Australian Government

Australian Space Agency

State of Space Report

A report by the Australian Government Space Coordination Committee

1 January 2018 – 30 June 2019

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- Attorney-General's Department
- Australian Communications and Media Authority
- Australian Trade and Investment Commission (Austrade)
- Bureau of Meteorology
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Department of Communications and the Arts[1]
- Department of Defence
- Department of Foreign Affairs and Trade
- Department of Home Affairs
- Department of Industry, Innovation and Science
- Department of Infrastructure, Transport, Cities and Regional Development
- Geoscience Australia

[1] On 1 February 2020, Department of Communications and the Arts merged with Department of Infrastructure, Transport, Cities and Regional Development to form Department of Infrastructure, Transport, Regional Development and Communications. For historical accuracy, their activities are presented separately, as they occurred during the period of reporting.

Contents

Foreword

Welcome to the *State of Space* report produced by the Australian Space Agency with the support of the Australian Government Space Coordination Committee.

Announced by Government on 25 September 2017, the Agency commenced operations on 1 July 2018. In order to bring the State of Space report into alignment with the future reporting intentions of the National Civil Space Strategy, this report covers a period of 18 months, encompassing the six months prior to the Agency commencing operations and the activities of its first full year.

The international community responded very positively to the establishment of the Agency, which generated momentum in the Australian space sector and garnered an enthusiastic community buy-in: by the end of June 2019, our cumulative reach in the media was 71 million, and this has continued to grow.

The existence of the Agency opened doors internationally to Australian participation in the global space economy. Within its first year of operation, the Agency secured four Memoranda of Understanding (MoU) with international space agencies and seven Statements of Strategic Intent and Cooperation with businesses that are investing in the domestic Australian space industry and growing the economy. The Agency also progressed MoUs with the states and territories with the aim of securing more in the near future.

Over the first six months we listened to the Australian space sector on its opportunities and challenges so we could work with the sector to help it grow domestically and internationally. The results of that consultation were reflected in the Australian Government's *Advancing Space: Australian Civil Space Strategy 2019-2028* released in April 2019. This Strategy outlines a high level plan to achieve a tripling of the Australian space sector and 20,000 new jobs over the coming decade.

The Government's civil space activities outlined in this report encompass the transition to a new phase in Australia's space engagement, enabled by the creation of the Agency. The Agency looks forward to working with the Australian space sector — government, industry and researchers — to grow Australia's involvement in the global space economy.

30 December 2019

Introduction

In 2018, the Australian space sector entered into a new phase of activity, with the establishment of Australia's first national space agency. The Australian Space Agency's (the Agency) purpose is to effect long-term transformation and growth of Australia's space industry, with the aim of achieving a space sector worth $12 billion per annum, supporting another 20,000 space industry jobs by 2030.

Space-based applications underpin a wide range of civilian and national security capabilities and the Australian Government recognises the importance of on-going and cost effective access to the space capabilities on which the nation relies. In support of this, the Government invests in a wide range of activities administered by a number of agencies. Since becoming operational on 1 July 2018, the Agency assumed the national civil-space coordination role previously undertaken by the Department of Industry, Innovation and Science and now acts as the front door for Australia's international engagement on civil space.

In addition to the establishment of the Agency, the 2018-2019 budget included major investment in civil space, with the allocation of $224.9 million over four years to Geoscience Australia (GA) to make reliable positioning data, accurate to 10 centimetres, available on land, air and sea across Australia. A further $36.9 million was provided to extend GA's Digital Earth Australia (DEA), a world-class digital infrastructure that uses satellite data to detect physical changes across Australia in unprecedented detail.

Previous *State of Space* reports have reviewed Australian Government space activities across calendar-year periods. However, in preparation for a shift to reporting every two years and a reporting period based on financial years, commencing with the 2019-2020 financial year, this edition of the *State of Space* covers an eighteen-month period, from January 2018 to end June 2019. This extended period not only brings the report into line with future financial-year reporting, but also encompasses the Agency's first full year of operation. This report therefore represents a hybrid period, with the first six months of 2018 operating under the previous administrative arrangements for Australian Government civil space activities, prior to the Agency commencing operations on 1 July 2018.

The format of this report has also been re-organised from previous editions. *Advancing Space: Australian Civil Space Strategy 2019-2028*, released in April 2019 (summarised in Figure 1), established four 'Strategic Space Pillars': International, National, Responsible and Inspire. Through these pillars, the Agency will work to achieve its purpose of transforming and growing a globally respected space industry. The Strategy also outlines seven National Civil Space Priority Areas, which were informed by the Expert Review Group (ERG) report as well as consultation by the Agency after its establishment. These priorities are: Positioning, Navigation and Timing; Earth Observation; Communications Technologies and Services; Space Situational Awareness and Debris Monitoring; Leapfrog R&D; Robotics and Automation and Access to Space. In this report, for the first time, the civil space activities of Australian Government departments and agencies are categorised under the four Strategic Space Pillars and the National Civil Space Priority Areas.

Previous editions of the *State of Space* report have not included economic baseline data, enabling the measurement of the future growth of the Australian space industry — the purpose for which the Agency was established. Research is currently being undertaken to establish this baseline data and future editions of the report, commencing with the 2019-2020 financial year, will include the necessary economic data.

It is noted that a number of the Government departmental contributors have had name changes. For historical accuracy, each Department will be referred to by the title it held across the majority of the period covered in this report.

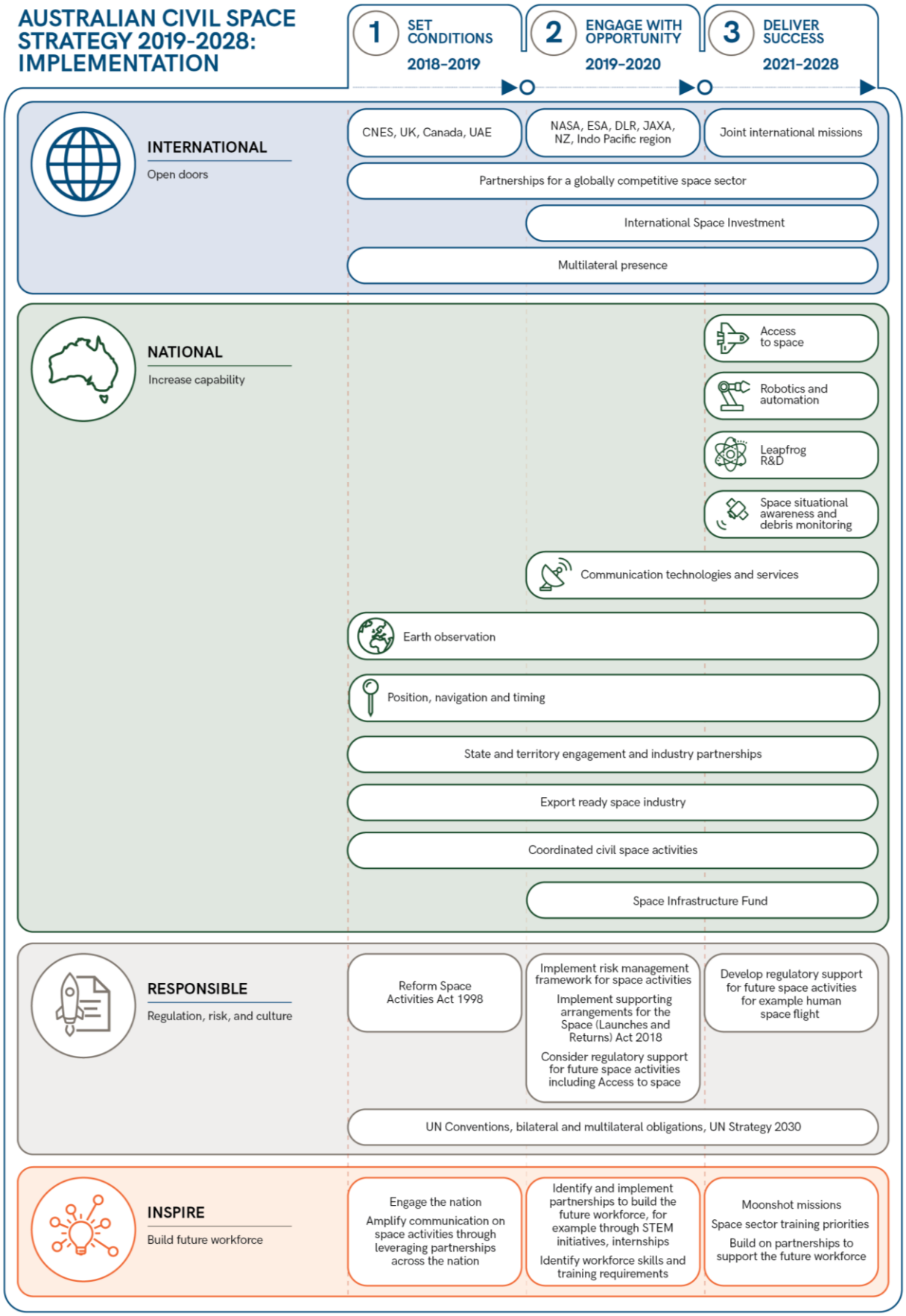

Figure 1 – Summary of the Australian Civil Space Strategy

Australian Space Agency Establishment

Background

The intent to establish a national space agency, to ensure that Australia has a long-term plan to grow its domestic space industry and support the development and application of space technologies, was announced on 25 September 2017 at the 68th International Astronautical Congress (IAC) in Adelaide.

Feedback from the extensive consultation process conducted by the ERG, appointed in July 2017 to review Australia's space industry capability, overwhelmingly established the need for the creation of a national space agency to anchor the coordination of Australia's domestic space activity and provide a front door for international collaborations on space projects. Following the announcement that a space agency would be established, the ERG, chaired by Dr Megan Clark AC, was tasked with developing a charter for the new agency.

The *Review of Australia's Space Industry Capability* produced by the ERG was delivered to Government on 29 March 2018. The report put forward nine recommendations for the establishment of an Agency, to which the Government responded in conjunction with the 2018-2019 Budget, in May 2018. The ERG's recommendations and the Government response are summarised in Appendix 1. The majority of the recommendations have now been completed or are ongoing as part of the operations of the Agency, as detailed in Appendix 1.

In support of the findings in the ERG report, the Government allocated $41 million in the 2018-2019 Budget over four years to support the operation of the Agency, which would commence operation on 1 July 2018. This funding included $15 million for the International Space Investment (ISI) initiative specifically to foster international partnerships and increase the competitiveness of Australian businesses within the global space economy. The ISI initiative is funded for three years from 2019-20. The 2019-2020 budget also included an additional $19.5 million for the Space Infrastructure Fund to support Australia's emerging domestic space industry. Through the Adelaide City Deal, funding of $6 million was also announced for the Australian Space Discovery Centre.

About the Agency

Purpose and Responsibilities

The Agency is a non-statutory, whole-of-government entity located within the Department of Industry, Innovation and Science (now the Department of Industry, Science, Energy and Resources) as a separately branded function. The Agency is the front door for Australia's international engagement on civil space and operates as the national priority-setting mechanism for the civil space sector.

The Agency's purpose is to transform and grow a globally respected Australian space industry that lifts the broader economy, inspires and improves the lives of Australians, underpinned by strong international and national engagement.

The Agency's role is to provide whole-of-government coordination of civil space matters. It is the primary source of advice to the Australian Government on civil space policy. Under this broad mandate, the Agency has six primary responsibilities:

- Providing national policy and strategic advice on the civil space sector.
- Coordinating Australia's domestic civil space sector activities.
- Supporting the growth of Australia's space industry and the use of space across the broader economy.
- Leading international civil space engagement.
- Administering space activities legislation and delivering on our international obligations.
- Inspiring the Australian community and the next generation of space entrepreneurs.

Governance

The Agency's governance structure is outlined in its Charter which was approved by the Prime Minister in October 2018. Agency governance is centred on the roles of the Agency Head, Deputy Head and the Advisory Board.

The Agency Head is appointed by, is accountable and reports to, the Minister. The Agency Head is responsible for overall governance and performance, management, policy leadership and strategic direction of the Agency. The Deputy Head has oversight of strategy, policy and day-to-day operations of the Agency, and supports the Agency Head in monitoring the performance of the Agency.

The Advisory Board is a non-statutory, independent, skills-based panel that provides advice to the Agency Head. The Advisory Board's purpose is to review and advise on the strategic direction and performance of the Agency, and to support the Agency to achieve its purpose. It is not a decision-making body, and has no governing legislation. Appointments to the Advisory Board are for a period of up to three years.

The Agency works in partnership with government agencies involved in space activities to ensure a whole-of-government approach is taken in respect of civil space activities. To meet its responsibilities, the Agency also works with a wide range of stakeholders, including industry, state and territory governments, Australian Government departments, researchers and international organisations.

Engagement mechanisms include:

1. **Australian Government Space Coordination Committee** (SCC). The Agency Chairs the SCC, the purpose of which is to coordinate and discuss whole-of-government policy settings on civil space activities. It is open to all relevant Australian Government departments and agencies functions as an inter-departmental committee comprising senior official representation from across Government.
2. **Space Industry Leaders Forum** (The Forum)**.** The Forum is the primary mechanism for engagement and coordination with the Australian space industry. The Forum will be established in the latter half of 2019 and include industry representatives, academia, relevant industry associations and other non-government space organisations within Australia.
3. **State and Territory Space Coordination** (STSC). The states and territories play a key role in the national space enterprise. The Agency engages closely with states and territories to support national space policy and strategy, coordinate activities and provide one voice for Australia's civil space sector.

Brand identity

The Agency released its brand identity in December 2018, with a new logo (refer to Figure 2). The identity captures the past, present and future of the Australian space sector. It is undoubtedly Australian, highlighting the unique geographical position and the strong link between space and our Indigenous people, who are considered the world's oldest astronomers.

Australian Government | Australian Space Agency

Figure 2 – Logo of the Agency

An explanation of the brand:

The abstract view of the vast continent conjures up images of Australia as seen from space: the dots allude to the light provided by industry and technological advances such as GPS and global monitoring. But the abstract view is also what Australians can see when they look to space. The image of the continent is actually made up of eight Aboriginal constellations and star maps, with each cluster capturing Australia's powerful cultural heritage and the spirit of the Agency – one that looks to space to provide real improvements for life on earth (refer to Figure 3).

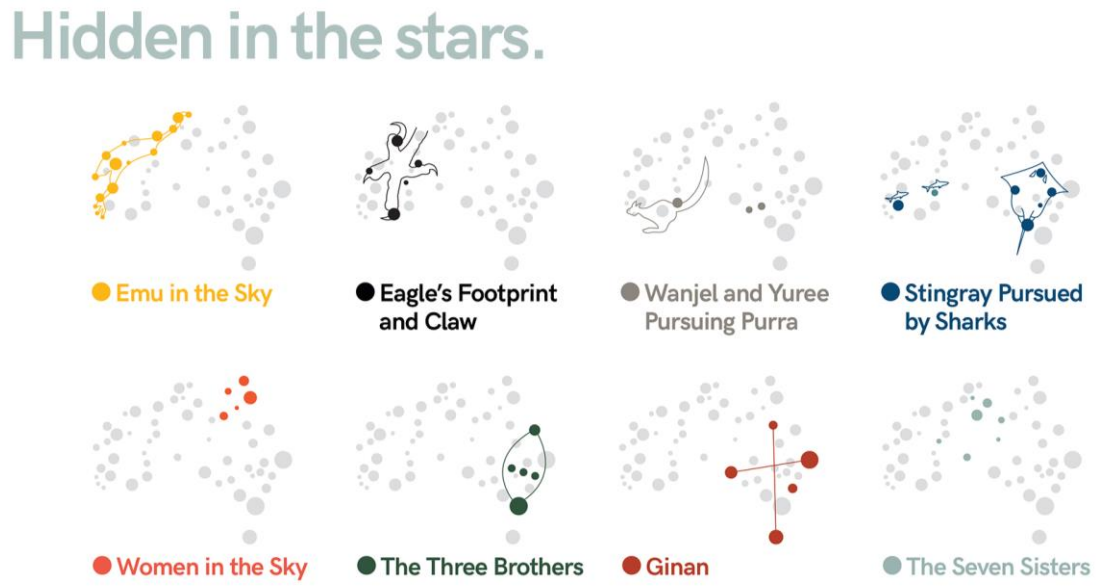

Figure 3 – Story of the brand of the Agency

Accomplishments of First Year (1 July 2018 – 30 June 2019)

The Agency was formally established on 1 July 2018 and immediately undertook an intense period of activity which included wide-ranging consultation with industry and meetings with state and territory representatives to understand their current and future commitments into the space economy. International promotion of the Agency and Australian space capability was also an early priority. The Agency's Charter was established and approved by the Prime Minister.

The Agency signed its first Memorandum of Understanding (MoU) with an international space agency (France's CNES) in September 2018. At the IAC in Bremen, in October 2018, two further MoUs were signed with the space agencies of Canada and the United Kingdom (UK). An additional MoU with the United Arab Emirates Space Agency was signed in February 2019. The Agency continues to engage with other international space agencies to secure MoUs.

In September 2018, the Agency signed its first Statement of Strategic Intent and Cooperation (SSI) with European aerospace manufacturer Airbus Defence and Space SAS. Another five SSIs were signed by June 2019: Italian satellite company Sitael (October 2018); Australian space and defence company Nova Systems (December 2018); United States (US) aerospace companies Lockheed Martin (January 2019) and Boeing (March 2019); space communications company Goonhilly Earth Station (February 2019) and Australian oil and gas company Woodside Energy (March 2019).

To advance the Agency's national engagement role, MoUs were signed with New South Wales and the Australian Capital Territory in March 2019. Further state and territory MoUs are expected to be signed in the next year.

The *Australian Civil Space Strategy* for the decade 2019-2028 was released in April 2019. Building on the work of the Expert Reference Group, released in 2018, it presents a pathway for the Agency to achieve the Government's goal of growing the Australian space industry to $12 billion per annum and creating up to 20,000 new space sector jobs by 2030.

The Agency facilitated three Priority Area workshops, in the fields of Space Situational Awareness, Robotics & Automation and Communications Technologies. Over 750 participants registered for these events.

