacturing and professional services divisions relevant to the enabler segment of the value chain. As a result, they are among NASA's most prominent contractors.

Locally in Australia, Electro Optic Systems (EOS) straddles the manufacturing, operations, and enabler segments for civil and defence space purposes. EOS provides space situational awareness services like laser tracking of space objects as well as manufacturing lasers and sensors. These technologies are used for defence, space debris management, and satellite communications. Many space sector firms also underpin activities in other sectors. For example, firms such as Optus that specialise in satellite broadband enable a raft of internet-related non-space activities who, in turn, service their own set of consumers and businesses.

Exhibit 6: Jacobs and EOS participating in multiple segments of the space value chain



2 Australia's space sector is expanding quickly and developing distinctive capabilities

Australian civil space sector revenue in 2019 is estimated at \$4.8 billion – equivalent to 0.25 per cent of GDP and about 20 per cent smaller than Canada's space sector by revenue. Most of Australia's space firms are concentrated in the enabler and applications segments which require relatively high-skilled, service-intensive jobs, reflecting the structure of the overall Australian economy. There are opportunities for many Australian firms with suitable capabilities to enter the sector, especially in areas such as manufacturing which are currently smaller in Australia than global averages.

2.1 The Australian space sector is worth \$4.8 billion and growing more quickly than its peers

Sector revenue for Australia's space sector is estimated to be \$4.8 billion as of 2019.²⁶ Australia's space sector is similarly sized to Canada's and is equivalent to 0.25 per cent of Australian GDP (**Exhibit 7**).

As an emerging industry, the growth rate of the Australian space sector is difficult to quantify due to limited, consistent historical data. Several sources have estimated that Australia's space sector growth has far outstripped its international peers, but the estimates of the actual rate of growth vary significantly. For example, Canada's space sector grew only 1 per cent per year in the four years to 2018, while the UK's space sector grew 3 per cent per year in the two years to 2017.²⁷ By comparison, a survey of 128 Australian space sector firms, 80 per cent of whom are SMEs, by the Nous Group found that revenue from space-related activities grew by 17 per cent per year since the establishment of the Agency, between FY2016-17 and FY2018-19.²⁸ For comparison, the rate of overall economic growth in Australia over this same time period was 4.9 per cent.²⁹

SMEs tend to be hubs of innovation and have faster growth rates than more established firms. Major employers in space applications, including major telecommunications firms Telstra and Optus, have experienced fluctuating revenues over the past few years due to a combination of commercial and technological factors, as competition intensifies and the sector continues to develop. This drags on overall space sector growth.

A longer term report on the space sector, titled *Satellite Communications and Astronautics in Australia* by IBISWorld, estimates an annual growth rate of 8 per cent between 2015 and 2020.³⁰ The authors consider the sector to be in the growth stage of its lifecycle as a result of increased innovation and multinational space projects.³¹

²⁶ AlphaBeta 2019 space database.

²⁷ UK Space Agency and London Economics (2019), *Size & Health of the UK Space Industry*; Canadian Space Agency (2019) *Canada's Space Strategy*.

²⁸ Nous Group (2020), *Australian space sector survey*, June 2020.

²⁹ Australian GDP was \$1.887 trillion in 2018-19 and \$1.798 trillion in 2016-17, an increase of 4.9%: ABS (2020) 1345.0 Key Economic Indicators and ABS (2020) 5206.0 Australian National Accounts.

³⁰ This report broadly covers the local space sector but does not explicitly use the Australian Space Agency's definition of the space sector.

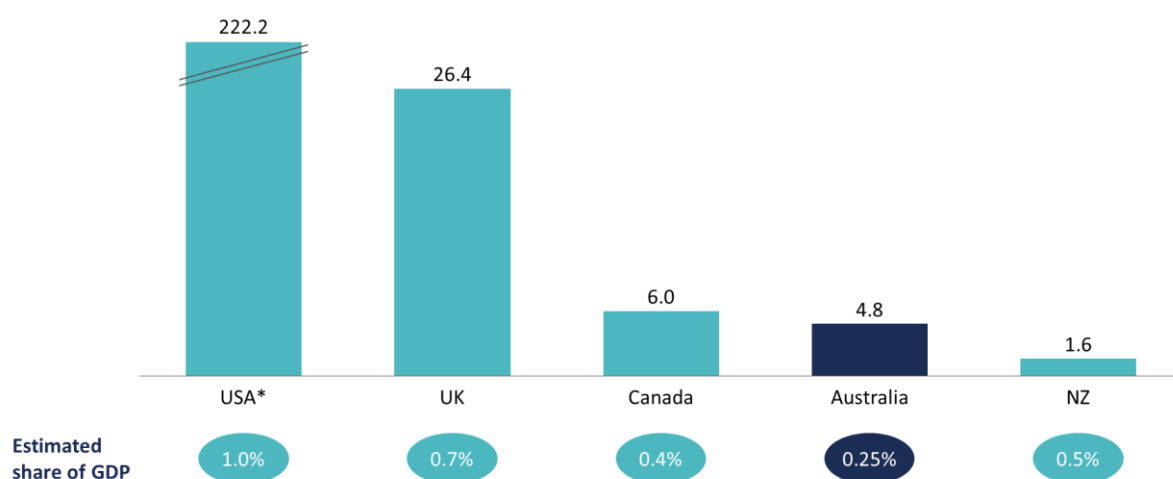
³¹ IBIS World (2020), *Satellite Communications and Astronautics in Australia* OD5545. This report estimates a higher level of sector revenue, at \$5.2 billion in 2018-19.

Despite this growth, comparing the GDP contribution of the Australian space sector to that of peer countries shows that Australia has yet to catch up. Australia's space sector revenue is equivalent to approximately 0.25 per cent of its GDP. **(Exhibit 7)**. That is slightly less than the relatively size of peer countries of a similar size. For example, the revenue of the Canadian space sector is equivalent to 0.4 per cent of GDP, while New Zealand space sector revenue is equivalent to 0.5 per cent of GDP.

Exhibit 7: International comparison of revenue and growth of space sectors

Space sector revenue, 2019

A\$ billion, per cent



* US estimate for 2016

Sources: UK Space Agency and London Economics (2019), Size & Health of the UK Space Industry – £14.8bn at exchange rate of 1:1.79; MBIE NZ and Deloitte Access (2019), New Zealand Space Sector – NZ\$1.75bn at exchange rate of 1:0.93; Canadian Space Agency (2019), Canada's Space Strategy – C\$5.7bn at exchange rate of 1:1.05; US Federal Aviation Administration – US\$158bn at exchange rate of 1:1.41.

Within Australia, the space sector is also comparable in size to several other small, but highly innovative and highly specialised sectors such as medical equipment manufacturing, aircraft manufacturing and repair, and cybersecurity. It is smaller than the biotechnology sector, which is more mature but similarly innovative and technology-driven (**Exhibit 8**).

Exhibit 8: Comparison of Australian space sector revenue against other sectors



Source: IBISWorld Industry Reports 2018, 2019, 2020.

The revenue growth rate in the Australian space sector is predicted to be stronger than the more mature sectors such as biotechnology and medical equipment manufacturing, at 7.4 per cent annual growth in the next five years compared to 3 per cent and 2.4 per cent respectively.³² The profitability of all these industries is estimated to increase as cost efficiencies continue to be achieved.

