



Australian Government



Australian
Space Agency

State of Space Report

A report by the Australian Government
Space Coordination Committee

1 July 2019 – 30 June 2020

space.gov.au



© Commonwealth of Australia 2020

Ownership of intellectual property rights

Unless otherwise noted, copyright (and any other intellectual property rights, if any) in this publication is owned by the Commonwealth of Australia.



Creative Commons licence

The material in this publication is licensed under a Creative Commons Attribution - 4.0 International licence, with the exception of:

- the Commonwealth Coat of Arms
- any third party material
- any trademarks, and
- any images or photographs.

The terms under which the Coat of Arms can be used are detailed on the following website:

pmc.gov.au/government/its-honour

Wherever a third party holds copyright in this material, the copyright remains with that party. Their permission may be required to use the material. Please contact them directly.

More information on this CC BY license is set out at the Creative Commons Website. Enquiries about this publication can be sent to:

Australian Space Agency

Level 3, McEwin Building

Lot Fourteen, North Terrace

Adelaide SA 5001

Phone: 1800 497 182 (within Australia) / +61 2 6276 1166

Email: enquiries@space.gov.au

space.gov.au

Attribution

Use of all or part of this publication must include the following attribution:

© Commonwealth of Australia 2020, published by the Australian Space Agency.

Citation

Australian Space Agency (2020), State of Space Report 2019-2020

Canberra: Commonwealth of Australia, December; available at: <https://www.space.gov.au>

Disclaimer

By accessing or using this publication, you agree to the following:

This publication is not legal or professional advice. Persons rely upon this publication entirely at their own risk and must take responsibility for assessing the relevance and accuracy of the information in relation to their particular circumstances.



Acknowledgements

The Australian Space Agency would like to thank the following Commonwealth agencies and organisations for their contribution in producing this report:

- Attorney-General's Department
- Australian Antarctic Division
- Australian Communications and Media Authority
- Australian Trade and Investment Commission (Austrade)
- Bureau of Meteorology
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Department of Defence
- Department of Foreign Affairs and Trade
- Department of Home Affairs
- Department of Industry, Science, Energy and Resources
- Department of Infrastructure, Transport, Regional Development and Communications
- Department of Prime Minister and Cabinet
- Geoscience Australia



Contents

Foreword	5
Australian Space Agency	9
Measuring Success	17
International	19
National	34
Responsible	69
Inspire	74
References	92



Foreword

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

When the Agency was established in July 2018, we prepared for our mission to triple the size of the sector to \$12 billion and create up to another 20,000 jobs in the decade to 2030. The Agency has experienced continuous momentum on the path to achieving these goals, as well as communicating to the Australian public the profound benefits of space technologies and services to life on Earth.

The Australian Space Agency's first year of operation was very much an establishment phase, characterised by relationship building both nationally and internationally. In our second year we delivered the Australian Government's *Australian Civil Space Strategy 2019-2028*, and implemented our first two space investment programs: the Space Infrastructure Fund and the International Space Investment initiative. We ended 2019 with one of our most exciting milestones yet, embarking on a new relationship with NASA on its inspiring Moon to Mars space exploration program. Significant progress has also been made in establishing an economic baseline for the Australian space sector, against which the Agency's future progress can be measured.

In February 2020, we moved into our headquarters in the dynamic Lot Fourteen innovation precinct in Adelaide, South Australia alongside industry neighbours such as the SmartSat CRC. In 2021, the Lot Fourteen precinct will become home to the Australian Space Discovery Centre, which will inspire the Australian community and the next generation of the space workforce through stories of opportunity, curiosity and technology. The Australian Space Discovery Centre will also include Australia's first publicly accessible Mission Control Centre which will enable businesses and researchers to communicate with satellites and spacecraft in orbit.

The Agency continues to open doors internationally by signing a Memorandum of Understanding with the Italian Space Agency, which has provided the opportunity to jointly develop a payload for the International Space Station. In addition, we have signed three Statements of Intent with the European Space Agency, NASA, and the UK Space Agency, as well as other space agreements with international counterparts. We have welcomed nine new industry partners with Statements of Strategic Intent, and established Memoranda of Understanding with the Western Australian and Tasmanian Governments. These agreements will continue to increase Australian capability to support national and international space opportunities.

We have much to learn as we push the boundaries of our knowledge and ensure Australia is at the forefront of space developments. Australia's space community has come a long way in a short period of time to show the world what the local sector can bring to the global stage. I am delighted that we are on track to meet the goals set by the Australian Government to deliver on the *Australian Civil Space Strategy 2019-2020* and I thank the industry for working with us on this journey.



I reflect back feeling inspired from what we have achieved as a nation. I am optimistic about the future of the sector and the important role space will play in our nation's future, including the recovery from COVID-19. I look forward to continuing to work across government, industry and the research sector as we grow and transform the civil space industry to lift the broader economy and inspire and improve the lives of Australians.

This is my final report as Agency Head and I am proud to have supported such a dedicated and world class team over the past two years on our journey to grow and transform the Australian civil space sector.

Dr Megan Clark AC

21 December 2020

Introduction

In the 2019-2020 financial year, the Australian Space Agency (the Agency) entered into the second phase of the *Australian Civil Space Strategy 2019-2020* (refer to Figure 1), moving from a period of establishment to fully operational, located in its new headquarters in the Lot Fourteen innovation precinct in Adelaide, South Australia.

The Agency has made rapid strides, opening doors internationally that have brought new opportunities to the Australian space sector. In September 2019, the Australian Government allocated \$150 million to a new Moon to Mars initiative, which will enable the local space industry to participate in NASA's efforts to return to the Moon and on to Mars. The Italian Space Agency has also offered Australia the opportunity to jointly develop a payload to be hosted on or deployed from the International Space Station.

The growth across the Australian civil space sector is reflected in the significantly greater length of this report when compared to the previous State of Space report, which covered a period of 18 months. The departments and agencies that make up the Space Coordination Committee (SCC) are increasing their space-related activities in response to Government investment and new opportunities in the space sector. The Committee itself has grown, welcoming the Australian Antarctic Division near the end of the reporting period.

To measure the growth of the Australian space industry, the Agency will provide a report on its progress in meeting the measures of success established by Government every two years. While 2019-2020 is not a reporting year, research is being undertaken to establish baseline data against which future progress can be measured. The Agency's *Economic snapshot of the Australian space sector: 2016-17 to 2018-19* report will be released publicly once finalised early in 2021. This report sets the 2016-17 financial year as an economic baseline and measures the sector's progress to 2018-19.

2019-2020 saw Australia face the national emergencies of the "Black Summer" bushfires and the COVID-19 pandemic. The Agency and other SCC members played their part in supporting Government efforts to meet these crisis situations. In partnership with CSIRO, Geoscience Australia (GA) and the Bureau of Meteorology (Bureau), in January 2020 the Agency established the Bushfire Earth Observation Taskforce to consider how space-based Earth Observation might support bushfire management, as well as other natural disasters.

During the COVID-19 pandemic, the Agency worked closely with the space sector to identify challenges, concerns and issues specific to the industry. The Agency prioritised the awarding of grants under its three flagship programs: Space Infrastructure Fund, International Space Initiative and Moon to Mars programs.

Following the format established with the 2018-2019 State of Space report, the civil space activities of Australian Government departments and agencies are categorised in this report under the four Strategic Space Pillars and National Civil Space Priority Areas of the *Australian Civil Space Strategy 2019-2020*. A new feature is a selection of case studies highlighting the activities of SCC member departments and agencies.

It is noted that the Machinery of Government changes in 1 February 2020 resulted in departmental mergers that have changed the names of some departmental contributors to this report. For simplicity, this report uses the titles created by the Machinery of Government changes and reports all activities under these new departments.

AUSTRALIAN CIVIL SPACE STRATEGY 2019-2028: IMPLEMENTATION

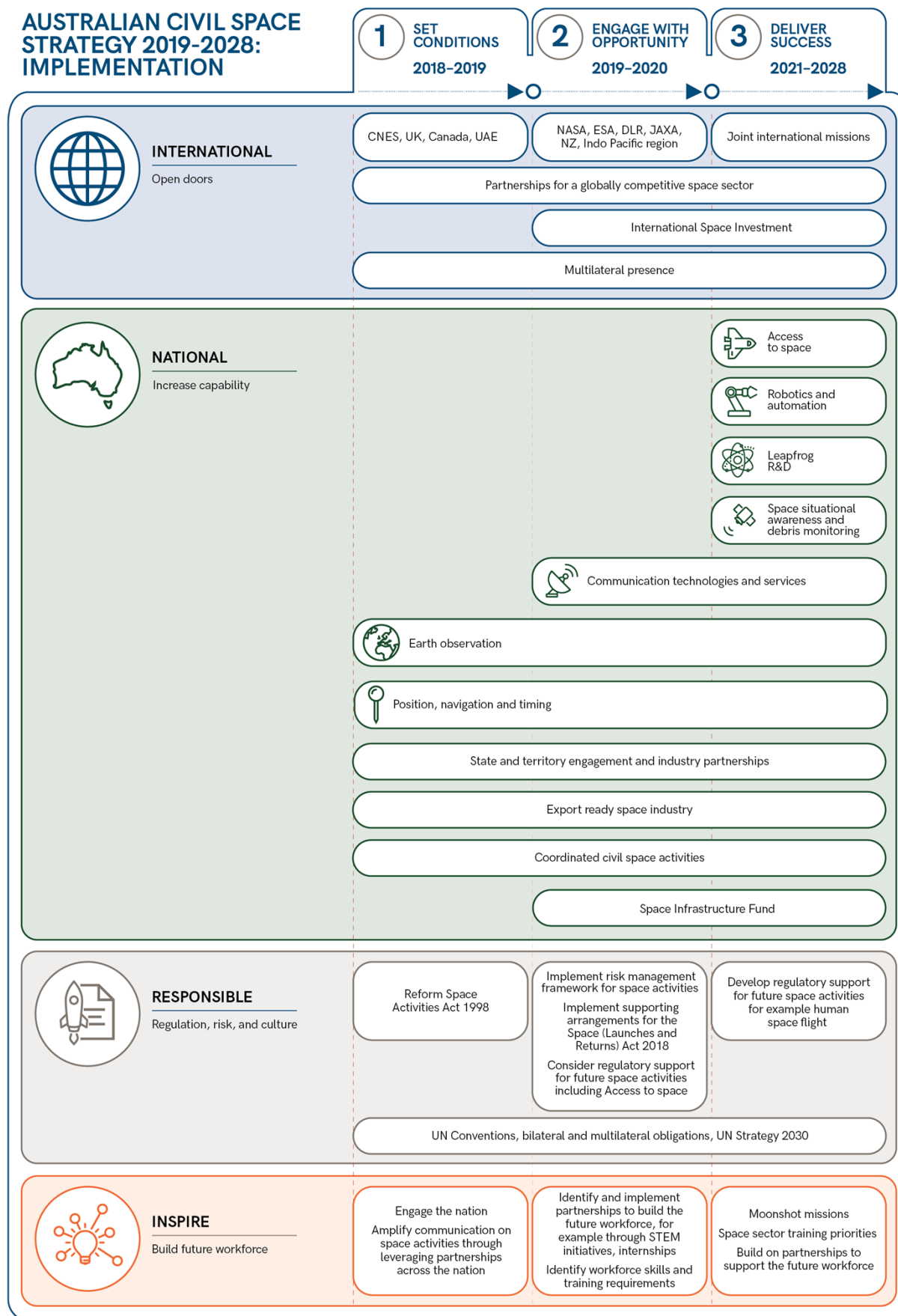


Figure 1 – Summary of the Australian Civil Space Strategy

Australian Space Agency

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.

About the Agency

Purpose and responsibilities

The Agency is a non-statutory, whole-of-government entity located within the Department of Industry, Science, Energy and Resources (DISER) as a separately branded function. Established on 1 July 2018, 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 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.



Figure 2 – All staff at the Agency's 5 December 2019 planning day, held at Geoscience Australia

Achievements

The second year since the Agency's formation has been marked by some major projects coming online and new initiatives announced.

The Prime Minister, as part of an official visit to the United States (US) in September 2019, announced the \$150 million Moon to Mars (M2M) initiative to support Australian businesses and researchers to participate in NASA's inspirational plan to return to the Moon and on to Mars. This investment will focus on three integrated elements that will lift Australian engagement in the global space sector. Further information on this initiative is below.

The headquarters in the Lot Fourteen innovation precinct of Adelaide was officially opened on 19 February 2020 by the Prime Minister; the Minister for Industry, Science and Technology; and the Premier of South Australia. A Mission Control Centre and the Australian Space Discovery Centre are scheduled to open in the headquarters site in 2021. These projects form part of the Adelaide City Deal, which is managed by the Department of Infrastructure, Transport, Regional Development and Communications (DITRDC).

A number of Space Infrastructure Fund (SIF) projects commenced, with the first three grant recipients announced in June 2020: Mission Control; the Space Automation, Artificial Intelligence and Robotics Command and Control Complex; and the Australian Space Data Analysis Facility.

The International Space Investment (ISI) Initiative commenced, with 10 projects announced in June 2020. These projects will be funded to grow Australia's space industry capability by building relationships with international space agencies. Case studies for each funding recipient are available on the Agency's website.

The Agency has responsibility for administering space activities legislation. The *Space Activities Amendment (Launches and Returns) Act 2018* came into force in August 2019, together with its associated Rules. The amended Act ensures that Australia's space regulation supports the growth of our space capabilities while ensuring safe and responsible activities.



Figure 3 – Agency Accomplishments for 2019-20

On 21 October 2019, the Agency signed a memorandum of understanding (MOU) with the Italian Space Agency (ASI) at the International Astronautical Congress (IAC). This was followed up by signing a Statement of Intent (SOI) with ASI on 17 February 2020 outlining the ASI offer to develop a payload to be deployed on the

International Space Station (ISS) as a joint project with the Agency. The Agency is currently considering how best to use this and other similar opportunities, in consultation with industry.

A further three SOIs were completed with the European Space Agency (ESA) (15 August 2019), NASA (21 September 2019) and the UK Space Agency (24 September 2019). The SOI with the UK Space Agency builds upon its existing MOU.

At the IAC, on 22 October 2019 the Agency also signed a Letter of Intent with the Deutsches Zentrum für Luft- und Raumfahrt (DLR), the German Aerospace Center, as well as signing an Arrangement with the New Zealand Ministry of Business, Innovation and Employment.

During the year, the Agency signed nine Statements of Strategic Intent and Cooperation (SSI) with Australian and international companies: Myriota (15 July); XTEK (18 July); Speedcast (6 August); US space technology company Maxar Technologies (22 August); FrontierSI (29 August); EM Solutions Pty Ltd (13 November); EOS Space Systems (2 December); Thales Australia (3 December) and Gilmour Space Technologies (11 December). Both Maxar and FrontierSI are significant contributors to the SmartSat CRC.

To advance the Agency's national engagement role, MOUs were signed with Western Australia (July 2019) and Tasmania (September 2019).

Members of the Space Industry Leaders Forum, a governance committee outlined in the Agency's Charter, were announced in November 2019. The Forum is the primary mechanism for engagement and coordination with the Australian space industry.

The Agency's estimated cumulative media reach from 1 July 2019 to 30 June 2020 was 76,931,340 across all platforms. The Agency expanded its social media presence with the addition of a YouTube channel in October 2019 and a Facebook page in April 2020. The Agency's space.gov.au website was also refreshed in June 2020.

The Agency became the Australian representative for the Japan Aerospace Exploration Agency's (JAXA) Kibo-ABC (Asian Beneficial Collaboration through "Kibo" Utilization) program, which offers schools and universities access to international education programs conducted on the Japanese Kibo module on the ISS, like the Kibo Robot Programming Challenge and Seeds in Space.

Working with CSIRO, the Agency commemorated the 50th Anniversary of the Moon landing in July 2019, highlighting the exciting role Australia played in receiving and broadcasting the first images of the Moon landing to the largest television audience of the time, in 1969. This event garnered national pride and was a major contributor to the 'inspire' pillar of the *Australian Civil Space Strategy 2019-2028*.

Headquarters opening

The Prime Minister announced the headquarters of the Agency would be located in Adelaide, as a part of the Adelaide City Deal signed at Lot Fourteen on 12 December 2018. The headquarters were officially opened just over a year later on 19 February 2020.