In advance of the commencement of the ISI initiative, eight consultation sessions were held, one in each state and territory, in June 2019.

Significant excitement about the Agency was evident across Australia, with an estimated cumulative media reach of 71 million, to 30 June 2019, meaning the majority of Australians heard or saw news on the Agency in its first year of operation, many multiple times. In September 2018, the Agency established its social media presence with Twitter (9,890 followers by end June 2019) and LinkedIn (8,469 followers) accounts. A fortnightly Agency newsletter commenced on 5 September 2018, with a steadily growing number of subscribers (2,823 by end June 2019). A public document *Welcome to the Australian Space Agency* was also produced to share the Agency's roles and priorities. An additional public document *About the Agency* was produced following the release of the *Australian Civil Space Strategy*. The Agency brand was released in November 2018.

The Agency also engaged with states and territories regarding its permanent location arrangements. This elicited active interest and on 12 December 2018 the Prime Minister announced that the headquarters of the Agency would be located in Adelaide. Staff were progressively recruited in Adelaide from January 2019.

On its establishment, the Agency also assumed responsibility for administering space activities legislation. In light of the Agency's regulatory activities, the *Space Activities Amendment (Launches and Returns) Act 2018* passed both Houses of Parliament and received Royal Assent on 31 August 2018, coming into force in August 2019. The amended Act ensures that Australia's space regulation supports the growth of our space capabilities while ensuring safe and responsible activities.

Following the passage of the Act, work commenced on the development of the associated Rules. During May and June 2019, eight stakeholder consultations (one in each state and territory) were held to inform the framing of these Rules, two of which will come into force with the Act in August 2019. The Agency consulted on a draft Cost Recovery Implementation Statement in November and December 2018.

Figure 4 – First anniversary of Agency establishment

Measuring Success

Activities under the four Strategic Space Pillars will grow and transform Australia's space industry and position Australia to triple the space sector's contribution to GDP to over $12 billion per annum and create an additional 20,000 jobs by 2030.

The *Australian Civil Space Strategy* outlines the targets for measuring the success:

1. Stimulate at least $1 billion pipeline in inward capital investment in Australia's space industry between 2019 and 2025, including R&D investment and infrastructure investment.
2. Achieve year-on-year growth of the Australian space industry that exceeds 8.5 per cent per annum.
3. Achieve year-on-year growth of direct and indirect jobs that would meet a target of 20,000 additional jobs by 2030.
4. Create a regulatory framework that ensures effective, efficient, and safe space activities.
5. Increase awareness of space activities and the impact on the Australian economy, cumulatively reaching at least 10 million Australians per year.

Progress against measures

The Agency has commenced a project to baseline the economic performance of the space sector in order to measure and report against the targets outlined. It is intended that an economic report is undertaken every two years to report on progress. Future *State of Space* reports will include an economic assessment.

It is clear that the space sector is growing rapidly. The global space industry is worth US$350 billion in 2018-19 and is forecast to grow over US$1.1 trillion by 2040[2].

Whilst the Agency is developing a baseline for analysis, the IBIS World Satellite Communications and Astronautics in Australia industry report[3] provides a snapshot of the Australian space sector which is outlined below to show preliminary outcomes.

Table 1 – Progress against measures of success (using the IBIS World report)

Target	Status
$1 billion pipeline of inward investment	The Australian Space Agency, through its engagement with industry and the states and territories has been tracking a strong civil space capital pipeline of activity. The observed pipeline includes: • $2.001 billion pipeline of capital projects including R&D in all states and territories FY2018/19-FY2027/28. – Over $729 million of this is inbound investment from industry, private foundations and international space agencies. 88 projects are being tracked across all states and territories.

[2] Morgan Stanley 'Investing in Space' 2019

[3] IBISWorld Industry Report OD5545 Satellite Communications and Astronauts in Australia, November 2018

Target	Status
Growth rate exceeds 8.5 per cent	The Australian space sector continues to show strong sustained growth (15.6 per cent from 16-17 to 18-19) when compared against other international space sectors, such as Canada (1.2 per cent from 2016-17) and the United Kingdom (3.3 per cent from 2016-17)[4].
20,000 additional jobs	In 2018-19 the Australian space sector employed approximately 13,200 people, representing an employment growth of 14 per cent from 2016-17 to 2018-19[5]. Over the two years from 2016-17 to 2018-19, the total number of businesses in the industry increased by almost 10 per cent, from 698 to 766[6].
Regulatory framework	On its establishment, the Agency assumed responsibility for administering space activities legislation, including carriage of the amendments to the *Space Activities Act 1998*. The *Space Activities Amendment (Launches and Returns) Act 2018* passed both Houses of Parliament and received Royal Assent on 31 August 2018. It comes into force on 31 August 2019. The Agency participated in a number of meetings to support the United Nations' Committee on the Peaceful Uses of Outer Space.
Cumulative reach of 10 million Australians	The estimated potential cumulative media audience from 1 July 2018 to 30 June 2019 for the Agency was 71 million, meaning the majority of Australians heard or saw news about the Agency in its first year of operation. This media reach does not include the media reach of the SCC membership who also achieve good media outcomes from their space activities. The estimated reach is based on reporting available to the Australian Government through iSentia media.
GDP contribution of $12 billion	Revenue from the industry in Australia is $5.2 billion in 18-19[7]. Whilst revenue is an indicator of activity, unlike value-add, it does not correspond directly to the economic contribution of the sector.

The findings in the above table use a different data source to that used by the Expert Review Group (ERG). For example, the ERG found the sector had around 10,000 employed, whereas IBIS World has a figure of 11,557. This discrepancy is due to the ways the space sector is defined. While the data sources are different, the findings of the report are comparable. Future *State of Space* reports will use a consistent definition of the space sector, which will be defined as part of the economic baseline activity.

The Agency is developing further metrics in conjunction with the development of an economic baseline for the Australian space sector. The Agency has commissioned a detailed economic baseline for 2016 that will deliver a more detailed analysis of both sector performance and job numbers and will be completed in 2020.

[4] IBISWorld Industry Report OD5545 Satellite Communications and Astronauts in Australia, November 2018

[5] IBISWorld Industry Report OD5545 Satellite Communications and Astronauts in Australia, November 2018

[6] IBISWorld Industry Report OD5545 Satellite Communications and Astronauts in Australia, November 2018

[7] IBISWorld Industry Report OD5545 Satellite Communications and Astronauts in Australia, November 2018

Civil Space Coordination

A number of Government agencies engage in a variety of space-related activities to support Australia's strategic, economic and social objectives. Ensuring that the operating environment for these activities is conducive to innovation, combined with coordination and international cooperation, are the key factors to maintaining and strengthening the space capabilities on which Australia relies for its national security and civil well-being.

To facilitate the transition from previous *State of Space* reports, to a new format under the Agency (which will be introduced for the 2019-20 financial year), Australian Government civil space activities for the period January 2018 to June 2019 are presented here under the four Strategic Space Pillars identified in the *Australian Civil Space Strategy*.

Until 30 June 2018, the Department of Industry, Innovation and Science was the central point of contact and coordination for the Australian Government's involvement in civil space. This role was assumed by the Agency, which includes chairing the Australian Government Space Coordination Committee (SCC). The SCC is a forum for information sharing and coordination of the Australian Government's activities and priorities in the civil space area. The SCC membership is comprised of Australian Government departments and agencies with an interest in civil space:

- **Australian Communications and Media Authority** (ACMA): ACMA is responsible for the regulation of radio communications services, including the radiocommunications licencing of space-based communications systems in Australia and International Telecommunications Union (ITU) satellite filing coordination.
- **Attorney-General's Department** (AGD): The Office of International Law within AGD provides legal advice to Government on international space law.
- **Australian Space Agency** (the Agency): The Agency provides whole-of-government coordination of civil space matters and is the primary source of advice to the Australian Government on civil space policy.
- **Australian Trade and Investment Commission** (Austrade): Austrade is the Australian Government's trade, investment and education promotion agency. It supports Australia's international space sector engagement.
- **Bureau of Meteorology** (the Bureau): The Bureau of Meteorology is Australia's national weather, climate and water information agency. It relies on real time Earth observations from space and space weather observations to deliver forecasts, warnings, analyses and advice covering Australia's atmosphere, water, ocean and space environments.
- **Commonwealth Scientific and Industrial Research Organisation** (CSIRO): CSIRO is Australia's national science agency, and is involved astronomy and space science, Earth observation science and applications, and space technology research and development. It also manages and operates critical international space-related infrastructure.
- **Department of Communications and the Arts** (DoCA): DoCA has policy oversight of radiocommunications services and spectrum management (including satellite communication) in Australia, including Australia's international treaty obligations as a member of the International Telecommunications Union (ITU).
- **Department of Defence** (Defence): Defence is concerned with civil space activities that overlap with defence-related issues in space.
- **Department of the Environment and Energy** (DEE): DEE is concerned with Earth observation as it relates to environmental management.
- **Department of Foreign Affairs and Trade** (DFAT): DFAT is responsible for Australia's engagement on space-related international security issues.
- **Department of Home Affairs** (Home Affairs): Home Affairs is responsible for critical infrastructure resilience policy.

- **Department of Industry, Innovation and Science** (DIIS): DIIS was responsible for coordination of the Australian Government's involvement in civil space until 30 June 2018, and still maintains a role in the development of the Australian space industry particularly on broader linkages between space and other industry sectors.
- **Department of Infrastructure, Regional Development and Cities** (DIRDC): DIRDC is concerned with Position, Navigation and Timing (PNT) as it relates to the transport sector. DIRDC also has policy oversight of the Civil Aviation Safety Authority (CASA) and aviation policy.
- **Geoscience Australia** (GA): GA provides for the Australian Government's geoscience requirements. It manages the nation's geographic and geological data and is involved in PNT and Earth observation services.
- **The Department of the Prime Minister and Cabinet** (PM&C), the **Treasury** and the **Department of Finance**: These departments have observer status on the SCC. They assist its members in coordinating their activities across all areas of Government.

Three working groups report to the SCC:

1. The Earth Observation from Space (EOS) Working Group;
2. The Position, Navigation and Timing (PNT) Working Group; and
3. Inter-Departmental Working Group on Space Law.

These working groups promote national coordination and planning and report to the SCC on relevant strategic priorities including coordinated advice on domestic and international policy, standards, and research.

The SCC provides the input into the *State of Space* reports.

International

Leverage international bilateral and multilateral partnerships that, where consistent with our national interests, open the door for Australian innovators and grow a connected, respected and globally competitive space industry in Australia.

International engagement

To open doors for future international collaboration, the Agency signed four Memoranda of Understanding (MoU) with international space agencies (refer to Figure 5 CNES, the French Space Agency (1 September 2018); Canadian Space Agency (2 October 2018); UK Space Agency (2 October 2018); United Arab Emirates (UAE) Space Agency (14 February 2019).

Figure 5 – Signing of MoUs (France, Canada, UK and UAE)

The potential that international (and national) companies see for investment in the Australian space sector is indicated by the level of interest in Statements of Strategic Intent and Cooperation (SSIs) with the Agency. While non-binding, and conferring no obligation or privileges, these statements provide an opportunity for businesses to highlight investment opportunities, and areas of growth, in Australia.

Five international industry partners signed SSIs in 2018-19: European aerospace manufacturer Airbus Defence and Space SAS (September 2018); Italian satellite company Sitael (October 2018); US aerospace companies Lockheed Martin (January 2019) and Boeing (March); and UK space communications company Goonhilly Earth Station (February 2019).

In November 2018, the Agency held the initial Australia-US Civil Space Dialogue in the US with key US Government agencies. This event was supported by the Australian Embassy in the United States, DFAT, GA and CSIRO. The establishment of the Agency was also commended in a resolution introduced into the US House of Representatives, which supported deeper cooperation between the two countries in space activities.

The Agency promoted Australian space expertise at the International Astronautical Congress in Bremen, Germany, through arranging a booth, titled *The Australian Space* (October 2018). The booth enabled a range of Australian organisations, including CSIRO, to exhibit their capabilities and engage with potential international partners. The Agency will continue to attend IAC in future years and present a booth to showcase Australian space capabilities.

At the end of February 2019, the Agency participated in the inaugural two-day Australian Space Industry Conference, organised by the Space Industry Association of Australia (SIAA) in conjunction with the Avalon 2019 Australian International Airshow and Aerospace & Defence Exposition. The Agency also arranged a booth in the airshow exposition area to promote Australian space capabilities to the international and national aerospace community attending the airshow as well as its public visitors.

In partnership with CSIRO, the Agency represents Australia on the International Space Exploration Coordination Group (ISECG) and International Mars Exploration Working Group (IMEWG).

A summary of SCC member contributions is outlined below.

Table 2 – SCC international engagement activities

Organisation	Summary of activity
Australian Communications and Media Authority	The ACMA engages internationally on the coordination, development and implementation of measures to enhance spectrum usage for satellite communications and space research services. It is a member of the International Telecommunications Union (ITU) and the Asia-Pacific Telecommunity.
Austrade	Over 2018-19 Austrade ran several space specific events: • The NSW-Austrade Space Startup Bootcamp to Austrade's Landing Pad in San Francisco. Co-funded by the NSW Government, Austrade took seven NSW Space Startups to participate in a week long program where they engaged with US-based old and new space companies, venture capital pitch coaches and legal experts. • The Agency-Austrade Space Finance Round Table brought together representatives from the Venture Capital and Private Equity Community in Australia and the US to discuss the opportunities and challenges related to funding emerging space technology companies. • The American Chamber of Commerce in Australia (AmCham)-Austrade Space Commercialisation Mission to the US took place 25-30 November 2018. Led by Col. (Rt) Pam Melroy, Austrade and AmCham took 11 Australian space companies to Houston and Los Angeles to visit key NASA facilities, US Space Primes, startups and government partners. In addition, the participants also attended the Space Commerce Conference and Exposition, which featured the Agency. • The Avalon Airshow 'Access to Space Workshop', organised by Austrade with the support of the Agency, brought together 30+ representatives from across the Australian space industry supply chain and key international space companies to discuss the opportunity easier access to space would provide to the Australian space industry. • Austrade, with the support of the Agency and CSIRO, organised a 'Companion Program' for Australian companies attending the 35th US Space Symposium in Colorado Springs (April 2019). This is an important venue for promoting Australian space capabilities to a range of potential international industry partners, especially in the US. The Companion Program consisted of two key events: A Space Industry Ecosystem Briefing; and the G'Day USA Space Industry xChange.
Bureau of Meteorology	The Bureau is a member of the World Meteorological Organisation (WMO) and a key contributor to its WMO Integrated Global Observing System (WIGOS). It also has a number of EOS-related bilateral agreements with meteorological services and space agencies in Japan, China, Korea, and the US. The Bureau benefits from the collaborative activities in these relationships, which provide access to the data from a wide range of meteorological satellites. The Bureau's Space Weather Services (SWS) is a member of the International Space Environment Service (ISES), and operates the regional warning centre for the Australasian region. It is

Organisation	Summary of activity
	a key partner in an international consortium including scientific organisations in Canada, France and Japan. This consortium is developing a global space weather advisory service supporting international civil aviation. Under international agreements, the Bureau operates a ground station near Darwin for the COSMIC-2 (Constellation Observing System for Meteorology, Ionosphere, and Climate) program and a Turn Around Ranging Station (TARS) for satellites in China's Fengyun-2 series at Crib Point, Victoria.
CSIRO	CSIRO is the designated Cooperating Agency in the Agreement between Australia and the US concerning Space Vehicle Tracking and Communication Facilities, which was signed on 17 October 2017. This new 25 year bilateral Treaty was ratified by the Australian Parliament in early 2018 and will remain in force until 2043. A new Cooperating Agency Agreement and new contract between CSIRO and NASA was also signed in 2018, remaining in force until 2028. A separate bilateral Treaty currently in place establishes CSIRO as the management lead of the NASA ballooning facility at the Alice Springs Ballooning Facility (ASBF). In 2017, CSIRO also entered into a MoU with the Japanese space agency, JAXA, on high altitude ballooning to enable JAXA to conduct scientific ballooning from the ASBF. In early 2019 CSIRO also began transition to management of the European Space Agency (ESA)'s deep space tracking station in New Norcia, WA, moving to full management of operations and maintenance on 1 June 2019. In 2018 CSIRO continued to build on its partnership with UK-based Surrey Satellite Technology Ltd through a 10 per cent share of the tasking and data acquisition capabilities of the NovaSAR-1 S-band Synthetic Aperture Radar (SAR) satellite. CSIRO will manage operations and data from the satellite as a National Facility following its launch (September 2018) and commissioning. A Letter of Intent between the CSIRO Centre for Earth Observation and the NZ Centre for Space Science Technology was signed in October 2018 with the purpose of encouraging and exploring opportunities for joint research activities in the field of Earth Observation and identifying areas of possible mutual interest and collaboration. In February 2019 the CSIRO Centre for Earth Observation and CNES inaugurated a new partnership with the signing of a Letter of Intent around Earth observation collaborations. This agreement, following the MoU between CNES and the Agency signed in September 2018, intends to further promote joint collaborations in Earth observation applications to address, among others, complex global challenges such as sustainable development issues and climate adaptation/mitigation. Specific collaborations with CNES in the South Pacific region will be further developed CSIRO and Geoscience Australia (GA) actively participate in the Committee on Earth Observation Satellites (CEOS). CEOS is an international body that brings together 55 organisations operating over 130 satellites to collaborate on civil space-based Earth observation missions, data systems, and global initiatives. It coordinates the activities of 31 space agencies and 132 satellites. CSIRO is Vice Chair (2017-2019) of the Strategic Implementation team (SIT) and will be Chair for 2019-2021. It is Chair (2018-2020) of the Working Group on Calibration & Validation (WGCV) and Vice Chair (2017-2019) and Chair (2019-2021) of the