Australian space sector employment is roughly in line with revenue

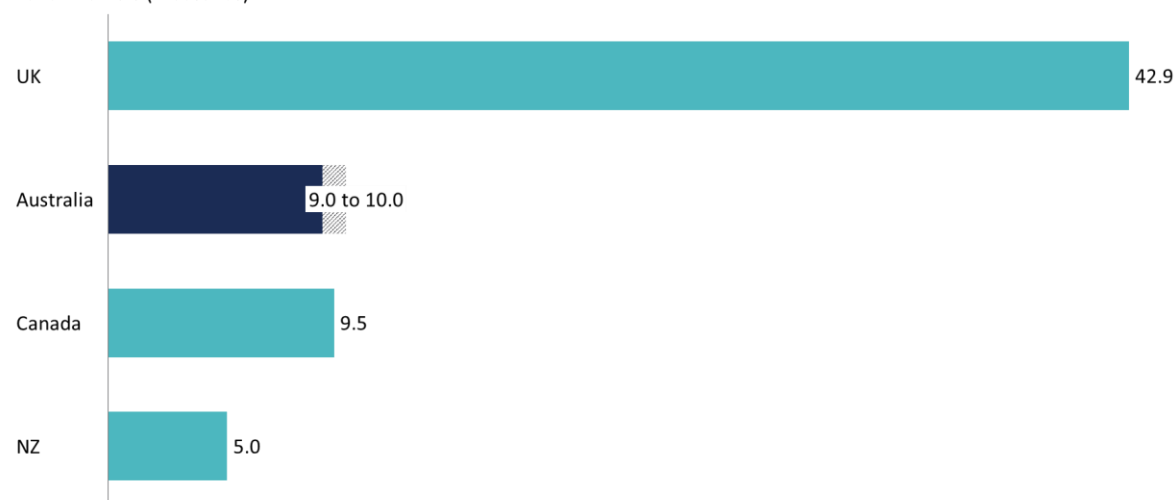
Employment in the Australian space sector can also be difficult to quantify due to limited granular, historical data sources, as discussed above for revenue. Based on AlphaBeta's space database estimates, the space sector employed approximately 9,000–10,000 workers (midpoint estimate of 9,500 workers) in 2019 (**Exhibit 9**).

³² Ibis World (2020), Biotechnology in Australia and Medical and Surgical Equipment Manufacturing in Australia;

Exhibit 9: Space sector employment in Australia and across peer economies

Employment in space sector

No. of workers (thousands)



Sources: UK Space Agency and London Economics (2019), Size & Health of the UK Space Industry; MBIE NZ and Deloitte Access (2019), New Zealand Space Sector; Canadian Space Agency (2019), Canada's Space Strategy.

This is a healthy employment number compared with overseas markets given the size and revenue of the Australian space sector. The UK, whose space sector receives about five times as much revenue as the Australian sector, employs roughly four times more workers: for the financial year 2017-18, 42,899 workers were estimated to have been employed in the UK space sector. New Zealand's space sector is much smaller and was estimated to have employed approximately 5,000 in the financial year 2018-19. Canada's space sector employs a similar number of workers as Australia – 9,567 in 2018 – but is more mature, with more established links to international supply chain.³³ Canada generates 1.25 times Australia's space sector revenue: equivalent to 0.4 per cent of Canada's GDP, compared to 0.25 per cent of GDP in Australia.

A 2018 study on Australia's local space sector workforce estimated that there were between 9,500 to 11,500 workers in the sector in 2015, whilst another 2019 study estimated employment at 13,200 workers.³⁴ Caution needs to be exercised in directly comparing the figures as differences between estimates may be due to the sample of firms analysed and differences in methodology. Local space workforce has remained steady over the past four years, particularly as different parts of the industry have experienced different rates of employment growth in that period. Major applications firms in Australia, such as Telstra and Optus, implemented large staff cuts in 2017 and 2018.³⁵ This trend may well continue and even accelerate due to the impacts of COVID-19. For example, during the pandemic, Foxtel has reduced its workforce by over 200 employees.³⁶ By contrast, a recent survey of 128 Australian firms in the space sector by the Nous Group found that employment in the sector grew by

³³ Canadian Space Agency (2020), Canadian Space Sector Report 2019.

³⁴ Department of Industry, ACIL Allen (2018), Review of Australia's Space Industry Capability; Ibis World (2019), Satellite Communications and Astronautics in Australia OD5545.

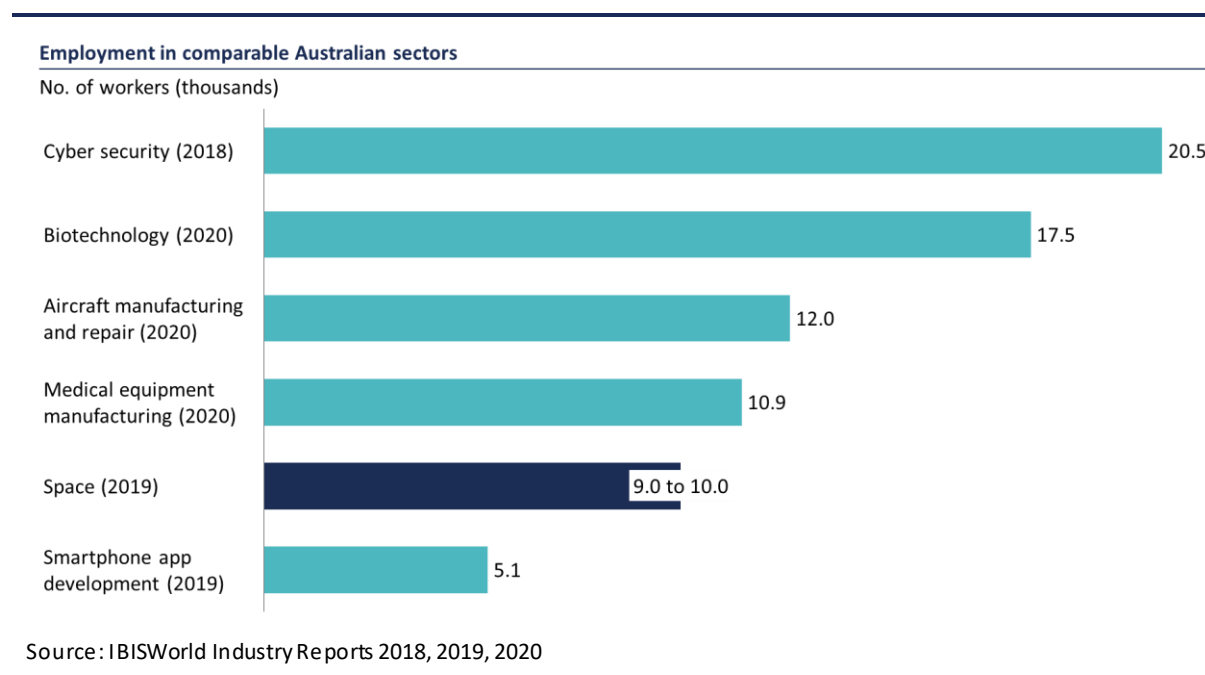
³⁵ Business Insider (2017), Telstra is cutting 2,800 staff; The Guardian (2018), Telstra to cut 8,000 jobs in major restructure; ABC News (2018), Optus to sack 400 workers.

³⁶ AFR (2020), Foxtel cuts 200 jobs, stands down 140 more.

