COMMERCIAL IN CONFIDENCE

REPORT

Space Centre Australia

Market Assessment and Economic Impact

Prepared for
Palm Branch Group

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THE CENTRE FOR INTERNATIONAL ECONOMICS
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Summary

- **The Australian and global space industries are rapidly growing.**
  - **The global space sector is set to nearly triple in the next 20 years (from US$450 billion currently to US$1.1 trillion by 2040).**
  - **By 2030, the Australian government aims to increase the size of the Australian industry from the current $5 billion to $12 billion by 2030.**
- **The space 'value chain' includes research and development and component development and manufacturing at the one end (for the launch vehicle, the payload and of course the satellites in the payload) and operations and applications for the orbiting payloads at the other end.**
- **In between, launch services and infrastructure (including assembly, testing and integration of the vehicle and the payload), and including the actual launch facilities provide the essential component linking both ends of the chain.**
  - **Satellites are not complete until they are in space — the process of researching, designing and building them is not really finished until they are launched. Further, the services they will provide — to consumers, corporations and governments — cannot take place until the satellite is orbiting.**
  - **Launch, and ancillary services, are thus a pivotal step in the space value chain — a crucial component of the full ecosystem that makes up the space economy. A space sport is an essential piece of infrastructure that allows this 'transport' to take place.**
- **None of the activities before or after launch have value without a successful launch. Further, the cost effectiveness of launch services has important implications for the ongoing success of space endeavours.**
- **To satisfy a growing industry, the market for global launch services will need to grow.**
- **Projections of growth in launch demand suggest that the market for Space Centre Australia's (SCA) services could be up to $610 million a year by 2028, with potential total revenue of up to $5.7 billion between 2022 and 2032.**
- **In a typical operating year by 2030, it is projected that SCA's activities could increase Australian GDP by 0.06 per cent (compared with what it would otherwise have been).**
  - **Most of this increase is experienced in Queensland, where gross state product is expected to be 0.3 per cent ($1 416 million) higher than otherwise in 2030.**
  - **Employment in Queensland is also expected to increase by around 0.3 per cent, equivalent to 7 200 persons (on a full time equivalent basis) in 2030.**

- **These economic changes will be distributed across key regions in Queensland in proportion to each regions’ capacity to supply key services to SCA.**

1 Introduction

This report

This report considers two aspects of the proposed Space Centre Australia (SCA).

- First, examining recent developments in the space industry, and making projections of future satellite launch demand, it considers the size of the potential market that SCA could access.
- Second, it estimates the potential economic impacts of the operations in SCA, particularly on the Queensland economy.

Space ports in context

The historian Ferdinand Braudel once noted that *'transport is the necessary finishing process of production'*. Goods are not complete until they are in the hands of their ultimate users and have no value until they can get there. Transport infrastructure in general has become an essential component of the modern economy.

In a similar sense, satellites are not complete until they are in space — the process of researching, designing and building them is not really finished until they are launched. Further, the services they will provide — to consumers, corporations and governments — cannot take place until the satellite is orbiting.

Launch, and ancillary services, are thus a pivotal step in the space value chain — a crucial component of the full ecosystem that makes up the space economy. A space sport is an essential piece of infrastructure that allows this 'transport' to take place.

Points to note

In undertaking this analysis of one Australian component of a total space sector, several points are worth noting.

- First, the space sector is intensely international. Components made in one country can be used anywhere in the world. Design and R&D are international and a space port such as that proposed by SCA can service both Australian and international customers.
- Second, there is not a single statistical definition of the 'space sector' and the interactions between different segments of the space sector have not been as carefully mapped as for other sectors of the economy. The 'space sector' is made up of many different activities that are distributed across the formally recognised sectors of the economy.

- Third, the sector is rapidly changing. Not only is it growing, but the relationship between different components of the sector is also changing. Rapid technological change is in many ways redefining exactly how the space sector works.

These factors all create challenges in assessing either the future market for launch services or the way in which the operations of a launch facility will affect economic outcomes.

The approach taken here is to use the best available information in the public domain and to combine this with basic economic analysis to project potential outcomes. The projections set out here should be regarded as reasonable orders of magnitude given the information currently available.

Report structure

The report is structured as follows.

- Chapter 2 sets out some background to the international space industry.
- Chapter 3 builds up an estimate of the total potential market for SCA using projections of satellite and payload launch.
- Chapter 4 provides an estimate of the economic impact of SCA in a typical operating year in 2030.

2 Background to the space industry

A growing industry…

Space innovation is expected to be a key driver of the ‘4th industrial revolution’. Satellite applications boost productivity and efficiency across a range of sectors including agriculture, mining, telecommunication, climate and meteorology, defence and location-based services capability, providing society with significant economic benefits. An OECD report estimates that a majority, 57 per cent, of cost savings that result from increased productivity within the space sector, fall outside of the industry.[1]

The space industry is also going through a rapid expansion, over 2,500 new satellites have been launched in the past 2 years, more than were launched in the previous decade combined.[2] This expansion comes as entry costs drop, and the demand for and reliance on the space sector by consumers and governments increases. In the past five years multiple countries have increased their investment in space research and development, seeking to integrate into the global space supply chain. Furthermore, private funding has reached an all-time high, as commercial projects receive an unprecedented private capital flow from angel and venture capital investments.[3]

Supporting the space boom provides significant possibilities for Australian businesses to get involved in the international space value chain.

…with four broad segments

The space industry is defined as a set of space-related activities along the space ‘value chain’, forming part of a broader space economy. The OECD defines the industry as ‘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 industry’.[4]

The space industry includes four broad segments:

- **Manufacturing and core inputs:** Activities comprise the building and integration of ground-based facilities and equipment that perform space-related activities; and the building and integration of items to go into space, including spacecraft, satellites, payloads, and products to be used in space.

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1 The Space Economy in Figures: *How Space Contributes to the Global Economy*, June 2019, OECD

2 Launch data, 2021, Space-Track.Org, accessed on 1st November 2021

3 The Space Economy in Figures: *How Space Contributes to the Global Economy,* (June 2019), OECD

4 Measuring the Economic Impact of the Space Sector, October 2020, OECD

- **Operations**: Activities include launch, the management of objects in space, and activities associated with using and managing satellites in space. It also includes operations and remote operations conducted in space.
- **Applications:** Activities refer to the use of space-derived resources to create usable and useful products and services, including software, hardware and publications, and services to be provided across the economy.
- **Enabling services:** Activities cover a variety of areas including product delivery and services which support space activities within the other three value chain segments. These include essential service delivery, infrastructure and capabilities, research, development and engineering, and specialised services, which facilitate and contribute to delivery of the products and services from manufacturing and core inputs, operations, and applications segments.

The Australian Space sector supports activity across the whole Australian economy through the provision of services and applications to industry.

Measuring the size of Australia's space sector is complex as there is currently no clear definition in the ABS ANSZIC codes, meaning that estimates of the contribution of each sector varies widely.

While two recent reports indicated that the revenue generated by the industry was between $4.4bn - $4.6bn in 2019, the split in activity across each sector was significantly different between reports.

- Space applications were estimated to generate between $1.4 billion and $3.8 billion comprising between 30 per cent and 80 per cent of the industry, while enablers generated between $430 million and $1.9 billion, operations between $360 and $780 million and manufacturing from $180 million to $470 million.[5, 6]
- Although the estimates vary, the contribution of applications in Australia is a significant proportion of the industry primarily deriving revenue through the provision of satellite TV, defence, and telecommunications, whereas both operations and manufacturing are currently limited in their contribution.[7]

The space value chain

Chart 2.1 illustrate the space industry value chain.

Launch activity is a key enabler in the space value chain, linking the ground-based manufacturing and development of satellites to space-based delivery of applications to customers.