The opening was the catalyst for a series of space events in Adelaide that week, including:

- Signing of a joint SOI with ASI to consider a joint activity on the ISS.
- Agency Advisory Board meeting.
- VIP Preview of HQ and the Australian Space Discovery Centre with over 200 stakeholders.
- SA Space State Dinner with over 450 stakeholders.
- The 9th Australian Space Forum with 1000 participants.



Figure 4 – Opening of the Agency Headquarters

Moon to Mars initiative

In May 2019, NASA announced project Artemis, which plans to land the first woman and next man on the Moon. Project Artemis is named after the twin sister of Apollo, to reflect NASA's historic Apollo missions. The announcement included an accelerated timeframe to put these new explorers on the Moon's surface by 2024. With an ambitious timetable, this project has opened up exciting opportunities for newer space agencies and the commercial sector to participate.

On 21 September 2019 during his trip to the US, the Prime Minister announced the \$150 million M2M initiative to enable and support Australian businesses to participate in NASA's inspirational plan to return to the Moon and on to Mars. Delivered through the Agency, this investment will focus on three integrated programs that will lift Australian engagement in the global space sector:

1. **Supply Chain**, supporting access to international space supply chains that support NASA, including capability building to help the Australian space sector meet the stringent requirements of supplying products and services in the global space industry.
2. **Demonstrator**, funding demonstrator and pilot projects which showcase investment-ready Australian capabilities to NASA and the US's international space supply chains (e.g. in the areas of robotics, automation, artificial intelligence, and Earth observation).
3. **Trailblazer**, working with NASA to identify how Australia can support a significant part of NASA's 'return to the Moon and on to Mars' program, leveraging Australia's key strengths (e.g. drawing on the demonstrator and pilot projects).

Following the announcement, the Agency undertook a number of meetings with space primes with the aim of understanding their Australian supply chains and to ascertain ways in which the Agency can connect them with Australian capability.

Between 14 February and 2 March, the Agency also undertook 11 consultations across eight capital cities with more than 500 people registering for the events, across a range of platforms. 70 written submissions were provided. By the end of the reporting period, guidelines for the first element of the Supply Chain were under development, with the first program to be opened in August 2020.

Responding to COVID-19

In March 2020 the Agency responded to Coronavirus disease (COVID-19) pandemic requirements set by the Australian Government. The Head of the Agency informed the space industry of the available support, and advised that the Agency would continue operating, with staff working from home and practicing the required

social distancing. The Agency newsletter and social media channels have continued to amplify government messages and provide information on funding and support.

Within DISER, the Agency supported relevant COVID taskforces, in particular the Resilience and Recovery Taskforce. As Australia moves into recovery, the Agency continues to work with the taskforce to ensure Australia's space capabilities are considered as a part of the nation's strategic recovery, particularly in manufacturing.

To provide support through the economic downturn, the Agency worked closely with the space sector to identify challenges, concerns and issues specific to the industry. This provided insights into how COVID-19 impacted their businesses and helped inform DISER's Industry Intelligence efforts. Many issues experienced by the space sector were similar to those in the manufacturing and digital sectors, with specific concerns around the financial sustainability of start-ups given the emerging nature of the sector. With industry and other international counterparts, the Agency focused on identifying areas where space could play a significant role in the post-COVID recovery strategy.

Recognising the financial stresses imposed by the COVID-19 response, the Agency prioritised the delivery of its funding programs. This included the ISI initiative, the SIF and the supply chain component of the M2M initiative, which provides opportunities for businesses to access international supply chains.

In order to provide short-term financial relief for the launch sector, a 12-month deferral on the original commencement date for the partial cost recovery model was agreed. Originally, partial cost recovery was intended to commence after 1 July 2020 associated with certain applications made under *the Space (Launches and Returns) Act 2018*. The deferral was approved by the Government at the 2019 Mid-Year Economic and Financial Outlook (MYEFO). The Agency will consult on draft rules for the fees prior to commencing any charges, which are now expected to commence in July 2021.

A number of key international and national events that the Agency planned to attend were cancelled, rescheduled or replaced by virtual meetings. The Colorado Springs Space Symposium was moved from March 2020 and has been re-scheduled for August 2021. The IAC, usually held in October, was postponed to October 2021, with a 'virtual' three day conference planned for October 2020. The 43rd Committee on Space Research (COSPAR) Scientific Assembly, an international space research conference being hosted in Australia, was rescheduled from August 2020 to February 2021. The Asia Pacific Regional Space Agency Forum (APRSAF) was also postponed from November 2020 to November 2021, with a virtual event to be held in November 2020. The Avalon Airshow was moved from February 2021 to November 2021.

The Agency worked closely with DISER to establish business continuity processes. Throughout the pandemic, the Agency has focused on the wellbeing, health and safety of its staff.

Governance

The Agency's governance structure 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 for Industry, Science and Technology. 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.



Figure 5 – The Agency Advisory Board, meeting at Agency headquarters, February 2020

The Agency Advisory Board is a non-statutory, independent, skills-based panel that provides advice to the Agency Head. 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 eight Independent members of the Agency Advisory Board were announced formally on 10 July 2019. The first meeting of the Advisory Board took place on 5 September 2019, to discuss the strategic direction and performance of the Agency. The Board's second meeting took place on 18 February 2020 at the Agency's headquarters in Adelaide. This meeting included an update from the Australian Communications and Media Authority (ACMA) regarding spectrum issues.

The ex-officio position for a Department of Defence representative was agreed between the Minister for Defence and Minister for Industry, Science and Technology on 22 November 2019, with AVM Catherine Roberts attending her first meeting on 18 February 2020.

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, Australian Government departments, industry, state and territory governments, 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 and functions as an inter-departmental committee comprising senior official representation from across government. The SCC aims to meet quarterly, with meetings undertaken on 18 September, 11 December 2019, 13 March and 11 June 2020.
2. **Space Industry Leaders Forum (the Forum).** The Forum is the primary mechanism for engagement and coordination with the Australian space industry. Its purpose is to assist the Agency with the business and technological aspects of the space industry and to provide input into national civil space strategy and policy. The Forum includes industry representatives, academia, relevant industry associations and other non-government space organisations within Australia. Members of the Forum were announced in November 2019, with the first meeting held via videoconference on 20 March 2020. STEM engagement was a high priority for the Industry Forum and a sub-working group is set to be established for its members. Due to COVID-19, a second Forum meeting was held on 30 June 2020 to advise support

available and to seek feedback on the impacts of COVID-19 on the industry. The Forum is intended to meet twice a year.

- 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. The STSC aims to provide engagement for jurisdictions to support national space policy and strategy and provide one voice for Australia's civil space sector. These meetings help to regularly connect with our state and territory counterparts, keep abreast of relevant space activities in each jurisdiction and coordinate our international outreach. STSC Meetings are intended to occur quarterly and were held on 4 September, 10 December 2019 18 March and 9 June 2020.

Civil Space Coordination

A number of Australian 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.

The Agency is the central point of contact and coordination for the Australian Government's involvement in civil space. This role includes chairing the SCC. The SCC membership is comprised of Australian Government departments and agencies with an interest in civil space:

- 1. Australian Antarctic Division (AAD):** The AAD leads, coordinates and delivers the Australian Antarctic Program. The AAD joined the SCC in May 2020 and its space-related activities will be reported in future State of Space Reports.
- 2. 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.
- 3. Attorney-General's Department (AGD):** The Office of International Law within AGD provides legal advice to government on international space law.
- 4. 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.
- 5. 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.
- 6. Bureau of Meteorology (the Bureau):** The Bureau 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.
- 7. Commonwealth Scientific and Industrial Research Organisation (CSIRO):**
CSIRO is involved in space science, research and development, and Earth observation science. It also manages and operates critical national and international space-related infrastructure.
- 8. Department of Defence (Defence):** Defence is concerned with civil space activities that overlap with defence-related issues in space.
- 9. Department of Foreign Affairs and Trade (DFAT):** DFAT is responsible for Australia's engagement on space-related international security issues.

10. **Department of Home Affairs** (Home Affairs): Home Affairs is responsible for critical infrastructure resilience policy.
11. **Department of Industry, Science, Energy and Resources** (DISER): DISER maintains a role in the development of the Australian space industry, particularly on identifying broader linkages between space and other industry sectors, such as defence and advanced manufacturing. The department also has an ex-officio position on the Agency's Advisory Board.
12. **Department of Infrastructure, Transport, Regional Development and Communications** (DITRDC): DITRDC provides policy oversight of radiocommunications services and spectrum management (including satellite communication) in Australia. DITRDC's interests in civil space also include the application of satellite-enabled services for road, rail, maritime and aviation sectors. These activities are carried out by DITRDC and its transport portfolio agencies: the Australian Maritime Safety Authority; the Civil Aviation Safety Authority and Airservices Australia. The department is also concerned with position, navigation and timing (PNT) as it relates to the transport sector.
13. **Geoscience Australia** (GA): GA is Australia's pre-eminent public sector geoscience organisation, and manages the nation's geographic and geological data. GA is responsible for Australia's fundamental national positioning infrastructure and services, and leads the Australian Government's operational monitoring of the land using satellite Earth observations.
14. **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.

Four working groups report to the SCC:

- The Earth Observation from Space (EOS) Working Group;
- The Position, Navigation and Timing (PNT) Working Group;
- The Inter-Departmental Working Group on Space Law; and
- The National Security Space Inter-Departmental Committee.

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 contributions to the *State of Space* reports.

Policy

The Agency worked on several civil space policy areas during 2019-20, including participation in working groups relating to:

- How the space sector can support economic recovery post-COVID-19.
- Options for Australia for space tourism and human space flight, as requested by the Minister for Industry, Science and Technology in her Statement of Expectations. A cross-portfolio community of interest was established and the Agency progressed a market analysis of space tourism and human space flight in Australia for completion in the latter half of 2020.
- Working with Defence and DFAT to ensure that the Agency considers matters of national interest that support the growth of the industry.

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 revenue to over \$12 billion per annum and create an additional 20,000 jobs by 2030.

The *Australian Civil Space Strategy 2019-2028* outlines the targets for measuring the Agency's success in achieving these goals:

- 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.
- Achieve year-on-year growth of the Australian space industry that exceeds 8.5 per cent per annum.
- Achieve year-on-year growth of direct and indirect jobs that would meet a target of 20,000 additional jobs by 2030.
- Create a regulatory framework that ensures effective, efficient, and safe space activities.
- Increase awareness of space activities and the impact on the Australian economy, cumulatively reaching at least 10 million Australians per year.

The Agency will provide a report on progress of meeting the measures every two years (noting that 2019-20 is not a reporting year). The Agency's *Economic snapshot of the Australian space sector: 2016-17 to 2018-19* report will be released publicly once finalised early in 2021. The report sets the 2016-17 financial year as an economic baseline and will measure the sector's progress to 2018-19.

The report will present the Agency's analysis of the Australian space sector's performance against key economic indicators such as jobs, revenue and growth (between FY16-17 and FY18-19), and investment (to September 2020)¹. The Agency used the recently released [Definition of the Australian space sector](#)² to help define the set of organisations to be included in the analysis. This framework is expected to be different to the methodology used by IBISWorld (numbers quoted below), drawing on an internal dataset administered by the Agency.

The Agency also commenced work to establish an evaluation framework for the Agency and its initiatives. This framework will inform reviews of the Agency, including the operational review of the Agency to be commenced within four years of operation, as outlined in the Agency's Charter.

The OECD report on the impacts of COVID-19 on the space industry³, released 5 August 2020, states that the full impact of COVID-19 on the global space sector (and its flow on to the Australian space sector), has yet to be determined and hard figures are not yet readily available.

Despite early fears that the industry could take a severe hit, indications are that the space sector has proven resilient in Australia and internationally. However, there could be medium and long-term effects that are yet to emerge.

¹ Note, revenue, jobs and growth are lagging indicators and investment is a leading indicator, which is why reporting timeframes differ.

² Australian Space Agency (2020), *Definition of the Australian space sector*

³ OECD The impacts of COVID-19 on the space industry, released 5 August 2020

Supported by the Australian Government's investment through the ISI initiative, the SIF and the M2M initiative, the Australian space sector is positioned well for future growth, with spill over benefits to other sectors of the economy.

Progress against measures

Table 1 – Progress against measures of success from 2018-19

Target	Status
\$1 billion pipeline of inward investment (Source: Agency data)	The 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 to 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.
Triple sector revenue to \$12 billion*	In 2018-19 the Australian space sector generated approximately \$5.3 billion in revenue, representing an increase of 13 per cent from 2016-17.
Growth rate exceeds 8.5 per cent*	Industry revenue is expected to grow at an annualised 5.4 per cent over the five years through to 2020-21. Industry revenue is forecast to grow at an annualised 8.3 percent over the five years through to 2025-26.
20,000 additional jobs*	In 2018-19 the Australian space sector employed approximately 13,200 people, representing employment growth of 14 per cent from 2016-17 to 2018-19. 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.
Regulatory framework (Source: Agency data)	The <i>Space Activities Amendment (Launches and Returns) Act 2018</i> came 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 (Source: Agency data)	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 monitoring.
GDP contribution*	Industry value added was \$2 billion in 2018-19, representing an increase of 13 percent from 2016-17. \$2 billion was approximately 0.1 percent of Australia's 2018-19 GDP.

* Source: IBISWorld (2020), Satellite Communications and Astronautics in Australia

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

As outlined in the *Australian Civil Space Strategy 2019-2028*, one of the Agency's key responsibilities is to transform and grow a globally respected Australian space industry through strong national and international engagement. The Agency continues to actively engage internationally, establishing and maintaining genuine relationships to open doors for Australia. Guided by the Strategy, in 2019-20 the Agency focused on firming its relationships with key international agencies, as well as confirm new relationships, to support the growth and transformation of the space industry.

The Agency signed arrangements with the following international organisations:

- European Space Agency (ESA), 15 August 2019
- National Aeronautics and Space Administration (NASA), 21 September 2019
- UK Space Agency, 24 September 2019
- German Aerospace Center, Deutsches Zentrum für Luft- und Raumfahrt (DLR), 22 October 2019
- New Zealand Space Agency, New Zealand Ministry of Business, Innovation and Employment, 22 October 2019
- Italian Space Agency, ASI, 21 October 2019 and 17 February 2020



Figure 6 – Signing of ASI MOU at IAC 2019

The Agency promoted Australian space expertise at the IAC in Washington D.C, through a united trade booth presence, *The Australian Space* (October 2019). The booth enabled a range of Australian organisations, including CSIRO, to exhibit their capabilities and engage with potential international partners. Promotional materials for all the states and territories were also available.

The Agency will participate in the virtual exhibition being created in association with the IAC 2020-Cyberspace edition and will continue to attend IAC in future years and present a united booth to showcase Australian space capabilities.



Figure 7 – Booth at IAC

At the end of February 2020, the Agency participated in the Australian Space Industry Conference, organised by the Space Industry Association of Australia (SIAA). The Agency also arranged a booth in the conference exposition area to promote Australian space capabilities to the conference delegates.

In partnership with CSIRO, the Agency represents Australia on the International Space Exploration Coordination Group (ISECG) and International Mars Exploration Working Group (IMEWG). The Bureau of Meteorology is now an observer to the IMEWG, an international forum established with the goal to foster international co-operation in relation to the exploration of Mars.

Significant work continues in international forums on the continued use of space for peaceful purposes. The Agency and DFAT continue to engage with the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), its subcommittees and working groups. The Agency continues to submit reports to UNCOPUOS including Australia's annual report, and compendiums related to space debris mitigation standards, and mechanisms adopted in relation to non-legally binding UN instruments on outer space.

The Agency regularly attends meetings of the Asia-Pacific Regional Space Agency Forum's (APRSAF) National Space Law Initiative. The purpose of this initiative is to promote information sharing and mutual learning on the practices and examples of national space legislation and/or policies in the Asia-Pacific Region and will include submitting a report on the status of national legislation in the Asia-Pacific Region to the UNCOPUOS Legal Subcommittee scheduled for March 2021. The Agency also participated in the regional APRSAF Conference in Nagoya, Japan from 26-29 November 2019.

Following the introduction of COVID restrictions, the Agency conducted videoconference international agency bilateral meetings with the DLR, ESA, UK Space Agency, New Zealand Space Agency, ASI, United Arab Emirates Space Agency (UAESA), Canadian Space Agency (CSA) and JAXA.