Organisation	Summary of activity
	Working Group on Information Systems and Services (WGISS). CSIRO is also Co-Lead of the Ad Hoc Team on Sustainable Development Goals (AHT-SDG).
Department of Communications and the Arts	Australia is a signatory to the Constitution and Convention of the ITU and has agreed and ratified all iterations of the World Radio Regulations, most recently in 2015. These treaties govern the global use of radio frequency spectrum and satellite orbits. Australia is also a signatory to the Asia-Pacific Telecommunity that is the regional focal point for ITU related discussions in the Indo-Pacific region. DoCA leads Australia's multi-stakeholder delegations to World Radiocommunication Conferences (WRC), international ITU preparatory meetings, and APT meetings that precede the four-yearly WRC.
Department of Defence	Defence engages with international partners on the military use of space through the Combined Space Operations initiative (CSpO) and bilateral partnerships and talks. Defence is a member of the CSpO. The partnership enables the sharing of space-related information and resources to synchronise space operations among like-minded partners. It also enables the reinforcement of the importance of the responsible use of space between defence departments. Australia acted as the Executive Secretariat for CSpO in 2018, with the Principal's Board meeting in Australia in December 2018. Defence Science and Technology (DST) is an active member of the Responsive Space Capabilities MoU, working with 10 other nations to explore the utility of small satellites, communication technologies and responsive launch options. DST also contributes to significant collaborative developments and experiments with its collaborative partners Canada, New Zealand, the UK and the US. Defence represents Australia at the technical and licensing/enforcement working groups of the Missile Technology Control Regime (MTCR) and the Wassenaar Arrangement, which set and promote best-practice guidelines for regulating the transfer of sensitive space-related goods and technology. Australia enacts these guidelines through national legislation.
Department of Home Affairs	The Critical Infrastructure Centre, representing Australia, is currently the secretariat for the Critical Five (C5) and the C5 GNSS subgroup. The C5 is the forum for the five country collaborative partners approache to critical infrastructure resilience. Participation in C5 and the GNSS subgroup is a valuable opportunity to share information on threats to critical infrastructure, mitigation approaches and policy.
Geoscience Australia	Geoscience Australia (GA) has formal cooperation arrangements with the US Geological Survey, in relation to the Landsat Earth observation program, and the European Commission, in relation to the Copernicus Earth observation program. Through both arrangements, GA works to promote continued Australian access to critical satellite Earth observation data, maximising the uptake and impact of Earth observation data on the Australian economy and society. GA is Australia's principal representative to the intergovernmental Group on Earth Observation (GEO). GEO facilitates cooperation between governments, industry and NGOs to exploit earth observation for societal benefit. GA coordinates Australia's GEO representation which includes participation from

Organisation	Summary of activity
	CSIRO, the Agency, the Bureau, the Department of the Environment, the Australian Bureau of Statistics and other agencies. GA is also supporting the Digital Earth Africa initiative, designed to build the world's largest operational platform for accessing and analysing decades of satellite imagery specific to Africa's land and seas. DE Africa is being co-funded by DFAT and the US-based Helmsley Charitable Trust. GA cooperates with NASA on the operation of the Yarragadee geodetic observatory in Western Australia. NASA provides the Satellite Laser Ranging instrument, and GA provides operational support and facility management. At Yarragadee and Mt Stromlo, ACT, GA also operates two Doppler Orbitography and Radio-positioning Integrated by Satellite (DORIS) beacons in partnership with CNES. The DORIS beacons support the precise determination of the orbit of low altitude satellites. To support its development of an Australian Satellite Based Augmentation System (SBAS), GA has a joint collaborative research project with Lockheed Martin to provide SBAS transmissions to the Asia Pacific region until July 2020. GA continues to collaborate with Land Information New Zealand (LINZ) on the potential development of a joint SBAS and has an SBAS cooperation with the Thai Geoinformatics and Space Technology Development Agency (GISTDA). GA has international agreements in relation to GNSS data sharing and satellite tracking with Japan, India and China. It also provides GNSS technical support to the Australian Government's Climate and Oceans Support Program in the Pacific (COSPPac). GA chairs the International GNSS Service (IGS), which is a voluntary federation of over 200 self-funding agencies, universities, and research institutions in more than 100 countries, working together to provide the highest precision GPS satellite orbits in the world. It is also a member of several other PNT-related international working groups and organisations.

Space Representation at the United Nations

Australia is a signatory to all the UN treaties that govern space activities. The Agency, with support from DFAT, represents Australia at the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) and its subcommittees (Legal and Scientific and Technical). The Agency and DFAT attended the UNCOPUOS meeting in June 2019, and the Scientific and Technical Sub-committee and Legal Sub-committee meetings in February and April 2019. At DFAT's invitation, Prof Stephen Freeland, Professor of International Law, University of Western Sydney, joined as an advisor to the Australian delegation for the 57th session of the Legal Subcommittee of COPUOS in Vienna.

DFAT represents Australia at the First and Fourth Committee, United Nations General Assembly. It leads Australia's engagement in the disarmament process at the United Nations Disarmament Commission and the Conference on Disarmament. DFAT is also involved in the United Nations Group of Governmental Experts (GGE) on further practical measures for the prevention of an arms race in outer space.

DFAT and DIIS participated in negotiations in May 2018, to draft a consensus resolution, aimed at strengthening the roles and activities of UNCOPUOS and its subsidiary bodies and endorsing development of a Space2030 Agenda. The Resolution, titled "Fiftieth anniversary of the first United Nations Conference on the Exploration and Peaceful Uses of Outer Space: space as a driver of sustainable development" was later

adopted by the UNISPACE+50 meeting and then the United Nations General Assembly. DFAT and the Agency attended the meetings of the UNCOPUOS Space2030 Agenda Working Group (October 2018 and June 2019).

An Australian delegation participated in the UNISPACE+50 meeting (June 2018), which celebrated the 50th anniversary of the first United Nations Conference on the Exploration and Peaceful Uses of Outer Space, held in 1968. UNISPACE+50 provided an opportunity for the international community to consider the future course of global space cooperation for the benefit of humankind. The meeting concluded with a commitment by United Nations Member States to strengthened global cooperation in space and the use of space for sustainable development

The Bureau's Space Weather Services is a member of the International Space Weather Initiative (ISWI), a program of international cooperation and capacity building sponsored by UNCOPUOS to develop the scientific insight necessary to understand the science, and to reconstruct and forecast near-Earth space weather.

In 2018, GA's Chief of the Positioning and Community Safety Division, Dr Andy Barnicoat, was elected President of the Asia Pacific Regional Committee of the United Nations Global Geospatial Information Management (UNGGIM). GA also co-chairs the UNGGIM Sub-Committee on Geodesy and in 2018 became a member of the United Nations International Committee on GNSS (ICG).

National

From areas of strength and addressing our challenges, transform and grow an Australian space sector that lifts the broader economy and leaps into areas of future competitive advantage.

Increasing capability nationally will be achieved primarily through activities aligned with the seven Priority Areas, state and territory engagement, industry partnerships, research and industry-research collaborations and investments through programs such as the Space Infrastructure Fund (SIF). These activities will need to be undertaken consistent with Australia's national and security interests; as such close coordination with Defence is important.

Space Capability Activities Supporting the Australian Civil Space Priority Areas

The National Civil Space Priority Areas are outlined in the *Australian Civil Space Strategy* and were determined after wide consultation undertaken by the ERG and consultations in the first six month of the Agency being established. They also support the CSIRO Space Roadmap, published in 2018, and the Global Exploration Roadmap from the International Space Exploration Coordination Group.

The Priorities focus on strengthening Australia's existing competencies and growing future capabilities, and will be an important guide when considering future space activities in Australia.

In each of the Priority Areas the Agency has worked with the space industry, relevant government agencies, researchers and users of space technology to further develop a national approach, which was detailed in the *Australian Civil Space Strategy*.

To grow the Australian space sector, the Agency is undertaking two major initiatives: the ISI initiative and SIF. In its 2018-19 Budget the Australian Government committed to providing $15 million over three years from 2019-20 to establish the ISI initiative, to support Australian participation in the activities of international space agencies. The ISI initiative is currently in the design phase and initial consultations were held in each state and territory in June 2019, prior to its commencement.

In the 2019-2020 Budget, the Australian Government allocated an additional $19.5 million for the SIF to support Australia's emerging domestic space industry. The SIF will fill space infrastructure gaps to support businesses and researchers to participate in the global space economy. The first two projects supported under the SIF will be a Mission Control Centre for Australian satellites and space-borne instrumentation/experiments, to be established in Adelaide, and a Robotics, Automation and AI Command and Control Centre located in Western Australia. Projects under the SIF commence in the 2019-20 financial year.

A summary of activities by the SCC membership is outlined further below under each Priority Area.

Communications Technologies and Services

Space is crucial for communications on land, our marine jurisdiction, and airspace. Australia can play a lead role in emerging technologies such as lasers for data communication, quantum technologies for secure communication, and hybrid radio and optical communications.

Australia's largest contribution to space has traditionally been in communications technologies and services. For example with the NASA Agreement with CSIRO to manage the Canberra Deep Space Communications Complex, as well as private sector investment in satellite based television and internet services. The Agency

facilitated a Priority Area workshop on communications technologies in its first six months and engaged with the community to understand the opportunities and challenges.

The *Australian Civil Space Strategy* identifies this Priority Area as part of Phase 2 (2019-2021). A roadmap is being prepared to build on activities to date, identify areas of opportunity for industry including investment, and identify areas where Government could provide effective investment to deliver on the Strategy.

Table 3 – SCC communications technologies and services activities

Organisation	Summary of activity
Australian Communications and Media Authority	The ACMA provides ongoing operational support for Australian-filed satellite networks. In 2018-2019 the ACMA's key spectrum planning priorities were to: support the deployment of novel satellite systems (particularly small satellites); undertake a general review of licensing procedures for space-based communications systems to consider whether existing procedures are commensurate with the risk of interference, including consideration of status of the satellite network in ITU satellite coordination process; consider and action, if appropriate, identification of possible additional bands for ubiquitous satellite use; and review of arrangements for ubiquitous earth stations in motion in the fixed satellite service in those parts of the Ku-band included in the Communication with Space Object Class Licence. The ACMA's future work priorities for the next five years are outlined in its Five Year Spectrum Outlook (FYSO). The FYSO includes a detailed work plan for 2018-2019. Consultation on the ACMA work plan for 2019-2020 commenced in April 2019 with the release of a draft 2019-2023 FYSO for public consultation.
Bureau of Meteorology	To meet its needs for real time satellite observations, the Bureau owns and operates a continental-scale direct reception network including two sites in Antarctica. The Bureau provides a positioning (ranging) service for the Chinese Fengyun 2 satellites from its Crib Point facility. The Bureau's Space Weather Services (SWS) provides a broad range of space weather services associated with measuring, modelling and forecasting the near space environment. The SWS supports defence, navigation, aviation, resource exploitation and other industry sectors.
CSIRO	CSIRO's spacecraft tracking and communications activities, together with its radio astronomy activities, are carried out by the CSIRO Astronomy and Space Science (CASS) Business Unit, which has approximately 280 FTE staff. CASS operates several major national space facilities. On 2 October 2018, CSIRO was awarded a new contract for the continued operations of the Canberra Deep Space Communication Complex (CDSCC) on behalf of NASA for a further 10 years. The CDSCC Deep Space Network station currently supports 30 space missions from different countries, reaching out as far as the Voyager spacecraft. The Parkes radio telescope and CDSCC have collaboratively supported the Voyager missions that have now passed through the heliosphere into interstellar space. In early 2019 CASS also began transition to management of the European Space Agency (ESA)'s deep space tracking station in New Norcia, WA, moving to full management of operations and maintenance on 1 June 2019.

Organisation	Summary of activity
	Management of both facilities allows the potential for new synergies in engineering, operations and capability development.
Department of Communications and the Arts	NBN Co Sky Muster satellite services The NBN Co Sky Muster satellite network provides access to fast broadband to over 400,000 homes and businesses, predominantly in regional, rural and remote Australia. As of June 2019, more than 95,000 homes and businesses had an active NBN Co Sky Muster satellite service. NBN Co is further developing its range of wholesale satellite products to better meet the needs of homes and businesses. This includes enhancing existing services by increasing data allowances. The company is also working on new products and additional applications to enable remote telehealth and distance education. In late 2018, NBN Co announced a new product, Sky Muster Plus. This service allows regional Australians access to unmetered data for web browsing, email and software updates. It also enables wholesale download speeds to exceed 25 Megabits per second when network capacity is available. Sky Muster Plus will launch in August 2019. NBN Co expects to begin providing its Sky Muster Business Satellite Service from late 2019. The service will enable access to business grade internet, data and voice services for eligible business customers in rural and remote Australia. Viewer Access Satellite Television Service The Viewer Access Satellite Television (VAST) service provides free-to-air television and radio broadcasts to more than 500,000 viewers, plus 30,000 travellers, mostly in regional and remote areas. VAST also provides a service to some metropolitan areas where terrestrial transmission services are not available. DoCA administers the funding provided to commercial broadcasters for the satellite transmission of commercial free-to-air television services over VAST, with ABC and SBS services funded via their Budget appropriations. Development of the Universal Service Guarantee (USG) Access to telephone and payphone services has long been seen as important to social and economic inclusion and has been underpinned by a legislated and contracted Universal Service Obligation (USO). USO services are typically delivered using Telstra's copper network, however around 1,000 services are delivered by satellite. The USG will provide premises across Australia with access to broadband, as well as voice services historically available under the Universal Service Obligation (USO). In 2018, DoCA examined the feasibility and cost implications of different approaches to delivering voice and other telecommunications services in rural and remote Australia as part of a new USG, which also includes broadband. On 5 December 2018, the Government announced the broadband component of the USG and most voice services would be provided by the National Broadband Network and the USG would incorporate the existing USO for voice.

Organisation	Summary of activity
	The Government has indicated it would also look at better ways to deliver the USG over time. As part of this work, DoCA monitors and assesses the ability of new space technologies to deliver quality telecommunications services in a more cost-effective way that can meet consumer needs. This includes understanding the potential role that new and emerging satellite systems (e.g. leosats) and proposed high altitude platforms could play in delivering future communication service. Through DoCA's work on the development of the Universal Service Guarantee (USG), satellite-based service providers and service retailers should have a clearer idea of service needs in rural and remote Australia, and potential long term commercial opportunities which could feed into service development. DoCA is open to working with vendors in this context. DoCA is working with the Agency to ensure it has a sound understanding of new and emerging space-based communications systems so it can factor them into its forward policy planning, particularly for service delivery in rural and remote Australia. <u>International Radiocommunications</u> Issues considered at WRC-19 will impact upon a range of communications technologies and satellite services, including (for example) the protection of satellite ground stations operating in certain frequency bands from unwanted emissions from next generation mobile broadband (5G) networks, and adjustments to international regulation of radiocommunications satellite filings, including for new non-GSO constellations (LEO/MEO).
Department of Defence	There are seven remaining tranches for current satellite communications for delivery under Joint Project 2008 to be completed by mid-2023. The final phase will see the completion of Satellite Ground Station-East, a new ground station in Kapooka Military Area, NSW, and the implementation of a holistic wideband satellite communications Network Management System. With support from the Australian Defence Information & Electronic Systems Association, Defence benefited from a collaborative Request for Information to support costed options development for Joint Project 9102 – the future "Australian Defence Satellite Communications System" (ASDSS). The ASDSS is based on recognition in the Defence White Paper 2016 that operations are reliant on space based satellite systems to support networked capabilities and to communicate, and the direction that priority will be given to strengthening the resilience and redundancy of satellite-based communications. Defence will present capability options for Joint Project 9102 ASDSS to Government in mid-2020, in a First Pass submission as part of a rolling sub-program approach. The capability options were informed by significant input from Australian and international space industries, addressing questions posed by Defence on a range of options balancing Government owned and operated, partnering and commercial leasing building blocks. Defence has partnered with the US Department of Defense to establish the Combined Communications Gateway Geraldton (C2G2). The Memorandum of Understanding for C2G2, signed in October 2014, enables the US to establish a Gateway capability in Australia. The facility will be jointly shared by the US and Australia, and will allow both partners to access Wideband Global

Organisation	Summary of activity
	SATCOM (WGS) resources. The request for tender for facility construction was finalised in August 2018, and the contract was awarded to Icon (previously known as Cockram) in September 2018. Construction has commenced and anticipated to be completed (i.e. Building Occupancy Date) in March 2020. Defence anticipates that C2G2 will reach an Initial Operating Capability in early 2020 and Final Operating Capability in early 2021.
Department of Home Affairs	The National Situational Awareness Tool (NSAT) is a valuable national resource that has increased situational awareness by improving crisis management collaboration across governments. Emergency Management Australia, in partnership with GA and members of the EMSINA, continue to utilise EM-Link. EM-Link is a digital version of NSAT that provides a quick, comprehensive and up-to-date listing of emergency management related geospatial web services for a chosen hazard and/or region.
Department of Infrastructure, Regional Development and Cities	Australia is an active participant in the Cospas-Sarsat Program, an international satellite-based distress beacon detection system.[8] During 2018, 410 people were rescued in Australia in incidents involving activation of a 406 MHz distress beacon. Importantly, Australia has the second-largest 406 MHz distress beacon ownership in the world, estimated at over 550,000 registered beacons. In support of the Cospas-Sarsat Programme, the Australian Maritime Safety Authority (AMSA) operates a satellite tracking station near Mingenew in Western Australia in support of the new Medium-altitude Earth Orbit Search and Rescue (MEOSAR) capability. The Low-altitude Earth Orbit Search and Rescue LEOSAR tracking stations in Western Australia and Queensland were decommissioned in the first half of 2019 as the MEOSAR capability commenced full operation. Data from the Cospas-Sarsat satellite tracking stations are used operationally by the Australian JRCC to respond to land, maritime and aviation distress situations. Airservices provides point-to-point satellite communications and ground-air communications for the aviation sector via a service provider. CASA recognises that the development of satellite-based communication, surveillance and navigation systems for aviation purposes will significantly enhance aviation safety, efficiency and capability.
Geoscience Australia	GA participated in the European Commission's trial emergency warning service (Galileo-based Reliable Automatic and Low Latent EWS, or GRALLE), which tested the use of satellite navigation infrastructure to transmit emergency warning information to citizens.

Space Situational Awareness and Debris Monitoring

Collisions in space with debris pose a risk to assets and life. Australia's geographical position makes it an ideal location for space debris tracking and space traffic management activities.