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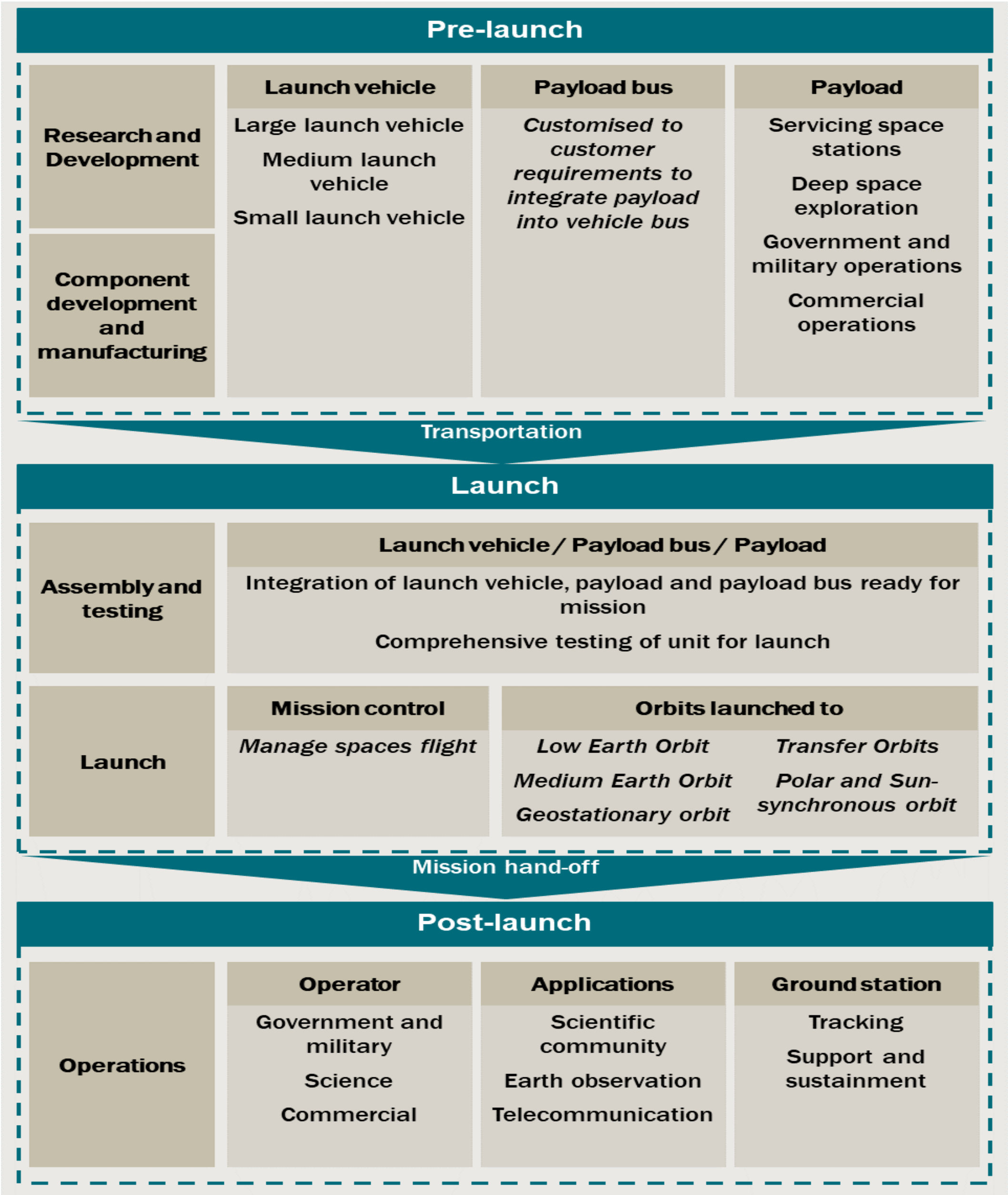
5 Economic snapshot of the Australian Space sector 2016/17 -2018/19, February 2021, Australian Space Agency

6 The economic contribution of Australia's space sector in 2018-19, February 2021, AlphaBeta

7 Economic snapshot of the Australian Space sector 2016/17 -2018/19, February 2021, Australian Space Agency

2.1 Space industry value chain



Data source: The CIE

Pre-launch activities occur separately for launch vehicles and payloads and include research and development, component development and manufacturing, and satellite applications. Each component is developed across a global supply chain, where the satellite, launch vehicle and bus operator could all be in separate countries. The global distribution of the supply chain means that once ready each component must be transported from its manufacturing location to the launch location, at significant cost. As a result, manufacturers prefer to be located close to launch locations to reduce cost. This means that a space port can attract and enable investment in, and development of manufacturing, satellite mission control and other space related downstream industries.

Once each component arrives at the launch location, teams will commence work assembling, integrating, and testing to ensure that each component is ready for launch. Depending on the size of the rocket and payload this can take up to 9 months to get the payload ready for launch.

Following launch, when the payload has reached its orbit, the mission is handed to the operator of the satellite, where it will begin to provide applications for its intended customer, such as defence, government, or broader society.

Enabling large and small launches in Australia through a Sovereign facility could lower costs for satellite manufacturers both in Australia and Asia, helping to further catalyse growth within the industry and supporting Australia's modern manufacturing initiative.

The space industry is growing rapidly

The global space industry has grown at a steady rate over the past 70 years since the beginning of the space race in 1955. However, in the modern era a reduction in launch cost has increased the number of businesses operating across the whole space value chain accelerating the growth of the industry to levels not previously experienced.

The global space sector is set to nearly triple in size over 20 years

In 2020, global space industry revenue was estimated at US$446.9 billion, by 2040 revenue is predicted to reach US$1.1 trillion, led by a boom in satellite applications.[8] International governments have recognised the opportunity in the space industry leading to an expansion in both public and commercial investment to capitalise on first mover advantages, this includes significant increase in activity from the United Kingdom, China, Russia, and the United States of America.

Governments have historically been the driving force behind activity and growth in the space industry, investing for purposes of national security and government interests. Although the importance of the industry to government remains high, the increased commercialisation of the industry has meant that multiple governments globally have also increased their support for the growth of sovereign commercial space capability including both the launch and operations of satellites.

Australia aims to capitalise on global growth and establish sovereign capability

In 2020, activity in Australia's space industry was estimated to reach $5.7 billion in revenue, up from $1.4 billion in 2009/10, revenue supported approximately 15,000 people in space related jobs across the country.[9]

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8 Space economy - global breakdown by sector 2020 | Statista, the-economic-contribution-of-australias-space-sector-in-2018-19.pdf (industry.gov.au)

9 Market study: *Australian space sector,* April 2021, Australian Communications and Media Authority

The Australian government's ambition is for Australia to become a prominent participant in the global space economy. By 2030, the Government aims to increase industry revenue to $12 billion and grow employment by 20,000 workers.[10]

To achieve growth the Government understands it has a role in supporting the industry. The Government's key growth objectives have been outlined in *'The Australian Civil Space Strategy'*:

- build international partnerships and contribute to global space value chains
- establish and grow local space capability across the value chain, focusing on Australia's competitive advantages
- implement an appropriately robust regulatory framework that meets international obligations, ensures safety, and promotes a business-friendly environment
- train and nurture a globally competitive workforce across industry, research and education, government, and community.[11]

As a central element of the space value chain the capability to launch is a significant enabler for the growth of the Australian space industry into international markets. Industry stakeholders have commented that the launch industry attracts and enables investment in and development of satellite manufacturing, satellite mission control and other space related downstream activities. This is due to modern satellite companies wanting to reduce their supply chain lengths and position their manufacturing hubs close to launch infrastructure, reducing overall logistics costs and transportation timelines.[12]

The international nature of the space industry means activity across the supply chain such as the design of the satellite application, manufacturing of satellites and launch vehicles, the launch site, and mission control can all occur across multiple countries, increasing the complexity and cost for the industry. As the competitive nature of the market increases, businesses will aim to reduce costs such as logistics costs, which in some cases can be as much as $50 million to transport a large satellite.

Australia has a competitive advantage by being able to facilitate a large array of launch orbits, including equatorial and polar. If Australia can launch both small and large launch vehicles to low earth orbits (LEO) or geostationary orbits (GEO), this will support both domestic satellite manufacturers to be more competitive and lead to the relocation of international companies servicing both the domestic and international satellite market.

The construction of a spaceport at Weipa which will launch large payloads will complement activity occurring in South Australia and the Northern Territory, making Australia a competitive and comprehensive provider of launch services. Additionally, it will support the Australian Civil Space Strategy by:

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[10] Australian Civil Space Strategy 2019-2028, April 2019, Department of Industry, Science, Energy and Resources

[11] Australian Civil Space Strategy 2019-2028, April 2019, Department of Industry, Science, Energy and Resources

[12] The Now Frontier: Developing Australia's Space Industry, November 2021, Parliament of the Commonwealth of Australia

- Helping to foster international partnerships and contribute to the global space value chain by offering competitive equatorial launches, easily accessible to South Asian countries and worldwide.
- Helping to facilitate the growth of local space capabilities, not just in launch capacity, but across the supply chain by providing direct access to GEO orbits for Australian Satellites.

The Australian government is supporting growth of the Australian space industry

The Australian government sees its role in supporting the Australian space industry as an enabler and customer. It aims to provide support for the sector so that the industry can demonstrate the space capabilities needed to enter competitive global commercial supply chains and become self-sustaining.

The development of the Civil Space Strategy 2019-2028 and Defence Strategy 2020 has led to the government investment of more than $700 million in the civil space sector since 2018 and a commitment of $7 billion over the next decade to develop space capabilities and realise its defence capability goals.