United States

On 2 July 2019, the Agency hosted Badri Younes, Deputy Associate Administrator for the Office of Space Communications and Navigation, while visiting Australia for the celebration of the 50th Anniversary of the Moon Landing. In February 2020, a NASA Deep Space Communication team, led by Younes, spent 3 days with the Agency to workshop areas of cooperation including optical communication, quantum encryption, optical clock and quantum memory.

Australia's most significant engagement with NASA occurred on 21 September 2019, when the Prime Minister announced the \$150 million M2M initiative to support Australian businesses to participate in NASA's inspirational plan to return to the Moon and on to Mars.

This space investment will benefit the broader Australian economy as it enables the integration of other supply chains such as advanced manufacturing, medical technologies and mining equipment technology and services. By joining with the US M2M endeavour, Australia will have the opportunity to engage in opportunities for remote medicine, remote asset management, in situ resource utilisation, automation, robotics, and optical communications. These represent an opportunity for Australia to apply and transfer local expertise and capabilities to global space value chains. Furthermore, the new materials sector will offer Australia broader commercial opportunities to develop products, services and applications for the space economy.

The Agency worked with Austrade and DFAT in preparation for the G'Day USA 2020 event, and an Industry exchange event at the 36th Space Symposium in Colorado Springs in March 2020. When the Symposium was re-scheduled due to the pandemic, the workshops and matchmaking sessions for a delegation of Australian companies were moved to a virtual format. In total, seven virtual workshops and sessions were conducted on a rolling basis from 23 April until the end of 2020. These events successfully connected space primes to Australian SMEs and start-ups, educated space companies on US Defence space procurement processes and provided business matching with similarly sized US space companies.

Europe

European Commission

On 24 July 2019, the Agency held the first bilateral technical discussion with the European Commission (EC) with participants from CSIRO and GA. It reviewed areas of future collaboration including space domain awareness, robotics and automation and Earth observation, consistent with the National Civil Space Priorities.

The Agency, CSIRO and GA held the second bilateral during Group on Earth Observations (GEO) Week in Canberra in November 2019. Progress on topics of mutual interest and areas for collaboration were reviewed and next steps for a formal EU-Australia Space Dialogue were set.

The Agency has worked closely with the DISER European Post, based in Brussels, to assist in the facilitation of the first Europe-Australia Space Dialogue. However, COVID-19 has delayed this program at the present time. Australia's Ambassador to the EU, Mr Justin Brown PSM, met with the newly appointed EU Commissioner for the Internal Market, Thierry Breton, in late June 2020. The Commissioner has a very broad remit including critical minerals, digital, artificial intelligence, cybersecurity, defence industry and space.

European Space Agency (ESA)

The Agency signed a joint SOI with ESA on 23 August 2019 to explore deeper cooperation and identify projects in a range of areas including deep space communications, navigation, remote asset management, data analytics and mission support. A technical report outlining areas of cooperation and opportunities was presented at ESA's Space19+ Ministerial Conference in November. ESA viewed this conference as a great success, with significant funding being provided to ESA to deliver its space activities. As part of this, funding was received for the expansion of their New Norcia space tracking facility in WA, for which CSIRO provides operations and maintenance support, with the construction of a new, second deep space antenna. Work on

the new 35m deep space antenna will commence in the second half of this calendar year – COVID-19 issues permitting. The main dish will be constructed by European primes, but ESA has promoted the use of Australian sub-contractors to encourage collaboration. Australian organisations will be allowed to participate as primes in providing local facilities, networking and communications equipment, services and construction for the facility.

Australian participation in the new antenna project is being planned in collaboration with ESA. As ESA develops a deeper commitment to the Australian tracking station facilities, Australian participation in this major initiative will look to build Australia's space capability while providing a path to support future ESA missions and open doors to further ESA collaboration.

A virtual bilateral meeting was held on 29 June 2020 that further explored opportunities for collaboration with ESA in several areas including potential collaboration on the Lunar Gateway. The Heads of the two Agencies have agreed to formalise collaboration through a framework agreement or MOU.

Regular discussions also took place with ESA on the bushfire work undertaken by the Agency, as well as on Advanced Communications and Space Situational Awareness, to refine areas of cooperation and collaboration.

United Kingdom (UK)

On 24 September 2019, Australia and the UK announced the UK-Australia Space Bridge. At the UK Space Conference, a SOI was signed to progress the initiative towards a Framework Agreement. The Space Bridge Framework Agreement was targeted to be signed by the end of 2019, however, has been delayed until 2021 due to COVID. A joint effort between the Agency, UK Space Agency, Austrade, and the UK Department for International Trade, the Space Bridge will support UK-Australia space industry partnerships and will bring benefits to Australian space industries, facilitating new trade and investment opportunities and the exchange of knowledge and ideas.

A delegation from the UK Space Agency and the UK Department for International Trade visited Australia in February 2020, to progress work on the Australia-UK Space Bridge and foster connections with the Australian space industry. UK and Australian companies are already referencing the Space Bridge as an innovative bilateral initiative to support the commercial space ecosystems of both nations. The continuing development of the Space Bridge framework forms a strong link to an international aligned UK industry strategy to assist with the recovery post COVID-19.

The Agency held a virtual bilateral meeting with the UK Space Agency on 30 June and continues regular discussions with the UK Space Agency with specialised topics on space situational awareness and robotics.

In pre-COVID-19 discussions, the UK Space Agency outlined that space would be a major focus for UK activities with significant budget anticipated to support UK national programs. As part of a new National Space Strategy, the UK Space Agency confirmed that Australia was a priority for international collaboration.

Italy

On 21 October 2019, the Agency signed a MOU with the ASI, the Italian space agency at the IAC. Building on this MOU, the two agencies explored an opportunity for a possible joint mission to the ISS. This resulted in the Agency signing of a SOI with the ASI on 17 February 2020, in conjunction with the opening of the Agency's new headquarters in Adelaide.

The SOI outlined the ASI offer to Australia to jointly develop a payload to be hosted on or deployed from the ISS. This joint project with the Agency may consist of pressurised and unpressurised payloads for scientific and technological missions like CubeSat/Microsat deployment or for research on the ISS itself. This is an extremely collaborative approach from an international agency and underscores the desire by ASI to work with Australia.

A suite of options was presented to ASI on 30 April to further plan the project and the Agency will collaborate with Australian industry to determine how best to use this and other similar opportunities.

Japan

The JAXA's Hayabusa2 asteroid mission, launched in 3 December 2014, is planned to return its asteroid samples to Earth on 6 December 2020, with the return capsule landing within the Woomera Protected Area. JAXA requires formal regulatory approvals for this return and the Agency is responsible for providing advice to the Minister on whether the activity meets the requirements of the Act.

The Agency has also been supporting JAXA with its logistical requirements for Hayabusa2. The Agency is leading cross-government engagement to support the activity, ensure pandemic requirements are met, and facilitate exchange of information across agencies. Engagement representatives travelled to Woomera in November 2019 to participate in a meeting with JAXA's media team alongside representatives from Department of Defence to discuss engagement opportunities and media processes. During the pandemic, the Agency has worked closely with JAXA to ensure previously agreed face-to-face engagement opportunities are supported through virtual systems to maintain the important relationship and support the significance of the mission.

The Agency continues work with JAXA on developing a bilateral arrangement, where areas of mutual interest for future collaboration will be identified.

In late 2019, the Agency became the Australian representative for Kibo-ABC (Asian Beneficial Collaboration through "Kibo" Utilization) – a JAXA initiative used for research on space medicine, biology, Earth observations, biotechnology and communications on the Kibo module, which is part of the ISS. The Agency inherits coordination of this activity from the Australian National University, which, prior to the formation of the Agency, successfully participated in many projects and supported opportunities for the Australian space community to participate in this exciting initiative.

Through Kibo-ABC, the Agency is supporting many of JAXA's international education programs to run simultaneously in Australia. This includes the Kibo Robot Programming Challenge (Kibo-RPC), and Seeds in Space (Asian Herbs in Space). The Agency is working with a local organisation, the One Giant Leap Australia Foundation, to undertake these programs in Australia and to assist reaching schools and universities on a national scale.

The impact of the COVID-19 situation on all education systems in the region meant that there was a slower than expected uptake in participation.

India

The Agency is finalising amendments to the 2012 MOU India Australia Cooperation in Civil Space Science Technology and Education that will broaden the scope of existing collaboration between the Indian Space Research Organisation (ISRO) and the Agency, to allow other Australian and Indian entities such as government organisations, universities and research institutes to enter into implementing agreements under the MOU⁴. These amendments are expected to be finalised in the coming months accommodating any delays introduced by COVID-19.

⁴ On 26 September 2019, the Memorandum of Understanding between the Government of India and the Government of Australia on Cooperation in Civil Space Science Technology and Education (2012) was amended to reflect the appointment of the Agency as the Executive Organisation representing the Government of Australia under Article 4(d) of the agreement, replacing the former Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE).

As India prepares to become the fourth country to launch humans into space, with its 'Gaganyaan' (Sanskrit for "Sky Craft") project, the Agency is leading cross-government coordination on ISRO's request to place temporary ground station tracking facilities in the Cocos (Keeling) Islands to support the Gaganyaan missions. This includes facilitating advice to ISRO from a number of Commonwealth agencies which will need to grant approvals for the project to go ahead.

Canada

As part of the Bushfire Earth Observation Taskforce, and the development of the Agency's Earth Observation Roadmap, conversations took place with the Canadian Space Agency to understand the details of its fire-dedicated mission WildFireSat. These discussions with Canada are continuing.

Introductions and relationships between Australian and Canadian industry were progressed during GEO week in November 2019 with a delegation from the Canadian Space Agency visiting Canberra and Adelaide. Further industry workshops were planned for later this year but will be rescheduled for next year due to COVID-19.

France

The Agency, working with CSIRO, has organised a personnel visit from the National Centre for Space Studies, Centre national d'études spatiales (CNES) to support the Agency to develop technology roadmaps for Australia's National Civil Space Priority areas. It is proposed that CSIRO will host the CNES personnel for the duration of the visit. It is currently scheduled for early 2021, dependent upon relevant COVID-19 travel restrictions.

SCC members

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. The ACMA participated in the Australian delegation to World Radiocommunication Conference (WRC) 2019.
Austrade	Over 2019-20 Austrade organised a number of space specific virtual events under its 'Digital Space Symposium Series' which commenced in April 2020 and remains ongoing. These events were organised for targeted organisations following the cancellation of the 36th Colorado Space Symposium. They included: • A business to business matchmaking session with select Australian companies and members of the CompTIA Space Enterprise Council in the US; • A series of capability exchange sessions focused on US space primes and Australian companies; and • A virtual fireside chat and start-up pitch session with representatives from the US Air Force responsible for space capability.
Bureau of Meteorology	<u>Earth observations</u>

Organisation	Summary of activity
	The Bureau of Meteorology is an active member of the World Meteorological Organization (WMO) and a key contributor to the WMO Integrated Global Observing System (WIGOS). It participates in, and leads, a number of expert teams relating to Earth observation and the international exchange of meteorological observations. Through WMO, the Bureau leverages Australia's investment in in-situ observations to obtain global observations and data from a wide range of meteorological satellites. The Bureau has a number of EO-related bilateral agreements with meteorological services and space agencies in Japan, China, Korea, and the US. 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. The Bureau participates in a number of activities aimed at helping other meteorological services improve their access to EOS data. The Bureau currently leads a WMO Region-V (Asia-Pacific) Task Team on Satellite Utilisation which aims to improve access to meteorological satellite data and products within the region, and provide guidance on the transition of receiving hardware as new missions are launched. This is supported by the effort and expertise of the Bureau's Satellite Virtual Laboratory Centre of Excellence, which conducts monthly online Regional Focus Group meetings, attended by participants from across the South Pacific each month. The Bureau also participates in the Direct Broadcast Network for Near Real-Time Relay of Low Earth Orbit Satellite Data (DBNet) for the Asia Pacific. This provides operational arrangements for the real-time acquisition of polar-orbiting satellite data and its rapid delivery to the global user community through regional processing centres. In Dec 2019 the Bureau hosted the 10th Asia Oceania Meteorological Satellite Users Conference. The event was attended by 132 participants from 28 countries. Presentations covered topics related to the utilisation of satellite observations for nowcasting, disaster mitigation, climate and Numerical Weather Prediction (NWP). The Bureau is an Associate Member of Committee on Earth Observation Satellites (CEOS) and member of the CEOS Sea Surface Temperature Virtual Constellation (SST-VC). The Bureau is also a member of: • The Sentinel-3 Validation Team for Temperature (S3VT-T). • The Group for High Resolution Sea Surface Temperature (GHR SST) Science Team and GHR SST Advisory Board. • The WMO DBNet-Coordination group, which enables exchange of real time data from the satellite ground stations. • NASA's CloudSat science team and Global Precipitation Measurement Mission (GPM) Ground Validation team. <u>Space Weather</u> The Bureau's Space Weather Services (SWS) is a member of the International Space Environment Service (ISES) and operates the ISES Regional Warning Centre

Organisation	Summary of activity
	(RWC) for the Australasian region. SWS currently has two representatives on the ISES Directing Board: the Secretary for Space Weather and the RWC Australia delegate. During 2019-2020, the SWS finalised and signed an agreement governing the Australia, Canada, France and Japan (ACFJ) consortium for the delivery of space weather products supporting international aviation operations. The International Civil Aviation Organisation (ICAO) selected the ACFJ consortium to be a global provider of space weather advisories for the aviation industry. The new global advisory service went live during November 2019 and has been operating successfully. The Bureau is represented on the WMO Inter-Programme Team on Space Weather Information, Systems and Services (IPT-SWISS) coordinating the international availability and access to space weather data. <u>International Radiocommunications</u> The Bureau was part of the Australian delegation to the WRC in November 2019. It regularly participates in World Radio Communication Conferences and the Asia Pacific Telecommunity (APT) Conference Preparatory Group meetings. The Bureau is also a member of the World Meteorological Organisation Steering Group on Radio Frequency Coordination (SG-RFC). The Bureau is now an observer to the International Mars Exploration Working Group (IMEWG), an international forum established with the goal to foster international co-operation in relation to the exploration of Mars.
CSIRO	CSIRO has two key operational agreements with NASA: the <i>Agreement between the Government of Australia and the Government of the United States of America concerning Space Vehicle Tracking and Communication Facilities</i>, under which it manages the Canberra Deep Space Communication Complex (CDSCC); and the <i>Agreement between the Government of Australia and the Government of the United States of America concerning the Conduct of Scientific Balloon Flights for Civil Research Purposes</i>, under which it manages the NASA Alice Springs Ballooning Facility. As part of the Deep Space Network, CDSCC will support the Lunar Artemis mission planned for 2024. CSIRO provides operations support for the ESA deep space tracking station at New Norcia, WA. JAXA formally indicated its intent to launch four high altitude balloons in 2022 at the CSIRO-managed NASA Alice Springs Ballooning Facility, under the CSIRO-JAXA Collaborative Agreement for the Conduct of Scientific Balloon Flights for Civilian Research Purposes (14 July 2017). These launches will be undertaken as part of JAXA's gamma ray astronomy program, new balloon technology and drop test program. In 2019-20 CSIRO continued to build on its partnership with UK-based Surrey Satellite Technology Ltd for a 10 per cent share of the tasking and data acquisition capabilities of the NovaSAR-1 S-band Synthetic Aperture Radar (SAR) satellite, preparing to manage satellite tasking and data downlink and access through Australian infrastructure as a National Facility, and supporting the satellite's commissioning phase.