[8] http://www.cospas-sarsat.int/

The Agency facilitated a Priority Area workshop on space situational awareness (SSA). This was the first workshop hosted across the government, research, education and private sectors. The workshop was organised to understand Australia's capabilities and consider opportunities for the future. The results were used to inform the *Australian Space Civil Strategy* and to inform the development of a roadmap to highlight opportunities for Australia. With regard to the Agency's regulatory responsibilities, the *Space Activities Amendment (Launches and Returns) Act 2018* adds the requirement for a debris mitigation strategy for certain authorisations involving objects going to space.

The *Australian Civil Space Strategy* identifies this Priority Area as part of Phase 3 (2021-2028), delivering success.

Table 4 – SCC space situational awareness and debris monitoring activities

Organisation	Summary of activity
Bureau of Meteorology	Space weather plays an important role in SSA through orbital perturbations and hazardous radiation events. The Bureau is a member of the Agency's national coordination and steering group for SSA activities.
CSIRO	Combining the capabilities of CDSCC (DSS43) and the ATNF (Australia Telescope Compact Array and Parkes radio telescope), CSIRO is progressing research in asteroid bistatic radar tracking techniques as part of space situational awareness. Asteroids emerging from the southern hemisphere, which account for 5 to 10 per cent of all Near Earth Asteroids, are not immediately detectable by the international NASA Near Earth Asteroid (NEA) program. This allows Australia an opportunity to contribute to the NASA NEA program as well as develop new science to assist future space exploration missions. Since 2015, CSIRO in conjunction with NASA's Jet Propulsion Laboratory (JPL), has successfully detected and tracked seven asteroids (including 2019 GC6 and 2019 EA2) with diameters of 0.02 to 2 km out to ranges of 0.1 to 10 lunar distances using exclusively Australian-based systems.
Department of Defence	The Department of Defence contributes to efforts to better understand the space environment and help ensure the security of space-based assets. This includes strengthening Defence's space situational awareness capabilities and working with the US to jointly operate military space surveillance systems in Australia. Defence and the US have jointly established a C-band space surveillance radar at the Harold E. Holt Naval Communications Station near Exmouth in Western Australia, and are working to relocate a US-owned optical Space Surveillance Telescope to Australia. Installation of the Telescope commenced in January 2019 and the associated facilities project to house the telescope is expected to be completed in 2019. Both assets will be operated by Australia. The radar and telescope will increase Defence's capability to detect and track objects in space, including space debris, and predict and avoid potential collisions. Existing infrastructure at the Harold E. Holt Communications Facility will be upgraded over the decade to 2025-26, including infrastructure upgrades to support the operation of the Space Surveillance Telescope. Defence is working with industry partners on the development of sovereign controlled space surveillance capabilities, including both space-based and ground-based systems. The RAAF has engaged with Australian industry and academic partners to identify sovereign space surveillance capabilities

Organisation	Summary of activity
	through the DST-led Space Fest Technology Demonstration and a request for information (RFI) through AusTender.
Geoscience Australia	GA operates the national Satellite Laser Ranging (SLR) Network with stations at Mount Stromlo (ACT) and Yarragadee (WA) contributing to the International Laser Ranging Service (ILRS).

Positioning, Navigation and Timing

Position, navigation and timing (PNT) is critical for many areas of the Australian economy, including agriculture and mining. While Australia does not have its own global navigation satellite system, Australia's PNT infrastructure needs to be world class to underpin the growth of the broader economy.

In the 2018-19 Budget, the Australian Government made significant commitments to Australia's PNT infrastructure, delivered through Geoscience Australia. The *Australian Civil Space Strategy* identifies this Priority Area as part of Phase 1 (2018-19) as setting the conditions for growth.

Table 5 – SCC position, navigation and timing activities

Organisation	Summary of activity
Bureau of Meteorology	The Bureau and GA collaborate on the use of real-time GPS data. GA receive, process and deliver the data in real time to the Bureau, where it's used in the Australian Community Climate and Earth-System Simulator (ACCESS) modelling suite. The ACCESS models deliver meteorological products that underpin the Bureau's forecast and warning services. The delays in GPS signals can be used to derive atmospheric moisture observations which improve forecasting skill.
Department of Communications and the Arts	Under consideration at WRC-19 are a number of treaty changes related to communication systems used for aeronautical and maritime navigation, and telemetry, tracking and command for satellites. DoCA leads Australia's delegation and has advocated on behalf of Australian interests throughout negotiations in the four year cycle leading up to WRC-19 (held October - November 2019).
Department of Defence	The Department of Defence continues to monitor the US GPS Modernisation program, and will begin transitioning to modernised GPS equipment when new services are made available. The Department of Defence supports a GPS monitoring station in South Australia and is assisting in the installation of a second monitoring station in Western Australia. Project JP 9380 is in the strategy and concepts development phase and aims to deliver enduring assured PNT to the ADF through the acquisition of both space based and terrestrial technologies.
Department of Infrastructure, Regional Development and Cities	Airservices Australia utilises Global Navigation Satellite System (GNSS) information for en-route, terminal, approach and landing navigation. This includes the Ground-Based Augmentation System (GBAS) in Melbourne and Sydney and the future deployment of the Satellite Based Augmentation System (SBAS). Airservices is working with GA on the development of the SBAS to support aviation certified L1 service, with an expected in service date of 2023.

Organisation	Summary of activity
	Airservices also uses GNSS for surveillance (Automatic dependent surveillance – Broadcast (ADS-B) and Contract (ADS-C)) and precise timing for system synchronisation in communications, surveillance and processing. CASA recognises that the transition toward satellite-based technology aligns with the International Civil Aviation Organisation (ICAO) agenda to achieve performance-based navigation using accurate positioning information and to enhance arrival and departure procedures at airports. Satellite based capabilities will provide accurate 3D position information to enable reduced separation standards and improve navigation accuracy to reduce the potential for controlled flight into terrain. Accurate positioning information will be critical to future drone operations where self-separation and autonomous flight will be required to enable multiple users to operate safely in the same airspace. This will also apply to the operation of future Vertical Take Off and Landing (VTOL) aircraft like the proposed 'Uber Elevate' vehicles where self-separation, artificial intelligence and autonomous flight will be enabled. SBAS will enable a poor weather 3D approach at every airport in Australia without significant aircraft equipage or ground infrastructure.
Geoscience Australia	GA is implementing the National Positioning Infrastructure Capability (NPIC) and the Australian SBAS. In the 2018-19 Budget, GA received funding commitments for two satellite positioning measures, Better GPS for Australian business and Better GPS for regional Australia. Together, these projects will deliver the NPIC, and SBAS, to improve the accuracy, reliability and availability of positioning data from GPS and other satellite navigation systems. $160 million was allocated to deliver SBAS to provide positioning capability to an accuracy of 10 cm across all of Australia, with ground-breaking applications in agriculture, mining and other industries. GA began the planning and design work for procurement of the system components for SBAS, which will include a satellite and ground infrastructure, and data analysis capabilities. GA has completed a trial of SBAS in partnership with the New Zealand Government's Land Information New Zealand (LINZ). The SBAS trial involved more than 30 organisations across ten industry sectors, and has assessed the economic and social benefits of improved satellite positioning technology. The benefits analysis is available at https://frontiersi.com.au/project/satellite-based-augmentation-system-test-bed/. GA also received $64 million for NPIC that will drive productivity and innovation in a number of industries, including transport, agriculture, mining and construction by providing more accurate GPS data. GA commenced the upgrade of its national network of ground stations as part of the NPIC. The network will eventually comprise 200 ground stations across the Australian continent. GA operates the national SLR Network with stations at Mount Stromlo (ACT) and Yarragadee (WA) contributing to the International Laser Ranging Service (ILRS). In partnership with the University of Tasmania, GA also operates the national Very Long Baseline Interferometry (VBLI) array with stations at

Organisation	Summary of activity
	Hobart (Tas), Yarragadee (WA) and Katherine (NT) contributing to the International VLBI Service (IVS).

Earth Observation Services

Earth observation (EO) has untapped potential to grow Australia's economy, for example, by improving agricultural monitoring, water management, and monitoring shipping routes. Through Geoscience Australia's Digital Earth Australia (DEA) initiative, Australia is world-leading in this field. Australia will continue to focus on and develop this priority area to grow Australia's broader economy.

In the 2018-19 Budget, the Australian Government made commitments to DEA, delivered through GA. The *Australian Civil Space Strategy* identifies this Priority Area as part of Phase 1 (2018-19) as setting the conditions for growth.

Table 6 – SCC Earth observation activities

Organisation	Summary of activity
Bureau of Meteorology	The Bureau's weather, climate, ocean and water services are underpinned by Earth observation satellites. The ACCESS models assimilate real-time data from more than 20 different satellite sensors. Space based observations are a crucial input for the data assimilation modules of the ACCESS weather and seasonal prediction models as well as ocean forecast models. The lead time for the prediction of weather events is critically dependent on satellite observations. The Bureau generates several Earth Observation-derived products, including Atmospheric Motion Vectors (AMVs), fog and low cloud, solar radiation, volcanic ash, and sea surface. The Bureau also coordinates the Asia Pacific Regional 'ATOVS' Retransmission Service (AP-RARS). These operational arrangements provide other national weather prediction centres with satellite data received at direct reception facilities in Australia, New Zealand, Antarctica, Japan, China, Singapore and Korea, within 30 minutes of the observation. The Bureau is an Associate Member of CEOS, as it has significant interest in the use of Earth observation data for meteorological, environmental and climate applications. The Bureau's Space Weather Services (SWS) operates a World Data Centre, the WDC – Space Weather, Australia, which is a member of the International Council for Science World Data System (ICSU-WDS). The Bureau-operated COSMIC-2 ground station became operational in May 2019, providing downlink and command-and-control services in support of the US-Taiwan constellation. The COSMIC-2 (Formosat-7) satellite constellation was launched on 25 June, 2019.
CSIRO	2018 saw the formal establishment of the CASS Space Research Program incorporating the CSIRO Centre for Earth Observation (CCEO). The CCEO supports the following CSIRO activities in Earth observation science: • Coordinating delivery of underpinning EO science, including a satellite data quality assurance and calibration and validation work program, and

Organisation	Summary of activity
	Earth observation informatics expertise for the management of petabyte-scale EOS datasets and support of sophisticated time-series analysis tools, web-services, model-data fusion and model-data assimilation science and applications projects. • Support for inter-agency and international cooperation, providing the primary point of contact on Earth observation matters for CSIRO. • Linkages to Earth observation industry and innovative applications development for next generation sensing systems, including oversight of the Defence Materials Technology Centre High Altitude Sensor Systems Program (for which CSIRO provides the Program Leader on secondment). • Operations and data management for the Australian capacity share of the UK-operated NovaSAR-1 satellite, which was launched successfully from India in September 2018. The first images from the commissioning phase were released in November 2018, and the satellite is expected to begin operations in FY2019-20. • Oversight of the CSIROSat-1 CubeSat project, commenced mid-2018. CSIROSat-1 will demonstrate new Earth observation and on-board processing technologies and is being built in collaboration with Australian start-up company Inovor Technologies. It will be launched from the International Space Station in 2021. CSIRO and GA represent Australia and the Agency on key programmatic aspects of international coordination on the SCC EOS working group. CSIRO and GA, working with domestic and international partners, are also establishing multiple new initiatives around furthering the Open Data Cube technology, initiated within Australia, to support the use of new generation meteorological satellites for non-meteorological applications. CSIRO and GA also support the use of Earth observation information for informing progress towards the United Nations Sustainable Development Goals. CSIRO has been assisting the Group on Earth Observations (GEO) with the use of Earth observation data for sustainable development goals, future data architectures, the GEO Land Degradation Neutrality Initiative and the GEOGLAM (Rangelands and Agricultural Crop Monitoring) Flagship. Regionally, CSIRO is assisting the Vietnam National Satellite Centre and the New Zealand Centre for Space Science Technology in establishing DataCube platforms in these agencies. Further enhancements are planned to the regional Copernicus data access and analysis hub, including potential expansion of the regional coverage to the Pacific and additional EOS datasets included beyond the Copernicus *Sentinel* missions. CSIRO is supporting the evolution of Earth Observation Australia as a national coordination group fostering cooperation between the Australian Government, industry, research and other groups in the national Earth observation community.

Organisation	Summary of activity
	CSIRO, with support from GA, is serving as the Vice-Chair of the CEOS Strategic Implementation Team (SIT) until October 2019. It will act as the SIT Chair from 2020 to 2021. This will include hosting the 2019 meeting of the Strategic Implementation Team, which will bring together space agency leaders and top technical experts from around the world. Through participation in CEOS, CSIRO and GA also support the work of the Group on Earth Observations (GEO).
Department of Communications and the Arts	A number of WRC-19 agenda items either affect EO services directly or consider measures to ensure protection of EO satellite services from interference, including from potential deployments of 5G mobile broadband. A new agenda item has been proposed for WRC-23 on space weather sensors.
Department of Defence	The Australian Geospatial-Intelligence Organisation (AGO), within the Department of Defence, is responsible for space-based imagery collection in support of Australian Government national security, foundation data and intelligence requirements. In line with guidance in the 2016 Defence White Paper, AGO has received Government approval to provide an enhanced space-based commercial imagery capability to Defence. In 2018, Defence Project DEF799 Phase 1 (DEF799-1) - Enhanced Commercial Access commenced construction. Managed by the AGO, this project improves Australia's ability to collect imagery of priority areas through direct access to commercial satellites. The project will: • construct a Direct Tasking and Receipt Facility (DTRF) at RAAF Base Edinburgh to task commercial satellites and receive imagery; • establish contractual arrangements with commercial providers for satellite access; • construct five antennas across three sites, through which the DTRF can task and download imagery from commercial providers; and • disseminate imagery into the Defence GEOINT Domain to meet AGO customer requirements. The capability will operate for 13 years. Project DEF799 Phase 2 Space-based Geospatial-Intelligence Sensors Capability seeks to acquire sovereign space-based GEOINT sensors to meet the future needs of Defence and the National Intelligence Community. AGO has commenced an initial two year study to define requirements, which will be achieved through wide stakeholder engagement including Defence, the National Intelligence Community, Federal Government agencies, industry, academia, and international allies and partners. The Study is scheduled to conclude in 2020-21 with Initial Operating Capability planned for 2028 to 2029.
Geoscience Australia	GA, the Bureau and CSIRO are jointly responsible for Earth observations from space (EOS) capability in Australia. The three agencies are working together to implement the National Earth Observations from Space Infrastructure Plan. Developing national EOS infrastructure will modernise Australia's national observatory networks and calibration facilities; strengthen domestic and international partnerships; improve scientific analysis, and operational

Organisation	Summary of activity
	mapping and monitoring; and strengthen data and knowledge sharing, and the efficiency of accessing this information through open data policies. This infrastructure will support industry, researchers, and Australian Government agencies to realise the benefits of EOS data. Digital Earth Australia DEA provides routine, reliable and robust intelligence about the Earth, its resources and how these have changed over the recent past. DEA translates EOS data into free ready-to-use insights about Australia's natural and built environment. Such insights are then used by Australian governments and businesses to build a stronger evidence base around soil and coastal erosion, agricultural practices, deforestation, mining, water quality, and human and urban settlements. DEA products and technologies are already enjoying significant uptake: Australian government and businesses are using DEA prepared satellite data to better understand water availability, estimate biomass, and understand how land management practices are affecting productivity. Over 10 continental-scale DEA products, as well as a range of statistical products that can be computed on-the-fly, are available from NationalMap.gov.au In the 2018-19 Budget DEA received funding of $36.9 million over four years, plus ongoing annual funding of $13 million. This funding will ensure DEA supports private sector exploitation of DEA capabilities. In 2018, DEA conducted an extensive Australian industry consultation, the results of which informed its Industry Strategy, released in March 2019. The strategy explains the approach DEA will be taking to industry engagement in areas such as data and technology, education, and market awareness. In its initial phase, DEA will focus on leveraging satellite data to improve Government business, including applications that streamline the implementation of environmental regulations that effect businesses. DEA will also lower the technical barriers to using this data such that businesses from start-ups to major established companies operate on a level playing field. Landsat 2019 marks the 40th anniversary of GA's Alice Springs ground station and its support for the Landsat program. Anniversary celebrations with dignitaries from Australia and the US will happen on-site in November 2019, and will involve the commissioning of newly completed satellite dish artwork by Native American artists. The satellite ground station continues to operate above targeted operational performance and is currently operating at 99.6 per cent with a 98 per cent target. From between November 2018 and May 2019, this ground station was the best performing ground station in the Landsat network, achieving 100 per cent success rate for Landsat 7 operations. The project to ensure Alice Springs is ready to support the Landsat-9 mission is on track. LandsatNext and the future Sentinel missions GA is exploring opportunities for Australian experts to participate in architecture studies being undertaken by the USA and European Commission for future operational land imaging missions. Engagement in these processes

Organisation	Summary of activity
	is critical in opening opportunities for future Australian participation or co-investment in the operational missions on which we depend. GEO Week The 2019 GEO Ministerial Summit will be held in Canberra on 4-9 November. GA is the Australian lead and host of GEO Week with support from CSIRO, the Agency, the Department of the Environment and Energy and other agencies. GA has designed a comprehensive program to showcase and connect Australian EOS capabilities internationally. GEO Week 2019 includes an Industry Track: an Australian initiative designed to strengthen engagement between the commercial sector and the GEO community. A number of US space and technology companies will participate in the Industry Track to showcase their products and innovations in the burgeoning global EOS market for new sensors, space technology and apps. Other GA Activities GA in partnership with CSIRO, the NZ Government, and the governments of WA, NSW and Qld operates a regional data hub that provides access to data from Europe's Copernicus program. The hub provides access to satellite Earth observation data covering the South-East Asia and South Pacific region. GA also coordinates Australia's use of the International Charter for Space and Major Disasters and the Copernicus Emergency Management Service. In February 2019, the Copernicus service was used in support of flooding in Queensland. The service, operated by the European Commission, provided valuable mapping products to support the emergency response. GA is working with stakeholders to scope a "National Calibration and Validation Facility". Such a facility would align investments in calibration and validation facilities and programs to make Australia a world-class "test bed" for Earth observation applications, while also ensuring the financial sustainability of critical calibration and validation infrastructure. GA is a founding partner of the Open Data Cube (ODC) project. The Open Data Cube is open source software that seeks to increase the value and impact of global EO satellite data by providing an open and freely accessible exploitation architecture. The ODC project seeks to foster a community to develop, sustain, and grow the technology and the breadth and depth of its applications for societal benefit.