The defence funding is proposed to be used to improve Australia's satellite communications, positioning, navigation, and timing data, as well as help grow Australian industry expertise, and Australia's space domain awareness capabilities. This investment includes the development and deployment of potentially three large defence satellite which could be ready for launch to Geostationary Earth Orbit (GEO) by 2028.[13] The strategy aims to create opportunities for civil sector companies to participate in defence activities such as establishing communications satellites and ground control stations.

The government is also supporting the industry by adjusting regulations, to ensure they meet technology advances and don't inhibit innovation, and by negotiating agreements with other countries. One such agreement is the bilateral Technology Safeguards Agreement which will set out principles under which US companies can collaborate with Australian firms on local launch projects. Australia and US plan to further strengthen space cooperation.[14]

Another agreement is the UK Australia Space Bridge Framework Arrangement which enhances cooperation across both countries to grow each space industry. The UK aims to capture 10 per cent of the global space industry by 2030, up from six per cent in 2010.[15] The expansion has included the development of small launch vehicle sites, increased

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13 Canberra looks to build Australian military satellite communication constellation, July 2020, Australian Defence Magazine, accessed Canberra looks to build Australian military satellite communication constellation - Australian Defence Magazine

14 Media release: '*New measures to help grow Australia's civil space sector*', July 2021, The Hon Christian Porter MP

15 Future of the UK Space Industry, February 2021, E Rough, E Kirk-Wade, A Adcock, C Housley

manufacturing capability and satellite application development. The UK's expansion can provide Australia with a significant opportunity to complement, support and collaborate with the UK space industry. The UK currently primarily uses the Soyuz rocket launched from French Guiana to launch its large satellites, a large launch facility in Australia could result in UK government and UK firms instead choosing to launch from Australia.

The number of Australian space sector businesses is growing

The Australian civil space sector is growing with the establishment of new companies helping to develop Australia's sovereign space capability. Since 2017 there has been an increase in companies active in the space sector from 432 to 558 in 2020, representing a 9 per cent annual growth rate.[16] Approximately 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 providence of foreign owned space firms in Australia.[17]

Recent Australian start-ups are becoming increasingly competitive internationally. Key stand outs include application start-up Myriota who are considered a world leader in secure, low cost and long-life battery satellite connectivity for the IoT and Fleet Space, who plan to launch 100 satellites, are a world leader in low-power satellites. Each has had successful series A and B funding rounds as they plan to expand into international markets. Additionally, Australia's Gilmore Technologies, Southern Launch and Equatorial Launch Australia are helping to create sovereign launch capability in Australia.

The establishment of a launch industry in Australia could act as a catalyst to grow the Australian satellite manufacturing industry. Currently, Australian firms have been reliant on overseas manufacturers for the construction of satellites. However, Fleet Space and Skykraft both intend to manufacture their next satellites here in Australia, these will then need to ship overseas for launch. Myriota's satellites are currently manufactured by Californian group Tyvak Nano-Satellites Systems.

The global launch services market will need to grow to meet demand

Space launch services comprises of a series of activities, including integration of payloads to rocket, launch infrastructure and launch assembly. In 2019 global space launch services were valued at $US 10 billion this is projected to reach $US 27-32 billion by 2027 as the number of payloads launched each year increases.[18]

Historically, launch costs have been the largest barrier to entry for the civil space industry. The reduction in launch cost, due to innovation in re-usable rockets has catalysed a boom in payloads being launched. The expansion in payloads has led to

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16 Market study: *Australian space sector,* April 2021, Australian Communications and Media Authority

17 The economic contribution of Australia's space sector in 2018-19, February 2021, AlphaBeta

18 Space Launch Services Market Size & Share Global Report 2020-2027, November 2020, Fortune Business Insights, accessed: fortunebusinessinsights.com

comments from industry indicating there is now a bottleneck from lack of availability of rockets.[19] In 2020, Australian firm Fleet Space had to wait 10 months before being able to launch their satellite, this has flow on impacts to business development as testing can't yet occur.

To meet the growing demand for launch services, there has been an increase in the development and manufacturing of rockets, particularly rockets focussed on smaller payloads, many of which are proposed to begin operations in 2022.[20] A growth of new rockets could shift the supply chain bottleneck towards launch infrastructure. The demand for new spaceports has been recognised by multiple countries leading to new spaceports being constructed in several countries, particularly the UK, US, Russia and China. Most new spaceports focus on launching smaller payloads into low earth orbit, except for SpaceX's launch site in Texas, which will launch heavy payloads.

Presently, Australia has a window to attract international investment to build secure, flexible, responsive, and high cadence launch capability to serve the growing global market. Building capability to serve this global demand now could prove to be far more effective than attempting to displace other suppliers in the future once costs are sunk.

Growth in payloads is primarily in LEO orbits

As of 1st September 2021, 1,483 satellites had been launched into orbit for the year. This is an increase of 340% compared to all satellites launched in 2019 and 1,150% compared to 2011.[21] Currently it is estimated that by 2029 an additional 24,700 satellites could be launched, primarily driven by mass constellations.[22] Figure 2.2 demonstrates the significant increase in satellite launches in the past 4 years.

The exponential increase in satellites has been supported by two key factors. First, an increase in the number of launches supported by the establishment of new spaceports in China and New Zealand and increased cadence of launches at current spaceports in the US and China. Second, the increase in LEO payloads launched has reduced the capacity to launch new heavy payloads to GEO. Table 2.4 demonstrates the shift to LEO payloads.

Although the number of payloads launched each year has increased significantly, the total mass launched has only increased marginally in comparison (chart 2.2). Between 2017 and 2020 there was an increase in mass launched from approximately 336 tonnes to 441 tonnes, a 21% increase.

The capacity and volume of launches will need to increase to maintain the current stock of operational satellites let alone increase it. LEO orbit satellites have an expected

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19 South Australia startup takes the Internet of Things out of this world, February 2019, N Carengurgh, accessed: https://createdigital.org.au/south-australian-startup-internet-of-things-world/

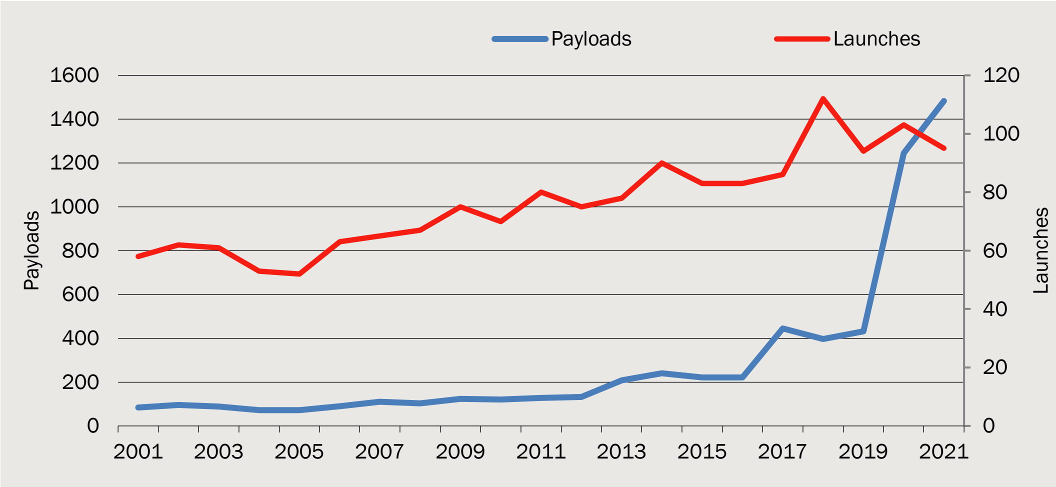
20 Small Launchers in a Pandemic World – 2021 Edition of the Annual Industry Survey, 2021, C Niederstrasser.

21 Launch data, 2021, Space-Track.Org, accessed on 1st November 2021

22 Global Satellite Manufacturing and Launch Markets, 11th Edition (2021), North Sky Research

lifespan of 5 years, meaning the newly launched volume of LEO satellites will need to be replaced within 5 years. As new LEO satellites reduced the number of GEO satellite launches, an increase in GEO launches back to normal levels to replace current GEO satellites will require additional launch capacity globally.