10 per cent each year between FY2016-17 to FY2018-19. Eighty per cent of the survey's respondents were SMEs, which tend to have stronger hiring rates compared to large established firms. The manufacturing segment of this survey, about 10 per cent of respondents, displayed especially high rates of employment growth; however, some caution should be exercised in interpreting this data given the small number of manufacturing firm responses.³⁷

Comparing employment in space to similar sectors in Australia finds that aircraft manufacturing and repair and medical equipment in Australia employ similar numbers of workers and receive similar amounts of revenue compared to the space sector (**Exhibit 10**).

Exhibit 10: Comparison of Australian space sector employment against other sectors



There are some notable differences. Whilst cyber security has much lower revenue, of about \$2.8 billion in 2018 compared to space's \$4.8 billion in 2019, it employs 20,500 people. This is likely because it is a far more labour-intensive and far less capital-intensive industry compared to space. For instance, many large organisations have cyber security teams who perform time consuming security tasks and fulfilling compliance protocols.

2.2 Australia's space sector is dominated by the applications segment of the value chain that provides services such as mobile communications, weather forecasting and GPS

Australia's space sector comprises a total of 558 firms and an estimated 9,000 to 10,000 workers across all four segments of the space value chain: manufacturing, operations, enablers, and

³⁷ Nous Group (2020), Australian space sector survey, June 2020.

applications (**Exhibit 11, Exhibit 12**). Exhibits 11 and 12, describe the distribution of approximately 9,500 space workers across the sector, reflecting the mid-point of the estimated range of 9,000 to 10,000 space workers.

Exhibit 11: Firm count, revenue estimates, and common services and activities across the Australian space value chain, 2019

	Manufacturing 		Operations 	Enablers 	Applications 	Total
Description	Space (e.g. Payload, bus, propulsion)	Ground (facilities, equipment & launch)				
	The manufacture of spacecraft , satellites, payloads, launch vehicles & products to be used in space	The manufacture of ground facilities and equipment including launch facilities	The operation & management of satellites & other objects in space	Services that support space activities including research & development, policy and regulation, infrastructure & professional services.	Services that enable downstream and consumer applications of space-related activities such as satellite television , satellite broadband, mobile communications and earth observation	
Number of firms	65	82	44	244	123	558
Space revenue (\$ millions)	\$51	\$126	\$357	\$432	\$3,808	\$4,775
Proportion of total Aus space revenue	1%	3%	7%	9%	80%	
Example firms	  	  	  	  	  	
Common services and activities identified¹	- Supply of material and components - Scientific and engineering support	- Supply of material and components - Ground station network	- Logistics and program management - Scientific and engineering support	- Education and training - Fundamental and applied research for space systems - Community engagement	Remote sensing and earth observation	

Notes: Non-exhaustive: these figures only represent firms that earned revenue from the space sector, according to our database. For each firm we estimated the proportion of space-related revenue based on an individual assessment of their activities.

¹ Common services and activities identified using most common capabilities of Australian space firms listed in the SIAA database in the relevant area. Organisations are able to self-select into the database so may only be tangentially involved in space. The 'Aviation' category has been withheld due to data quality concerns.

Sources: AlphaBeta analysis; SIAA (2020).

The breakdown of revenue across each stage of the value chain is as follows:

- **Manufacturing:** There are two sub-segments of manufacturing.
 - *Space:* The manufacturing of products involved in the launch and orbit of spacecraft and satellites was worth an estimated \$51 million in 2019, equivalent to just 1 per cent of the total Australian space sector. 65 firms and 260 workers in Australia were involved in this sub-segment.
 - *Ground:* The ground facilities and equipment that support launches and space operations. There were 82 firms in this sub-segment, receiving \$126 million in revenue which was equal to 3 per cent of total sector revenue, employing about 330 workers.
- **Operations:** The operations segment received about \$357 million in revenue, equivalent to 7 per cent of total sector revenue, and included 44 firms and 150 workers locally.
- **Enablers:** Revenue for enabler firms was about \$432 million, representing 9 per cent of total space sector revenue. There were approximately 244 firms in this segment, representing the largest contingent of firms of all segments. About 490 workers were employed in this segment.
- **Applications:** The applications segment was by far the largest of component of the value chain by revenue, with \$3.8 billion in revenue in 2019 (80 per cent of total sector revenue). There were approximately 123 firms and 7,940 workers in this segment.

Most of Australia's space firms and workers are concentrated in the enabler and applications segments (**Exhibit 12**). These segments involve relatively high-skilled, service-intensive jobs which reflect the structure of the overall Australian economy. For example, the enablers segment includes a host of education and research organisations, such as universities, and professional services firms which work across multiple sectors in the economy. Applications dominate the Australian space sector as their services are valuable consumer services such as satellite television, radio, broadband, mobile telecommunications, and navigational and observation tools and services, such as geospatial analysis. About 84 per cent of Australia's space sector workers belong to this segment and work for major employers such as Optus and Foxtel.

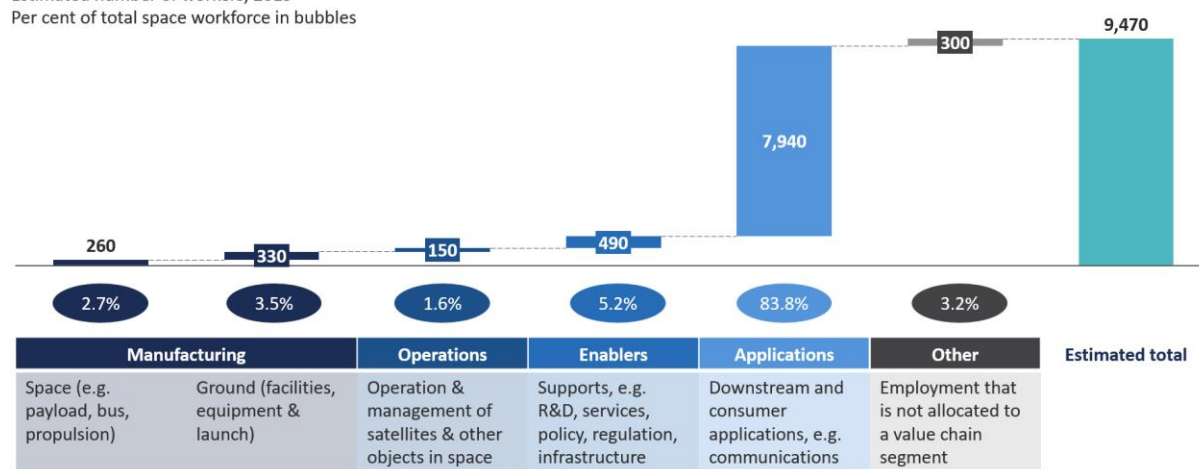
Many space sector firms, especially in the enablers and applications categories, also perform non-space sector work: for example, Jacobs (engineering and professional services) and Optus (telecommunications). The revenue and employment estimates in this report were weighted to account only for firms' space-related activities.

Exhibit 12: Employment estimate broken down across the space value chain

Employment across the space value chain

Estimated number of workers, 2019

Per cent of total space workforce in bubbles



Notes: These estimates assume that where firms operate across multiple segments of the value chain, their employment is split equally between those segments. For example, if a firm works across both Enablers and Applications, then the model assumes their employment is split equally between these functions. If the labour intensity of different segments in the value chain differs then this will overestimate employment estimates in capital-intensive segments and underestimate employment in labour-intensive segments.