Organisation	Summary of activity
	Following the 2019 SOI between the Agency and the UK Space Agency to establish a UK-Australia 'Space Bridge', CSIRO worked with the UK Space Agency and other international partners to design projects that will use space technology to deliver sustainable benefits to Pacific Island countries vulnerable to climate change and natural disasters. CSIRO and GA represent Australia and the Agency on key programmatic aspects of international coordination on Earth observations from space. 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. Regionally, CSIRO is assisting the Vietnam National Satellite Center and the NZ Centre for Space Science and Technologies in establishment of DataCube platforms in these agencies. CSIRO is also supporting the use of Earth observation information for informing progress towards the United Nations (UN) Sustainable Development Goals. CSIRO organised a Radar workshop at the Pacific Geographic Information System (GIS) and Remote Sensing Council (PGISRS) in Fiji in November 2019, in the context of its regional engagement around EO technology. CSIRO serves as the Australian principal on CEOS and engages with CEOS on the following activities: • Strategic Implementation Team (SIT) Co-Chair (together with GA) from Oct 2019 for two years to strategically lead the space data providers and ensure CEOS delivers its Work Plan. • Current Leads of key Working Groups and Teams (Calibration and Validation; Information Systems and Services; Sustainable Development Goals) as well as Contributor (Disasters, recently stimulating the creation of a sub-team looking at bushfires) • CSIRO serves as the CEOS Representative on GEO Executive Committee, and also provides an alternate CEOS Programme Board Member. • CSIRO, GA and the Bureau of Meteorology are members of the Australian Government delegation to the Group on Earth Observations (GEO): GA currently leads Australia's engagement in this forum. GA and CSIRO coordinated the 2019 four-yearly GEO Ministerial Summit, held in Canberra in November 2019. This included initiating a successful inaugural Industry Track for the event, including the CSIRO EO 2.0 event to showcase live demonstrations of different EO platforms and stimulate industry interactions with the GEO ecosystem. CSIRO and GA co-lead the newly created GEO Pacific Island Advisory Group (PIAG). CSIRO represents CEOS on the GEO Executive Committee. It is also a member of the GEOGLAM Advisory Committee, and provides a CEOS Program Board alternate Member. CSIRO has been assisting the GEO with the use of EO data for: • Sustainable Development Goals.

Organisation	Summary of activity
	• Future Data Architectures. • GEO Land Degradation Neutrality Initiative. • GEOGLAM (Rangelands and Agricultural Crop Monitoring) Flagship. CSIRO's Memorandum of Intent with ESA on Earth observation with a focus on Science and Technology cooperation was renewed in 2020. A Letter of Intent between CSIRO and DLR to grow collaboration around Space, Aeronautics and Energy Research was renewed in April 2020. The MOU between CSIRO and the Vietnam National Space Centre was renewed in June 2020. CSIRO is assisting the Vietnam National Satellite Centre and the NZ Centre for Space Science and Technologies in establishment of DataCube platforms in these agencies. CSIRO is a member of the International Space Exploration Coordination Group (ISECG) and International Mars Exploration Working Group (IMEWG). In partnership with the Agency, it contributes to concepts and technical input for the exploration of space. CSIRO is a member of the International Astronautical Federation. CSIRO participated in the Australian Space exhibition booth at the 70th IAC, Washington D.C in October 2019. CSIRO promotes Australian space expertise internationally at all strategic and annual GEO and CEOS events (Symposium, Forums, and Plenaries).
Department of Infrastructure, Transport, Regional Development and Communications	Australia is a signatory to the Constitution and Convention of the International Telecommunication Union, which underpins the work of the ITU. Australia is also involved in agreeing and ratifying the changes made to the Radio Regulations 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 (APT) that is the regional focal point for ITU related discussions in the Indo-Pacific region. DITRDC leads Australia's multi-stakeholder delegations to World Radiocommunication Conferences (WRC) and the international preparatory meetings of the ITU Radiocommunication Sector (ITU-R) and APT that precede the four-yearly WRC. These meetings include discussions of issues such as satellite and space radiocommunication issues, which inform Australia's preliminary views and positions on WRC agenda items. DITRDC led the Australian delegation to the World Radiocommunication Conference 2019, held at Sharm el-Sheikh, Egypt. DITRDC also participates in the Australian Radiocommunications Study Groups (ARSGs) led by ACMA. These groups help with Australian's preparation for WRCs, and the regional (Asia-Pacific) and international ITU-R preparatory meetings which precede WRCs. DITRDC will be hosting the first meeting of the Australian preparatory group for the World Radiocommunications Conference in 2023 (WRC-23) in the second half of 2020. DITRDC will also lead the Australian delegation to the first regional meeting preparing for WRC-23 (the Asia-Pacific Telecommunity Conference Preparatory Group for WRC-23, APG23-1) to take place in September 2020.

Organisation	Summary of activity
	The Australian Maritime Safety Authority (AMSA) is an active participant in international bodies, such as the International Maritime Organization (IMO), International Telecommunications Union (ITU), International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), International Civil Aviation Organisation (ICAO) and Cospas-Sarsat, which deal (in part) with radionavigation and satellite-based systems, procedures, policies and radiocommunication. AMSA is a member of the Cospas-Sarsat Council, participating in the Joint Working Group, and the South West Pacific Data Distribution Region Working Group. AMSA is also contributing to an informal working group on the revision of a general performance standard for shipborne satellite navigation system receivers for the provision of position, navigation, timing (PNT) and associated information. Australia is also a signatory to the Convention on International Civil Aviation (the Chicago Convention), which created the International Civil Aviation Organization (ICAO). ICAO is a United Nations agency which develops standards and policies for global civil aviation. It works closely with the United Nations Office for Outer Space Affairs (UNOOSA) to cooperate and coordinate on the development of aviation and aerospace activities. DITRDC participated in ICAO's 40th Assembly in September 2019, where a Resolution concerning commercial space transport (Resolution A40-26) was adopted. This Resolution recognises the need for ICAO to work with other UN entities, in particular the UNOOSA and the UNCOPUOS. It reaffirms the role of ICAO in developing policy guidance in the areas where international commercial space transport operations intersect with international civil aviation, in coordination with the UNOOSA. A key focus of discussions at the Assembly was the need for the growing civil space sector to be safely interoperable with the existing global air traffic management system and supporting infrastructure. The Civil Aviation Safety Authority (CASA) communicates with international civil aviation authority counterparts on space-related issues on best practice and whole-of-government cooperation. CASA engages, as required, with international space agencies, particularly where launch and return activities are undertaken in Australian airspace. Most recently, this has included working with the US (NASA) and Japan (JAXA) on Hayabusa 2 re-entry operations in Australian airspace in December 2020. Airservices is in discussions with the Civil Aviation Authority in Singapore and will be looking to resume conversations with Indra Australia and Enaire (Spain's air navigation service provider) to discuss potential collaboration opportunities on technical studies in relation to the viability of space based technologies. Airservices also intends to approach the Department of Transport in Canada to discuss progress on the viability of aeronautical communications via space.
Department of Defence	Defence engages with international partners on the military use of space through the Combined Space Operations (CSpO) Initiative and bilateral partnerships and talks. CSpO is a military space partnership with Canada, France, Germany, New Zealand, the UK and US. It focuses on sharing information, developing shared policies, and maximising the combined capabilities of all partner nations.

Organisation	Summary of activity
	Partnerships enable the sharing of space related information and resources to synchronise space operations among likeminded partners. This also enables the reinforcement of the importance of the responsible use of space between defence departments. Defence participates in the International Telecommunication Union (on the development of international radiofrequency regulations) and other related meetings. The RAAF's No.1 Remote Sensor Unit assisted with the SpaceX Crew Dragon spacecraft launch to the ISS on May 31. Alongside a global network of space surveillance operators, the unit monitored the launch's progress to ensure the upper stages of the Falcon rocket re-entered Earth's atmosphere in the planned locations over the Indian Ocean. The C-band radar at Learmonth also tracked the capsule as it passed over Australia and assisted in further refining its orbit. The 2020 Australian <i>Defence Sales Catalogue</i>, released in March 2020, showcases 21 Australian companies who list space as a key capability. Of these, 14 companies have accompanied Team Defence Australia on various international trade shows and missions. The Team Defence Australia initiative delivers a program of international trade shows, complemented by a program of targeted trade missions, to showcase Australian defence industry capabilities on a world stage.
Department of Foreign Affairs and Trade	DFAT continues its work to shape rules and norms on responsible behaviour in space. In January 2020 DFAT co-sponsored and supported a Wilton Park conference in Singapore, where representatives from 18 Indo-Pacific states considered protocols and mechanisms to improve communication between commercial and government satellite space system operators and between states in order to reduce the perception of threats in outer space. The conference, the second in a series being held in different regions, encouraged delegates to consider alternative approaches by regional policy makers, who were mostly new to these issues. Participants widely agreed that the existing patchwork of multilateral, regional and bilateral arrangements was not adequate for times of stress, and needed to be addressed by the international community.
Department of Home Affairs	The Critical Infrastructure Centre, representing Australia, is currently the secretariat for the Critical Five (C5) and the C5 Global Navigation Satellite System (GNSS) subgroup. The C5, comprising Australia, Canada, New Zealand, the UK and US, is the forum for the five country collaborative partner's approach 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	GA works to promote continued Australian access to critical satellite Earth observation and GNSS data, and to facilitate technical cooperation that increases the uptake and impact of Earth observation and GNSS data. GA has formal cooperation arrangements with the US Geological Survey, in relation to the Landsat Earth observation program. As a certified Landsat Ground Network (LGN) contributor, GA operates the Alice Springs Ground Station through which GA provides command and control, and data downlink support for the Landsat program and its missions.

Organisation	Summary of activity
	GA has a formal agreement with the European Commission around its Copernicus program. Under this agreement GA operates, with CSIRO and state government partners, of the Copernicus Australasia Data Hub which provides users in the region with access to data from Europe's Sentinel program. GA cooperates with NASA on the operation of the Yarragadee geodetic observatory in WA. NASA provides the Satellite Laser Ranging instrument, and GA provides operational support and facility management. GA also operates two Doppler Orbitography and Radio-positioning Integrated by Satellite (DORIS) beacons in partnership with the French space agency, CNES, at GA facilities. The DORIS beacons support the precise determination of the orbit of low altitude satellites. GA has international agreements on GNSS data sharing and satellite tracking with Japan, India and China. GA is collaborating with Land Information New Zealand (LINZ) on the development of a joint Satellite Based Augmentation System (SBAS) named the Southern Positioning Augmentation Network (SouthPAN). GA and LINZ commenced procurement of the SouthPAN system. 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. GA is Australia's principal representative to the intergovernmental Group on Earth Observation (GEO). GEO facilitates cooperation between governments, industry and Non-Governmental Organisation (NGOs) to exploit earth observation for societal benefit. GA coordinates Australia's GEO representation which includes participation from CSIRO, the Agency, the Bureau of Meteorology, the Australian Bureau of Statistics and other agencies. GA is an associate member of the international CEOS. GA is working with CSIRO to deliver a Team Australia chairmanship of CEOS's Strategic Implementation Team in 2020-2021. GA is supporting the Digital Earth Africa initiative. DE Africa will 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 Australia's DFAT and the US-based Helmsley Charitable Trust GA is exploring opportunities for Australian experts to participate in US and European Commission activities for future operational land imaging missions. Engagement in these processes is critical in opening opportunities for future Australian participation or co-investment in the operational missions on which we depend. GA is a founding partner of the Open Data Cube (ODC) project. The ODC is open source software that seeks to increase the value and impact of global Earth observation satellite data by providing an open and freely accessible exploitation architecture. The ODC project seeks to foster a global community to develop, sustain, and grow the technology and the breadth and depth of its applications for societal benefit.

International Outreach

UK Space Conference

The Agency had 14 engagements with space agencies, organisations and businesses to progress areas of collaboration. The Head of the Agency presented at the plenary session: *The Global Future of Space*, on 24 September alongside UK Chief Scientist Prof Carol Mundell and Prof Jan Wörner, ESA Director General.

International Astronautical Congress (IAC)

The 70th IAC was held in Washington D.C from 21-25 October 2019. The Minister for Industry, Science and Technology attended the IAC, reinforcing that space is a key priority of the Australian Government. The Minister held a bilateral meeting with NASA Administrator Bridenstine to build upon the Prime Minister's commitment of \$150 million to support NASA's plan to go forward to the Moon and on to Mars. The Agency supported the participation of States and Territories and space organisations at a booth in the congress exhibition, titled *The Australian Space*, to showcase Australian space capabilities.

Group on Earth Observations (GEO) Week

The inter-governmental GEO held its Ministerial Summit in Canberra from 4-9 November 2019, hosting Ministers from 40 countries. Hosted by GA, GEO Week provided the opportunity for governments, businesses, the research community, non-profits and stakeholders to meet and explore the integration of Earth observation data into the global economy. The Agency supported GEO Week, taking the lead in coordinating the first ever Industry track, which brought commercial organisations into the GEO discussions for the first time, linking together the governmental panels with industry. The Agency sponsored the Industry Track, which had strong representation from international organisations.

Asia Pacific Regional Space Agency Forum (APRSAF)

Agency representatives attended and presented at the APRSAF-26 from 26-29 November 2019. This forum provides active engagement for the Agency with the regional and emerging space agencies in Asia. The Agency was able to engage and make connections with its regional partners, seek opportunities for space activities occurring in the region and understand the strategies of the regional space agencies.

Space Representation at the United Nations

Australia has ratified the five UN treaties that govern space activities. The Agency, with support from DFAT, represents Australia at the UNCOPUOS and its subcommittees (Legal, and Scientific and Technical).

The Agency and DFAT attended the UNCOPUOS Scientific and Technical Subcommittee meeting in February 2020. Key agenda items included the long-term sustainability of outer space activities and the Space2030 Agenda and implementation plan. UNCOPUOS is an important mechanism to support international cooperation, but COVID-19 curtailed its activities in 2020. The Legal Subcommittee and the UNCOPUOS plenary session scheduled for March and June 2020 were cancelled due to COVID-19 restrictions.



Figure 8 – Agency representation at UNCOPUOS

DFAT has worked closely with the Department of Defence and the Agency to align and refresh space security policy settings.

DFAT leads space security work at the Conference on Disarmament and the United Nations Disarmament Committee, as well as the United Nations First and Fourth Committees. At the United Nations First Committee in October 2019, DFAT worked to encourage both stability and responsible behaviour in space.

Australia recognises the growing threat to space assets on which we all rely, and is promoting international cooperation to build transparency and confidence between nations rather than an outright prohibitions-based approach, which fails to recognise the dual-use nature of many space objects. This work should allow the views of all States which, regardless of their level of development, extensively benefit from using space systems even if they do not operate their own. To advance this agenda, Australia will join with likeminded countries to develop and submit a resolution at the UN First Committee (which deals with disarmament, global challenges and threats to peace) named “Reducing Space Threats through Responsible Behaviours”.

DFAT also works with the Agency to implement the UNCOPUOS Guidelines for the Long-term Sustainability of Outer Space Activities.

The Bureau’s Space Weather Services is a member of the International Space Weather Initiative (ISWI). ISWI is 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.

The Bureau is a member of the UNCOPUOS Expert Group on Space Weather, and recently led the development of a short survey of the activities of international organisations who are active in, or impacted by, space weather with the goal of generating baseline data on the current state of activities in this area globally. The survey results will be collated and analysed throughout 2020-21.

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 SIF, ISI, M2M as well as investments by states and territories. This also acknowledges investment by Defence and CSIRO and other agencies across Government, which will further build Australia's national capability. Close coordination with Defence is important as these activities will need to be undertaken consistent with Australia's national and security interests.

Technology Roadmaps

The Agency is developing technology roadmaps to outline opportunities for growth under the National Civil Space Priorities. Priority has been given to Earth Observation, Communication Technologies and Services, Space Situational Awareness; and Remote Operations. Additional roadmaps have commenced, to support the M2M initiative including the Space Medicine and Life Sciences roadmap.

During 2019, multiple series of round tables were held with government (including Defence, the Office National Intelligence, CSIRO and GA), industry and academic organisations to inform the development of technology roadmaps and also assist in the development of Technical Advisory Groups. By the end of June more than 10 technical advisory group workshops had been conducted, plus meetings on specialist topic areas.

A visit to NASA's CDSCC, operated by CSIRO, in February gave the Agency an opportunity to showcase the country's expertise in optical communications and quantum technologies; several areas have been identified as of common interest to both Space Agencies for further discussions, such as: free-space frequency stabilisation, high precision clock, Continuous Variable Quantum Key Distribution (CVQKD), Quantum Memory or utilisation of an Australian Optical Ground Station Network. This work will also inform activities under the M2M initiative.

Between May and the end of June 2020, a series of virtual meetings was held with NASA HQ to showcase the best of Australia's capabilities and to validate the state-of-the-art and gap analyses for the roadmaps.

Moon to Mars Initiative

As outlined earlier, the Agency is partnering with NASA on its inspiring plan to go back to the Moon and travel on to Mars. The M2M initiative will support the transformation of industries across the economy. It will accelerate the growth of the space sector by providing opportunities to enter national and international supply chains, increasing demand for new capabilities, creating inspiration and enabling spin-out technologies for economic growth.

The program includes three integrated programs, with funding starting in the 2020-21 financial year:

- **Supply Chain program:** consisting of both grant and facilitation components, this program targets projects and activities to build capability in Australia's space industry, and support local industry to deliver products and services into national and international space supply chains.