Leapfrog Research and Development

Australia has a strong research base in space-related R&D, contributing 6.8 per cent of the World's publications in this sector between 2012 and 2016[9]. To transform our space sector and leapfrog into new areas consistent with broader economic and security interests, Australia can encourage and support research that inspires, identify areas to develop, and commercialise R&D that would grow and transform the space sector. Areas of new opportunity include new rocket technology, new high-tech materials, space medicine, synthetic biology, quantum communications, in-orbit servicing, and optical wireless communication technologies.

[9] Office of the Chief Economist Australian Innovation System Report 2017

The *Australian Civil Space Strategy* identifies this Priority Area as part of Phase 3 (2021-2028), delivering success.

Table 7 – SCC research and development activities

Organisation	Summary of activity
Bureau of Meteorology	Several Bureau scientists are actively involved in international science teams, including the Technical Advisory Committee for the GOES-R (GOES-16) meteorological satellite, the GOES-R Independent Advisory Committee, the CloudSat Science Team, and the GPM Science Team. Membership of these teams enables early access to data for testing, through collaboration on algorithm development.
CSIRO	In September 2018, CSIRO launched its Space Roadmap, which identifies three broad opportunity areas in which Australian industry can capitalise: Space-derived services, Space object tracking, and Space exploration and utilisation. https://www.csiro.au/en/Do-business/Futures/Reports/Space-Roadmap. These areas are consistent with the Civil Space Priorities identified in the *Australian Civil Space Strategy*. In November 2018, CSIRO announced the establishment of the Space Technology Future Science Platform (Space FSP), with an initial $16 million investment in a multi-year, multi-disciplinary program to develop frontier space technologies and applications that represent a step-change in CSIRO's research capabilities. The Space FSP aims to build world-leading capability and drive cutting-edge research within CSIRO in support of Agency's goal of tripling the size of the Australian space industry by 2030. Investments will focus on the priority areas identified in the CSIRO Space Roadmap and by the Agency. Eleven projects were carried out in the first half of 2019 under the Space FSP in areas including satellite technologies, EO, space object tracking, communications and signal processing, remote operations and resource utilisation, and biomedicine. This portfolio of activities will continue to grow in 2019-20. To support opportunities for Australian space start-ups and SMEs to develop research and business collaborations with CSIRO, the wider research sector, aerospace Primes, and space technology end-users, CSIRO held Space 2.0 Workshops in June and December 2018. CSIRO also manages and operates the Australia Telescope National Facility (ATNF), including the Australian Square Kilometre Array Pathfinder, and will partner with the Square Kilometre Array Observatory to operate the SKA-Low telescope in Australia. The Australian Square Kilometre Array Pathfinder (ASKAP) located at the Murchison Radio Observatory in the mid-west of WA is now in full operation using limited modes, and is just a few steps away from starting the key survey projects that will take advantage of its special capabilities. Key results and techniques generated through the development of ASKAP are contributing to the international Square Kilometre Array (SKA) design and development effort. ASKAP is also building industry involvement in green energy power systems that will be relevant to the much larger SKA project. Early science

Organisation	Summary of activity
	with CSIRO's innovative phased array feed receivers is already demonstrating breakthrough science discovery, for example in the area of Fast Radio Bursts. CSIRO is the centre agent for the Pawsey Supercomputing Centre (Perth), which is involved in a range of SKA-related activities. It supports two of the SKA precursor projects, the ASKAP and the Murchison Widefield Array (MWA), and is also working on projects with ESA. In addition to those mentioned above, a range of other space-related research and development activities are carried out across CSIRO, including: the CSIROSat-1 project; Earth observation data analytics and applications; high-performance materials and devices; advanced manufacturing processes; advanced communications technologies; extremely sensitive receiver technologies, and bistatic radar techniques for asteroid detection. CSIRO is a Supporting Participant of the newly established SmartSat Cooperative Research Centre, and a participant in several collaborative projects under the Defence Materials Technology Centre's High Altitude Sensor Systems Program.
Department of Communications and the Arts	At WRC-19 new work streams will be established to support development of space radiocommunication technologies, including between satellites, between GSO and non-GSO satellites and aeroplanes, high altitude transport (sub-orbital vehicles), between satellites and stations on the Earth's surface (e.g. shipping), and space weather.
Department of Defence	<u>Defence Science and Technology Group</u> DST Group contributes significantly to the development of Australia's space capabilities through a number of research and development programs in collaboration with international and domestic partners. DST commenced a strategic research initiative in space systems that has three core research areas: understanding the space environment, with a focus on space situational awareness; operating small satellites with innovative and niche capabilities and exploiting data from space-based systems contributing to defence capabilities. DST is contributing to the *International Small-Satellite Command and Control Network* (ISC2N) ground station network. This multi-national ground station network will support Australian and international partner small satellite missions. DST is leading development of a Defence S&T Strategy for Space to identify and invest in strategic space technologies that have the potential to deliver game-changing capabilities in Resilient Affordable Space Systems and Comprehensive Space Domain Awareness. DST Small Satellite development work continues. Following the successful completion of the initial Buccaneer risk mitigation mission, in 2018, the main mission program has been commissioned for a launch in 2021. DST is contributing to the UNSW small satellite mission M2. In addition DST is supporting the CSIRO CSIROSat-1 mission with small satellite expertise and ground station support.

Organisation	Summary of activity
	Defence's Next Generation Technologies Fund proposes to sponsor a Small Business Innovation Research for Defence challenge to develop Cubesat payloads for Earth Observation. The Fund also supported the SmartSat Cooperative Research Centre (CRC) bid with a commitment for a Defence tied fund. This CRC has now been established, with DST as a core partner. The SmartSat CRC will be the S&T engine for both Defence and commercial programs in Australia. DST hosted an Emerging Disruptive Technologies Assessment Symposium (EDTAS) on 5-6 March 2019 in Perth, which focused on Space Technologies. The symposium was co-hosted by Curtin University, Edith Cowan University, the University of Western Australia, and Murdoch University. Through this symposium, DST brought together internationally recognised academic, industry and Defence leaders in a multi-disciplinary workshop environment over two days to explore and shape the long-term vision for space technologies. More information on this symposium can be found at: https://www.dst.defence.gov.au/NextGenTechFund/emerging-disruptive-technology-assessment-symposium-edtas The Defence Innovation Hub Since its launch, the Defence Innovation Hub has invested over $21.5 million in space related innovation projects. This includes: • A $5.5 million innovation contract with Western Sydney University to develop neuromorphic vision systems for next-generation space situational awareness capability. The project will develop an optical imager designed for space surveillance based on dynamic range asynchronous array imaging technologies. • An innovation contract with Inovor Technologies to deliver a prototype nanosatellite that will enhance space situational awareness. This $5.7m investment will continue to expand Australia's growing space capability and has potential to contribute to supporting the global space surveillance network. • Support for Defence satellite communications through two Innovation Hub contracts with EM Solutions for test and demonstrating a prototype communications antenna on Navy vessels ($5.8m) and to develop a low profile, flat panel antenna system ($1.9m). • An innovation contract valued at $1.5 million with Saber Astronautics to develop and demonstrate technology that can autonomously identify and model electronic signals. This innovation has the potential to provide an enhanced electromagnetic spectrum operations decision support capability. • An $800,000 Phase 1 concept exploration contract with Silentium Defence to advance the concept of a system to enhance space situational awareness. The Hub has also made investments in a range of other innovations with space related applications. Australian industry can leverage opportunities for investment in space capabilities through the Defence Innovation Hub.

Organisation	Summary of activity
	Other Defence Activities Defence is half-way through a three-year space research and development program between the University of New South Wales at the Australian Defence Force Academy in Canberra and the Royal Australian Air Force (RAAF) to deliver world-class space education to Defence personnel and inform the future direction of Defence space capability. Defence's strategic and coordinated approach to the defence industry is also delivering greater support to the space sector. Notably, the Centre for Defence Industry Capability delivers advice and support to industry and intelligence, surveillance, reconnaissance, space and cyber have been identified as priority investment areas for both the Defence Innovation Hub and the Next Generation Technologies Fund.
Department of Infrastructure, Regional Development and Cities	Airservices Australia is monitoring the development of a satellite based surveillance and communications capability. This capability would likely be the introduction of Automatic Dependent Surveillance - Broadcast (ADSB) predominantly for oceanic airspace surveillance and very high frequency (VHF) radio as a replacement for high frequency (HF) radio.
Geoscience Australia	During 2018-19, DEA significantly increased its engagement with Australian businesses, especially in the agricultural sector. In March 2019, DEA released its Industry Strategy, developed in consultation with over 500 individuals from across a range of industry sectors. The Industry Strategy articulates how DEA plans to maximise the benefits of EOS across the Australian economy and ensure the market for Australian-made EOS products and services grows significantly. The first and most visible part of the DEA Industry Strategy - DEA Labs – was announced in May 2019. DEA Labs is a small-scale incubator program designed to accelerate the adoption of DEA services and technology by Australian businesses. The program supports businesses to prototype, test, refine and operationalise solutions that solve existing problems or gaps in domestic markets across sectors. In its pilot round, DEA received over 30 expressions of interest. Three businesses were successful in their bids: Cibo Labs Pty Ltd, DataFarming Pty Ltd, and NGIS Pty Ltd. Each business receives $50,000 and access to DEA expertise to test and develop their proposal and deliver products for commercial release. A further five shortlisted proposals will receive non-financial technical support and advice from DEA experts. GA works closely with the research community and established networks, like the Terrestrial Ecosystem Research Network (TERN) facility of the National Collaborative Research Infrastructure Strategy (NCRIS), to help identify areas where Earth observation datasets and applications will be of future interest to Australian Government users and the private sector. GA works closely with users and employees within the NCRIS facilities to ensure that EOS datasets are consistent across research and operational platforms.

Robotics and Automation

Australia is a world leader in remote asset management in industries including mining, oil and gas, transport, agriculture, and fisheries. Australia can leverage its expertise in robotics technology and systems for remote operation and exploration in space. Such systems are becoming more accessible with the lowering cost to access space.

Robotics and automation will play an increasing role in space activities in the coming decade. To support this capability, one of the initial projects supported by the SIF will be a Robotics, Automation and AI Command and Control Centre located in Western Australia to commence in 2019-20 to enable developments in space-related robotics and AI.

The Agency also facilitated a Priority Area workshop on robotics and automation. This was the first workshop hosted across the government, research, education and private sectors. The workshop was organised to understand Australia's capabilities and consider opportunities for the future. The results were used to inform the *Australian Space Civil Strategy* and to inform the development of a roadmap to highlight opportunities for Australia. The *Australian Civil Space Strategy* identifies this Priority Area as part of Phase 3 (2021-2028), delivering success.

Access to space

There are emerging opportunities for Australia to leverage international space missions and commercial launch activities from Australian territory to support industry growth. Protecting national safety and meeting international and national obligations will be critical before domestic launch can occur.

The global space sector is being transformed, opening up opportunities for companies small, medium and large. To keep pace with these changes, the Australian Government has reviewed the regulatory framework to ensure it remains appropriate for the Australian context. The findings of the review will be implemented in the *Space (Launches and Returns) Act 2018.*

The updated framework provides greater clarity and flexibility for the Australian space industry and ensures there is appropriate consideration of:

- the removal of barriers to participation, encouraging innovation and entrepreneurship
- the safety of space activities and the risk of damage to persons or property as a result of these activities
- the implementation of certain obligations under the UN Space Treaties.

The updated Act also broadens the regulatory framework to include launches from aircraft in flight and high power rockets. It streamlines the approvals processes and adjusts the insurance requirements appropriate to risk levels for launches and returns.

More discussion of the Act and the work of the Agency is outlined under the 'Responsible' Pillar. The *Australian Civil Space Strategy* identifies this Priority Area as part of Phase 3 (2021-2028), delivering success.

State and Territory Engagement

The Head of the Agency met with First Ministers or their relevant counterparts in May and June 2018, prior to the establishment of the Agency on 1 July 2018. The meetings were an opportunity to outline the vision of the Agency and to explore investment opportunities across Australia. The next series of meetings occurred in March 2019. These meetings were an opportunity to provide an update on the activities of the Agency, gain an understanding of space activities underway in each jurisdiction and explore investment opportunities to grow and transform Australia's space industry. These meetings are an important mechanism to understand the opportunities for the space sector across Australia, and provide an important channel for States and Territories to engage with the Agency.

As part of its Charter, the Agency formally established the State and Territory Committee with the first meeting held in December 2018. Memorandums of understanding are being progressed with each jurisdiction and MoUs with the ACT (refer to Figure 6) and NSW were completed by 30 June 2019.

Figure 6 – Signing of jurisdictional MoUs with ACT and NSW Governments

Industry partnerships

As outlined in the summary of Achievement, the Agency signed its first Joint Statements of Strategic Intent and Cooperation with industry. The statements:

- highlight areas of investment and growth for Australia
- build upon Australia's unique potential including space research and development, and commercial applications
- are impartial and offer no additional benefit to our department or the Agency

In September 2018, the Agency signed its first Statement of Strategic Intent and Cooperation (SSI) with European aerospace manufacturer Airbus Defence and Space SAS. Another five SSI's were signed by 30 June 2019: Italian satellite company, Sitael (October 2018); Australian space and defence company, Nova Systems (December 2018); US aerospace companies Lockheed Martin (January 2019) and Boeing (March 2019); space communications company Goonhilly Earth Station (February 2019) and Australian oil and gas company Woodside Energy (March 2019).

Figure 7 – Signing of first SSIs (L-R: Airbus, Nova Systems and Sitael)

Space Infrastructure Fund

In the 2019-20 Budget, the Australian Government allocated an additional $19.5 million for the SIF to support Australia's emerging domestic space industry. The SIF will fill space infrastructure gaps to support businesses and researchers to participate in the global space economy.

Filling gaps in Australia's space infrastructure allows businesses and researchers to focus on growing and developing their day-to-day operations, and providing space-related solutions to drive economic benefit across the whole economy – providing new tools for farmers, supporting emergency services and helping manage drought. It also provides the tools businesses need to access international opportunities – opening doors for Australia internationally.

Projects to be delivered

There are seven SIF projects identified. An outline is shown in Figure 8 and a summary of each project highlighted below.

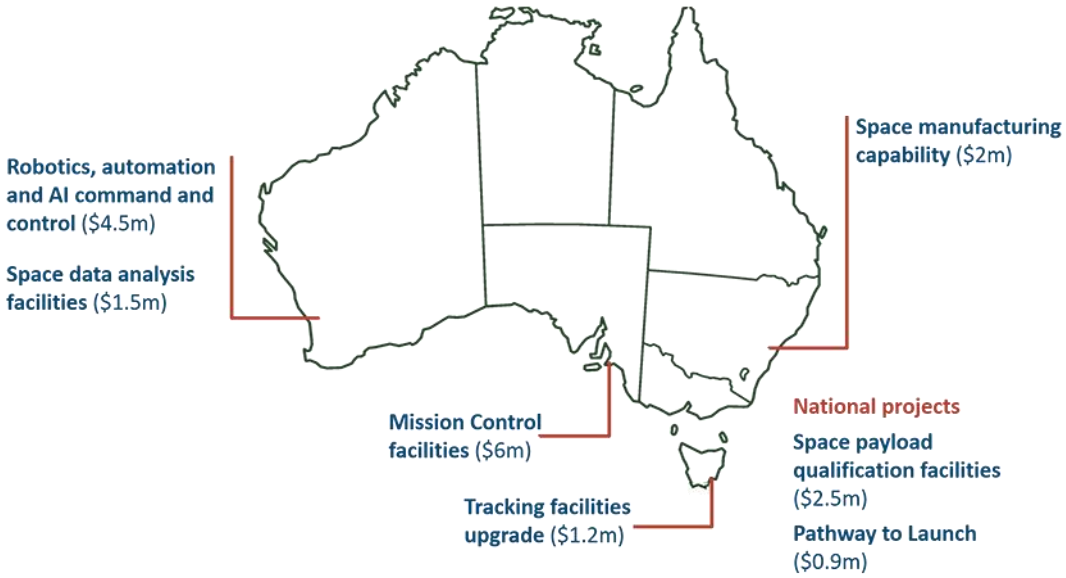

Figure 8 – Map of SIF projects

Space manufacturing facilities (NSW, $2 million)

Supporting the delivery of future space manufacturing capability, and development of high-tech skills and new space objects.

Mission control (SA, $6 million)

A platform for SMEs and researchers to control small satellite missions, enabling real-time testing and accelerated improvement of satellite technology.

Tracking facilities upgrade (TAS, $1.2 million)

Upgrading infrastructure to support precision tracking of satellites and spacecraft.

Robotics, automation and AI command and control (WA, $4.5 million)

Allowing SMEs and researchers control over autonomous operations in space; building capability in space technologies.

Space data analysis facilities (WA, $1.5 million)

Providing SMEs and researchers with space data analysis capability for agriculture, mining, emergency services and maritime surveillance.

Space payload qualification facilities ($2.5 million)

Providing capability for SMEs and researchers to test space equipment and have it mission-ready in Australia.

Pathway to launch ($0.9 million)

Undertake work to address the active interest and growing readiness in industry for launch in Australia, while ensuring safety on Earth and in space.

Defence and National Security

Australia's space businesses deliver a wide range of products and services that touch on all areas of the economy. Many of these technologies and services are 'dual-use', meaning they support defence capability as well as civil capability.

The Agency is committed to transforming and growing our civil space industry, and recognise that this can also support a defence outcome. To achieve its purpose to grow Australia's space industry, the Agency has developed a close working relationship with the Department of Defence. This ensures alignment between Australia's civil and Defence related space activities, and that our efforts to support the growth of the sector are complementary.

Across the SCC membership, there are a number of national security initiatives.