2.2 Global launches 2001-2011



Data source: Space-track.org

2.3 Payloads launched

Orbit type	2016	2017	2018	2019	2020	2021*
Elliptical	1	2	2	8	3	1
GEO	37	37	32	28	20	12
LEO	64	208	268	262	1,156	1,322
MEO	9	7	27	14	5	1
Total (still in operation)	**111**	**254**	**329**	**312**	**1,184**	**1,336**
Total (payload launched)	**221**	**445**	**397**	**432**	**1,245**	**1,483**

Note: 2021 data up until 1st September 2021

Source: Satellite database, September 2021, Union of Concerned Scientists, accessed https://www.ucsusa.org/resources/satellite-database

Launch competition is growing

In 2020 there were 20 separate active spaceports, across 10 countries (table 2.4). The increased demand for launch services has created opportunities for investment into new launch facilities. As a result, several countries have invested in the construction of new spaceports, particularly across Europe and the USA. New space ports are in Norway, England, Japan, America, Argentina and Australia. Most spaceports under development focus on small rocket launches into polar or sun synchronous orbits, except for SpaceX's launch site in Texas, which will provide facilities for heavy launch vehicles.

2.4 Spaceport orbital launches in 2020

Spaceport	Launches	Country
Cape Canaveral / Kennedy	30	USA
MARS	3	USA
Kodiak	2	USA
Vandenberg	1	USA
Mojave Air and Space Port	1	USA
Xichang	13	China
Jiuquan	13	China
Taiyuan	7	China
Wenchang	5	China
De Bo 3 Launch platform	1	China
Baikonur	7	Kazakhstan
Plesetsk	7	Russia
Vostochny	1	Russia
Kourou	7	French Guiana
Mahia	7	New Zealand
Tanegashima	4	Japan
Satish Dhawan	2	India
Shahrud Missile Test Site	1	Iran
Semnan	1	Iran
Palmachim Airbase	1	Israel
Total	**114**	

Source: Spaceflight 2020, November 2021, Wikipedia, accessed: https://en.wikipedia.org/wiki/2020_in_spaceflight

Proposed space ports

In response to growing demand for launch capability, there have been four spaceports proposed in Australia.

- Southern Launch in South Australia is being developed as a dedicated small to medium payload rocket launch facility, that can cater primarily to polar and sun-synchronous orbits.
- Equatorial Launch Australia in the Northern Territory is being developed as a small to medium rocket launch facility, that will primarily cater to geosynchronous orbits.
- Abbot Point launch site in Queensland was recently approved as a small rocket launch facility, where Gilmore Space Technologies, who are still pending approval, plan to launch an Australian built rocket to low earth orbit.
- Space Centre Australia in North Queensland proposed to be the first large rocket launch facility in Australia.

3 Space Centre Australia and its potential market

Space Centre Australia is a large program intended to provide a multi-use facility for the development, research, manufacturing, launch and return of vehicles into space. It would be Australia's first large scale multi-use spaceport and would support the advancement of both the Australian and international space sector. Located in Northern Queensland, the proposed site is strategically located to capitalise on the benefit provided to equatorial launches, while also having access to significant infrastructure and amenity.

Launch capability

Space Centre Australia (SCA) would provide a competitive location for both domestic and international launch vehicles to operate, increasing the access to space in a currently constrained market. The proposed design includes four mount and launch platforms (2 small, 1 medium and 1 large) that will be able to cater to a range of different launch vehicles. At full operation the location could achieve a launch cadence of:

- 1 small rocket launch per week
- 1 medium rocket launch per month
- 1 large rocket launch per quarter

SCA could utilise relationships with the Australian Defence Force to increase the capability of the site by confirming access to RAAF Base Scherger, which would provide facilities to accommodate large transport aircraft to deliver key sensitive rocket and satellite components. In the longer-term RAAF Scherger could act as a logistics location for launch activities.

The spaceport will be able to cater to a range of different orbits including, Low Earth Orbit (LEO), Medium Earth Orbit (MEO), and Geosynchronous Orbit (GEO). SCA will not look to provide polar or sun-synchronous LEO launches, instead SCA will look to collaborate with Southern Launch, so that customers have the potential to utilise Australia as a single launch location.

Space Port Australia facilities

SCA will look to attract domestic small launch vehicles as well as large scale domestic and international launch vehicles by providing high quality launch facilities that can be used as end-to-end for space missions or for systems that are suitably equipped to allow safe and secure hand-off operations to another location following launch. The facilities that SCA plan to provide include:

- Launch Mount and Platforms

- Rocket Servicing Structure
- Launch and Mission Control Centre
- Rocket Assembly Facility
- Payload Processing Facility
- Test and Integration Facility
- Environmental Surveillance Systems
- Tracking and Surveillance
- Communications Complex
- Broadband Satellite Communications Station
- Sensitive Handling Facilities
- Storage Facilities

Competitive advantage

The proposed location for SCA's launch facility near Weipa provides an attractive location for customers. Firstly, it is located at 12 degrees south of the equator, providing launch vehicles with additional velocity at launch, reducing the cost of fuel to get payloads into GEO orbits. Secondly, the current infrastructure that has been established by mining operations near Weipa can be utilised by space vehicle manufacturers, including road access, airport, deep water seaport, utilities, and communication systems. Thirdly, the amenity of the local region has been significantly developed, the township of Weipa has significant access to accommodation, shopping facilities, health care and recreation facilities.

Furthermore, Australia is an attractive location for international customers to launch from. As a first world location Australia is geopolitically stable and has defined as well as reliable logistic options, alleviating the risk that could be associated with other equatorial launch locations. The development of Australia's Space Sector has helped to increase the domestic capability and establish a secure and reliable supply chain that can be utilised by domestic and international customers.

Employment and education opportunities

The Space Port will require approximately 290 staff across a range of functions such as assembly, maintenance, and administration in Northern Australia, with 260 of those roles located in Weipa. Roles will be a combination of highly skilled and technical labour, providing the opportunity to increase employment and capability across Australia in the space industry as well as for the local Weipa and Napranum communities.

Space Centre Australia's 260 staff will be permanently located in Weipa, contributing to the community, and increasing employment in Northern Australia. Staff will be predominantly within the local region. To enhance the capability of the local work force in preparation for the establishment of the space sector in the region, SCA will work with local communities and the State Government to help facilitate educational programs, increasing the ability of local indigenous communities to participate in the work force. In addition, SCA will provide training packages to support the local workforce's transition from the mining industry into the space sector.

Estimating the Total Addressable Market (TAM)

Conducting a market analysis of the space launch sector, demonstrates that there is an opportunity for Space Centre Australia to capture part of the global space launch market. The Total Addressable Market is estimated to be between $AUD 354-610 million per year.

This analysis provides an overview of the market for commercial and institutional satellites, helping to identify the Total Addressable Market for Space Centre Australia.

The following methodology was used:

- Assessment of the current size of satellite launch market:
  - satellite databases were combined with online launch records to analyse the trends in satellite launches by orbit type and mass.
- Forecasting future payload launches:
  - a combination of literature, planned constellations, current trends and operational lifetime of current satellites was used to estimate a forecast launch profile by orbit type and mass.
- Estimation of Total Addressable Market:
  - filters were applied to the forecast estimated to understand the Total Addressable Market for Space Centre Australia.

Current size of the satellite launch market

Since 2016 the historical trend of payloads launched has been significantly disrupted, increasing exponentially year on year. The assessment of the current stock of satellites, historical payload mass and average life of a satellite forms a baseline of launch activity, used to project the TAM for Space Centre Australia.

The growth in satellites has been driven by the development of small- and large-scale constellations, such as Starlink, OneWeb, Fleet Space and many others. These companies provide services to the demand of businesses and individuals across the globe for satellite applications. As demonstrated in table 3.1, these new satellites are primarily launched to a non-polar orbit, an orbit which Space Centre Australia could service. Expansion has created opportunity for small and large rockets manufacturers to meet demand, however these rockets are limited by the number of spaceports.

Since 2018 the expansion of Low Earth Orbit (LEO) payloads launched has been enabled by a decrease in the number of satellites, and launches, to Geosynchronous Earth Orbit (GEO, tables 3.1 and 3.2). A reason for this shift is partially a change in preference from longer lasting, larger GEO satellites to smaller, regularly updated and replaced LEO satellites, as well as the high volume of LEO payloads driving significant demand. However, due to the strategic importance of GEO orbits, it is expected that governments and commercial businesses alike will replace the current stock of operational satellites, meaning that GEO orbit launches will return to levels prior to 2018.

In this analysis a high growth scenario will be explored assuming that GEO orbit launches increase, driven by countries' desire to have sovereign satellites capability, particularly in defence. Currently the Australian government is planning to build up to three defence satellites that would be launched to GEO from 2028.

To support the growing LEO launch market and maintenance (or potential expansion) of GEO launches, the annual launch capacity of the space launch industry will need to increase significantly, with both additional rockets and spaceports.