- **Demonstrator program:** demonstrator and pilot projects for Australian industry and researchers to develop and launch products that will create new capability, and enable new business ventures, revenue streams or markets. This provides a pathway to showcase Australia's strengths to the world.
- **Trailblazer program:** The Agency's inspire piece - a major project supporting NASA's Moon to Mars activities.

The initiative will benefit local businesses and researchers in the short term by building capability. In the medium to long term, the initiative will also help secure Australia's economic recovery from the COVID-19 pandemic, creating more high-tech jobs, uniting and strengthening industry, and upholding our way of life.

Bushfire Earth Observation Taskforce

In January 2020, the Agency established the Bushfire Earth Observation Taskforce, in partnership with CSIRO, GA and the Bureau of Meteorology, in response to the Minister for Industry, Science and Technology's request to examine all ways the scientific agencies might assist with managing of bushfire risk. The Agency was asked to consider how space-based Earth Observation might support bushfire management. The Taskforce examined the role of satellite imagery in the management of bushfire risk and how Australia might make better use of both internationally sourced and potential new Australian bushfire-focussed space missions. The taskforce also leveraged the Technical Advisory Group for Earth Observations.

Three workshops with end users were held in March 2020. Several engagements with international space agencies (ESA, NASA, CSA and Italy) were also held to share experience, enhance understanding of ongoing and future fire-related missions and consider potential opportunities for Australia.

The Bushfire Earth Observation Taskforce delivered its report to the Minister in early June 2020. The report was submitted as evidence to the Royal Commission into National Natural Disaster Arrangements and made public through this process. The Agency also appeared before the Royal Commission and a Senate inquiry into bushfire arrangements.

A summary of the opportunities and limitations identified in the report are outlined below.

	SUCCESSES	LIMITATIONS
 PRE-FIRE: prevention & preparedness	✓ Grassland curing data available every 8 days ✓ Flammability ratings available every 16 days ✓ Wide range of datasets available to be used to perform risk assessments incl weather monitoring ✓ Staff from federal agencies integrated into state emergency service teams	✗ Require integrated early fire detection platform providing high resolution data ✗ Complete, up-to-date foundational data sets not readily available ✗ Fuel state data not yet nationally operational ✗ Location of fire break construction is occasionally not known
 DURING-FIRE: response	✓ Collaboration and sharing of resources ✓ Line scanning aircraft available to provide near-real time imagery of fires ✓ Hotspots for strategic fire mapping ✓ Weather observation ✓ Water bodies mapping for large aircraft to re-stock	✗ Tasking of high-resolution data via satellite too slow ✗ Insufficient coverage of multiple large fires via airborne ✗ Difficult to know if detected hotspots are false positives ✗ Commercial licencing arrangement are a barrier to data sharing ✗ Resolution & frequency of data available for tactical response
 POST-FIRE: recovery	✓ High resolution drone imagery available for built severity mapping ✓ Burn extent mapping of vegetation available	✗ Ability to have burnt extent mapping within a week post fire before regrowth begins ✗ Airborne collection not having wide enough coverage ✗ More timely imagery for severity mapping ✗ No national agreement on classifying burn severity

Figure 9 – Taskforce Summary results

Sovereign Industrial Capability Priorities

The Defence Sovereign Industrial Capability Priorities were first identified in the 2018 Defence Industrial Capability Plan, which outlines Government's 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 domain awareness systems to enhance data collection, analysis or dissemination.

Implementation plans for each of the Sovereign Industrial Capability Priorities are being released throughout 2020.

Defence is investing in space capabilities and strengthening its international relationships to reflect its interests in space. Continued investment and development of space capabilities will be required to further improve Defence's resilience and enhance a large number of space-dependent capabilities across the joint force. Investment of around \$7 billion in space capabilities over the next decade, which includes investment in sovereign-controlled satellites, will provide assured access to these services when needed. Defence is also making an additional investment of around \$4 billion in geospatial information and intelligence capability.

A number of grants were awarded to companies supporting space capabilities through Defence's Sovereign Industrial Capability Priority Grants. This dedicated annual grants program of up to \$17 million supports eligible Australian small to medium-sized enterprises to invest in projects that build capabilities aligned to one of the initial ten Priorities.

Assessments of Sovereign Industrial Capability Priority Grant applications continue and more details on the grants program, can be found on DISER's website.

Space Capability Activities Supporting the Australian Civil Space Priority Areas

The National Civil Space Priority Areas are outlined in the *Australian Civil Space Strategy 2019-2028*. They also support the CSIRO Space Roadmap, published in 2018 and the Global Exploration Roadmap from the International Space Exploration Coordination Group.

To grow the Australian space sector, the Agency is undertaking three major initiatives: the ISI Initiative, the SIF and the M2M initiative.

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 CDSCC, as well as private sector investment in satellite based television and internet services.

The *Australian Civil Space Strategy 2019-2028* 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 manages access to the radiofrequency spectrum through the development and maintenance of a regulatory framework for satellite services in Australia, and through licensing of space services. The ACMA represents Australia's space spectrum management interests internationally, including filing and coordination of Australian satellite systems with the International Telecommunication Union and providing ongoing operational support for Australian-filed satellite networks. The ACMA's space-related activities for 2019–20 are detailed in its Five-Year Spectrum Outlook (FYSO) annual progress report. This can be found at ACMA five year spectrum outlook Key developments include: • Participation in the Australian delegation to the World Radiocommunication Conference 2019. • Consultation on planning for future use of the 2 GHz band. • Improved spectrum access and pricing arrangements for satellite services by providing an additional 2.6 GHz of spectrum and decreasing licence taxes across a range of bands. • New regulatory arrangements to support Earth Stations in Motion in the Ku-band. • Improved procedures for licensing of space-based communication systems. • Amendments to the Foreign Space Objects Determination to include three new operators seeking to provide satellite-based communication services to Australia: Kepler Communications (Canada), SpaceX Services (USA) and Swarm Technologies (USA). The ACMA's future work priorities are also outlined in the FYSO, which includes a detailed work plan for the forthcoming financial year. Public consultation on the draft FYSO 2020–24 closed in June 2020.
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. In January 2020 the Bureau's Learmonth ground station became fully operational, providing access to LEO data from the Suomi National Polar-orbiting Partnership (SuomiNPP) satellite, NOAA-20, Metop series and Fengyun-3. This ground station improves national operational coverage over the Indian Ocean and provides data for numerical weather prediction models and direct applications. As space weather impacts upon communications services, 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 industries SWS operates a World Data Centre, titled WDC – Space Weather, Australia, which is a member of the International Council for Science World Data System (ICSU-WDS). In recognition of the significance of space weather intelligence for

Organisation	Summary of activity
	the growth transformation of Australia's space industry, the Bureau has placed a Space Industry Lead for Space Weather Services within the SmartSat CRC at Lot Fourteen to support the strengthening of this capability. The Bureau of Meteorology Space Weather Services is also working with Saber Astronautics Australia on a number of projects at the new Mission Control Centre at Lot Fourteen, Adelaide. The new ICAO space weather aviation advisory service will continue to be developed and refined in collaboration with international partners throughout 2020-21. The service is expected to develop and improve rapidly throughout the first 3 years of operation. The Agency and Space Weather Services will cooperate on the implementation of the UNCOPUOS Long-Term Sustainability Guidelines of Outer Space Activities (LTS Guidelines) as part of the Space 2030 Agenda.
CSIRO	The CDSCC, operated by CSIRO for NASA, provides two-way communications and control between the Earth and spacecraft, for around 30 space missions, reaching out as far as the Voyager spacecraft. Highlights in 2019-20 included: • Apollo 11 Moon landing 50th anniversary celebrations on 21 July 2019. • USGS (including agency head Dr Jim Reilly) visited CDSCC in November 2019 during GEO Week. • the rebuild of the 70m DSS43 antenna to extend its life to 2030. CSIRO manages the Australian Tracking and Data Relay Satellite System (TDRSS) Facility at Yarragadee, and the TDRSS monitoring station and Ballooning Facility at Alice Springs on behalf of NASA. CSIRO continued to provide operations support for the ESA deep space tracking station at New Norcia, WA. Highlights in 2019-20 included: • July 2019: Vega Flight VV15 became the first launch supported under CSIRO operation of the New Norcia tracking station. While flight VV15 unfortunately terminated a few minutes after launch, CSIRO efforts for the launch activity were successful. • December 2019: Soyuz Flight VS23 launch support and initial acquisition of the CHEOPS satellite (Characterising Exoplanet Satellite), ESA's first mission dedicated to the study of Exoplanets (extrasolar planets). • January 2020: New Norcia's 35m antenna supported ESA's first dual spacecraft simultaneous communication when it sent commands to ESA's Mars Express (MEX) and the ExoMars Trace Gas Orbiter (ExoMars TGO). The Breakthrough Prize Foundation continues to use CSIRO's 64m Parkes radio telescope in eastern Australia to search for extra-terrestrial intelligence, through a multi-year, multi-million dollar agreement.
Department of Defence	All remaining phases of Joint Project 2008 are expected to be completed by mid-2023. The Satellite Ground Station-West near Geraldton, WA was fully delivered in June 2020. Augmenting this facility, the Satellite Ground Station-East in the Kapooka Military Area, NSW, and the implementation of a holistic wideband satellite communications Network Management System remain to be completed.

Organisation	Summary of activity
	Joint Project 9102 Phase 1, the Australian Defence SATCOM System, received 'first pass' government approval in June 2020. The project aims to deliver a sovereign controlled Wideband/Narrowband SATCOM system over the Indo-Pacific region with global access through sharing arrangements with international partners and supplementation/augmentation through commercial SATCOM contracts. The Request for Tender is planned for March 2021. Initial operational capability is anticipated in 2027 and the final operational capability in 2031. Australian industry opportunities will be solution dependent but are likely to be in the control system, operational support, sustainment, and facilities fields. In addition, \$50 million over 15 years has been identified to support innovation and research in technologies that will support future phases of the project. The Agency is assisting Defence to identify where these opportunities lie.
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, Transport, Regional Development and Communications	<u>NBN Co Sky Muster satellite services</u> 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 30 June 2020, more than 100,000 homes and businesses had an active NBN Co Sky Muster satellite service. Since 2016, NBN Co has continually developed its range of wholesale satellite products to better meet the needs of homes and businesses. This has included enhancing existing services by increasing data allowances and releasing new products and additional applications to enable remote telehealth and distance education. In August 2019, NBN Co launched a new product, Sky Muster Plus, which was subsequently upgraded in April 2020. This product allows regional Australians access to unmetered data for all online content and applications except for video streaming and virtual private network traffic. It also enables wholesale download speeds to exceed 25 megabits per second when network capacity is available. In response to COVID-19, from the end of March 2020, NBN Co provided satellite broadband retailers with temporary access to an additional 45 Gigabytes of download data for each standard Sky Muster plan. This arrangement was initially offered for three months but was later extended. NBN Co began providing its Sky Muster Business Satellite Service in October 2019. The service enables access to business grade internet, data and voice services for eligible business customers in rural and remote Australia, and is aimed at medium to large businesses. <u>Development of the Universal Service Guarantee</u> 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

Organisation	Summary of activity
	delivered using Telstra's copper network, however around 1,000 services are delivered by satellite. In 2017 the Government announced that it would implement a new Universal Service Guarantee (USG) to provide access to broadband as well as voice services. During 2019-20 the Government developed the Alternative Voice Services Trials program to identify new ways to deliver voice services, including by new providers, and assess their effectiveness. This may include satellite solutions. The program will open for applications on 4 August 2020. <u>Viewer Access Satellite Television Service</u> The Viewer Access Satellite Television (VAST) service provides free-to-air television and radio broadcasts to over 200,000 households and 30,000 travellers, mostly in regional and remote areas. VAST also provides a service to metropolitan areas where terrestrial transmission services are not available. DITRDC administers the funding provided to commercial broadcasters towards the satellite transmission of commercial free-to-air television services over VAST, with ABC and SBS funded via their Budget appropriations. <u>International Radiocommunications</u> DITRDC leads Australia's engagement in key international radiocommunications policy-making for discussing WRC-23 agenda items. These agenda items deal with issues relating to a range of communications technologies and satellite services, including a possible new allocation to the aeronautical mobile satellite (route) service, possible regulatory actions related to the Global Maritime Distress and Safety System (GMDSS), maritime and aviation safety services and applications, and conducting studies on satellite-to-satellite links in a number of frequency bands. Another agenda item deals with frequency allocation to space research services, which expects to provide certainty for governments and space agencies participating in satellite space programs. <u>Satellite-based services</u> AMSA continues to contract Inmarsat (expires 30 June 2022) and Iridium (expires 31 December 2024) to provide Australia's satellite-based GMDSS services. Australia is an active participant in the Cospas-Sarsat satellite-based distress beacon detection system. AMSA operates a satellite tracking station near Mingenew, WA, and the Mission Control Centre (MCC) in Canberra, which processes distress beacon data for forwarding alerts to fifteen countries. <u>Satellite communications</u> 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's Alice Springs satellite ground station continues to operate above targeted operational performance and is currently operating at 99.7% (98% target). Operational certification for Landsat-7 on a second 9m antenna at the ground station is in progress and will provide enough additional capacity for the site to support Landsat-7, Landsat-8 and Landsat-9 into the future. The plans to support

Organisation	Summary of activity
	the Landsat 9 mission are on track with Level 5 testing successfully achieved. GA is seeking certification of ground station infrastructure at Alice Springs to support Landsat-9 downlink following the satellite launch in 2021. To mark the 40th anniversary of Australia's participation in the USGS Landsat program GA hosted the Landsat Ground Station Operators Working Group meeting in Alice Springs on November 11th 2019. The event was attended by the Director of the USGS, Dr Reilly, and GA CEO James Johnson as well as key local figures from the Alice Springs Indigenous community, the Alice Springs Mayor's office and attendees from several countries who participate in the Landsat program. To celebrate the anniversary, GA commissioned the Lakota Sioux artwork painted on one of the 9m antennas at the Alice Springs Ground Station. This antenna complements the Australian Indigenous artwork on the primary 9m antenna commissioned in 2016 and recognises the strong relationship between GA and the USGS. GA co-chairs the Australian National Ground Segment Technical Team (ANGSTT). This group was established to provide a way for several groups that operate ground infrastructure to collaborate and to provide access to satellite data, share knowledge and coordinate technical expertise within government. Through this team agencies and state governments coordinate development and use of Earth observation satellite ground stations. Participants include GA, Bureau of Meteorology, Landgate, CSIRO and the Agency. GA participated in the previous European GRALLE (Galileo-based Reliable Automatic and Low Latent Emergency Warning Service) project in 2018. Earlier, in 2015, a test in Victoria of Japan's Quasi-Zenith Satellite System (QZSS) demonstrated that QZSS is capable of Emergency Warning Service (EWS) broadcasts in Australia. A new pilot project is being undertaken in 2020 to identify a pathway to operational implementation of QZSS EWS in Australia, with a focus on bushfire EWS in NSW. A working group has been formed to progress a pilot project to determine the possibility of operationalising EWS via satellite in Australia using the Japanese QZSS.

Case study: Alice Springs Ground Station



Figure 10 – Indigenous artwork on satellite antenna

The ground station at Alice Springs has operated since 1979 and is one of three ground stations around the world certified in the Landsat Ground Network (LGN) to allow USGS/NASA to send command and control signals to Landsat satellites as well as downlink data. The ground station is operated remotely by GA requiring minimal attendance on site for maintenance and operation tasks. Improvements to the ground station in 2020 include the installation of a 3m antenna for the acquisition of NOAA satellite data which will improve GA's ability for Hotspot monitoring and provide a capability for acquisition of new satellites in the coming years.

In celebration of the 40 years of operational support Landsat in November 2019, GA officials commissioned artwork created by Lakota Sioux artist Rosaline (Little Eagle) Oren from South Dakota that now adorns the reflector surface of the newest Landsat satellite antenna at Alice Springs. Another antenna at Alice Springs already features artwork based on an Australian Aboriginal painting by Roseanne Kemarre Ellis. This artwork recognises the role of the Arrernte Aboriginal people in Central Australia as custodians of the land where the ground station is located. The use of this artwork recognises the ancestral stewards of lands in Central Australia and in South Dakota (where USGS also operates Landsat antennas) and showcases the indigenous connections between the two agencies.

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.