Table 8 – SCC national security activities

Organisation	Summary of activity
Bureau of Meteorology	The Bureau's ionospheric forecasts support defence communications, comprising the JP2043 Defence HF Communications System (DHFCS) and JP9101 Extended-DHFCS, and defence radar operations (JP2025 JORN – Jindalee Operational Radar Network). The Bureau's Space Weather Services provides expert advice on the risk assessment of space weather impacts on Australia's critical infrastructure. This assessment is led by the Critical Infrastructure Program for Modelling and Analysis (CIPMA) section of the Trusted Information Sharing Network (TISN).
Department of Defence	All Defence activities directly contribute to Australia's national security objectives. In 2018, the Australian Government released the Defence Industrial Capability Plan, which outlines the long-term vision to build a robust, resilient and internationally competitive Australian industry base that is better able to meet defence capability requirements. The plan identifies space-based intelligence and surveillance as sovereign capabilities under the following Sovereign Industrial Capability Priorities: surveillance and intelligence data collection, analysis dissemination and complex systems integration, which includes developing and upgrading sensors and software, and space situational awareness systems to enhance data collection, analysis or dissemination; and enhanced active and passive phased array radar capability. Implementation plans for each of the Sovereign Industrial Capability Priorities will be released from mid-2019. Defence works to secure radiofrequency spectrum resources for defence satellite networks and to manage interference to and from other countries' satellite networks and terrestrial systems, in accordance with ITU rules.

Organisation	Summary of activity
Department of Foreign Affairs and Trade	In August 2018 and March 2019, Australia participated as part of the United Nations Group of Governmental Experts (GGE) on further practical measures for the prevention of an arms race in outer space, which was established through the General Assembly Resolution 72/250 in 2017. The 25 experts were mandated to consider and make recommendations on substantial elements of an international legally binding instrument on the prevention of an arms race in outer space, including, inter alia, on the prevention of the placement of weapons in outer space. The March meeting ended without agreement after Experts were unable to reach consensus on a set of recommendations. The GGE has now concluded its work. In October 2018, DFAT participated in the US-led Schriever Wargame, which explored critical space and cyberspace issues in depth and in October-November, it coordinated Australia's responses to First Committee resolutions on space.
Department of Home Affairs	Within the Department of Home Affairs, the Critical Infrastructure Centre (CIC) manages national security risks within Australia's critical infrastructure, including space-related infrastructure. The CIC engages with critical infrastructure owners and operators through the Trusted Information Sharing Network (TISN), which is comprised of eight sector groups (Banking and Finance; Health; Food and Grocery; Transport; Communications; Water Services; Energy; Commonwealth Government) with members including owners and operators of critical infrastructure, Commonwealth, state and territory government agency representatives and peak and national bodies. The Space Cross Sector Interest Group (Space-CSIG) is an active and valued member of TISN. The Agency provides secretariat support services to the Space-CSIG. Home Affairs' *Critical Infrastructure Resilience Strategy* seeks to ensure the continued operation of critical infrastructure, including space-related infrastructure, in the face of all hazards. More resilient critical infrastructure will help achieve the continued provision of essential services to businesses, governments and the community, as well as to other critical infrastructure sectors. There are four key outcomes in the strategy: **1.** A strong and effective business-government partnership. **2.** Enhanced risk management of the operating environment. **3.** Effective understanding and management of strategic issues. **4.** A mature understanding and application of organisational resilience. In 2019 the Critical Infrastructure Resilience Strategy is being refreshed, coinciding with a series of initiatives to refresh TISN. The Space-CSIG is closely involved in and consulted on these changes to ensure the critical role of the sector is well captured in these arrangements.

Responsible

Promote a space sector culture that is globally respected, ensures national safety and security under an appropriate regulatory framework, and meets international obligations and norms.

Regulation associated with space activities

The Agency is responsible for regulating civil space activities under the *Space Activities Act 1998* (amended to become the *Space (Launches and Returns) Act 2018* from August 2019). This includes regulating the launch of space objects, launches from Australia and from mid-2020 High Power Rockets. It also has responsibility for implementing Australia's obligations under the United Nations space treaties. The Agency and other Commonwealth organisations also cooperate in the implementation of the UNCOPUOS Long-Term Sustainability of Outer Space Activities Guidelines (LTS Guidelines). The below table highlights the space-related regulatory activity of SCC members.

Table 9 – SCC space regulation activities

Organisation	Summary of activity
Department of Communications and the Arts; and Australian Communications and Media Authority	DoCA and the ACMA are both involved in the regulation and management of the radiofrequency spectrum, primarily domestic management of the radiofrequency spectrum. DoCA leads Australia's engagement in key policy making international radiocommunications fora, including discussions at the ITU on revisions to the treaty-level Radio Regulations which govern international use of the radio frequency spectrum and satellite orbits. During 2018-19, DoCA, worked closely with the ACMA and Australia's multi-stakeholder radiocommunications expert group to develop Australian positions on more than 30 radiocommunications issues. Many have implications for satellite communications, including: • spectrum allocation for Earth-to-space uplink in the fixed satellite service; • a milestone-based approach for deployment of non-geosynchronous orbit (GSO) satellite systems; • technical and operational requirements for Earth Stations in Motion (ESIM), commonly fitted on aeroplanes and ships to provide passenger Wi-Fi; • regulatory requirements enabling shared use of certain frequency bands by non-GSO and GSO fixed satellite services; • elevation to primary status of meteorological and earth exploration satellite services in specific bands; • global identification of spectrum for 5G mobile broadband applications; • a second satellite provider for the Global Maritime Distress and Safety System; • regulation of, and spectrum allocation for, short duration mission satellites. DoCA leads the Australian delegation to the World Radiocommunication Conference (WRC), which makes adjustments to the Radio Regulations Treaty governing radio frequency spectrum and satellite orbits (including satellite filing and coordination procedures). There is a standing agenda item in WRCs that

Organisation	Summary of activity
	deals with improvements in regulatory arrangements for space services. For WRC-19 there are more than 10 separate issues under consideration in this agenda item. Regulatory changes for satellite services under consideration as part of a number of WRC-19 agenda items include those related to non-GSO short duration missions.
Department of Defence	Defence works to secure radiofrequency spectrum resources for defence satellite networks and to manage interference to and from other countries' satellite networks and terrestrial systems, in accordance with ITU rules and regulations. Defence must ensure access to satellite communications, which enables communication for network-enabled operations. Emerging challenges include the risk of interference to other space systems from large constellations of GSO satellites and non-GSO satellites that support ESIMs. Defence staff will be accredited as delegates and will participate as part of the Australian Delegation to WRC-19 (further details above). The Defence Export Controls (DEC) regulate the transfer of defence and strategic goods and technologies, which includes sensitive space-related technologies. Examples include the export of Australian satellites to foreign launch service providers and the intangible transfer of space-related technology to foreign entities through commercial arrangements or research collaborations. Defence will contribute to international efforts to understand the application of international law to military space operations through a grant to the University of Adelaide to develop the Woomera Manual on International Law of Military Space Operations.
Department of Foreign Affairs and Trade	DFAT was part of the Australian delegations to the United Nations COPUOS in June 2018 and June 2019. The key achievement of the 2019 meeting was agreement to the voluntary guidelines on the Long-term Sustainability of Outer Space. DFAT also participates on the Space Law Inter-Departmental Working Group, a subcommittee of the SCC.
Department of Infrastructure, Regional Development and Cities	CASA's *Civil Aviation Safety Regulations Part 101* (CASR 101) applies regulatory restrictions to the operation of unmanned aircraft and rockets (including high powered rockets) in the interest of aviation safety. CASR Part 101 provides, among other things, that a person needs to seek CASA approval of an area for the operation of rockets transiting from surface to 100 km and their return. CASA has oversighting responsibility for assessment and approval of rocket (including High Power rocket) launches within Australia and collaborates with internal and external stakeholders to ensure that all high-altitude aviation activities do not impact the safety of all airspace users and to consider the impact of launch and recovery activity on the efficient and equitable use of airspace for all airspace users. CASA must also consider national security when considering airspace changes. CASA has previously assessed applications for overflight and emergency landing requirements for high-altitude aviation activity (such as balloons and long duration aircraft flights) within Australia. There is an increasing demand for approvals to enable high altitude operations. The Office of Airspace Regulation (OAR) within CASA assesses applications for high altitude activity to determine any potential residual risk and the need for airspace solutions to mitigate the

Organisation	Summary of activity
	risks. This could include declaration of Temporary Danger Areas or Temporary Restricted Areas. CASA contributes as required to assist the Agency in implementing the relevant provisions of the amended Space Activities Act, which will come into force on 31 August, 2019 (to be known as the *Space (Launches and Returns) Act 2018*), acknowledging that the nature of space related activity is evolving to include sub-orbital flights, high-altitude surveillance capabilities, high-altitude communication systems, low earth orbit balloon and Remotely Piloted Aircraft Systems (RPAS) activities. The OAR within CASA will assess applications for high altitude activity including potential residual risk and the need for airspace solutions to mitigate the risks in relation to airspace solutions for rocket flights from surface to 100km and the return of those rockets. These solutions could include declaration of Temporary Danger Areas or Temporary Restricted Areas
Geoscience Australia	GA is appointed as a legal metrology authority under the *National Measurement Act (1960)* to provide legal chains of traceability for satellite-derived positions of GNSS tacking stations.

Reform of the Space Activities Act 1998

A review of the *Space Activities Act 1998* was announced by the then Minister for Industry, Innovation and Science in October 2015. The review's aim was to ensure that Australia's space regulation is appropriate to technology advancements and does not unnecessarily inhibit innovation in Australia's space capabilities. The review indicated that greater flexibility and streamlining of requirements would be beneficial. Public consultations on aspects of the reform were held in 2016 and 2017.

On its establishment, the Agency assumed responsibility for administering space activities legislation, including carriage of the amendments to the *Space Activities Act 1998*. The *Space Activities Amendment (Launches and Returns) Act 2018* passed both Houses of Parliament and received Royal Assent on 31 August 2018, coming into force on 31 August 2019.

The amended Act (renamed the *Space (Launches and Returns) Act 2018*)), together with its supporting subordinate legislation, ensures that Australia's space regulation supports the growth of our capabilities while ensuring safe and responsible activities. It removes barriers to participation, encourages innovation and entrepreneurship, and implements certain obligations under the UN Space Treaties. A refreshed Flight Safety Code and Maximum Probable Loss Methodology will also be published.

Rockets that do not exceed 100 km altitude are currently regulated by the CASA. Requirements for High Power Rockets, as defined in subordinate legislation (which commences in June 2020), will pass to the Agency.

Reform of the Radiocommunications Act 1992

Following the 2015 Spectrum Review, the Government announced that it would reform and modernise the spectrum legislative framework. Reform will be undertaken through staged amendments to the Radiocommunications Act 1992 in order to deliver tangible improvements to the current arrangements and a more efficient regulatory framework. DoCA recognises the importance of space research activities and the protection from interference that these activities require. In developing the proposed draft legislation, DoCA will continue to work with industry, including the space industry, to make sure that any reforms are fit for purpose and deliver a public policy benefit to the community.

Inspire

Partner in a vision to build an Australian space sector that inspires industry, researchers, government and the Australian community to grow the next generation of the space workforce.

Inspire is a stand-alone pillar in the *Australian Civil Space Strategy*, recognising the important role space can play in inspiring our community and encouraging our students to engage in Science Technology Engineering and Mathematics (STEM). With a target of growing the workforce by 20,000 additional jobs by 2030, it is important that Australia builds a strong workforce pipeline to support the future needs of the space industry. Future *State of Space* reports will highlight the inspirational and STEM activities supported by the SCC membership. The Agency's focus in its first 12 months has been in understanding the opportunities, engaging the nation through media and amplifying communications. Key activities included:

- Supporting NASA with its expansion of the Global Learning and Observation to Benefit the Environment (GLOBE) program in Australia. The Agency, working with CSIRO, has reinvigorated the GLOBE program which will commence in 2019-20.
- The Agency established its social media presence on Twitter and LinkedIn in September 2018 and commenced the Agency fortnightly email newsletter. The cumulative audience reach through media to 30 June 2019 was over 71 million, meaning that most Australians have read or seen Agency related activities (in many cases, more than once).
- Major media interviews were featured in national and international media including the New York Times, Politico and Florida Today. Locally, the Agency also responded to hundreds of public enquiries through its enquiries inbox and phone line.
- 9 October 2018 marked 100 days from the establishment of the Agency. This milestone occurred within World Space Week, 4 – 10 October, a global celebration of the benefits of space, in which the Agency participated.
- The release of the inaugural Agency merchandise in February 2019 in partnership with Questacon was met with excitement in the sector.
- The Agency provided support for a number of STEM-focussed events, including: Australian Youth Aerospace Association (AYAA), Victorian Space Science Education Centre (VSSEC), National Youth Science Forum, Australian Space Design Competition, Code Like a Girl, STEM X Academy (teacher professional learning program provided by the Australian Science Teachers Association, CSIRO and Questacon), Sydney Festival and the Southern Hemisphere Space Studies Program (in association with the International Space University)
- The Agency has joined with Questacon and CSIRO's Parkes radio telescope for the promotion of the 50th anniversary of the Apollo 11 Moon landing in July 2019. In late 2018 Questacon opened an exhibit about the Moon, as part of its Apollo 50th events.
- With $6 million in funding through the Adelaide City Deal, the Agency is partnering with Questacon to develop the Space Discovery Centre and create a user experience that will foster an understanding of Australia's role in the space sector. The Discovery Centre will provide STEM education, engagement, and inspiration for young Australians, as well as activities such as mission simulation and training for tertiary education.
- The Agency is working to understand the breadth of advocacy groups and support amateur, university and school groups are raising the profile of space careers.

A summary of other inspirational events by SCC members is outlined below.

Table 10 – SCC inspirational activities

Organisation	Summary of activity
CSIRO	CSIRO has carried out numerous education and outreach activities related to space throughout 2018-19. In particular: • CSIRO worked closely with ABC TV and BBC Studios on the second Stargazing Live series in Australia, which went to air 22-24 May 2018 and featured CSIRO staff and the Parkes radio telescope. • The Parkes radio telescope and CDSCC together attracted more than 100,000 public visitors to their sites, inspiring students and families to understand astronomy and space sciences. • The Pulse@Parkes program enables senior high school students to remotely operate the Parkes radio telescope to observe pulsars. • Regular space-related stories are published in CSIRO's 'Double Helix' magazine for kids aged 8-14 years. • CSIRO hosted a sold-out panel event on the future of space exploration as part of Sydney's 'VIVID Ideas' Festival on 26 May 2019. • CSIRO has worked closely with the Agency, US Embassy and other partners to celebrate the 50th anniversary of the Apollo 11 Moon landing. In 2018-19 this has included production of a dedicated website (www.csiro.au/apollo11), collaboration with the Royal Australian Mint on the packaging and promotion of their commemorative Apollo 11 coins (4 June 2019), and sponsorship of the Powerhouse Museum's 'Apollo 11' exhibition in Sydney that opened on 28 June 2019. • The Breakthrough Prize Foundation has signed a multi-million dollar agreement to use CSIRO's 64-m Parkes radio telescope to search for extra-terrestrial intelligence.
Department of Defence	Defence's Next Generation Technologies Fund supported the SmartSat CRC bid with a commitment for a Defence tied fund. This CRC has now been established, with DST as a core partner. The SmartSat CRC will be the S&T engine for both Defence and commercial programs in Australia. The program for this CRC includes public engagement and STEM pipeline support with over 70 PhD sponsorships. In addition, DST is providing support to the Australian Research Council's Training Centre for CubeSats, UAVs and their Applications (CUAVA) that is sponsoring PhD and post graduate students to develop skills for payloads of interest and flight on UAVs and satellite platforms. The Australian Government released its Defence Industry Skilling and STEM Strategy in February 2019. A skilled workforce for defence industry will be critical with the increasingly vital role industry will play in the modernisation of Australia's Defence capability. The measures outlined in the strategy may have beneficial spill over effects for parallel industries, including Australia's space industry.

Appendices

Appendix 1 - Government response to ERG recommendations

Table 11 – Government response to ERG recommendations

	Recommendation	Australian Government Response	Update
1	The Agency is responsible for the development of a national space industry strategy, and that strategy gives priority to areas that build on Australia's strengths and utilises national competitive advantage and capabilities, in particular: • communication technologies and services, satellite ground stations, and deep space communications network ground stations; • Space Situational Awareness and debris monitoring as part of global networks; • Positioning, Navigation, and Timing infrastructure to enhance the competitiveness of the broader economy including agriculture, transport, fisheries, emergency services, mining and oil and gas, and national security; • the application of advanced integrated Earth observation satellite data for the benefit of all Australians and the broader economy, and to increase Australian exports of these services; • research and development in areas of national strength to support Australian participation in joint space missions, space tourism, and industry applications, for example, space and remote medicine, space physics, planetary science, astronomy, quantum communications and technologies, artificial intelligence, advanced	**Supported.** The Australian Government will establish the Australian Space Agency, which will be an ongoing entity, with initial funding of $26 million over four years. The Agency will prepare a national civil space industry strategy (the Strategy) that is aligned with the Government's current policy priorities. In developing the Strategy, the Australian Space Agency will take into consideration the priorities identified in this recommendation.	**Completed.** The Agency has been established and the *Advancing Space: Australian Civil Space Strategy 2019- 2028* was released in April 2019 which includes seven priority areas (including the priorities identified by the ERG).

	Recommendation	Australian Government Response	Update
	antenna and sensor technology; and • robotics and autonomous systems for remote asset management on Earth and in space across the broader economy.		
2	The national space industry strategy gives importance to emerging frontiers where Australia can leapfrog into areas of future competitive advantage, including the application of artificial intelligence, robotics, and big data analytics to space systems and space-derived information; next-generation communication technologies, including optical, hybrid optical radio, and quantum communications, to enable secure, broadband space-based communications; innovative sensors, antennae, and instrumentation. Australia should also take advantage of the global space technology paradigm shift towards constellations of miniaturised spacecraft for communications and Earth observations, and next-generation rocket and spacecraft propulsion systems.	**Supported.** The Australian Space Agency will prepare the Strategy, ensuring that it is aligned with the Government's current policy priorities. In developing the Strategy, the Australian Space Agency will give consideration to the priorities identified in this recommendation.	**Completed.** The *Advancing Space: Australian Civil Space Strategy 2019-2028* was released in April 2019 which includes consideration of emerging frontiers, leapfrog technologies and R&D.
3	The Government will establish a dedicated, ongoing, and whole-of-government statutory agency (the Agency) to realise Australia's civil ambitions in space, and that interim arrangements are made to establish the Agency immediately. The Agency will be responsible for civil space strategic policy direction setting, international representation, coordination of national civilian activities, and strategies to facilitate the growth of the Australian space industry sector as set out under the Agency Charter.	**Supported**. On 1 July 2018, the Australian Government will establish the Australian Space Agency on an ongoing basis. It will perform its functions as set out in the Agency's Charter, which will be finalised within three months of commencing operations. The Australian Space Agency will be located within the Department of Industry, Innovation and Science. In addition, the Australian Space Agency will develop close linkages with federal departments and agencies as well as state and territory governments and international agencies to ensure a whole of	**Completed.** The Agency was established on 1 July 2018. The Charter was released in October 2018. The Charter includes that the statutory basis for the Australian Space Agency will be considered after a review of its operations that will commence within four years of the establishment of the Australian Space Agency.