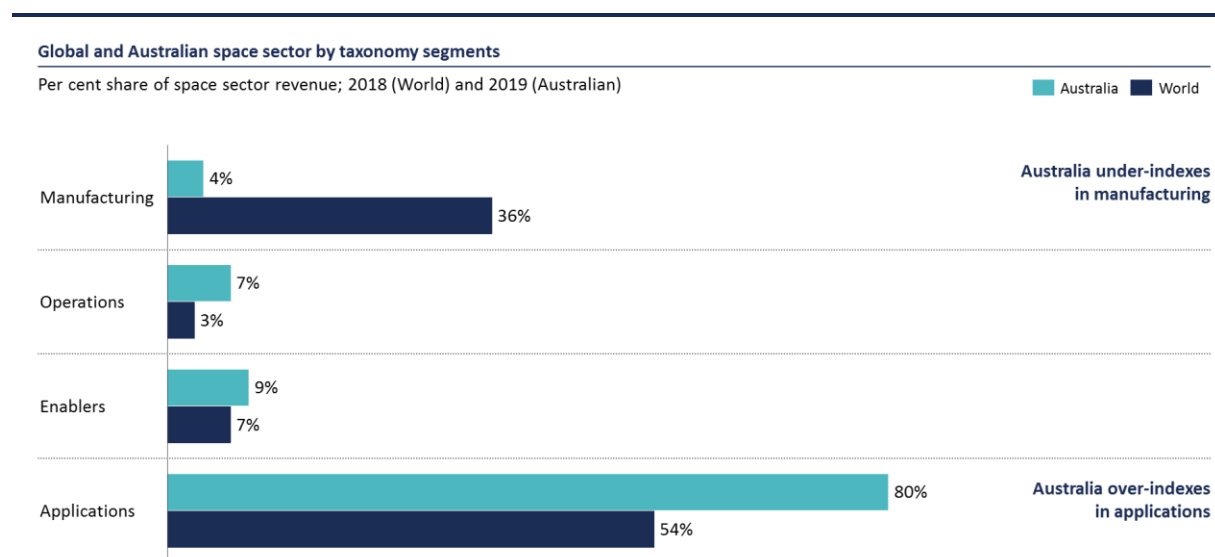
Sources: AlphaBeta analysis

The unique composition of Australia's space sector reflects areas of global competitive advantage

To understand Australia's competitive advantage in the space sector compared to the rest of the world, the composition of the Australian space sector can be understood in two ways: first, the proportion of each value chain segment compared to the total sector, and secondly the proportion of each value chain segment compared to the total economy.

The composition of the Australian space sector is different to that of its international peers (**Exhibit 13**). Australia has less manufacturing activity but substantial applications activity, at 4 and 80 per cent of the Australian value chain, respectively. Globally, the manufacturing segment is responsible for over a third – 36 per cent – of revenue while the applications segment makes up 54 per cent of global value chain revenue. There are contrasts between Australian and global revenue averages for the operations and enablers segments of the value chain as well although they are not as stark. Operations receives 7 per cent of space revenue in Australia but just 3 per cent globally; enablers receive 9 per cent in Australia and 7 per cent globally.

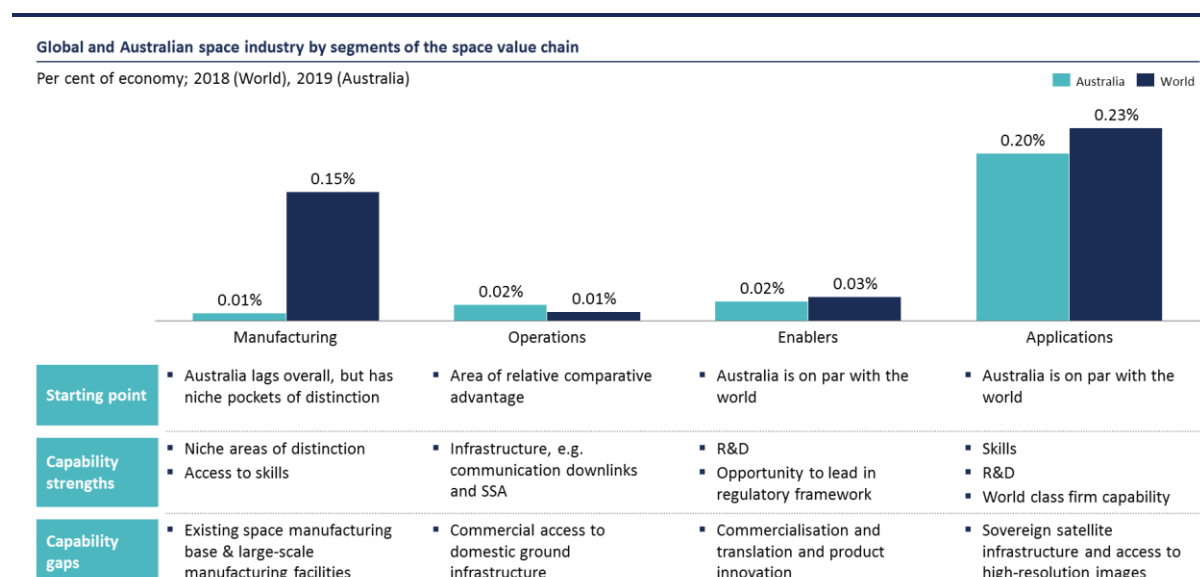
Exhibit 13: Comparison of value chain segments as proportion of total space sector, between Australia and the global average



Sources: Bryce Space Industry report; AlphaBeta space firm database.

Comparing the contribution of space value chain segment to Australian and global economic output reveals which segments are of greater comparative value to the overall Australian economy (**Exhibit 14**).

Exhibit 14: Comparison of share of value chain as proportion of total economy, between Australian and global economies

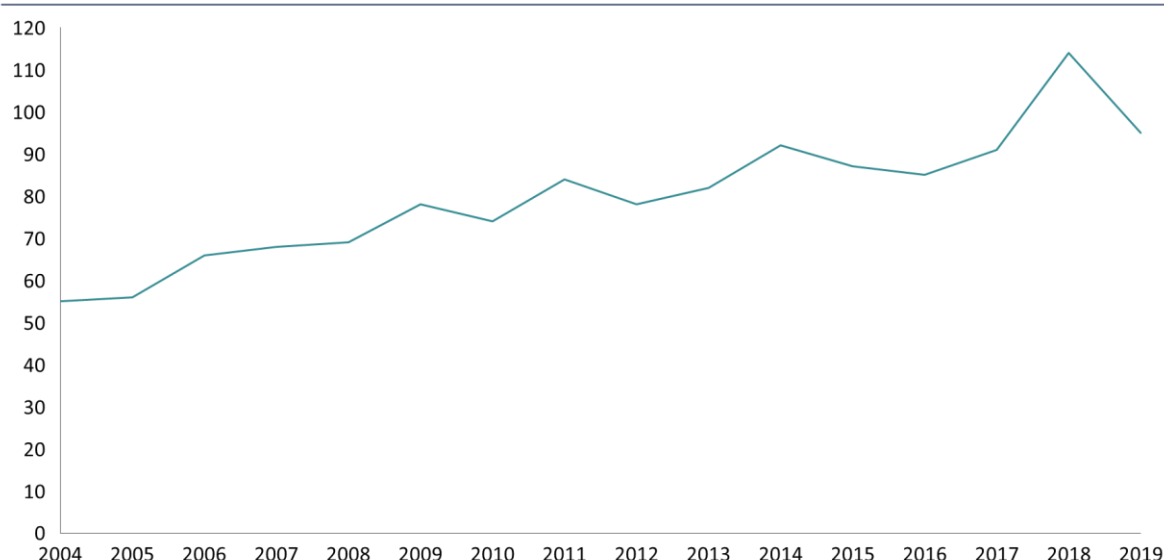


Sources: Bryce Space Industry report; AlphaBeta space firm database.