3.1 Satellites launched and still in orbit 2014-2020

Orbit type	2014	2015	2016	2017	2018	2019	2020
GEO	33	38	37	37	32	27	20
LEO: Non-Polar Inclined	12	24	15	37	28	126	864
LEO: Sun-Synchronous	48	37	47	128	188	111	178
LEO: Equatorial	0	12	0	3	0	0	0
LEO: Polar	7	7	2	40	52	24	114
LEO: Elliptical	0	3	0	0	0	1	0
Other	18	16	10	9	29	22	8
Total (still in orbit)	**118**	**137**	**111**	**254**	**329**	**311**	**1,184**

Note: 'Other' includes Medium earth, High Earth, Heliocentric, planetary transfer, lunar transfer, trans atmospheric orbits
Source: Satellite Database | Union of Concerned Scientists (ucsusa.org)

3.2 Launches to orbit type

Orbit type	2014	2015	2016	2017	2018	2019	2020
LEO	49	45	43	52	67	66	82
GEO	28	32	32	33	27	24	19
Other	15	10	10	6	20	12	13
Total	**92**	**87**	**85**	**91**	**114**	**102**	**114**

Note: 'Other' includes Medium earth, High Earth, Heliocentric, planetary transfer, lunar transfer, trans atmospheric
Source: Satellite Database | Union of Concerned Scientists (ucsusa.org)

Payload launch mass

To assess the current launch market, the mass of satellites still in orbit and the mass of payloads no longer in orbit was assessed. Due to limited data of payloads no longer in orbit only 2017 and 2020 were assessed in detail. The two years were chosen as a majority of LEO satellites would not have come to the end of their operational life therefore not required to be replaced.

A payload no longer in orbit is typically a result of three actions; the satellite reached the end of its operational life and was decommissioned, either returning to earth or remaining as space junk; the launch was a failure; or the payload included crewed flights or deliveries of equipment and supplied to the International Space Station (ISS) or

Tiangong Space Station. Table 3.3 show the difference in number of total payloads launched in a year and the number of still operational satellites. Payload mass no longer in orbit in 2017 and 2020 was primarily from missions to the ISS or Tiangong Space Station, except for a few large satellites that orbited for under a year. Small satellites no longer in orbit, on average weigh less than 10kg and did not significantly impact total mass launched.

To estimate the total mass launched each year, the mass of satellites still in orbit (and launched in that year) and the mass of payloads launched in that year (satellites or supplies to the ISS) need to be summed (table 3.4). The mass of satellites that are still in orbit that were launched in 2017 is approximately 242,000kg, the mass of payload launched that is no longer in orbit was approximately 95,000kg of payload, taking the total mass launched to approximately 337,000kg. Comparatively, the mass of satellites still in orbit but launched in 2020 was 306,000kg, in the same year there was approximately 135,000kg of payload launched that is longer in orbit, taking the total mass launched in 2020 to 441,000kg. The increase in payload mass no longer in orbit between the two years is primarily due to test flights performed by China in preparation for the Tiangong Space Station.

Between 2017 and 2020 there was an increase in global launch capacity of 31.4%, significantly smaller than the 280% increase in payloads. Over this same period there was a reduction in the mass launched to GEO of 155,800kg down to 52,800kg, new capacity in the launch market is therefore needed to allow GEO payloads to continue to launch, without reducing the increased launch capacity to LEO.

3.3 Payload launched 2014-2020

	2014	2015	2016	2017	2018	2019	2020
Payload still in orbit	118	137	111	254	329	311	1,184
Total payloads	240	221	221	445	397	432	1,245
Difference	122	84	110	191	68	121	61

Note: 2021 is an estimate only, Other includes medium earth, and elliptical orbits

Source: Space-track.org and Satellite Database | Union of Concerned Scientists (ucsusa.org)

3.4 Estimated total mass of payload launched

	Mass (2017)	Mass (2020)
Geosynchronous Orbit	155,800	52,800
Low Earth Orbit	72,900	242,800
Other	13,900	10,900
Mass of payload no longer in orbit	~95,300	~135,300
Total	**~336,100**	**~441,800**

Note: Mass of payload not in orbit was estimated for 2020 and 2017 using wiki spaceflight 2020, this includes failed launches

Source: Space-track.org and Satellite Database | Union of Concerned Scientists (ucsusa.org)

Satellite operational life and launch cost

A key driver of future requirements for launch capacity is the operational life of a satellite. The expected operational life of a LEO satellite launched in 2021 was 5 years compared to a GEO satellite which was 14 years (table 3.5).

The lower expected life of LEO satellites is due to three factors.

- First it allows operators to upgrade technology regularly;
- Second LEO satellites are less robust and may be damaged by debris in lower orbits, and
- Third lower satellites have higher drag pulling them back to earth. As a result, LEO satellites are typically smaller and cheaper to launch (table 3.6 and table 3.7).

The cost to launch a LEO satellite varies by provider, SpaceX has increased competition in the industry and boasts a launch cost of $AUD 3,300/kg to LEO, leading to the company capturing 25% of the launch market in 2021. In comparison Ariane currently charge $AUD 14,500 /kg to launch to LEO, Ariane 6 will reduce this to ~$AUD 8,300 (table 3.7). In 2020 the value of LEO launches was between $AUD 1.7 billion – $AUD 5.4 billion, the large range is due to significant variance in launch cost.

The higher operational life of GEO satellites is due to two key factors; first it is more expensive to launch to high orbits meaning a longer operational life is required; second once in orbit the satellite will take longer for its orbit to decay meaning it can stay in orbit for longer. The cost to launch a GEO satellite ranges between $AUD 7,800 – $AUD 41,700 depending on rocket manufacturer (table 3.7). Ariane 6 will increase competition in the market, with a proposed launch cost to GEO of $AUD 15,700. In 2020 the value of launch to GEO was between $AUD 0.4 billion – $AUD 2.2 billion, the large range is due to significant variance in launch cost.

Separate to the cost associated with the launch vehicle, the space port will collect a launch fee and launch service fee, which varies by the size of launch. It is assumed in this market assessment that the fee received by a space port for the launch of a large vehicle would be $AUD 15 million on average, however, this cost could be as large as $AUD 150m depending on the payload launched. Estimation of the Total Addressable Market for the space port uses the assumption of $AUD 15 million per large launch (table 3.8).

A special note must be made on the variance in launch costs of the vehicle, satellite bus and space port, due to the bespoke nature of each launch, particularly those involving large satellites. Prices may exceed those advertised in the public domain, depending on the special requirements of each satellite. Additional costs are particularly prevalent in transportation, testing, assembly, and configuration of each satellite.

In the market assessment, once a satellite reaches the end of its expected operational life it is assumed the operator of the satellite will replace it to maintain capability or service. As such it is expected that the number of payloads to LEO will increase, while the number of payloads to GEO will return to the same level as 2017.

3.5 Expected operational life by orbit type

Orbit type	Average Operational Life
GEO	14 years
LEO	5 years
Other	7-9 Years

Note: Average expected operational life for satellites launched in 2020

Source: Satellite Database | Union of Concerned Scientists (ucsusa.org)

3.6 Average mass of satellite

Orbit	Average Mass (KG)
Geosynchronous Orbit	3,720
Low Earth Orbit	240
Other	1010
Average	380

Note: Past 5 years

Source: Satellite Database | Union of Concerned Scientists (ucsusa.org)

3.7 Cost to launch to orbit (2020)

Orbit	Cost ($AUD / KG)	Note
Geosynchronous Orbit	7,840 – 41,720	Cost of SpaceX Heavy Falcon and Ariane 5
Low Earth Orbit	3,290 – 14,490	Cost of SpaceX Heavy Falcon and Ariane 5
Other	5,600 –28,000	Middle of LEO and GEO

Note: Ariane 6 will reduce the average cost once launched in 2022

Source: Wikipedia Falcon Heavy, Wikipedia Ariane 6, Wikipedia Heavy space flight

3.8 Space port total fee for launch ($AUD million)

Orbit	Value
Small rocket	0.75 – 1.0
Medium rocket	5.0 – 7.0
Large rocker	15.0 – 150.0

Source: CIE

3.9 Value of launch activity in 2020 ($AUD million)

Orbit	Value
Geosynchronous Orbit	414 – 2,202
Low Earth Orbit	1,243 – 5,478
Other	61 – 305
Total	**1,719 – 7,987**

Source: CIE

Forecast growth in satellites

The forecast number of payloads to be launched by the end of the decade has varied significantly over the past three years, as growth in satellites continues to exceed expectation. For example, in 2019 it was forecast that 1,000 payloads would be launched per year by the end of the decade, this was surpassed in 2020.[23] A 2021 estimate from Northern Sky Research, forecast 24,700 payloads will be launched across the decade.[24] However, given the Federal Communications Commission (FCC) has approved SpaceX to increase the number of Starlink satellites from 12,000 to 42,000, it is likely that even this may be exceeded.