	Recommendation	Australian Government Response	Update
		government approach is taken in respect of civil space activities. The establishment of a statutory basis for the Australian Space Agency will be considered after a review of its operations that will commence within four years of the establishment of the Australian Space Agency.	
4	The Government provides ongoing, core operational funding to the Agency to enable its establishment and effective operation…	**Supported**. The Australian Government will establish the Australian Space Agency as an ongoing entity, with initial funding of $26 million over four years.	**Completed.**
	… with additional funding for an ongoing Space Industry Development Fund once the Agency is fully operational. This Fund will invest in: international partnerships to enable increased industry participation; industry-led collaborative research and development in the areas of strategic priority and leapfrog technologies; and support for national nodes in partnership with State and Territory governments and their industries. It will also provide early stimulus to national infrastructure such as enabling commercial ground stations and shared test facilities for satellite manufacture and equipment verification.	**Noted.** The Australian Space Agency will prepare a detailed investment plan for consideration by the Government as part of its Strategy for the development of the space industry within the first six months after it commences operation. This will include principles and models for space industry development, including providing the Government with its analysis of the costs and benefits of creating a Space Industry Development Fund.	**Completed.** The *Advancing Space: Australian Civil Space Strategy 2019-2028* includes an implementation plan which outlines areas of potential investment in the future.
	The Government provides scope for the Agency to bring forward for dedicated funding every three to four years, major national space projects such as satellite projects, to meet national and international terrestrial and marine needs, and to participate in discovery science missions as part of international consortia and national space competition missions.	**Supported in Principle.** The Australian Space Agency has the capacity to seek to bring forward requests for funding, including to support major space-related projects.	**Ongoing.** The 2019-20 Budget provided $19.5 million for Space Infrastructure Fund projects and $6 million through the Adelaide City Deal for the Australian Space Discovery Centre.
5	The Government extends existing partnership and treaty-level	**Supported.** The Australian Government will be proactive in	**Ongoing.** The Agency has progressed MoUs and other

	Recommendation	Australian Government Response	Update
	agreements, and establishes new partnerships to increase the participation of Australian industry and research, particularly by: • strengthening partnerships in space to allow greater technology transfer and technology development in Australia; • extending existing partnerships and treaty-level agreements, as well as promoting commercial arrangements to allow increased participation of Australian industry on missions; • securing existing and establishing new ground stations and deep space communications centres in Australia; • securing new partnership agreements with key space agencies and commercial partners in the global space sector, including in Asia and Oceania; and • securing cooperation agreements for access to critical national Earth observation data, including for weather, land and oceans, and emergency and disaster management.	its international engagement to build and develop its international partnerships relevant to the space industry, consistent with the Foreign Policy White Paper, in consultation with the Department of Foreign Affairs and Trade and other affected commonwealth agencies, and supported by the Australian Space Agency. The Australian Government is investing $15 million over three years from 2019–20 to enable the Australian Space Agency to partner with international space agencies on strategic projects. This investment will provide Australian businesses opportunities to be involved in established international space programs.	arrangements with space agencies. The Agency is also progressing arrangements within the international space industry, for example through the signing of SSIs. The ISI initiative will commence in late 2019.
6	The Agency works with other Government departments across a range of portfolio areas, such as agriculture, environment, and communications, to emulate the Australian Defence Innovation Hub Investment program and the US' SBIR and STTR programs to link both large and small business to the purchasing needs for civil Government projects and investments, including the space-related investments.	**Supported in Principle.** The Australian Space Agency will examine opportunities to link the Australian space industry to the purchasing needs of government but the procurement requirements of individual portfolios will remain the priority. The Government has introduced a number of cutting- edge programs that facilitate government engagement with innovative businesses such as the Business Research and Innovation Initiative that can lead to greater opportunities for such businesses in government procurement	**Ongoing.** The Agency will continue to consider activities that will support the growth and transformation of the space industry. This includes working through the four governance committees in the Charter, which provide avenues to consider these opportunities.

	Recommendation	Australian Government Response	Update
		processes and improved outcomes for government.	
7	In order for commercial entities and other participants to move quickly, that the Agency facilitates regulatory approval processes for small satellite launch facilities in Australia and the launch of Australian satellites overseas, and investigates opportunities to partner with appropriate international launch providers.	**Supported in principle.** The Australian Government has undertaken a review of the *Space Activities Act 1998* and is implementing amendments to streamline the Act, including removing barriers for undertaking space activities. The revised Act is expected to be introduced into the Parliament in 2018. The Australian Government will ensure it continues to meet its commitments, including those under international instruments relating to space and arms control.	**Completed.** The *Space Activities Amendment (Launches and Returns) Bill 2018* received Royal Assent on 31 August 2018.
8	The Government gives priority to strategies that enable active engagement with Australian schools and the broader community on global space activities; space-related training and education to improve capability; space-inspired STEM outreach; and industry-led research collaboration to underpin the space industry.	**Supported in principle.** The Australian Space Agency will consider appropriate strategies to address this recommendation.	**Ongoing.** The Agency will continue to consider appropriate strategies to support STEM outreach and build the future workforce. This will be considered in collaboration with partners such as Questacon. This activity is directly supported by the *Australian Civil Space Strategy,* which includes 'inspire' as a key pillar and included as a key action in the implementation plan.
9	In conjunction with the Government acting on these recommendations, we call on industry to play an important role in achieving the national goals and strategies for the Australian space industry by investing in innovation to remain globally competitive; engaging with the Agency in setting strategic priorities; exploring partnerships with small- and medium-sized companies to participate in global supply chains;	**Supported.** The Australian Space Agency will actively engage with industry to support industry in achieving the aspirational goal to grow Australia's space sector.	**Ongoing.** The Agency will continue to actively engage with industry as it considers ways to grow and transform the Australian space industry. The Agency will also continue to consider innovative ways to support the growth of the sector, for example through progressing SSIs.

	Recommendation	Australian Government Response	Update
	collaborating with research institutions; and supporting competitions for development of innovative technology, applications, and skills.		The Agency's engagement with industry is also reinforced through the Charter, which includes the establishment of the Space Industry Leaders Forum.
10	Agency Charter (appendix 6 of report)	**Noted.** The Australian Government will draw on the advice provided in the report for the Charter of the Australian Space Agency to develop a high-level document to guide the activity of the Australian Space Agency. The Australian Space Agency is to finalise the Charter within three months of commencing operations.	**Completed.** The Charter was released in October 2018.

Appendix 2 - Australian Government departmental and agency functions

Attorney General's Department

The Attorney-General's Department delivers programs and policies to maintain and improve Australia's law and justice framework. AGD's Office of International Law provides legal advice to Government on international law. This includes advice on legal issues relating to space, to ensure Australia's engagement in the space domain is consistent with Australia's international obligations.

Key space-related activities

AGD's Office of International Law provides legal advice to Government on key international space law treaties. AGD is a member of the SCC.

www.ag.gov.au

Australian Space Agency

The Agency is a non-statutory, whole-of-government entity located within the Department of Industry, Innovation and Science as a separately branded function. The Agency is the front door for Australia's international engagement on civil space and operates as the national priority setting mechanism for the civil space sector.

Key space-related activities

The Agency is responsible for: providing national policy and strategic advice on the civil space sector; coordinating Australia's domestic civil space sector activities; supporting the growth of Australia's space industry and the use of space across the broader economy; leading international civil space engagement; administering space activities legislation and delivering on our international obligations; and inspiring the Australian community and the next generation of space entrepreneurs.

The Australian Space Agency is the Chair of the SCC and a member of the Space Cross-Sector Interest Group.

www.space.gov.au

Australian Communications and Media Authority

The Australian Communications and Media Authority (ACMA) is a statutory authority within the federal government portfolio of Communications and the Arts. The ACMA is Australia's regulator for broadcasting, the internet, radiocommunications and telecommunications. The ACMA's regulatory functions and responsibilities are set out in the *Australian Communications and Media Authority Act 2005*.

The ACMA manages the radiofrequency spectrum in Australia in accordance with the *Radiocommunications Act 1992* (the Radiocommunications Act), which empowers it to regulate radiocommunications in Australia by establishing a planning framework and licensing arrangements, as well as undertaking compliance and enforcement activities.

Key space-related activities

The ACMA manages access to the radiofrequency spectrum through the development and maintenance of a regulatory framework for satellite services in Australia, including licensing. It also represents Australia's space spectrum management interests internationally, including the filing and coordination of Australian satellite systems with the ITU. The ACMA is a member of the SCC and various working groups.

www.acma.gov.au

Australian Trade and Investment Commission (Austrade)

The Australian Trade and Investment Commission (Austrade) contributes to Australia's economic prosperity by helping Australian businesses, education institutions, tourism operators, governments and citizens as they develop international markets and promote international education, win productive foreign direct investment, strengthen Australia's tourism industry and seek consular and passport services.

Austrade leverages the deep commercial knowledge and relationships of its international and domestic networks, and the badge of government, to deliver value for our clients and investors. Austrade connects export-ready Australian businesses to overseas opportunities and works with them to achieve commercial outcomes. It wins productive foreign direct investment and promotes Australian capability internationally, while working with priority industry sectors to drive sustained long-term growth of Australian exports. Austrade reduces the time, cost and risk for clients and provides authoritative commercial insights and information to help clients to make informed business decisions. It informs and influences policy to support positive trade and investment outcomes and provides financial assistance for exporters through programs like the Export Market Development Grants scheme and the TradeStart network. Austrade contributes to economic diplomacy and protect the welfare of Australians abroad through timely, responsive consular and passport services in specific locations.

Key space-related activities

Austrade's Advanced Manufacturing, Defence and Space Team manage Austrade's space initiatives and engagement with national and international clients and stakeholders. Austrade is a member of the SCC.

www.austrade.gov.au

Bureau of Meteorology

The Bureau is Australia's national weather, climate and water agency. It is responsible for the acquisition, analysis and archiving of meteorological, oceanographic, hydrological and space weather data - much of which is EOS data – and for delivering associated services, under the *Meteorology Act 1955* and the *Water Act 2007.* The Bureau is also responsible for sustaining the intergovernmental relationships, including with the World Meteorological Organization (WMO), essential to the global exchange of these data.

Key space-related activities

The Bureau plans, builds and operates satellite reception infrastructure and maintains significant technical, engineering and science capability to support this infrastructure. The Bureau delivers satellite-derived products and services to the Australian community and supports leading-edge forecasting and climate research. The Bureau also provides space weather services primarily for defence and communications activities and is a recognised global leader in this field. The Bureau is a member of the SCC.

www.bom.gov.au

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

CSIRO is an independent statutory authority constituted and operating under the provisions of the *Science and Industry Research Act 1949*, which designates functions to: conduct scientific research to benefit Australian industry and the community, and to contribute to the achievement of national objectives; encourage and facilitate the application of the results of scientific research; manage and make available national facilities for scientific research; contribute to scientific collaboration between Australia and other countries; contribute to training the next generation of Australian researchers.

Under the *Science and Industry Research Act 1949*, CSIRO is granted powers to undertake a broad range of activities consistent with performing the above functions. These include: arranging for scientific research to be undertaken on behalf of the organisation; forming partnerships, joint ventures and spin-off companies; and deriving income from intellectual property through licensing and royalty arrangements.

More than 300 CSIRO staff are involved in space activities. CSIRO has developed extensive capability in space-related areas that include Earth observation, communications, advanced aerospace technologies, spacecraft tracking and radio astronomy.

Key space-related activities:

CSIRO currently operates the Australia Telescope National Facility, which manages three of Australia's radio telescopes. CSIRO also operates the Canberra Deep Space Communication Complex on behalf of NASA and the New Norcia tracking station for ESA.

CSIRO carries out space-related activities in the following areas:

- Earth observations from space (EOS); this includes: joint responsibility for national EOS capabilities with the Bureau and GA, development of advanced EOS processing methods, applications and services, partnership in the NovaSAR-1 satellite, EOS satellite data calibration/validation, fostering collaborative international scientific relationships, and providing national representation on international organisations such as CEOS.
- Radio astronomy, including operation of the Australian Square Kilometre Array Pathfinder telescope, the Parkes radio telescope and the Australia Telescope Compact Array, and development of associated big data management infrastructure and expertise.
- Spacecraft tracking and communications, including 'Follow the Sun' operation of the Deep Space Network through CDSCC and management of key treaty-level agreements with NASA.
- Development of new space technologies and capabilities, through the CSIRO Space Research Program, CSIRO Space Technology Future Science Platform and R&D activities across the organisation.
- These activities are coordinated primarily through CSIRO Astronomy and Space Science (CASS).

CSIRO also continues to grow its space-related capabilities in other areas, ranging from materials and manufacturing to cybersecurity, satellite sensor systems and radar technologies for asteroid tracking.

www.csiro.au

Department of Communications and the Arts

The Department of Communications and the Arts (DoCA) provides policy oversight of radiocommunications services and spectrum management (including satellite communication) in Australia.

Key space-related activities

DoCA leads Australia's engagement in international forums on use of radiofrequency spectrum and satellite orbits, including the WRC. DoCA is a member of the SCC and leads discussions amongst Australia's multi-stakeholder Preparatory Group for WRCs.

DoCA provides advice to the Minister for Communications as a shareholder Minister of NBN Co Limited. It also provides advice to the Australian Government, and information to the public, regarding provision of satellite broadband services to premises predominantly in regional, rural and remote Australia by NBN Co. NBN Co owns and operates two Sky Muster satellites used for the delivery of high speed broadband across Australia and its territories.

DoCA is also responsible for the development of the Universal Service Guarantee (USG), which covers the future arrangements for delivery of basic telecommunications services nationally, including possible use of space-based systems in rural and remote areas. DoCA monitors technology, service, commercial and policy developments relevant to communications, such as the Internet of Things (IoT) and artificial intelligence, including those involving space-based systems.

On 1 February 2020, Department of Communications and the Arts merged with Department of Infrastructure, Transport, Cities and Regional Development to form Department of Infrastructure, Transport, Regional Development and Communications.

www.communications.gov.au

Department of Defence

Space is a critical capability for the Australian Defence Force as a modern, networked military. The Department of Defence uses both military and civil space-based systems for a range of applications, including global positioning, navigation and timing; satellite communications; intelligence, surveillance and reconnaissance; mapping; and weather forecasting. Defence requires assured access to the space capabilities that play a vital role in all ADF and coalition operations.

Key space-related activities

- Contributing to space situational awareness: Defence contributes to efforts to better understand the space environment and help ensure the security of our space-based assets. This includes working with the US to jointly operate space-monitoring infrastructure in Australia.
- Engagement with international partners on military use of space: Defence engages with international partners on the military use of space through the Combined Space Operations initiative and bilateral partnerships and talks.
- Managing radiofrequency spectrum access: Defence works to secure radiofrequency spectrum resources for its satellite networks, in accordance with ITU rules.
- Space-based geospatial intelligence collection: AGO, within Defence, is responsible for space-based imagery collection in support of Australian Government national security, foundation data and intelligence requirements.
- Space R&D: DST Group contributes significantly to the development of Australia's space capabilities through a number of R&D programs in collaboration with international and domestic partners.
- Position, Navigation and Timing: Defence continues to monitor the US GPS Modernisation program, and will begin transitioning to modernised GPS equipment when new services are made available.
- Support to industry: Defence's strategic and coordinated approach to the defence industry is delivering greater support to the space sector. Notably, the CDIC Centre for Defence Industry Capability delivers advice and support to industry. Intelligence, surveillance, reconnaissance, space and cyber have been identified as priority investment areas for both the Defence Innovation Hub and the Next Generation Technologies Fund.

Defence is a member of the SCC, the PNT Working Group, the Space Law Working Group and the Earth Observation Working Group.

www.defence.gov.au

Department of the Environment and Energy

The Department of the Environment and Energy (DEE) designs and implements Australian Government policy and programs to protect and conserve the environment, water and heritage, promote climate action, and provide adequate, reliable and affordable energy.

Key space-related Responsibilities

DEE is concerned with Earth observation as it relates to environmental management.

DEE is a member of the SCC.

www.environment.gov.au

Department of Finance

The Department of Finance (Finance) is a central agency of the Australian Government and plays an important role in assisting government across a wide range of policy areas to ensure its outcomes are met.

Finance supports the government's ongoing priorities through the Budget process and fosters leading practice through the public sector resource management, governance and accountability frameworks. Finance plays a lead role in advising the government on many of its strategic priorities, including advancing public sector reform through the Smaller Government Agenda and providing advice to the government on optimal arrangements for the management and ownership of public assets. We do this through our professional and considered approach to providing advice, developing policy, delivering services and engaging with our clients and stakeholders. Finance has observer status on the SCC.

www.finance.gov.au

Department of Foreign Affairs and Trade

The Department of Foreign Affairs and trade (DFAT) provides foreign, trade and development policy advice to the Government. It works with foreign governments, the private sector, NGOs, academia and other Australian Government agencies to ensure that Australia's pursuit of its global, regional and bilateral interests are advanced and protected.

Key space-related Responsibilities

DFAT's key space responsibilities lie in space security issues (with Defence), UN engagement, multilateral and bilateral agreements and commitments, space issues that affect bilateral and regional relationships, and civil space matters to the extent that they affect the above.