Australia is most competitive globally in the operations segment, a segment of the sector that includes activities such as the operations and management of satellites. Over the last 5 years, the sector's profit margins grew as satellites became cheaper whilst demand for satellite-based services grew.³⁸ The number of countries with a satellite in orbit has increased by approximately 65 per cent in the last decade, from 50 in 2008 to 82 in 2018.³⁹ As of 2019, the number of active satellites are at an all-time high at over 2,514. Ten years ago in 2009, there were just 986 satellites, less than half as many (**Exhibit 15**). Satellite services are crucial for a range of industries and activities, such as telecommunications, defence, agriculture, mining exploration, meteorological services, and environmental and climate change monitoring.

Exhibit 15: Number of satellites launched between 2004 to 2019

Number of satellites launched per year, globally



Sources: Statista; JSR 2020.

Operations contributes 0.02 per cent to Australia's GDP but the global operations segment is just 0.01 per cent of world GDP. This hints at an Australian competitive advantage in operations. Government-supported projects to increase resolution of GNSS technology in Australia, such as the development of a Satellite-Based Augmentation System (SBAS) and the National Positional Infrastructure Capability (NPIC) program, helps further drive Australian capability in this area.

The operations segment will be a strong driver of growth in the future. For example, Global Navigation Satellite Systems (GNSS) and GNSS-based positioning, navigation, and timing services were predicted

³⁸ Annual profit margin growth 2015-2025 of 0.2%: Ibis World (2020), Satellite Communications and Astronautics in Australia OD5545.

³⁹ OECD (2019), The Space Economy in Figures.

to grow 11 per cent per year between 2014 and 2023, due to increasing demand in the Asia Pacific region for satellite-based products and software for industries such as mining, and chipsets in smartphones.⁴⁰ These services require the operation of satellites and processing data transmission between satellites and receivers. Demand for these navigational and positioning services are expected to be fairly resilient to the economic shock of the COVID-19 pandemic, as their use in telecommunications, supply chains, and logistics tend to improve productivity and efficiency.

Australian strengths in the enablers and applications segments of the value chain are on par with global averages. The contribution of these two segments of the value chain to the Australian economy is similar compared to global averages. The enabler segment adds 0.02 per cent to the Australian economy, compared to 0.03 per cent to the global economy. Australia's research and development capabilities, currently supported by Australian Research Council and Cooperative Research Centres as well as the \$19.5 million Space Infrastructure Fund and the \$15 million International Space Investment initiative, help grow and support the enabler segment although commercialising research will likely prove a challenge for local researchers. This will especially be the case in the absence of scaled commercial ecosystems looking to take up new innovations, as is the case for space manufacturing. There is an opportunity to improve both Australia's space sector and other sectors like advanced manufacturing by encouraging more cross-sector cooperation.

Within the applications segment, Australian firms contribute 0.2 per cent to the Australian economy and global firms contribute to 0.23 per cent to the global economy. A more detailed look at the activities within the space sector reveal that applications services such as subscription broadcasting, telecommunications, and surveying and mapping drive much of overall sector revenue (**Exhibit 16**

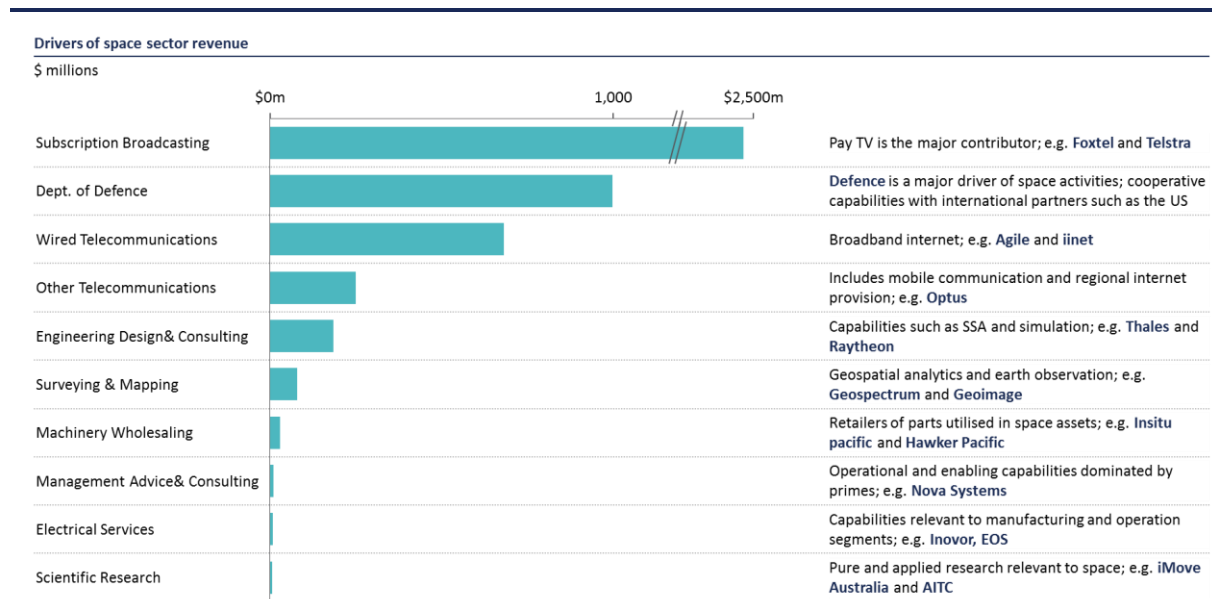
Exhibit 16). These technologies underpin critical applications such as weather forecasting and bushfire management. Satellite television for pay television services such as those provided by Foxtel and Telstra is by far the largest contributor of applications revenues, at nearly \$2.5 billion in 2019. Spending by the Department of Defence is the second largest contributor to overall sector revenue, at about \$1 billion in 2019. This underscores the importance of the local civil space sector to domestic capability.

In the future, fixed satellite managed services (e.g. business and government internal networks and internet service to aircraft passenger cabins) have been flagged as a key area for Australian industry growth due to an established domestic market for managed services. This segment grew at an annual rate of nearly 8 per cent between 2012 and 2016 and is predicted to continue to grow.⁴¹

⁴⁰ Bryce Space and Technology (2019), Global Space Industry Dynamics: Research Paper for Australian Government, Department of Industry, Innovation and Science.

⁴¹ Bryce Space and Technology (2019), Global Space Industry Dynamics: Research Paper for Australian Government, Department of Industry, Innovation and Science.

Exhibit 16: Contributors of Australian space sector revenue



Source: AlphaBeta space firm database.

Australia is less well-represented in the space manufacturing segment compared with the global market. Manufacturing disproportionately contributes more to global GDP than it does to Australian GDP: Australian space manufacturers contribute 0.01 per cent to Australian GDP and it is 0.15 per cent in the global case. Like other manufacturing activities, space manufacturing benefits from scale meaning that much of the world's space manufacturing occurs in North America and Europe. Australia can consolidate its niche speciality manufacturing presence by creatively using existing local industrial capabilities to service the global market. For example, the Australian firm Gilmour Space Technologies is developing globally competitive hybrid-engine rockets to launch low-cost satellites. Its supply chain enables them to engage local Australian suppliers, such as manufacturers who have historically focussed on automobile parts.