Space Situational Awareness (SSA) assists with the management of orbital resources, ensuring that orbits which are valuable for space-based services remain available for use. The *Space Activities Amendment (Launches and Returns) Act 2018* includes the requirement for a debris mitigation strategy for certain authorisations involving objects going to space.

The *Australian Civil Space Strategy 2019-2028* 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	The Bureau of Meteorology Space Weather Services (SWS) is a member of the Agency's SSA Technical Advisory Group and is contributing its space weather expertise to the development of the Agency's 10-year roadmap. The Bureau's SWS is using near real-time COSMIC 2 profiles of ionospheric electron density to improve its modelling of the Earth's ionosphere, a key component of the geo-space affecting the orbits and survival of LEO satellites.
CSIRO	Asteroids emerging from the southern hemisphere, which account for 5–10 per cent of all Near Earth Asteroids, are not immediately detectable by the international NASA Near Earth Asteroid (NEA) program. Australia is contributing to this NASA program as well as developing new science to assist future space

Organisation	Summary of activity
	exploration missions by combining the capabilities of CDSCC (DSS43) and the ATNF (Compact Array and Parkes radio telescopes) to perform bistatic radar tracking of asteroids. Since 2015 CSIRO, in collaboration with NASA JPL, has demonstrated the successful detection and tracking of seven Near Earth Asteroids with diameters of 0.02–2 km at ranges of 0.1 to 10 lunar distances, including asteroids 2019 GC6 and 2019 EA2 in 2019, using exclusively Australian-based systems.
Department of Defence	Defence has moved towards Space Domain Awareness (SDA) as a broader concept than Space Situational Awareness, as SDA underpins all other space missions, providing the ability to identify, characterise and understand factors that affect the space domain. Through Joint Project 9360, Australia is investing in a diverse sensing and command and control system that will provide a sovereign SDA capability while allowing for flexibility to adapt to emerging threats, through an iterative approach to capability management. In WA, the Space Surveillance Telescope (SST), located at the Harold E. Holt Naval Communications Station near Exmouth, achieved “first light” in April 2020, a significant milestone which meant that calibration had been completed to allow the first images of objects in orbit to be seen by the telescope. Once operational, the SST will join the C-Band Radar as jointly operated by the US and Australia, providing object information to the global Space Surveillance Network (SSN). The C-Band Radar has been contributing to the SSN since 2015, supporting a variety of missions including the first manned SpaceX launch to the ISS in May. Air Force’s No.1 Remote Sensor Unit will expand its capabilities in 2022 with the planned delivery of the SST in WA. This highly advanced telescope will enable the observation and detection of objects in space up to 36,000 km above Earth. Complementary to these new capabilities, the Defence Innovation Hub has invested over \$16.5 million in space domain technologies over the last 24 months and Defence continues to invest in the Smart Satellite Cooperative Research Centre as a foundation partner. These early investments in Australian technology advancement are critical to building the foundation of the Australian space industry and Defence. Sovereign Industrial Capability Priority Grant applications will continue and small to medium-sized enterprises delivering space domain awareness related capabilities are encouraged to apply.
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).

Position, 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.

The Australian Government has made significant commitments to Australia’s PNT infrastructure, which underpins many activities in daily life, as well as a broad spectrum of economic activities.

The *Australian Civil Space Strategy 2019-2028* identifies this Priority Area as part of Phase 1 (2018-19), setting the conditions for growth.

Table 5 – SCC Position, navigation and timing activities

Organisation	Summary of activity
Bureau of Meteorology	<u>Earth observations</u> The Bureau of Meteorology and GA collaborate on the use of real-time GPS data in the ACCESS modelling suite. The delays in GPS signals can be used to derive atmospheric moisture observations which improve forecasting skill. These data are used operationally in the Bureau's weather model. <u>Space Weather</u> The Bureau's SWS uses Total Electron Content (TEC) and ionospheric scintillation monitors to monitor disruptions to PNT services throughout the Australian region and beyond. The Bureau's SWS provides advisories when GNSS-based navigation and surveillance applications may be impacted by space weather. These include the Ground-Based Augmentation System (GBAS) installations at Sydney and Melbourne airports. Similarly, precision GNSS users such as in the agriculture, mining and surveying industries, require advisories for when precise positioning applications may be degraded. The monitoring of space weather conditions for these application areas is achieved using GNSS data, and GNSS-based modelling of the ionosphere.
Department of Defence	Joint Project 9380 Phase 1 – Assured Position, Navigation and Timing (A-PNT) in a Contested Environment is in the pre-Gate 1 stage of development, and is also in the process of defining the scope of a number of different parts of the project. One part of the project is to harden our GPS User Equipment by upgrading some, prioritised Defence platforms with M-Code capability under a Foreign Military Sales case with the US Department of Defence. Another aspect of the project will be to develop our own support system with test and certification capability, and to identify alternatives to GPS capabilities that could be used by Defence when access to PNT from GPS is disrupted.
Department of Infrastructure, Transport, Regional Development and Communications	DITRDC leads Australia's engagement in key international radiocommunications policy-making fora discussing WRC-23 agenda items, including one relating to review of the amateur service and the amateur-satellite service allocations in certain frequency bands to determine if additional measures are required to ensure protection of the radionavigation-satellite service. AMSA is contributing to an informal working group on revision of a general performance standard for shipborne satellite navigation system receivers for the provision of position, navigation, timing and associated information. Airservices Australia utilises Global Navigation Satellite System information for en-route, terminal, approach and landing navigation, surveillance utilising Automatic Dependent Surveillance – Broadcast (ADS-B) and timing. This includes the Ground-Based Augmentation System in Melbourne and Sydney and the future deployment of the Satellite Based Augmentation System (SBAS). Airservices, CASA and GA are working collaboratively to acquire the Southern Positioning Augmentation Network, a satellite-based augmentation system (SBAS). SBAS technology will improve the accuracy and integrity of position,

Organisation	Summary of activity
	navigation and timing for the maritime sector and provide increased procedural capability, enhance safety and regularity of flights. This will support aviation certified L1 service, with an expected in-service date of 2024/2025. 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. DITRDC is leading the work to develop a whole of government framework for drones policy. Accurate positioning information is 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 such as Urban Air Mobility vehicles where self-separation, artificial intelligence and autonomous flight will be enabled.
Geoscience Australia	GA Positioning Australia program is implementing the National Positioning Infrastructure Capability (NPIC) and a Satellite-Based Augmentation System (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. The Positioning Australia program is delivering the NPIC and SBAS measures to improve the accuracy, reliability and availability of positioning data from GPS and other satellite navigation systems. With SBAS, the Commonwealth allocated \$160 million to develop a positioning capability delivering an accuracy of 10 cm across all of Australia, with ground-breaking applications in agriculture, mining and other industries. In February 2020, Australia and New Zealand formally committed to partner under the Australia New Zealand Science, Research and Innovation Cooperation Agreement (ANZSRICA) on developing a trans-Tasman SBAS, named the Southern Positioning Augmentation Network. GA has progressed the planning and design work for procurement of the system components for the Southern Positioning Augmentation Network, which will include a satellite and ground infrastructure, and data analysis capabilities. GA received \$64 million to fund NPIC which will drive productivity and innovation in a number of industries, including transport, agriculture, mining and construction by providing more accurate GPS data. GA has 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 Satellite Laser Ranging (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 (VLBI) array with stations at Hobart (Tas), Yarragadee (WA) and Katherine (NT) contributing to the International VLBI Service (IVS).

Case study: Satellite-Based Augmentation System

Satellite transmissions from the Australia-NZ SBAS Test-Bed concluded on 31 July 2020, having met and exceeded all objectives. Highlights included: Signal-in-space transmissions five months after contract execution; first Dual Frequency Multi-Constellation signal-in-space in June 2017; certification and importation of SBAS user equipment to Australia and New Zealand; completed SBAS testing in 10 industry sectors across Australia and New Zealand; and published a comprehensive economics benefits analysis of SBAS technology for Australia and New Zealand.

Positioning Australia released open source software that is capable of determining satellite orbits, positions and timing errors and capable of managing the acquisition, processing and delivery of multi-GNSS data and related products. Users can integrate this software into devices and applications to incorporate precise positioning into their operations. This supports the program's vision of "instantaneous GNSS positioning, anywhere, anytime, with the highest possible accuracy and the highest possible integrity".

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.

Earth observation delivers significant economic and social good benefits to Australia, in areas such as agriculture, water and environmental management, and disaster management.

The *Australian Civil Space Strategy 2019-2028* identifies this Priority Area as part of Phase 1 (2018-19), setting the conditions for growth.

Table 6 – SCC Earth observation activities

Organisation	Summary of activity
Bureau of Meteorology	The Bureau's goals are to contribute to zero lives lost due to natural hazards, and \$2 billion in added social and economic value for Australians (by 2022) in five identified priority sectors: Aviation and Land and Maritime Transportation, Agriculture, Energy and Resources, Water, National Security and Defence Industries. Earth observations from space and space weather services significantly contribute to meeting these goals. The Bureau's weather, climate, ocean and water services are underpinned by Earth observation satellites. Its ACCESS models assimilate real-time data from around 26 different satellites. . In June 2020 the model was upgraded with the addition of several new satellite data streams. The Bureau also generates many EOS-derived products, including Atmospheric Motion Vectors (AMVs), fog and low cloud, solar radiation, volcanic ash, sea surface temperatures and Normalised Difference Vegetation Index (NDVI).

Organisation	Summary of activity
	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. It participates in a number of activities aimed at helping other meteorological services improve their access to EOS data. In September 2019 the Bureau announced plans for a \$5 million project to develop new near-real-time water resources information to raise public awareness of water volumes, movements and ownership in the Murray Darling Basin. In October 2019 the Bureau rolled out the Air Quality Forecast System (AQFx) into NSW. The Service has been operational in Victoria since mid-2018 and is intended to become a national system. The Bureau's supercomputer upgrade commenced in May 2020, with assistance from the vendor Cray. In 2020 the Bureau also became a member of AARNet, the Australian Academic and Research Network, which Bureau researchers will use to access the National Computational Infrastructure's (NCI) supercomputer, which plays a vital role in the Bureau's research. The Bureau will continue to work with the Agency, GA and CSIRO on the Earth Observation Roadmap.
CSIRO	The CSIRO Centre for Earth Observation (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 Earth observation informatics expertise for the management of petabyte-scale EO 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 EO industry and innovative applications development for next generation sensing systems, including oversight of the DMTC 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, and support for the satellite's commissioning phase. In 2020-21 CSIRO expects to commence operations of Australian science access to NovaSAR-1 as a national facility. • Management of the CSIROsSat-1 CubeSat project. This satellite will test Earth observation and on-board processing technologies. CSIRO and GA represent Australia and the Agency on key programmatic aspects of international coordination on EOS. CSIRO and GA, working with domestic and international partners, are 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. Regionally, CSIRO is assisting the Vietnam National Satellite Centre and the NZ Centre for

Organisation	Summary of activity
	Space Science and Technologies in establishment of DataCube platforms in these agencies. CSIRO is also supporting the use of Earth observation information for informing progress towards the United Nations (UN) Sustainable Development Goals. CSIRO serves as the Australian principal on CEOS and engages with CEOS on the following activities: • Strategic Implementation Team (SIT) Co-Chair (together with GA) from Oct 2019 for two years to strategically lead the space data providers and ensure CEOS delivers its Work Plan. CSIRO and GA organised the international SIT-35 meeting (gathering around 70 representatives of space agencies from all over the world), originally planned to be held in Hobart late March 2020, but rescheduled virtually. • Current Leads of key Working Groups and Teams (Calibration and Validation; Information Systems and Services; Sustainable Development Goals) as well as Contributor (Disasters, recently stimulating the creation of a sub-team looking at bushfires) • CSIRO serves as the CEOS Representative on the GEO Executive Committee. GA and CSIRO coordinated the four-yearly GEO Ministerial Summit, held in Canberra in November 2019. This included initiating a successful inaugural Industry Track for the event. A highlight was the CSIRO EO 2.0 event to showcase live demonstrations of different Earth Observation platforms and stimulate industry interactions with the GEO ecosystem. CSIRO and GA co-lead the newly created GEO Pacific Island Advisory Group (PIAG). CSIRO has been assisting the GEO with the use of EO data for: Sustainable Development Goals; Future Data Architectures; the GEO Land Degradation Neutrality Initiative; and the GEOGLAM (Rangelands and Agricultural Crop Monitoring) Flagship. CSIRO was appointed by the UN Convention to Combat Desertification to review the Good Practice Guidance document looking at tools and data to help better assess Land Degradation evolution. CSIRO contributed technical and coordination expertise to the 2020 Bushfire Earth Observation Taskforce led by the Agency. It worked with the Agency, GA and the Bureau of Meteorology to deliver a report to the Minister of Industry, Science and Technology. CSIRO contributed technical and coordination expertise to the development of the national EOS Roadmap led by the Agency, together with GA and the Bureau of Meteorology and other organisations (due to be delivered in 2020-21).
Department of Defence	The Australian Geospatial-Intelligence Organisation (AGO), within the Department of Defence, is responsible for delivering the Defence 799 series of projects. These currently provide continued access to commercial satellite

Organisation	Summary of activity
	imagery and will deliver the future sovereign space-based imagery capability to support Defence, national security and whole-of-government activities. The 2020 Defence Strategic Update and Force Structure Plan confirmed significant investment by Government to maintain awareness of Australia's rapidly changing strategic environment. The government has committed to: • continued access to commercial satellite imagery capabilities out to the mid-2030s (Phase 1); • increased funding for Phase 2 with the intent of prioritising development of a sovereign satellite imagery capability to enhance coverage of the Indo-Pacific region; and • ongoing capability through additional sovereign satellites beyond 2040 (Phase 3). During FY 2019-20, Defence Project 799 Phase 1 - Enhanced Commercial Access completed facility construction and began operations. Initial Operating Capability was declared in October 2019. This capability enhances how Defence accesses commercial satellite imagery. AGO staff can directly task earth observation satellites from an operations centre at RAAF Base Edinburgh and downlink imagery through one of the three new antenna facilities around Australia. The infrastructure delivered under Phase 1 can access satellites operated by US company Maxar; however, the project is working to bring on board an additional vendor to further enhance commercial imagery access. The next phase of the project series will deliver the future sovereign space-based imagery capability to meet the needs of Defence, the National Intelligence Community and Whole-of-Government.
Department of Infrastructure, Transport, Regional Development and Communications	DITRDC leads Australia's engagement in key international radiocommunications policy-making fora discussing WRC-23 agenda items dealing with space weather sensors used for global predictions and warnings, and frequency allocations and protection for Earth Observation-satellite service. AMSA uses satellite-based Synthetic Aperture Radar data to monitor for illegal oil discharge from vessels within Australian waters and as evidence in marine pollution prosecution. There was no compliance monitoring, or incident response, imagery acquisition in 2019-2020; however, the data is available to support monitoring and prosecutorial action when required.
Geoscience Australia	<u>Earth observations from space (EOS)</u> GA supports Earth Observation Australia (EOA). EOA plays a key role in bringing together government, business, research and other players in the Earth observation community. GA, the Bureau of Meteorology and CSIRO are jointly responsible for EOS capability in Australia. They are co-chairs the SCC's EOS Working Group (AEOSWG). Digital Earth Australia (DEA) provides routine, reliable and robust intelligence about the Earth, its resources and how these have changed over the recent

Organisation	Summary of activity
	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. In the 2018-19 Federal Budget, DEA received funding of \$36.9 million over four years (and \$13 million per annum ongoing). Through delivery of its Strategy 2028, GA works to ensure that space data supports economic, social and environmental wellbeing. In particular, through the Digital Earth Australia Program GA is making it quicker and easier to access Earth observation satellite data and analyse it to produce readily accessible information and insights about Australia's changing landscape, coastline and oceans. <u>Australian Industry Engagement / DEA Labs</u> During 2019-20, Digital Earth Australia (DEA) continued to expand its engagement with Australian businesses. In February 2020, DEA completed the first round of its small-scale grants program, DEA Labs. The DEA Labs initiative provided three Australian agtech businesses with funding and access to analysis-ready satellite data, high performance computing and technical support from DEA staff. All three businesses were able to successfully develop new products for their clients and more efficient processes that will increase their productivity and profitability in the future. In the final quarter of 2019-20, DEA completed its consultation with the Australian agriculture sector and delivered the Harvesting the benefits of Earth observation report. The report provides DEA the insights it needs to maximise its engagement with businesses in the Australian agriculture sector and help them reap significantly greater benefits from the use of satellite data. In 2020-21, DEA will continue its engagement with Australian businesses through targeted consultation with the Mining and Extractive Technologies, Financial Services, Urban Planning and Infrastructure sectors. As with the Agriculture Sector each of these engagements will deliver a series of workshops and result in a summary report that highlights the main challenges and opportunities to increase the use of Earth observation to deliver increased productivity in the sectors. DEA is also planning for a DEA Labs Round Two; an expanded version of its initial small-scale grants program. DEA expects to target specific challenges identified through its industry consultation in the grant round. <u>Group on Earth Observations (GEO)</u> GA has continued to be an active and valued contributor to GEO both in terms of governance (ExCOM, Programme Board (PB)) and technical activities (Flagships and Work Program). During 2019-20, GA has made substantial contributions to supporting the GEO Virtual Symposium, and acting as Co-

Organisation	Summary of activity
	chair to both the GEO PB Private Sector Working Group to the PB and the Pacific Island Advisory Group to ExCOM. <u>Committee on Earth Observation Satellites (CEOS)</u> GA has been actively supporting and contributing to the CEOS entities (e.g. WGCV, LSI-VC) and as Co-Chair, with CSIRO, of CEOS's Strategic Implementation Team. In particular, GA has been supporting the CEOS ARD Webinar series and the CARD4L Product Alignment Assessment (PAA). PAA is the CARD4L product evaluation process and has recently endorsed the USGS Landsat Collection 2 Surface Reflectance and Surface Temperature as CARD4L compliant products. <u>Bushfire Earth Observation Taskforce</u> GA worked with the Bushfire Earth Observation Taskforce to improve collaboration between Australian government agencies, and increase data sharing and the utility of satellite data in response to natural disasters such as bushfires. <u>Landsat</u> 2019 marked 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. <u>GEO Week</u> The 2019 GEO Ministerial Summit was held in Canberra on 4-9 November. GA was the Australian lead and host of GEO Week with support from CSIRO, the Agency, the Department of the Environment and Energy and other agencies. Australia designed a comprehensive program to showcase and connect Australian EOS capabilities internationally. GEO Week 2019 included an Industry Track: an Australian initiative designed to strengthen engagement between the commercial sector and the GEO community. <u>Other GA Activities</u> 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 the

Organisation	Summary of activity
	2019-2020 bushfire crisis, the Copernicus service was used and provided valuable mapping products to support the emergency response. 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.