The introduction of new heavy lift rockets, Starship and Ariane 6 between 2022-2024 and opening of SpaceX's large new launch facility at Boca Chica will significantly increase the launch capacity of the industry over the next 3 years. Even so, future growth will be dependent on the development of new rockets and opening of additional spaceports.

To forecast the number of payloads, this analysis considers two scenarios.

Scenario one (low):

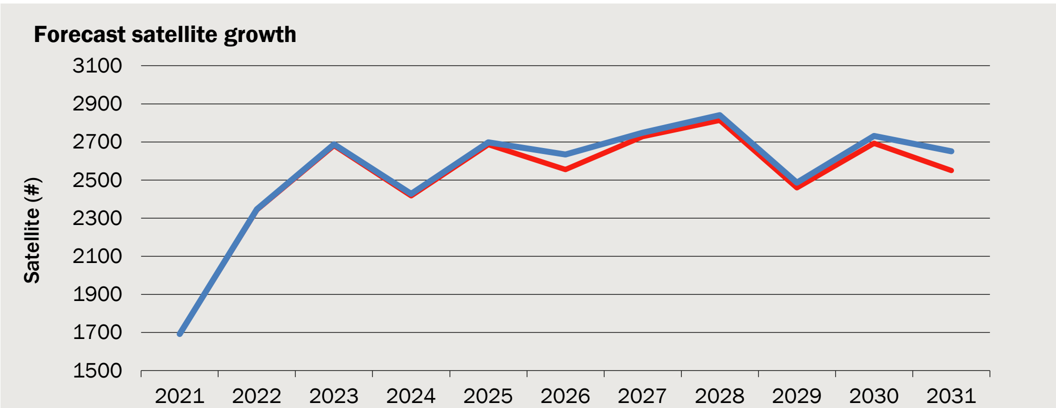
- LEO satellites continue rapid growth over the next three years, at which point the rate of growth decreases and transitions to maintenance of stock of satellites.
- GEO and other satellites do not increase, only maintenance of current operations.

Scenario two (high)

- LEO satellites continue rapid growth over the next three years, at which point the rate of growth decreases and transitions to maintenance of stock of satellites.
- GEO grow at the same average rate as the previous 15 years.

The two scenarios do not lead to a significant change in the number of satellites launched per year, they do however diverge on the mass of satellites launched (charts 3.10 and 3.11).

3.10 Forecast number of satellites (Low vs High scenario)

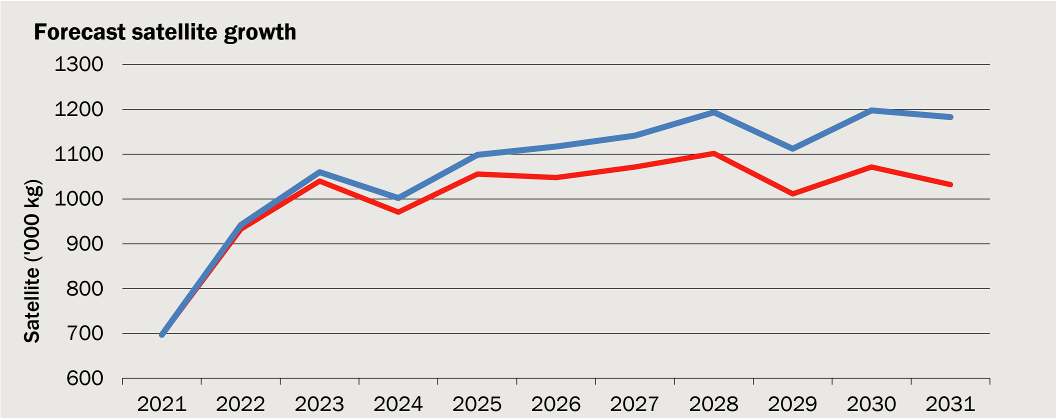


23 Australia Space Launch Assessment, September 2019, Euroconsult for Australia

24 NSR report: 24,700 satellites to be ordered and launched by 2030, June 2021, accessed here: NSR Report: 24,700 Satellites to be Ordered and Launched by 2030 - NSR

Data source: CIE forecast

3.11 Forecast satellite mass (Low vs High scenario)



Data source: CIE forecast

Space Centre Australia TAM

Space Centre Australia's TAM is driven by two categories of payload launch.

- First, net new payloads to the market that are yet to have a launch location, these are payloads that are currently being designed, or are likely to be designed over the next decade, for example it includes Australia's three large defence satellites that may be launched from 2028.
- Second, the market includes current satellite production or replacement satellites that could be relocated from elsewhere to launch from Australia, this could include large British government satellites which have typically been launched by Soyuz rockets in French Guiana.

Given this, the TAM is estimated from global projections using the following procedure:

1. remove all satellites in orbits not serviced by Space Centre Australia
2. remove other government / military satellites from countries with local launch capacity (US, EU, Japan, India, Russia, China)
3. (*Optional)* remove satellites associated with Starlink.

Remove orbits not serviced by Space Centre Australia

Space Centre Australia does not intend to launch payloads to polar or sun synchronous orbits, the estimated number of satellites launched to this orbit type is show in table 3.12. These launches can still be undertaken in Australia by Southern Launch in South Australia, providing the Australian launch market with the ability to service all launch orbits.

3.12 Projected Polar and sun-synchronous orbits

Orbit	2028	2022-2031
Sun synchronous	608	5,041
Polar	380	3,336

Source: CIE

Remove other government/military satellites from countries with launch local capacity

Government and military satellites may contain sensitive information, should a country have local launch capacity it is likely the government would preference launching military and government satellites from state owned launch facilities. As such this type of satellite has not been included in the TAM.

Countries with launch capacity include:

- USA
- Russia
- China
- India
- Japan
- New Zealand
- Kazakhstan
- French Guiana

Although the European Space Agency has a launch site in French Guiana, European government satellites have not been excluded due to the launch location not being located within Europe. Additionally, there is potential for international launch providers to use facilities in Australia, which may increase the desire of international organisations to launch government or military satellites from Australia. Geopolitical stability and simplified logistic costs could encourage nations to utilise Australian launch facilities over those in other locations.

Furthermore, there is a chance that due to space cooperation with the United States, there may be opportunity to launch US government satellites from Australia, however as the US has significant launch capacity, these satellite types have been excluded.

The total number of government and / or military satellites that have been removed from the TAM estimate are highlighted in table 3.13.

3.13 Government and/or military satellites (countries with launch capacity)

Orbit	2028	2022-2031
GEO	6-14	73-118
LEO (non-polar)	2	64
Other	1	14

Source: CIE

(Optional) Remove Starlink satellites

Starlink satellites have been removed due to SpaceX owning, operating and manufacturing a heavy lift rocket, as well as having a dedicated launch site at Boca Chica and access to other sites across the United States (table 3.14). However, should SpaceX decide to expand their Starlink constellation to 42,000 satellites up from the initially proposed 12,000, representatives from SpaceX have anecdotally mentioned the company may need to add a new launch site, Australia could be considered.

3.14 Starlink LEO non polar satellites

Orbit	2028	2022-2031
LEO (non-polar)	1,037	9,024

Source: CIE

Total addressable market

The total addressable market (TAM) estimates the size of the global launch market that SCA will be able to compete for, i.e., SCA will be able to capture up to 100% of this market depending on approach to market and launch capacity in Weipa.

The TAM for Space Centre Australia is between $354-$610 million in 2028 or $3.5 – $5.7 billion across the decade 2022-2031. Due to the nature of bespoke launches (such as the James Webb Telescope), the TAM could be significantly higher. Should three large satellites per year require bespoke launch facilities, each paying up to $150 million in launch fees, the total addressable market could increase to nearly $1 billion per year.

The satellites considered as part of the TAM include those that are net new satellites, as well as the replacement of satellites currently in orbit primarily from countries that do not currently have satellite capability.

Tables 3.15 and 3.16 show a summary of the projected satellite launches and the associated mass, which cover scenarios with and without Starlink. The low scenario assumes:

- GEO payload launches return to pre-2017 levels, followed by no further growth.
- Increasing growth of LEO payloads in 2022 and 2023, approaching an asymptote across the decade.

The high scenario assumes:

- GEO payload launches return to pre-2017 levels, followed by steady growth, at the same rate as over decade 2007-2017.
- Increasing growth of LEO payloads in 2022 and 2023, approaching an asymptote across the decade.

This data has been taken into table 3.17 and 3.18 and converted into project revenue using the assumption that each large launch could return at least $15 million in revenue for a space port.