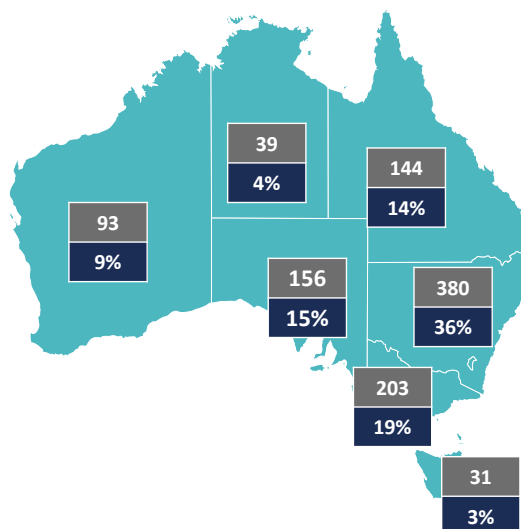
Box 2: Most of Australia's space firms are based along the east coast and South Australia

The local Australian sector is made up of an estimated 558 firms (including many SMEs), serving all four segments of the space value chain and who have a diverse range of capabilities. While many Australian space firms operate in multiple states and territories, an estimated one-third of Australian space sector firms are based in New South Wales and about a fifth of firms based in Victoria. South Australia hosts a relatively large proportion of firms, given its population, at one sixth of total firms.

Exhibit 17: Distribution of Australian space firms across states and territories

Distribution of Australian space firms across states and territories

Number and share of firms



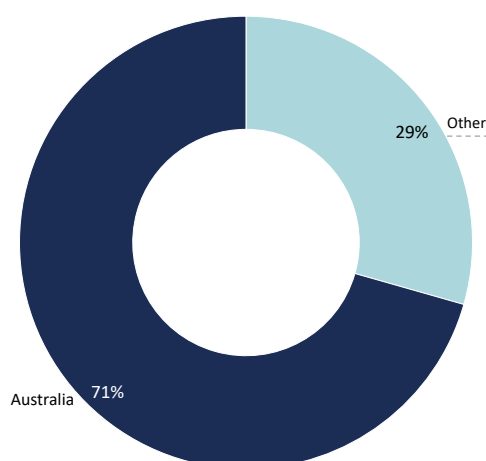
Source: AlphaBeta space firm database

About 70 per cent of firms participating in the Australian space sector are Australian-owned. The remaining 30 per cent of firms are owned internationally, with the United States, the United Kingdom, and Japan being the most common providers of foreign-owned space firms in Australia.

Exhibit 18: Australian space sector firms by parent location

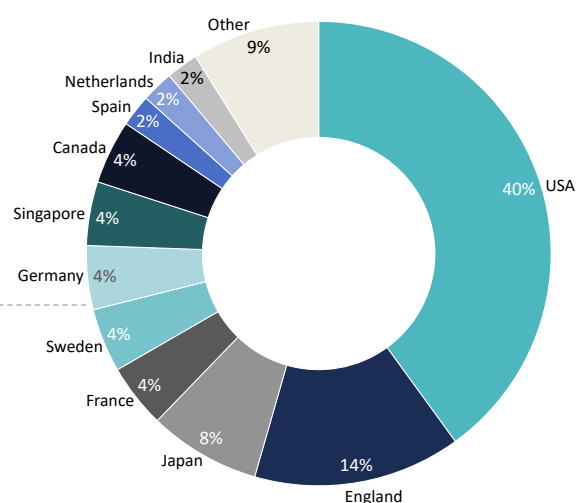
Australian space industry by parent location

Per cent share of space sector firms



Foreign owned Australian space companies, by parent location

Per cent share of space sector firms



Source: AlphaBeta space firm database

2.3 A further 4,000 firms are in space-adjacent sectors and could extend their capabilities into space

Growth and the continued prosperity of the Australian space sector will be contingent on more firms entering and participating in the value chain. There are a range of firms in Australia who do not yet participate in the space economy but by virtue of their capabilities, are well-positioned to enter the space sector (**Exhibit 19**).

Exhibit 19: Adjacent industries containing firms that may be suitable to enter the space sector

Segment of value chain	Industry groups
 Manufacturing	- Aircraft Manufacturing and Repair - Communication Equipment Manufacturing - Electrical Equipment Manufacturing - Electronic Equipment Manufacturing - Machine Tool and Parts Manufacturing - Machinery and Equipment Manufacturing - Metal Ore Mining - Oil and Gas Extraction - Photographic, Optical and Ophthalmic Equipment Manufacturing - Professional and Scientific Equipment Manufacturing - Specialised Machinery and Equipment Manufacturing - Structural Metal Product Manufacturing
 Operations	- Computer System Design and Related Services - Scientific Testing and Analysis Services - Data Processing and Web Hosting Services - Defence - Engineering Design and Engineering Consulting Services - Management Advice and Related Consulting Services - Other Professional, Scientific and Technical Services
 Enablers	- Computer System Design and Related Services - Engineering Design and Consulting Services - Management Advice and Related Consulting Services - Professional, Scientific and Technical Services - Scientific Research Services - Scientific Testing and Analysis Services
 Applications	- Communication Equipment Manufacturing - Computer System Design and Related Services - Data Processing and Web Hosting Services - Defence - Engineering Design and Engineering Consulting Services - Management Advice and Related Consulting Services - Professional, Scientific and Technical Services - Telecommunications Services - Scientific Research Services - Scientific Testing and Analysis Services - Surveying and Mapping Services - Telecommunications Network Operation

Industry groups can map to multiple segments of our space taxonomy. There is a many-to-many relationship between industry groups and taxonomy segments.

For example, computer system design can encompass an operational capability such as situational space awareness (SSA), or an application such as earth observation.

Notes: Industry names adjusted for readability; bold denotes that industry spans multiple segments. There is a many-to-many relationship between industry groups and segments, which means that industry groups can map to multiple segments. For example, computer system design can encompass an operation capability such as situational space awareness (SSA), or an application such as Earth observation information services.

Analysis of suitable subindustries with space-relevant capabilities has identified 23 subindustries within which are 4,125 firms that are high-potential candidates (**Exhibit 20**). Several criteria were used to determine which subindustries were relevant, including subindustries which contain firms already in the space sector and those which were identified by the Australian Space Agency.⁴² Industries were also filtered for whether they were high-growth, high-tech industries (based on patents and grants) as these were more likely to contain firms that reflected the dynamic and technology-intensive nature of space.

⁴² See Appendix 4.2 for methodology.

Exhibit 20: Count of firms in space-adjacent sectors who have been identified to be suitable to enter the space sector, as mapped to value chain segments

Taxonomy Segment	Average annual revenue (AUD millions)	Number of firms
Manufacturing	\$363m	1,945
Operations	\$596m	599
Enablers	\$570m	433
Applications	\$418m	1,168
Total		4,145

Notes: Unlike in the database of existing Australian space firms, there is less of a bias towards applications in our adjacent firms database. This is because of two main reasons:

1. The applications segment of the existing space firms is heavily comprised of subscription television, which we do not see as a large opportunity for future growth.
2. Our industry analysis lends weight to high-technology and high-growth industry groups which are more evenly spread across the taxonomy.

Sources: AlphaBeta analysis; iilion data.