Case study: Understanding water availability

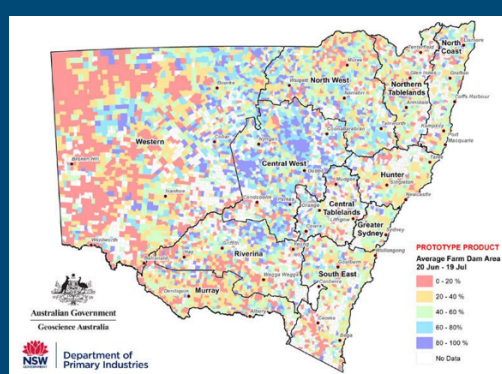


Figure 11 – NSW State Seasonal Update: July 2020 showing average parish-level farm dam extents 20/6- 19/07/2020

During 2019-20, Digital Earth Australia (DEA) worked with the New South Wales Government and Murray-Darling Basin Authority (MDBA) to pilot new automated methods of digitally mapping crop and water extent across the Murray-Darling river system.

Understanding water availability is essential for land management, particularly during times of drought. Using DEA Waterbodies, the NSW Government can routinely provide a snapshot of water availability across the state through its monthly State Seasonal Update. DEA Waterbodies is now available in each state and territory across Australia and can be accessed via the [DEA Maps portal](#).

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 2016⁵. 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.

The Australian Civil Space Strategy 2019-2028 identifies this Priority Area as part of Phase 3 (2021-2028), delivering success. To align with the M2M initiative, the Space Medicine and Life Sciences roadmap has been progressed.

Table 7 – SCC Research and development activities

Organisation	Summary of activity
Bureau of Meteorology	Bureau scientists are actively involved in international science teams, including the Sentinel-3 Validation Team for Temperature (S3VT-T), GHRST

⁵ Office of the Chief Economist Australian Innovation System Report 2017

Organisation	Summary of activity
	Science Team, GOES-R Technical Advisory Committee, 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, and leveraging through collaboration on algorithm development. The Bureau conducts climate science research projects for customers such as the Northern Australia Climate Project, Antarctic Science Partnership and Forewarned is Forearmed. Ongoing work is being undertaken on strategic science research projects that improve Bureau services and increase its value and impact (such as Bush Fire and Natural Hazards CRC projects). The Bureau has partnered with the NSW Rural Fire Service on the development of a new fire danger rating system. The Australian Fire Danger Rating System (AFDRS), which incorporates the latest fire science, will be implemented operationally across Australia in late 2022 following a successful trial of the prototype over the last several years. "Forecasting for the Future: New science for improved weather, water, ocean and climate services", was the theme of the Bureau's annual R&D Workshop held in November 2019. The Workshop provides a forum for researchers from around the world to communicate innovations and advances in science, including in the use of satellite data. The Bureau is also involved in the development of radar and satellite nowcasting applications.
CSIRO	CSIRO Astronomy and Space Science (CASS) is actively involved in research and development through the ATNF, CDSCC, Space Technology Future Science Platform and CCEO. Current activities include: • A wide range of new cutting-edge research activities in the areas of: small satellite technologies (including sensors, power systems and materials): Earth observation data analytics: communications, tracking and signal processing; robotics, remote operations and in situ resource utilisation, and space life sciences through the Space Technology Future Science Platform • The development of the CSIROSat-1 CubeSat, with South Australian start-up Inovor Technologies Pty Ltd and other partners. CSIROSat-1 will be an Earth observing satellite for scientific research purposes, and will carry a shortwave infrared imaging system and on-board data processing capabilities. • Research into extremely sensitive receiver technologies • The use of bistatic radar techniques for tracking and investigating asteroids • Free space optical communications atmospheric research The inaugural Space Technology Future Science Platform Symposium was held in November to present the range of frontier science and innovation that CSIRO is undertaking to support industry growth and development opportunities across the domestic space sector. CSIRO became a Supporting Participant in the SmartSat CRC. CSIRO is developing AquaWatch Australia as part of its emerging Missions portfolio. The aim of this Mission is to establish an integrated ground-to-space

Organisation	Summary of activity
	national water quality monitoring system, to safeguard our freshwater and coastal resources and grow Australia's high-tech space industry. The SmartSat CRC approved co-investment to initiate the user consultation phase ('Phase 0') of this Mission. CSIRO operates the Australia Telescope National Facility (ATNF). Key activities and developments in 2019-20 include: • The Australian Square Kilometre Array Pathfinder (ASKAP) located at the Murchison Radio Observatory in the mid-west of WA has now completed the first round of pilot surveys, demonstrating that the science goals of each of the major 5-year surveys can be realised. • A smaller observatory-led project RACS (Rapid ASKAP Continuum Survey) has successfully completed its first epoch and has already proved to be the most sensitive such survey at cm radio wavelengths yet conducted. The innovative phased array feed (PAF) technology developed by CSIRO continues to deliver high impact science through the Early Science program, including new results in the detection and localisation of Fast Radio Bursts. Key results and techniques generated through the development of ASKAP are contributing to the international Square Kilometre Array (SKA) design and development effort. ASKAP has also built industry involvement and a green energy power system that will be relevant to the much larger SKA project. 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, ASKAP and the Murchison Widefield Array (MWA), and is also working on projects with ESA. In June 2020 the Pawsey Supercomputing Centre received a grant under the Agency's SIF Fund to establish a new Australian Space Data Analysis Facility which will provide improved analysis of Earth observation and space situational awareness data. <u>Space Technology Future Science Platform</u> The Space Technology Future Science Platform (Space FSP), which was established in Nov 2018, is CSIRO's newest space program. In 18 months it has grown from a \$16 million investment to a \$24 million program, and will continue to grow in coming years. The Space FSP aims to build world-leading capability and drive cutting-edge research within CSIRO, generating new innovations that hold the potential to generate significant societal benefits and commercial opportunities and will help transform the Australian space sector. In 2019-20 the Space FSP supported 18 projects across a wide range of new cutting-edge research activities in the following areas: • small satellite technologies, including hyperspectral imaging sensors, rollable and self-deployable solar arrays, high-power batteries for space applications, on-board data processing, and novel additive manufacturing of structural components • Earth observation data analytics and applications, including Synthetic Aperture Radar science and multi-sensor DataCube implementation

Organisation	Summary of activity
	- communications and signal processing, including exploration of radio astronomy technologies for space object tracking, terahertz technologies for high-speed in-space communications, free space optical communications atmospheric research, and the use of pulsars as True Random Number Generators for security, navigation and timing applications - robotics, remote operations and in situ resource utilisation, including modular robotics for space applications, techniques for off-Earth resource modelling, and technologies for resource characterisation and extraction - space life sciences, including development of a novel light-controlled closed experimental system suitable for experimenting on human cells cultured in microgravity. Combining the capabilities of CDSCC (DSS43) and the ATNF (Compact Array and Parkes radio telescopes) CSIRO is progressing research in asteroid bistatic radar tracking techniques. CSIRO has demonstrated the successful detection and tracking of seven near Earth asteroids to date, including asteroids 2019 GC6 and 2019 EA2 in 2019, in collaboration with NASA JPL. <u>CSIRO Space 2.0 Workshop (August 2019)</u> The fourth Space 2.0 Workshop was run jointly by CSIRO and the Space Agency. It brought together Australian space start-ups and SMEs with CSIRO, the wider research sector, government, industry, investors and end-users to discuss opportunities for large-scale national space activities that would contribute to the goals and priority areas of the Space Agency. A key outcome of this workshop was the development of the AquaWatch Australia concept, which was subsequently taken forward by CSIRO and the SmartSat CRC.
Department of Defence	<u>More Together Defence Science and Technology Strategy 2030</u> The More Together Defence Science and Technology Strategy 2030, released on 4 May 2020, outlines Defence's science and technology (S&T) ambitions and aspirations and establishes the overall S&T priorities for Defence's highest strategic priorities. The key objectives of this Strategy are to focus on larger S&T programs supporting Defence strategic priorities, increase scale by partnering with national S&T enterprises and international partners, and deliver a capability edge through streamlined and secure innovation pathways. The Strategy introduces the Science, Technology and Research (STaR) Shot concept to focus the national S&T enterprise on Defence objectives to deliver leap-ahead capabilities. The Resilient Multi-mission Space STaR Shot is one of the eight STaR Shots and is aimed at providing resilient global communications, position navigation and timing, and geospatial intelligence capabilities direct to Defence users, enabled by a low earth orbit (LEO) smart satellite constellation. Further details can be found on the website of the strategy. <u>Defence Science and Technology Group</u> Defence Science and Technology Group (DSTG) contributes significantly to the development of Australia's space capabilities through coordinating and

Organisation	Summary of activity
	focusing Defence space S&T efforts to Defence's highest strategic priorities, and by partnering with the national S&T enterprise and collaborating with international partners. DSTG has three key space research programs: • The space strategic research program, delivered through the Resilient Multi-mission STaR Shot, to focus future strategic research and proactively develop leap-ahead Defence space capabilities. • The Next Generation Technologies Fund Space Capabilities theme to focus resources on Defence's highest space S&T priorities and support more streamlined transitioning of good technological ideas into capability. • The Space Strategic Research Initiative program was established to develop expertise and understanding of the space environment with a focus on space situational awareness, the development and operation of very small satellites with innovative and niche capabilities (including the Buccaneer CubeSat program), and to investigate the exploitation data from space-based systems contributing to future defence capabilities. DSTG continues to contribute to the International Small-Satellite Command and Control Network. This multi-national research ground station network supports Australian and international partner small satellite exemplar missions. Defence is a core member of the SmartSat Cooperative Research Centre (CRC), with its contribution funded by the Next Generation Technologies Fund Space Capabilities theme. Defence is seeking SmartSat CRC to deliver high-risk, high-payoff collaborative research, increase industry capacity and capabilities, and provide technology outcomes that can be matured and demonstrated under the Resilient Multi-mission Space STaR Shot. Defence and Defence Industry guidance to the program is achieved through the SmartSat Defence and National Security End User Advisory Board. DSTG in partnership with the Royal Australian Air Force is developing the Buccaneer Main Mission (BMM) CubeSat that is scheduled for launch in 2022. Inovor Technologies are developing the satellite bus for this mission, and the primary payload is an advanced digital high-frequency radio receiver that is being developed by DSTG. The BMM CubeSat will support calibration research for the Jindalee Operational Radar Network (JORN). DST Group continues to perform research in the area of Space Domain Awareness (SDA), working collaboratively with national and international partners to explore ways to improve Defence's current and future capabilities. This includes the Phantom Echoes activity, working with the Five-Eye nations to demonstrate how allied SDA sensors and processing capabilities can be integrated to enhance their performance over that of individual systems working independently. DSTG is also collaborating with the JAXA, conducting cooperative science activities for the Hayabusa2 asteroid sample space mission re-entry that will occur within the Woomera Prohibited Area in December 2020. <u>Defence Innovation Hub</u>

Organisation	Summary of activity
	The Department of Defence's strategic and coordinated approach to Defence industry is delivering greater support to the space sector. Intelligence, surveillance, reconnaissance, electronic warfare, space and cyber was a priority investment area for the Defence Innovation Hub in 2019-20. Since its launch in 2016, the Defence Innovation Hub has invested over \$32.3 million in space related innovation projects. This includes: • 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 • A \$3.1 million contract with DEWC Systems Pty Ltd to develop an improved sovereign, space-based tactical sensor system. • A \$299,000 innovation project with CyberOps to develop a security framework and architecture for nano-satellite development programs and operating systems. 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.
Department of Infrastructure, Transport, Regional Development and Communications	Airservices Australia is monitoring the development of a satellite based surveillance and communications capability. This capability would likely be the introduction of satellite based ADS-B predominantly for oceanic airspace surveillance and satellite based very high frequency (VHF) radio as a replacement for high frequency (HF) radio.
Department of Prime Minister and Cabinet	The PM&C plays a policy and coordination role for critical technologies. This includes supporting the promotion and protection of Australia's space technology development in the research sector. A key part of PM&C's support is a foresight capability to detect technological developments that may significantly impact Australia's national security interests, economic prosperity and social cohesion. A proactive approach to mapping the innovation ecosystem in this area informs whole-of-government critical technologies priorities and thus optimise where targeted market intervention occurs
Geoscience Australia	GA works closely with the research community and established networks, like the Terrestrial Ecosystem Research Network (TERN) NCRIS facility, to help identify areas where EOS 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 National Collaborative Research Infrastructure Strategy (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. Australia is already a world leader in remote operations, providing a base of expertise that can be transferred to robotic operations in the space environment. A roadmap is being developed to highlight opportunities in this sector for Australia.

The *Australian Civil Space Strategy 2019-2028* identifies this Priority Area as part of Phase 3 (2021-2028), delivering success.

Table 8 – SCC Robotics and automation activities

Organisation	Summary of activity
CSIRO	CSIRO contributed technical and coordination expertise to the development of the national Remote Operations, Robotics, AI and ISRU Roadmap led by the Agency. Research into ISRU, remote operations and modular robotics for space applications is being undertaken through the Space Technology Future Science Platform.
Department of Infrastructure, Transport, Regional Development and Communications	In August 2019, Australian Infrastructure and Transport Ministers endorsed the National Land Transport Technology Action Plan 2020-2023, which underpins the National Policy Framework for Land Transport Technology. The Action Plan is a collaboration between Commonwealth, state and territory governments and transport agencies to identify key short to medium term priorities for coordination on cooperative intelligent transport systems (C-ITS) and automated vehicles. Given the involvement of at least two automated vehicle developers in launching fleets of low earth orbiting satellites (Geely and Tesla/SpaceX) to connect vehicles to communications systems, more intersection between vehicle developments and the space industry is anticipated over time.

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 of all sizes, universities and even schools to send payloads to orbit. To keep pace with these changes, and ensure a framework is in place that supports entrepreneurship while ensuring safety, the Australian Government has passed the *Space (Launches and Returns) Act 2018*, which came into force, along with its associated rules and regulations on 31 August 2019.

The updated regulatory 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 in this area is outlined under the 'Responsible' Pillar.