3.15 Projected satellites launched (2028)

Scenario		Low Scenario		High Scenario
Include / exclude Starlink	Inclusive	Exclusive	Inclusive	Exclusive
GEO	27	27	45	45
LEO	1,775	738	1,775	738
Other	14	14	14	14
Total	**1,817**	**779**	**1,835**	**797**

Source: CIE

3.16 Projected satellite launch mass (2028) ('000 kg)

Scenario		Low Scenario		High Scenario
Include / exclude Starlink	Inclusive	Exclusive	Inclusive	Exclusive
GEO	101	101	167	167
LEO	560	312	560	312
Other	14	14	14	14
Total	**676**	**427**	**742**	**494**

Source: CIE

3.17 Addressable Market by 2028 ($AU 2021)

Scenario		Low Scenario		High Scenario
Include / exclude Starlink	Inclusive	Exclusive	Inclusive	Exclusive
Total satellites launched	1,817	779	1,835	720
Total mass of satellites launched ('000 kg)	676	427	740	432
Estimated size of launch market ($AU 2021, undiscounted)	6.4 billion	4.3 billion	7.4 billion	5.3 billion
Spaceport potential revenue ($AU 2021, undiscounted)	526 million	354 million	610 million	442 million

Source: CIE

3.18 Addressable Market by 2022-2032 ($AU 2021)

Scenario		Low Scenario		High Scenario
Include / exclude Starlink	Inclusive	Exclusive	Inclusive	Exclusive
Total satellites launched	17,400	8,357	17,538	8,496
Total mass of satellites launched ('000 kg)	6,475	4,307	6,969	4,823
Estimated size of launch market ($AU 2021, undiscounted)	60.8 billion	42.8 billion	68.5 billion	50.9 billion

Spaceport potential revenue ($AU 2021, undiscounted)	5.0 billion	3.5 billion	5.7 billion	4.2 billion

Source: CIE

Total addressable Australian market for large launches

An Australian large launch facility may be able to capture large payload launches from countries that don't currently have large launch capability within the country. Multiple countries governments, military, and businesses, choose to launch large satellites into both LEO and GEO orbits. These types of launches can only be addressed from several launch locations globally, as described earlier.

The total number of countries that operate large satellites and do not have a large launch facility is approximately 24, over the past decade these countries have launched around 80 large satellites, primarily to GEO, weighing a combined total of 308,000kg.[25] These countries are dependent on launching from a select number of large launch facilities, using both a foreign launch location and launch vehicle. The value of these launches is estimated to be at least $5.5 billion across the past decade. The largest contributor was the United Kingdom, which over the decade sent 24 large satellites into orbit, launching from French Guiana, Baikonur, and Cape Canaveral.

3.19 Location of large launches 2012-2021 for countries without launch capability

Launch location	Launch vehicle	Number of large payloads	Mass of launches (Kg)	Estimated launch revenue ($AUD, Million)	Estimated Space port revenue ($AUD, Million)
Baikonur Cosmodrome (Kazakhstan)	▪ Proton	17	4,700 88,000	1,221	255
Cape Canaveral (USA)	▪ Atlas 5 ▪ Falcon 9 / heavy	1 25	5,300 118,000	157 1,162	390
Guiana Space Center (French Guiana)	▪ Ariane 5 ▪ Soyuz	9 22	39,500 16,600	1,735 573	465
Sea Launch Odyssey	▪ Zenit	2	11,000	229	30
Tanegashima Space Center (Japan)	▪ H2A	1	4,900	103	15
Xichang Satellite Launch Center (China)	▪ Long March	4	19,000	343	60

Source: Satellite Database | Union of Concerned Scientists (ucsusa.org)

25 Some satellites are launched as multinational launches, making it difficult to determine the exact number of counties. Analysis only includes satellites still in operations with publicly available data.

Over the next decade countries will continue to be reliant on foreign launch facilities. This provides Space Centre Australia with significant opportunity as current launch facilities reach capacity through the launch of small payloads into LEO orbits, particularly in the United States of America and China.

If SCA can provide a competitive and attractive launch location, partnering with a large international launch vehicle provider, could lead to the facility capturing a portion of the international market, which could be equivalent to $AUD 2.5 billion in launch revenue across the decade, and $AUD 645 million space port revenue. Furthermore, demonstration of a successful Australian satellite launch from SCA can potentially lead to an increase in both defence and commercial market sovereign satellite launches from SCA.

For example, from 2028 Australia plans to launch three large defence satellites into a GEO orbit to increase Australian sovereign satellite capability. These satellites could have a launch mass of over 3,000kgs which would cost between $AUD 60-100 million to launch and generating $AUD 45 million in space port revenue.

4 Potential economic impact

Spaceports and the space value chain

The historian Ferdinand Braudel once noted that *'transport is the necessary finishing process of production'*. Goods are not complete until they are in the hands of their ultimate users and have no value until they can get there. Transport infrastructure in general has become an essential component of the modern economy.

In a similar sense, satellites are not complete until they are in space — the process of researching, designing and building them is not really finished until they are launched. Further, the services they will provide — to consumers, corporations and governments — cannot take place until the satellite is orbiting.

Launch, and ancillary services, are thus a pivotal step in the space value chain — a crucial component of the full ecosystem that makes up the space economy. A space sport is an essential piece of infrastructure that allows this 'transport' to take place.

Economic value of infrastructure

In general, the economic value of infrastructure, including in transport, is the increment to total economic value that the infrastructure allows — this includes, for example, the incremental value to final consumers of new production. For example, a new road is valuable to the extent that is lowers total transport costs for users and induces additional valuable activities.

In the case of space, the analogy is that by lowering the total costs of launch (where the total cost is financial as well as risk and safety) the space port infrastructure allows more valuable space activity to take place than would have been the case in the absence of the space port.

One challenge with estimating this value is the underlying data concerning the space industry is not currently sufficiently detailed to allow a full evaluation.

- There is no single space industry recognised in national accounting data. Rather, what is the space sector is made up of components of a number of other industry groups (manufacturing, scientific and technical services and so on).
- This is further complicated by the fact that the space industry is rapidly changing, along with the interactions between different players in the space value chain.

Approach taken here

The analysis presented here is broad brush. We consider that Space Centre Australia will have a key measurable economic effect in that SCA will generate additional economic activity by allowing launch activities to take place in Australia that would not otherwise have taken place. This is the direct consequence of providing domestic launch facilities where the launches (and associated activities) would otherwise have taken place overseas.

Economic impact method

To assess the national and regional effects of the operations of Space Centre Australia (SCA) we use the CIE's in-house economywide model of Australian states and regions, the CIE REGIONS model.

Essentially, the use of this model to simulate SCA involves estimating the first-round increase in economic activity from SCA, allocating this to particular industries and regions, and then simulating the subsequent effects of this increase in economic activity.

Because there is no single 'space industry' identified within the Australian national accounts data that form the basis of the model's database, the increase in economic activity is applied to a number of different industry groups, including manufacturing, services, construction, utilities and transport. Table 4.1 shows the distribution of shocks used to simulate SCA across industry groupings. It shows, for example, that the majority of the shock is within manufacturing, followed by utilities and then services.

4.1 Composition of shocks by industry

Industry	Distribution of shock to simulate SCA
	%
Manufacturing	38
Construction	5
Services	16
Transport	9
Trade (eg wholesale and retail)	9
Utilities (water, electricity etc)	23

Source: CIE estimates based on SCA data

Further, the increase in economic activity is expected to take place in a number of regions in Queensland, in addition to the region surrounding the space port near Weipa, North Queensland. The model simulations determine the allocation of this based on the relative composition of existing activity within the regions (discussed below).

Order of magnitude effects

The Australian space industry is currently estimated to be worth around $4.6 billion in revenue, and $2 billion in value added[26]. This corresponds to around 0.1 per cent of national Gross Domestic Product (GDP).

By 2030, it is anticipated that space industry revenue will be around $12 billion, with value added of $6 billion. By around 2030, the space industry will directly contribute around 0.24 per cent of GDP.

Anticipated value added from Space Centre Australia (SCA) will be just under $500 million in FY2031. This implies that it will contribute around 8 per cent of the total value of the space industry by then. Using the direct contribution of the space industry to GDP (0.24 per cent), SCA's direct incremental effect on GDP would be around 0.02 per cent. That is, the additional direct space industry activity associated with SCA would be equivalent to 0.02 per cent of GDP. This estimate doesn't account for any flow on and indirect effects as the initial increase in activity extends elsewhere.

Simulations with CIE REGIONS suggests that accounting for both direct and indirect effects, SCA will allow total Australian GDP to increase by 0.06 per cent relative to what it would otherwise have been. This difference between direct and indirect effects provides an indication of some of the flow on effects of the space port.