In the manufacturing segment of the value chain, there are Australian firms in aerospace, electronic equipment, and metal production that possess capabilities that overlap with space and ground manufacturing. In the operations segment, example adjacent industries include computer system design, data processing, engineering design, and defence (for example firms, see **Exhibit 21**). In the enablers segment, computer system design and engineering design are also plausible sources of new space firms, as well as scientific and analytical services. Finally, the broad range of activities relevant to the applications segment of the value chain presents a very rich set of adjacent industries, from computer system design, data processing, to professional services.

Of the firms who have been identified as possibly being suitable to participate in the space sector, the most common capabilities they have involve those related to the fields of engineering, design, and advanced manufacturing. Specific capabilities include precision machining and design, remote operation and automation, and machinery and component manufacturing.

Case studies: Space-adjacent manufacturing firms entering the sector (space manufacturing)⁴³



XTEK is an established manufacturer of ballistic armour and produce advanced composites manufacturing technology for Defence Forces and Government agencies. XTEK's unique technical advantages positioned the firm well for space applications, leading to the recent partnership with SkyKraft to deliver on a grant from the Australian Space Agency to design small satellites for low Earth orbit and to research and develop Australia's space technologies.



HTA has provided heat treatment processing services for the last 15 years, both in Australia and globally. Starting out as a heat treatment facility for aerospace and defense metal components, HTA is now also approved to treat space components, including approvals for SpaceX in Los Angeles, USA.

⁴³ [XTEK](#) and [HTA](#) company websites.

Of the over 4,000 firms identified as potential candidates to enter the space sector, we focused on 380 firms who appear to have the highest potential to transition into the space industry. This was based by their size (measured by revenue and employment), whether they were export active, and whether they clearly reported having space-relevant capabilities. The ten most common capabilities of these high-potential firms illustrate the depth and diversity of firms that could participate in space (Exhibit 21).

Exhibit 21: Common capabilities of firms that have been identified as space-adjacent

10 most common capabilities of firms listed in the adjacent firm database		Example firms		
Number of firms with this capability				
Precision machining and design	38			
Remote operation and automation	36			
Machinery and component manufacturing	35			
R&D and manufacturing	30			
Advanced manufacturing and design	25			
Systems design and engineering	25			
Electronics manufacturing	23			
Network operation	19			
Engineering design, manufacturing and support	18			
Major infrastructure delivery	15			

Source: AlphaBeta analysis.

By encouraging space-adjacent firms to expand their operations into the space sector, Australia will be able to more rapidly scale its local sector while providing a commercial opportunity for these firms to develop both their domestic capabilities and foreign partnerships.

3 Government will continue to play a central role in stimulating and supporting the increasingly commercial space sector

Despite the increasing number of commercial actors in the space industry, Government continues to play a central role in driving both civil and defence space activity. Government support enables Australian firms to demonstrate the space capabilities needed to enter competitive global commercial supply chains while providing support for the sector to develop and become self-sustainable. This chapter outlines three factors which are critical to helping Australia's space sector grow:

- 1. Government partnership and facilitation and supporting major infrastructure projects*
- 2. Reducing barriers to entry through innovative regulatory and standards frameworks*
- 3. Developing regular and robust measurements to improve sector visibility*

3.1 Major infrastructure projects and government facilitation can drive local innovation and developing supplier capabilities

The role of government as a partner and facilitator is an important factor in driving local innovation and capability development of the sector. As part of the 'open doors' priority, the Australian Space Agency is leading international collaboration through international partnerships for industry and research. This has included attending several international forums such as the UN Committee on the Peaceful Use of Space, and:

- Entering five memorandums of understanding with foreign governments,
- Formalising strategic partnerships with NASA, ESA, the German Space Agency (DLR), and the New Zealand Ministry of Business, Innovation and Employment, and
- Engaging on five UN space treaties.⁴⁴

These partnerships enable programs like the Australian Government's Moon to Mars initiative, which provides a total of \$150 million to Australian business and research projects that can support NASA's Artemis mission to the Moon and subsequent missions to Mars. The growing network of collaborations and support from government will create an environment that can foster and inspire new space-related ventures. Part of the Moon to Mars initiative is the Trailblazer Program which will be the initiative's flagship aimed at inspiring Australians with a major space exploration program.

Large mission-driven projects are key for scaling the local space sector. Government is both a major customer, employer, and policy maker and can thereby exert substantial influence over the sector's

⁴⁴ In September 2019, Australia announced its support for NASA and their international partners on the Artemis program and other landmark exploration missions to the Moon and Mars. As at October 2020, Statements of Intent have also been signed with the European Space Agency, the German Aerospace Centre, and the New Zealand Ministry of Business, Innovation, and Employment. The Agency has further signed memorandums of understanding (MOUs) with the national space agencies of France, Canada, the UK, the UAE, Italy and Japan.

growth trajectory. As a customer and employer, Government can help drive demand and stimulate the local space value chain by purchasing goods and services from the local sector.

Major Government-supported projects can provide nascent Australian firms with the confidence to scale their operations. For example, the construction of the ambitious SKA project in remote Western Australia is set to drive local innovation in telescope construction, energy infrastructure astronomy, data storage, basic research, and analytics over its 50-year lifetime. Australia is co-hosting the SKA (with South Africa) in large part due to support from the Australian Government, which is investing nearly \$300 million to construct this globally significant project.⁴⁵

Government procurement is critical in developing domestic firm capability, especially where it created a 'first' or 'strategic' customer for small, innovative firms. Existing small and medium firms in the space sector in Australia reported they are largely self-funded by customer contracts, rather than debt or equity financing. This is a common issue for Australian small businesses, with one in five reporting that it was relatively difficult for them to access finance in 2018.⁴⁶ Australia invests only two-thirds the venture capital of OECD peers.⁴⁷

For small and medium space businesses, the dearth of larger local customers or projects is a dampener on growth. Smaller innovative firms interviewed for the report noted that governments commissioning new capabilities, such as geospatial assets or analysis, can be important first or major customers for innovative new products.

Government can also nurture the local space ecosystem by investing in key pieces of infrastructure that boost local firm capability as well as attract foreign firms and foreign investment. The Australian Government has already committed to several infrastructure initiatives. For example, it launched the Space Infrastructure Fund, worth \$19.5 million, to develop critical Australian capabilities across the space value chain. The fund will include projects to develop future space manufacturing facilities, data analysis facilities, robotics and AI technology development, and testing facilities for SMEs and researchers. Government committed over \$260 million in 2018 to improving Australian satellite-based positioning infrastructure, including setting up the National Positioning Infrastructure Capability (NPIC) which will see GPS accuracy narrow to within three centimetres in Australia.⁴⁸

The space sector also has a central role to play in national defence. The Department of Defence will invest \$7 billion in improving its space capabilities over the next decade, including \$50 million in space research and innovation activities, focusing on new and emerging technologies to create greater Australian industry capacity.⁴⁹

After the establishment of these signature pieces of space-related infrastructure, local firms are well positioned to take advantage of these projects through their future business and investment

⁴⁵ The Hon. Christopher Pyne MP (2015), Media release: Agenda to transform the Australian economy. The Australian Government announced \$294 million for the Square Kilometre Array as part of the National Innovation and Science Agenda in December 2015.

⁴⁶ Reserve Bank of Australia (2018), Access to Small Business Finance.

⁴⁷ OECD (2019), Venture Capital Investments 2018.

⁴⁸ Department of Industry, Science, Energy and Resources (2018), Better GPS and satellite imagery to support a smarter economy.