DFAT is a member of the SCC and participates in the Space Law Inter-Departmental Working Group.

www.dfat.gov.au

Department of Home Affairs

Home Affairs is a central policy agency, providing coordinated strategy and policy leadership for Australia's national and transport security, federal law enforcement, criminal justice, cyber security, border, immigration, multicultural affairs, emergency management and trade related functions.

Through the CIC, Home Affairs implements the *Critical Infrastructure Resilience Strategy* to enhance critical infrastructure resilience in the face of all hazards. Home Affairs implements the strategy in partnership with industry through the Trusted Information Sharing Network, a forum where owners and operators of critical infrastructure work together and share information on threats and vulnerabilities, developing strategies to mitigate risk.

Cross Sector Interest Groups within the TISN provide an opportunity for cross-sectoral consultation between key stakeholders and Government on specific matters. CSIGs are convened when a specific critical infrastructure issue demands attention and may be disbanded once the issue has been adequately addressed. Home Affairs actively contributes to the work of the Space-CSIG within the TISN.

Key space-related activities

The CIC manages national security risks from foreign involvement in Australia's critical infrastructure, including space-related infrastructure. It is focused on assessing the risks of sabotage, espionage and coercion in the five priority sectors of gas, electricity, telecommunications, water and ports. The CIC works with state and territory governments, regulators and private owners and operators to identify risks and develop and implement asset-specific mitigation strategies and sector-wide best practice guidelines.

Home Affairs is a member of the SCC. Its Critical Infrastructure Centre is a member of the Space Cross Sector Interest Group and the PNT Working Group.

www.homeaffairs.gov.au | www.cicentre.gov.au | www.tisn.gov.au

Department of Industry, Innovation and Science

Until the formation of the Australian Space Agency, the Department of Industry, Innovation and Science (DIIS) had three key areas of responsibility on civil space:

1. a coordination function, chairing the SCC and acting as the central point of contact and coordination for the Government's involvement in civil space;
2. a regulatory function, administering the *Space Activities Act*; and
3. a policy function, supporting the advancement of Australia's space capabilities.

The Agency is a non-statutory, whole-of-government entity located within the Department of Industry, Innovation and Science as a separately branded function. The Secretary of DIIS is the relevant Accountable Authority.

DIIS provides policy advice on broader linkages between space and other industry sectors and is a member of the SCC.

www.industry.gov.au

Department of Infrastructure, Regional Development and Cities

The Department of Infrastructure, Regional Development and Cities (DIRDC) is responsible for the design and implementation of the Australian Government's infrastructure, transport and regional development policies and programs. It works to support economic growth through transport; make travel safer; increase transport access; keep transport secure; support regional development and local communities and provide good governance in the territories.

DIRDC's interests in civil space include the application of satellite-enabled services for road, rail, maritime and aviation sectors. These activities are carried out by DIRDC and its portfolio agencies: the Australian Maritime Safety Authority (AMSA); the Civil Aviation Safety Authority (CASA) and Airservices Australia.

DIRDC is a member of the SCC.

On 29 May 2019, the department was re-named as the Department of Infrastructure, Transport, Cities and Regional Development (DITCRD). On 1 February 2020, Department of Communications and the Arts merged with Department of Infrastructure, Transport, Cities and Regional Development to form Department of Infrastructure, Transport, Regional Development and Communications.

www.infrastructure.gov.au

Australian Maritime Safety Authority

AMSA provides a range of regulatory functions and services that use satellite based technology including: a capacity, within Australia's search and rescue region, to respond to civilian, maritime and aviation distress situations via satellite-based alerting systems such as Cospas-Sarsat; the dissemination of maritime safety information (MSI) via recognised mobile satellite service providers, that includes navigation, search and rescue and urgent safety messaging; the provision of navigational services (in the main, a network of visual and electronic aids to navigation to meet the needs of commercial shipping); vessel tracking services, including administration of the MASTREP, use of shore-based and satellite-based AIS and LRIT of ships; oil spill preparedness and response, including use of satellite-based synthetic aperture radar for oil spill monitoring for compliance and emergency response.

Key space-related activities

AMSA is a significant user of satellite technology for a number of applications including aviation and maritime search and rescue, pollution surveillance, oil spill and disaster response, ship and navigation safety and ad-hoc imagery. It is also active in international bodies, such as the IMO, the ITU, the IALA, ICAO and Cospas-Sarsat, which deal (in part) with radionavigation and satellite-based systems, procedures, policies and radiocommunications.

www.amsa.gov.au

Civil Aviation Safety Authority (CASA)

CASA is the government body that is responsible for the regulation of Australia's civil aviation safety and Australian-administered airspace. CASA is required to ensure that Australian-administered airspace is safe, efficient and equitable for all users whilst also considering national security requirements.

CASA's role is described in the *Civil Aviation Act 1988*, and implemented through the Civil Aviation Safety Regulations 1998. These regulations are broken down into parts, which may have associated Manual of Standards as well as supporting guidance material

CASA's Office of Airspace Regulation (OAR) has the authority to administer and regulate Australian - administered airspace. The OAR is responsible for determining the architecture, classification and level of services for all Australian airspace and this includes mitigation through airspace solutions to protect all airspace users from launches and recoveries of rockets and space vehicles.

Until the amended *Space Activities Act* comes into force, CASA has oversighting responsibility for the assessment and approval of rocket launches (including high power rockets) within Australia and collaborates with the required internal and external stakeholders to ensure that all high-altitude aviation activities are conducted with the safety of aviation navigation as the highest consideration.

Key space-related activities

CASA currently has oversight responsibility for assessment and approval of rocket (including high power rocket) launches within Australia and collaborates with internal and external stakeholders to ensure that all high-altitude aviation activities do not impact the safety of all airspace users and to consider the impact of launch and recovery activity on the efficient and equitable use of airspace for all airspace users. CASA must also consider national security when considering airspace changes.

CASA has previously assessed applications for overflight and emergency landing requirements for high-altitude aviation activity (such as balloons and long duration aircraft flights) within Australia. There is an increasing demand for approvals to enable high altitude operations. The OAR within CASA assesses applications for high altitude activity to determine any potential residual risk and the need for airspace solutions to mitigate the risks. This could include declaration of Temporary Danger Areas or Temporary Restricted Areas.

CASA will contribute as required to assist the DIIS and Airservices Australia in implementing the relevant provisions of the amended *Space Activities Act*, acknowledging that the nature of space related activity is evolving to include sub-orbital flights, high-altitude surveillance capabilities, high-altitude communication systems, low earth orbit balloon and RPAS activities.

www.casa.gov.au

Airservices Australia (Airservices)

Airservices provides air navigation services, including air traffic management for civil aviation, from the surface to the limit of atmospheric flight.

Airservices Australia is a member of the PNT Working Group.

www.airservicesaustralia.com

Department of the Prime Minister and Cabinet

The Department of the Prime Minister and Cabinet (PM&C) provides high quality advice and support to the Prime Minister, the Cabinet, Portfolio Ministers and Assistant Ministers to achieve a coordinated and innovative approach to the development and implementation of Government policies. It coordinates and

develops policy across the Government in economic, domestic and international issues, Aboriginal and Torres Strait Islander affairs and public service stewardship.

PM&C has observer status on the SCC.

www.pmc.gov.au

Geoscience Australia

GA is the Australian Government's national geoscience organisation, applying geoscience to Australia's most important challenges. It is the Australian Government's technical adviser on all aspects of geoscience, and custodian of the geographical and geological data and knowledge of the nation. The GA work program supports the work of other Australian Government agencies, state and territory governments, researchers, international partners, and industry.

GA supports civil space activities through leadership and planning, operational service delivery, ongoing maintenance of infrastructure and data, strategic partnerships, and knowledge-transfer. These activities create value for stakeholders by supporting capability development and critical decision-making across the agency's six strategic priorities:

1. Building Australia's Resource Wealth
2. Ensuring Australia's Community Safety
3. Securing Australia's Water Resources
4. Managing Australia's Marine Jurisdictions
5. Providing Fundamental Geographic Information
6. Maintaining Geoscience Knowledge and Capability

GA is the lead agency for PNT and non-meteorological operational use of EOS in Australia. GA provides geoscience infrastructure, knowledge and expertise that assures access to space capability, supports innovation, science skills and development, strengthens domestic and international coordination, and protects economic well-being.

Key space-related activities

GA is jointly responsible for Australia's EOS capabilities with the Bureau and CSIRO and is developing DEA. As the lead agency for PNT, it is also developing the SBAS and the NPIC.

GA is a member of the SCC and co-chairs the Australian National Ground Segment Technical Team. Through this team agencies and state governments coordinate the development and use of Earth observation satellite ground stations. GA supports Earth Observation Australia, which plays a key role in bringing together government, business, research and other players in the Earth observation community. It co-chairs the SCC's EOS Working Group (AEOSWG) with CSIRO and the Bureau. GA also chairs the PNT Working Group (PNT-WG) and is a member of the Space Cross Sector Interest Group.

www.ga.gov.au

Treasury

As a central policy agency, the Treasury is expected to anticipate and analyse policy issues with a whole-of-economy perspective, understand government and stakeholder circumstances, and respond rapidly to changing events and directions.

Treasury provides sound economic analysis and authoritative policy advice on issues such as: the economy, budget, taxation, financial sector, foreign investment, structural policy, superannuation, small business, housing affordability and international economic policy. It also works with state and territory governments on key policy areas, as well as managing federal financial relations.

The treasury has observer status on the SCC.

www.treasury.gov.au

List of Figures

List of Tables

List of acronyms

ABC	Australian Broadcasting Corporation
ACCESS	Australian Community Climate and Earth-System Simulator
ACFJ	Australia, Canada, France, Japan
ACMA	Australian Communications and Media Authority
ACT	Australian Capital Territory
ADF	Australian Defence Force
ADS-B	Automatic Dependent Surveillance – Broadcast
ADS-C	Automatic Dependent Surveillance – Contract
AEOSWG	Australian Earth Observation from Space Working Group
AGD	Attorney-General's Department
The Agency	Australian Space Agency
AGO	Australian Geospatial-Intelligence Organisation
AHT-SDG	Ad Hoc Team on Sustainable Development Goals
AI	Artificial Intelligence
AIS	Automatic Identification System
AmCham	American Chamber of Commerce in Australia
AMOS	Advanced Maui Optical and Space Surveillance Technologies
AMSA	Australian Maritime Safety Authority
AMVs	Atmospheric Motion Vectors
AOMSUC	Asia Oceania Meteorological Satellite Users Conference
AP-RARS	Asia-Pacific Regional ATOVS Retransmission Service
APRSAF	Asia-Pacific Regional Space Agency Forum
APT	Asia-Pacific Telecommunity
AsA	Airservices Australia
ASBF	Alice Springs Ballooning Facility
ASDSS	Australian Defence Satellite Communications System
ASKAP	Australian Square Kilometre Array Pathfinder
ATNF	Australia Telescope National Facility
ATOVS	Advanced TIROS Operational Vertical Sounder (see TIROS)
AusTender	Australian Government online tendering system
Austrade	Australian Trade and Investment Commission
AYAA	Australian Youth Aerospace Association
Beidou	Global navigation system developed by China
The Bureau	Bureau of Meteorology
C2G2	Combined Communications Gateway Geraldton
C5	Critical Five
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
CASS	CSIRO Astronomy and Space Science
CCEO	CSIRO Centre for Earth Observation
CDIC	Centre for Defence Industry Capability
CDSCC	Canberra Deep Space Communication Complex
CEOS	Committee on Earth Observation Satellites
CIC	Critical Infrastructure Centre
CIPMA	Critical infrastructure Program for Modelling and Analysis
CIR	Critical infrastructure Resilience
CNES	Centre National d'Etudes Spatiales (French space agency)
COPOUS	United Nations Committee on the Peaceful Uses of Outer Space
COSMIC-2	Cosmic Observing System for Meteorology, Ionosphere and Climate-2
COSPPac	Climate and Oceans Support Program in the Pacific
COSPAS-SARSAT	International search and rescue satellite system. COSPAS: Russian acronym for "space system for the search of vessels in distress"; SARSAT: Search and Rescue Satellite
CRC	Cooperative Research Centre
CSIG	Cross Sector Interest Group

CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSpO	Combined Space Operations
DAWR	Department of Agriculture and Water Resources
DoCA	Department of Communications and the Arts
DEA	Digital Earth Australia
DEAfrica	Digital Earth Africa
DEC	Defence Export Controls
DEE	Department of Environment and Energy
Defence	Department of Defence
DFAT	Department of Foreign Affairs and Trade
DHFCS	Defence High Frequency Communications System
DIIS	Department of Industry, Innovation and Science
DIRDC	Department of Infrastructure, Regional Development and Cities
DMTC	Defence Materials Technology Centre
DORIS	Doppler Orbitography and Radiopositioning Integrated by Satellite
DSS	Deep Space Station
DST	Defence Science and Technology
EOA	Earth Observation Australia
EOS	Earth observations from space
EM	Emergency management
EM-Link	Emergency Management Link
EMSINA	Emergency Management Spatial Information Network Australia
ERG	Expert Review Group
ESA	European Space Agency
ESIMS	Earth Stations in Motion
EWS	Emergency Warning Service
Five Eyes	Intelligence alliance between Australia, Canada, New Zealand, UK, USA
FSP	Future Science Platform
FTE	Full-time Equivalent
FY	Financial Year
FYSO	Five Year Spectrum Outlook
GA	Geoscience Australia
Galileo	GNSS developed by the European Commission through ESA
GBAS	Ground-based Augmentation System
GEO	Group on Earth Observations
GEOGLAM	Group on Earth Observations Global Agricultural Monitoring
GEOINT	Geospatial Intelligence
GGE	United Nations Group of Governmental Experts
GMDSS	Global Maritime Distress and Safety System
GOES-R	Geostationary Operational Environmental Satellite-R series
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GRALLE	Galileo-based Reliable Automatic and Low Latent EWS
GSO	Geosynchronous Orbit
HF	High Frequency
Home Affairs	Department of Home Affairs
IAC	International Congress
IAG	International Association for Geodesy
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
ICAO	International Civil Aviation Organization
ICG	International Committee on GNSS
ICSU-WDS	International Science Council World Data System
IDS	International DORIS Service
IGS	International GNSS Service
ILRS	International Laser Ranging Service
IMO	International Maritime Organisation
IoT	Internet of Things
ISC2N	International Small-Satellite Command and Control Network
ISECG	International Space Exploration Co-ordination Group
ISES	International Space Environment Service
ISRO	Indian Space Research Organisation

ISWI	International Space Weather Initiative
ITU	International Telecommunication Union
ITU-R	ITU Radiocommunication Sector
IVS	International VLBI Service
JAXA	Japan Aerospace Exploration Agency
JORN	Jindalee Operational Radar Network
JPL	Jet Propulsion Laboratory
LEO	Low Earth Orbit
LEOSAR	Low-altitude Earth Orbit Search and Rescue
LEOSAT	Low Earth Orbit Satellite
LINZ	Land Information New Zealand
LRIT	Long Range Identification and Tracking
LTS	Long-Term Sustainability
MASTREP	Modernised Australian Ship Tracking and Reporting System
MEOSAR	Medium-altitude Earth Orbit Search and Rescue
MILAMOS	Manual on International Law Applicable to Military Uses of Outer Space
MoU	Memorandum of Understanding
MSI	Maritime Safety Information
MTCR	Missile Technology Control Regime
MWA	Murchison Widefield Array
NASA	National Aeronautics and Space Administration
NavIC	Navigation with Indian Constellation
NEA	Near Earth Asteroid
NBN	NBN Co Limited
NCRIS	National Collaborative Research Infrastructure Strategy
NGO	Non-Governmental Organisation
NOAA	US National Oceanic and Atmospheric Administration
NPI	National Positioning Infrastructure
NPIC	National Positioning Infrastructure Capability
NSAT	National Situational Awareness Tool
NSW	New South Wales
NT	Northern Territory
NWP	Numerical Weather Prediction
NZ	New Zealand
OAR	Office of Airspace Regulation
ODC	Open Data Cube
OOSA	UN Office of Outer Space Affairs
PM&C	Department of the Prime Minister and Cabinet
PNT	Positioning, Navigation and Timing
PNT-WG	PNT Working Group
QLD	Queensland
RAAF	Royal Australian Air Force
R&D	Research and Development
RFI	Request for Information
RIMPAC	Rim of the Pacific
RPAS	Remotely Piloted Aircraft Systems
SAR	Synthetic Aperture Radar
SARP	Standards and Recommended Practices
S&T	Science and Technology; also State and Territory
SATCOM	Satellite Communications
SBAS	Satellite-based Augmentation System
SBAS-IWG	SBAS Interoperability Working Group
SBS	Special Broadcasting Service
SCC	Australian Government Space Coordination Committee
SIAA	Space Industry Association of Australia
SIT	Strategic Implementation Team
SKA	Square Kilometre Array
SLR	Satellite Laser Ranging
SSA	Space Situational Awareness
SSI	Statement of Strategic Intent and Cooperation
STSC	State and Territory Space Coordination
STEM	Science, Technology, Engineering and Mathematics
SWS	Space Weather Service
TARS	Turn-Around Ranging Station
TAS	Tasmania
TCBM	Transparency and Confidence Building Measures

TERN	Terrestrial Ecosystem Research Network
TIROS	Television Infrared Observation Satellite
TISN	Trusted Information Sharing Network for Critical Infrastructure Resilience
UAE	United Arab Emirates
UK	United Kingdom
UN	United Nations
UN-GGIM	The UN Committee of Experts on Global Geospatial Information Management
UNISPACE+50	Fiftieth anniversary of the first United Nations Conference on the Exploration and Peaceful Uses of Outer Space
UNSW	University of New South Wales
US	United States
USG	Universal Service Guarantee
USO	Universal Service Obligation
VAST	Viewer Access Satellite Television
VHF	Very High Frequency
VIC	Victoria
VLBI	Very Long Baseline Interferometry
VSSEC	Victorian Space Science Education Centre
VTOL	Vertical Take Off and Landing
WA	Western Australia
WGCV	Working Group on Calibration and Validation
WGISS	Working Group on Information Systems and Services
WGS	Wideband Global SATCOM
WIGOS	World Meteorological Organisation Integrated Global Observing System
WMO	World Meteorological Organization
WDC	World Data Centre
WRC	World Radiocommunication Conference