Effects in Queensland

Most of the economic effects of the space port will be in Queensland. The simulations indicate, for example, that in 2031 Queensland's Gross State Product (GSP) would be 0.31 per cent higher than otherwise as a consequence of SCA. This is equivalent to $1 416 million.

SCA will also induce additional employment in Queensland of around 7 200 persons (estimated on and FTE basis) in 2031. This is an increase of around 0.3 per cent, consistent with the increase in GSP

Effects on regions

The change in economic activity in Queensland will be distributed across the relevant regional areas (here we use the Australian Bureau of Statistics' 'Statistical Area Level 4, or SA4), in particular:

- Outback Queensland (where Weipa is located)
- The Cairns region
- Central Queensland; and
- The Brisbane region.

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The effect on individual regions depends, in part, on the initial composition of economic activity within those regions. This composition is summarised in table 4.2.

It is important to note, that despite SCA being located in Outback Queensland, this region has the highest share of mining activity, and the lowest share in the other industries that are expected to mostly contribute to the operations of the space port.

4.2 Estimated composition of economic activity by region, FY2031

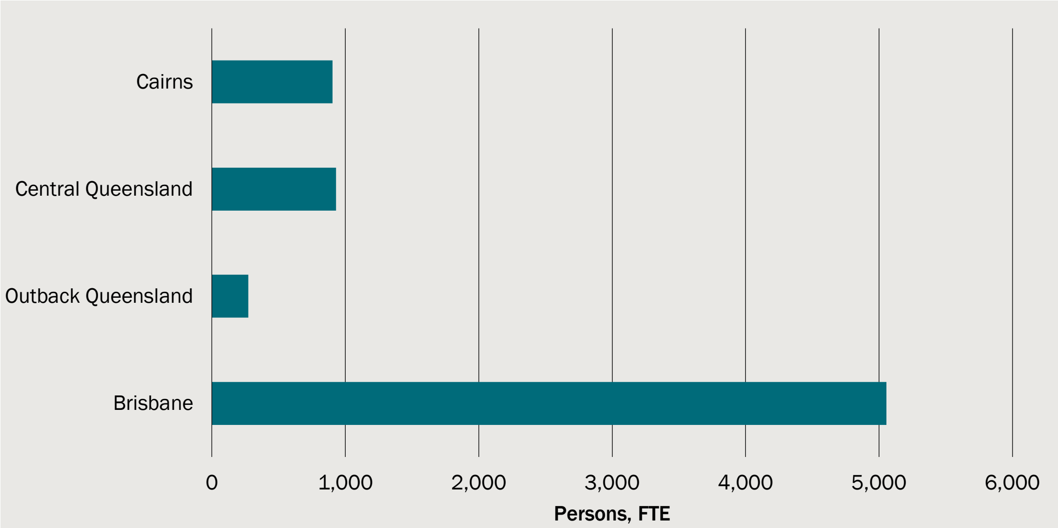
	Cairns	Central Queensland	Outback Queensland	Brisbane
	%	%	%	%
Agriculture	5	3	6	0
Mining	12	43	56	7
Manufacturing	5	7	2	5
Utilities	3	6	2	3
Construction	5	4	3	5
Trade	8	5	3	8
Transport	6	5	3	5
Services (includes hospitality, technical services, and government services)	56	28	26	66
Total	100	100	100	100

Source: CIE REGIONS model estimates

Regional employment

Chart 4.3 illustrates the potential increase in employment by region in 2031, relative to what would otherwise have been the case.

4.3 Increase in employment by region in 2031



Note: Relative to what would otherwise have been the case

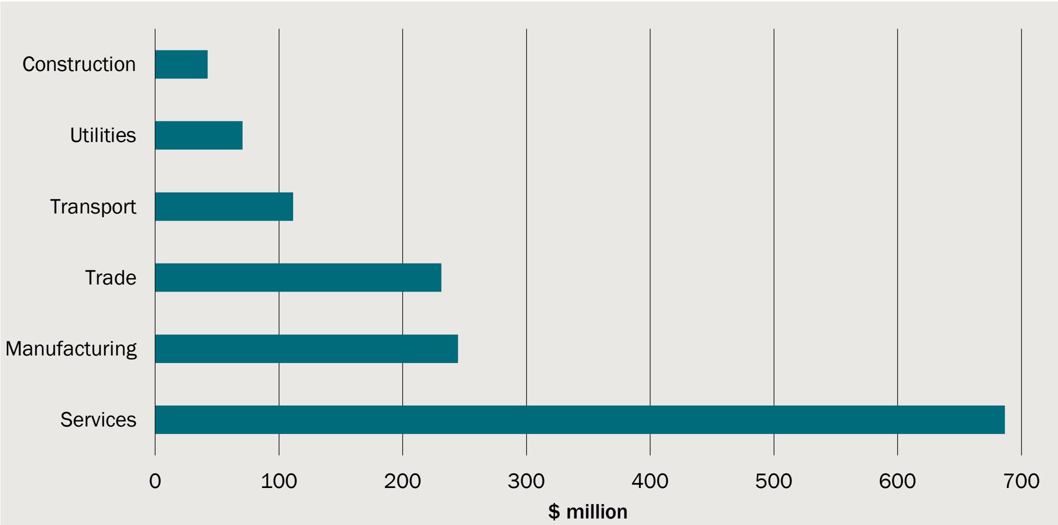
Data source: Simulations with CIE REGIONS model.

Increase in activity by industry

The increase in economic activity will also be spread across different industry groups. There are two components to this: the initial increase arising through the direct effects of SCA, and the induced impact resulting from these direct effects.

Chart 4.4 shows the total increase in value added by industry group for all of the affected regions combined.

4.4 Increase in value added by industry in Queensland regions, $ million



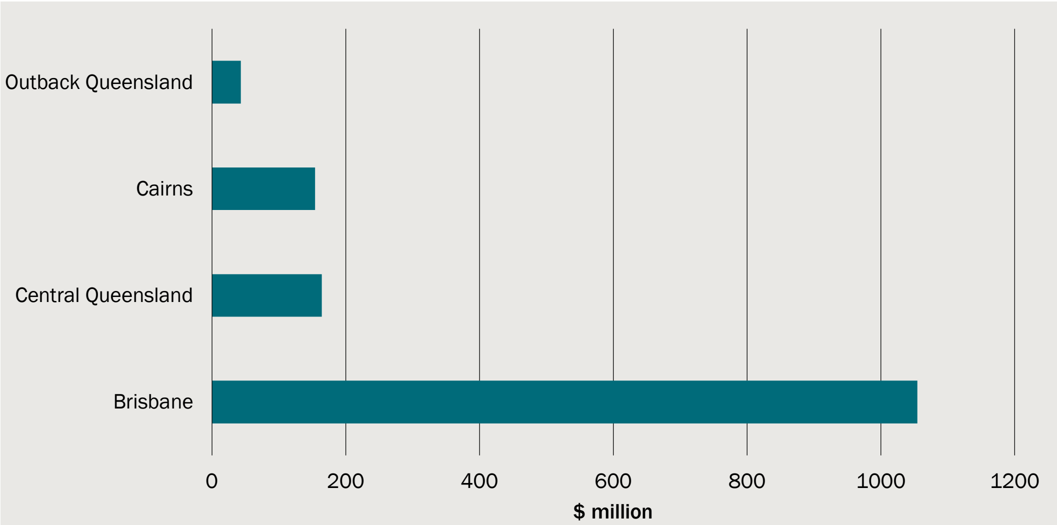
Note: Relative to what would otherwise have been the case

Data source: Simulations with CIE REGIONS model

Increase in economic activity by region

Chart 4.5 shows the increase in total economic activity by region (relative to what would otherwise have been the case) as a result of SCA.

4.5 Increase in economic activity by region



Note: Measured as value added relative to what would otherwise have been the case

Data source: Simulations with CIE REGIONS model

5 Conclusions

The analysis presented in this report allows a number of broad conclusions.

- First, launch facilities are services are a crucial component of the space sector and the availability of cost effective and safe launch locations will be an important part of the ongoing development of the space sector, both overseas and in Australia.
- Second, this implies healthy demand for launch facilities that could potentially be serviced by SCA.
- Third, the potential operations of SCA are likely to have a significant economic impact on the Queensland economy and on the regional locations surrounding SCA in North Queensland.

Importantly, however, the analysis presented here has also revealed several limitations in the available data concerning both the international and Australian space sectors. Currently there are limited official statistics indicating the full set of linkages between different components of the industry, as well as between different components of in the industry and the wider economy.

Further development of this dataset will be an important component of continuing to understand the growth and opportunities in the space sector.

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