⁴⁹ Department of Defence (2020), Media release: Morrison government invests in new sovereign controlled satellite capability.

decisions. This is further supported by the Australian Space Agency's International Space Investment initiative - committing \$15 million to projects that grow the Australian space industry and target at least 80 per cent Australian investment. The Australian Space Agency is also developing roadmaps for each priority area in consultation with the sector (including other government agencies) to build on competitive strengths by identifying strategic investment opportunities.

As a policy maker, Government can help boost the inputs needed by the sector, such as access to skilled workers, access to finance, and a suitable regulatory framework. This can be done both at the federal and state-level, with key states already developing space strategies. For example, NSW and Queensland both recently released 2020 strategies, aiming to both strengthen and grow their local industry. States and territories are heavily investing in STEM education programs, across the education sector, to develop a skilled workforce and provide employment pathways to the space industry.⁵⁰ These investments help signal long-term, national commitment to space-based technologies and help attract investors and firms. The Australian Government's Modern Manufacturing Strategy is a contemporary example of policy that seeks to support and stimulate the space sector.

3.2 Government is working to encourage innovation through creating a safe and certain regulatory environment

Australian Government agencies have developed and implemented a range of new activities and investments to leverage opportunities and help support the industry through:

- Managing and shaping the regulatory landscape to support and enable safe, efficient space activities.
- Updating and implementing a regulatory framework: As of July 2020, there have been four overseas payload permits issued under this framework. Partial cost recovery has been deferred until mid-2021, in recognition of the impact that the COVID-19 pandemic has had on the Australian space industry.
- Representing Australian interests at the UN Committee on the Peaceful Uses of Outer Space to support the long term sustainability of outer space activities, ensure the effective implementation of international space law, develop norms of behaviour and transparency and confidence building measures, exchange information on regulatory arrangements and best practices for civil space activities, and promote the importance of space in future economic and societal growth.

3.3 Regular and robust measurements will improve sector visibility, which could help support and encourage investors

Finally, a clear view of the space sector is crucial for its future health. Without a clear fact base, firms are unable to make informed decisions, investors and entrepreneurs lack clarity and may instead

⁵⁰ Queensland Government (2020), Queensland Space Industry Strategy 2020-2025. The Queensland Government invested over \$526,000 in 2018-19 for 168 apprentices and trainees across aviation and aerospace.

redirect their investments to markets where opportunities are more clearly articulated. Policymakers may fail to correctly identify issues that hinder growth.

The Commonwealth and State and Territory Governments recognise this and are implementing measures to address the lack of sector measurement. Annual 'State of Space Reports' released by the Australian Space Agency also document the Government's activities and sector progress against key metrics, keeping industry informed of opportunities and policy priorities. Some states and territories, such as South Australia, maintain public directories of their space capabilities, including the number of organisations in their state engaging in space-related activities.

At the national level, Government can further support the sector by implementing a robust sector measurement program. Existing industries rely on the Australian Bureau of Statistics (ABS) who regularly produce economic data about individual sectors. However, the ABS does not capture space in its industry and occupation classifications. Currently, the lack of quality data means that it is difficult to regularly measure and understand the size and nature of the Australian space sector. Moving forward, the Government can seek to implement a regular and robust measurement program for the sector, as it does for established industries.

Measuring the space sector is a difficult analytical exercise. Like Australia, other governments do not capture space as a distinct sector in their regular industry measurements or in their national accounts data. Studies about other jurisdictions note the challenges faced by this lack of quality data. For example, the UK's and Canada's measurements both note the uncertainty inherent in all space sector economic estimations due to the incomplete coverage from survey responses, firm administrative data, and publicly reported data. To improve the robustness of estimates, the Australian Space Agency have recently released a definition of the Australian space sector in an effort to capture space activity in a systematic and robust manner. This aligns to the definition used by other peer countries as well as the OECD. Appendix 4.2 describes the measurement approach used in this report.

3.4 Conclusion

With the establishment of the Australian Space Agency, the Australian space sector has entered a new phase of development. Currently, the sector stands to benefit from a suite of ambitious government-supported satellite and space exploration projects over the next decade. Increased collaborations with overseas space agencies will further fuel growth. Strong global demand also opens new doors to local firms.

This new chapter in Australian space is bringing forth fresh challenges. Boosting local capability and encouraging more firms and workers to enter the space workforce will be vital for the sector to make the most of new opportunities. Educators and government have important roles to play to help firms find the skills and other inputs they need. Refining regulatory frameworks will also support firms to compete globally. Finally, in a rapidly growing sector like space, policymakers will have to be alert to how these challenges evolve, so that they can continue to support firms effectively over the coming years.

4 Appendices

4.1 Appendix A: Australian Space Agency definition of the Australian Space Sector

The Australian Space Agency's definition of the Australian Space Sector (2020) is as follows:

The Australian space sector is defined as a set of space-related activities along the space value chain and is part of the broader space economy.

All actors (private, public and academic) participating in production, operation, supply and enablement activities that form the space value chain are part of the space sector. Space value chain segments broadly include: Manufacturing and core inputs (Ground and Space segment manufacturing and services); space operations; space applications; and enablers (such as regulation and essential service delivery, infrastructure and capabilities, research, development and engineering, and specialised support services).

While the space sector captures the provision of space related goods, services and applications to broader industries, it does not include subsequent non-space (value adding) activities that are enabled by space activities (such as food grown using precision agriculture techniques). These flow-on activities are captured by the broader space economy.⁵¹

4.2 Appendix B: Measuring the space sector

Measuring the space sector in Australia is difficult due to a lack of reliable and high-quality data as well as a lack of nationally consistent reporting methods. To address this, and to create robust estimates, this report uses a combination of economic data, government policy, survey data, and insights from researchers and industry leaders.

This report created a data set of firms in the Australian space sector. We identified a total of 558 firms and organisations from the SIAA, government, and industry experts. The contribution of each firm to the Australian space industry was calculated by estimating the contribution of its space operations to its overall revenue. The list was cleaned to remove duplicates and firms that were no longer operating. The website of each firm or organisation in the database was scanned to determine its capabilities. The capabilities were used to classify firms according to our taxonomy.

This report also sought to identify firms in adjacent industries that could enter the space industry. We began by identifying subindustries with a high probability of including firms that had space relevant capabilities. Of the 120 ANZSIC codes in the Australian space firm database, 23 were identified as

⁵¹ The Australian Space Agency ([2020](#)), Defining the Australian space sector.

having high potential to enter the space industry. The industries were rated and ranked based on the following factors:

1. **Relevance to Australian Space Agency Civil Strategy and priority areas:** Industries with capabilities related to the priority areas were ranked higher
2. **Growth:** The space industry can leverage the growth of adjacent industries for its own development. Industries were ranked based on ABS industry growth data
3. **Technology:** This factor is used as a proxy for the high skill requirement of the space industry. Using IP Australia, industries were ranked based on the number patents filed and granted for the last five years of available data.

This adjacent firm database consists of 4,125 firms from the 23 selected ANZSIC codes. The top 200 firms by revenue for each of the 23 ANZSIC codes was requested from illion in order to build up the database. Firms that were already contained within the space Australian firm database were removed from the database. The firms in the database were assigned a taxonomy segment based on their ANZSIC code. The top 20 from each ANZSIC code that export are Australian owned were filtered to identify a list of 380 firms with the most potential to enter the space industry.

To supplement the data analysis used in this report, we conducted interviews with 15 experts involved in the space industry or who are active in space research to provide insight into this study.