The *Australian Civil Space Strategy 2019-2028* identifies this Priority Area as part of Phase 3 (2021-2028), delivering success.

Table 9 – SCC Access to space activities

Organisation	Summary of activity
Bureau of Meteorology	The Bureau of Meteorology will provide meteorological data critical to the safe launch of rockets from Indigenous launch platforms. Launches from private commercial land will be considered on a case by case basis.
Department of Infrastructure, Transport, Regional Development and Communications	DITRDC leads Australia's engagement in key international radiocommunications policy-making fora discussing WRC-23 agenda items, including one dealing with sub-orbital vehicles being developed with the intention to operate at higher altitudes than conventional aircraft, with a sub-orbital trajectory. Airservices provides air space management services during launch and recovery operations. Civil aviation is a significant user of space based technology and Airservices facilitates the use of Communication Navigation and Satellite applications using space technology.

State and Territory Engagement

Engagement with the states and territories provides an important mechanism for the Agency to understand the opportunities for the space sector across Australia. On 10 July 2019, the Agency signed an MOU with WA, this is the third State to have formalised an agreement. This MOU outlined the depth of expertise WA has in space, which includes: space operations, particularly ground-based satellite and deep space communications; space situational awareness; data processing, analysis and supercomputing; the application of space-sourced data; and remote asset management in extreme environments.

A MOU was signed with the Tasmanian Government on 25 September. This MOU draws on the support of Tasmania's space capabilities including space medicine, ground stations and tracking facilities.



Figure 12 – Signing of memorandums of understanding with Tasmania and Western Australia

Across the reporting period, the Agency has been working with the NSW Western City and Aerotropolis Authority to develop the proposed SIF announced \$2 million Space Manufacturing Facility. The Agency participated in several workshops and work continues to further refine the grant opportunity under the SIF Space Manufacturing Facility in preparation of draft guidelines.

The Agency also supported Queensland Government's 'Satellite Park Development Opportunities Workshop' in which Queensland engaged with satellite communications and data analytics stakeholders to understand

how they can develop a satellite park in the state. This work builds on the recommendations of the Queensland inquiry into space opportunities and subsequent independent assessment.

Prior to travel restrictions, the Head and Deputy Head of the Agency commenced the next series of meetings with State and Territory first ministers (or relevant minister for space) as part of the Agency's regular engagements. This included meetings with the New South Wales and South Australian Governments. These meetings provide an opportunity to brief States and Territories of the activities of the Agency and in turn be briefed on the space activities of the relevant jurisdiction.

New South Wales and Queensland each released new space industry strategies which identified their states' competitive advantages in the space industry and opportunities for future growth. Each state also allocated funding to support their strategies. The NSW Government announced along with its strategy a \$5 million investment to develop a National Space Industry Hub, located in the Sydney Innovation and Technology Precinct. The Queensland Government announced during the launch of its strategy funding of \$8 million in support of its outcomes. Both strategies uniquely articulate the strengths of each state while maintaining a close alignment with the Agency's own 10 year outlook.

Industry Engagement

The Agency continues to engage with industry in order to understand its requirements and assist the Australian space industry to grow in line with its mandated purpose. While travel and conference attendance was reduced from March 2020, the Agency adapted to the COVID-19 environment and engaged with several stakeholders in a regular (if not more frequent) manner using virtual meetings. These meetings continued to be a benefit to both industry and the Agency and by the end of June 2020 the frequency of virtual engagements had reached pre-pandemic levels.

With the onset of COVID restrictions, the Agency engaged with industry directly and indirectly through organisations such as SmartSat CRC, CSIRO, SIAA, Austrade, the UniSA Innovation and Collaboration Centre and venture capital firms, to understand challenges and concerns during the COVID-19 situation.

The Agency is continuing to participate in Earth Observation Australia meetings to further build relationships with the earth observation sector and share the strategy of the Agency. The Agency also meets monthly with the Australian National Ground Segment Technical Team, a group which coordinates the earth observation infrastructure for government agencies.

Partnerships

To highlight areas of investment and growth for Australia, and to build upon Australia's unique potential, including space research and development, and commercial applications, the Agency develops Statements of Strategic Intent (SSIs).



Figure 13 – Signing of statements of strategic intent (Maxar and Thales)

In 2019, the Agency signed nine SSIs with Australian and international companies: Myriota (15 July); XTEK (18 July); Speedcast (6 August); US space technology company Maxar Technologies (22 August); Frontier SI (29 August); EM Solutions Pty Ltd (13 November); EOS Space Systems (2 December); Thales Australia (3 December) and Gilmour Space Technologies (11 December). Both Maxar and Frontier SI are significant contributors to the SmartSat CRC.

Australian Space Forum and Australian Space Research Conference

The Agency supported both the SA Space Forum and Australian Space Research Conference (ASRC), both of which eclipsed their previous year's attendance. The SA Space Forum had over 900 attendees. During the forum, Deloitte along with industry and government partners (such as Amazon Web Services, McLaren, SmartSat CRC and the Agency) launched the Gravity Challenge to build solutions to real industrial, social and environmental problems by leveraging space capabilities. Ten projects were identified, from understanding wet and dry season of the Northern Territory to autonomy produce medicine in space.

Broader Industry Outreach

Through a number of key national events, the Agency has engaged in space-related sectors with links to the broader economy.

In July 2019, the Agency sponsored and participated in the Australian Youth Aerospace Association (AYAA) Aerospace Future Conference in Sydney. This Conference focussed on careers in space, aerospace and aviation. The Agency also participated in the Victorian Space Science Interdisciplinary Network Meeting which explored the depth of Victoria's space science endeavours. Further space industry participation across the broader economy is being promoted through active engagement and sponsorship of two national competitions: Australian Technology Competition and Gravity Challenge 2.0.

Given the importance of reaching other areas of the economy that can benefit from space, the Agency engaged the opportunity to speak at a number of industry events such as the South East Asia Congress, in Darwin, the AWS Public Sector Summit (Canberra), Austmine – Mining and Innovation Roadshow in Adelaide and the International Mining and Resources Conference 2019 in Melbourne.

The Agency has also scoped Australian space medicine Leapfrog R&D capability and opportunity through a small Space Medicine round table. It is anticipated that round table participants, as a group, will help develop a 10 year plan for Australian space health under, or with, the National Space and Radio Science Committee of the Academy of Science, and may explore an institute to further national collaboration and networking on space medicine issues. This work will also inform the Agency's technology roadmap on space medicine.

Funding Programs

Space Infrastructure Fund

In the 2019-20 Budget, the Australian Government allocated \$19.5 million for the SIF to support Australia's emerging domestic space industry. The SIF was announced on 2 April 2019 and will end on 30 June 2022.

The SIF aims to increase capability and fill space infrastructure gaps to support businesses and researchers to participate in the global space economy. Building a core foundation for space operations and technology will: support the creation of high-tech jobs in Australia; support industry through targeted investments; speed up the delivery of new space-based services; reduce barriers and make space more accessible for start-ups and small-to-medium business and benefit Australians who rely on satellites for daily activities like GPS, communications and farming. The SIF also provides the tools businesses need to access international opportunities – opening doors for Australia internationally.

SIF Projects being delivered

The SIF supports seven enabling projects that fill gaps in Australian space infrastructure. A map showing the distribution of SIF projects is shown in *Figure 14* and a summary of each project highlighted in Table 10. \$13.2 million in grants have been awarded in 2019-20, supporting four key space infrastructure projects in Australia.



Figure 14 – Map of SIF projects

International Space Investment initiative

In the 2018-19 Budget, the Australian Government committed \$15 million over three years from 2019-20 for the ISI initiative, to build the Australian space industry by enabling and encouraging engagement with international space agencies. The initiative comprises two streams: the open competitive Expand Capability stream (approx. \$11 million) with the remaining to be deployed to an Open Doors stream which is in further planning.

The Agency conducted consultations from 14 June - 1 July 2019 to inform the design of the ISI. More than 180 stakeholders attended the consultations and 55 written submissions were received. In order to streamline the delivery of the initiative, the Agency has engaged the Business Grants Hub in AusIndustry. The ISI – Expand Capability guidelines were launched on 17 October, and applications were open for submission between 5 November and 17 December 2019. 153 eligible applications were received through the Business Grants Hub, which were reviewed by an assessment committee.

ISI Projects being delivered

On 17 June 2020, the ten projects selected to receive grants under the ISI - Expand Capability initiative were announced. A summary of each project is highlighted in

Table 11.

Table 10 – Summary of SIF Projects and Funding allocation

	Description	Budget (\$,m)	Comment
Mission Control Centre, SA	A platform for SMEs and researchers to control small satellite missions, enabling real-time testing and accelerated improvement of satellite technology. The Mission Control centre will be located at Lot Fourteen with the Agency headquarters, as part of the Adelaide City Deal. The South Australian Government is also contributing \$2.5 million to the Mission Control Centre	6.0	On 16 June Saber Astronautics, based in Sydney and Boulder, Colorado, was awarded a \$6 million grant to establish the national centre in Adelaide.
Space manufacturing capability in Aerotropolis, NSW	This project will support the delivery of future space manufacturing capability, and development of high-tech skills and new space objects. It will commence in 2020-21.	2.0	Project planning underway, including consultation with the Western City and Aerotropolis Authority.
Robotics, Automation and AI Command and Control Centre, WA	Complementing the Mission Control Centre in South Australia, the Australian Space Robotics, Automation, and AI Command Control Complex will build on Australia's strengths as a leader in remote asset management. The complex will encourage local research and development of remote asset management capabilities for use in space. Fugro will provide \$5 million in cash and a \$5 million in-kind contribution to the project.	4.5	On 23 June Western Australian company Fugro Australia Marine was awarded a \$4.5 million grant to help develop the complex in Perth.
Space data analysis facilities, WA	The Australian Space Data Analysis Facility (ASDAF) will help analysis of satellite data by small to medium enterprises and researchers. The facility will provide improved analysis of Earth observation data for SMEs and researchers in fields including agriculture, mining, emergency services and maritime surveillance. It will also provide space situational awareness data for satellite operators.	1.5	On 23 June WA's Pawsey Supercomputing Centre was awarded a \$1.5 million grant to establish the new space data analysis facility in Perth.
Tracking facilities upgrade, Tas	\$1.2 million has been committed to upgrading the University of Tasmania space tracking facilities to commercial standard. This will allow for precision tracking of satellites and spacecraft in orbit and for de-orbit tracking.	1.2	The contract was signed in December 2019 and the project is underway.
Space payload qualification facilities (National)	Providing capability for SMEs and researchers to test in Australia space equipment that is mission-ready. This project will be launched in 2020-21.	2.5	A national audit to understand existing infrastructure is currently underway to inform the design of the project.
Pathway to launch (National)	Undertake work to address the active interest and growing readiness in industry for launch in Australia, while ensuring safety on Earth and in space.	0.9	This is to support the Agency to initiate the risk activation framework to support the operation of the <i>Space (Launches and Returns) Act 2018</i> .

Table 11 – Summary of ISI Projects and Funding allocation

Description		Budget (\$,m)	Comment
AI Crew for space: helping with complex systems tests	Partnering with NASA's Jet Propulsion Laboratory (JPL) the project will develop an Artificial Intelligence (AI) space crew complementing human teams to help people work more effectively in remote environments.	1.53	On 27 May 2020, a \$1.53m grant was awarded to Akin Australia Pty Ltd.
Spacesuits for preserving human health and mobility	Working with NASA, ESA and others, this project focuses on developing a spacesuit that reduces the unhealthy side effects of living in space, such as bone and muscle loss, and fainting upon return to Earth.	0.84	On 16 June 2020, a \$0.84m grant was awarded to Human Aerospace Pty Ltd.
Underwater Virtual Reality Training Simulations for Astronauts	Developing an underwater virtual reality training simulator for astronauts and human space exploration.	0.19	On 29 May 2020, a \$0.20m grant was awarded to Raytracer Pty Ltd.
OSSO: The Open Source Space Operations infrastructure	Developing open source software infrastructure for spacecraft operations, which will provide new tools for business to support their space assets in space	0.78	On 26 June 2020, a \$0.78m grant was awarded to Saber Astronautics Australia Pty Ltd.
South Australian Multi-Sensor Space Observatory	The establishment of new space observatory, with sensors to support space traffic management and debris tracking, will allow for the integration of data between multiple sites around the world, partnering with Western Sydney University and the Swedish Space Corporation.	1.46	On 29 May 2020, a \$1.46m grant was awarded to Silentium Defence Trading Pty Ltd.
Design and qualification of micro-satellite constellation launch systems	The focus will be on developing constellations of microsatellites which deliver Air Traffic Management (ATM) services and higher power payloads including Communication, Navigation and Surveillance services.	0.87	On 09 June 2020, a \$0.87m grant was awarded to Skykraft Pty Ltd.
Decision Support System for Collision Avoidance of Space Objects	The project will develop a tool to help satellite operators assess the real risks to satellites from collisions with other satellites and space debris, enabling operators to make decisions with greater certainty and speed.	0.21	On 16 June 2020, a \$0.21m grant was awarded to Stamen Pty Ltd [t/a Industrial Sciences Group].
The SpIRIT (Space Industry Responsive Intelligent Thermal) CubeSat mission	The SpIRIT is an advanced nanosatellite, being designed as part of a multilateral mission with the Italian Space Agency and the UK Space Agency. This Australian-made spacecraft will host international payloads and show our competitiveness in nano-satellite R&D and advanced manufacturing.	3.95	On 23 June 2020, a \$3.95m grant was awarded to the University of Melbourne.
VertiSense-Mitigation of Sensorimotor Effects of Simulated Weightlessness	In collaboration with NASA's Human Research Program (HRP), the project will focus on how to counter sensorimotor disturbances experienced by astronauts after spaceflight, creating commercial opportunities to develop and	0.43	On 10 June 2020, a \$0.43m grant was awarded to the University of Canberra.

	Description	Budget (\$,m)	Comment
	manufacture wearable microgravity garments for the Australian space industry.		
Advanced GNSS Receiver for CubeSats, Rockets and Remote Sensing	This project will develop an advanced GPS receiver for CubeSats, rockets and remote sensing, which will improve both timing and position or velocity estimation.	0.69	On 19 June 2020, a \$0.69m grant was awarded to the University of New South Wales.

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.

Case study: M2 Pathfinder



Figure 15 – M2 Mission, due to launch in 2021

On June 13 2020, an Australian-made CubeSat, the M2 Pathfinder, was launched from New Zealand's Mahia Peninsula as part of a joint partnership between the University of New South Wales Canberra and the Royal Australian Air Force. The M2 Pathfinder allows high technology capabilities to be tested in space at a lower cost than larger satellites. The project was designed to test communications architecture and technologies and will help inform and develop Australia's space capabilities and future Defence space systems.

Additional tests with the M2 over the coming months will seek to improve the design of future satellites and provide valuable experience to the engineering and flight operations teams. M2 Pathfinder is a precursor to the M2 mission, which will launch two CubeSats in 2021.

Defence Minister Linda Reynolds stated that the collaboration has generated "educational benefits for Defence personnel studying space programs" which "further enhances the future Defence space workforce".

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

Table 12 – SCC National security activities

Organisation	Summary of activity
Bureau of Meteorology	The Bureau's ionospheric forecasts support defence communications, and defence radar operations. The Bureau's Space Weather Services provides expert advice on the risk assessment of space weather impacts on Australia's critical infrastructure.
CSIRO	CSIRO cooperates with Defence Science and Technology Group in a number of space-related areas including space situational awareness, Earth observation, communications technologies, materials and manufacturing, and CubeSat technologies.
Department of Defence	The vast majority of Defence's activities outlined in this report are national security related. The 2020 Defence Strategic Update and 2020 Force Structure Plan, released on 1 July 2020, outline a new strategy for Defence and the capability investments

Organisation	Summary of activity
	needed to deliver it. Further information can be found on the website. The Defence Strategic Update sets out the challenges in Australia's strategic environment and their implications for Defence planning. It provides a new strategic policy framework to ensure Australia is able – and is understood as willing – to deploy military power to shape our environment, deter actions against our interests and, when required, respond with military force. The 2020 Force Structure Plan details the Government's intentions for new and adjusted ADF capability investments to implement the new strategic objectives. The 2020 Defence Strategic Update and the 2020 Force Structure Plan will ensure that Defence can respond to new challenges as they emerge. This delivers on the Government's commitment to protect Australia and its interests. Space is highlighted as its own domain. The strategic steps and investments the government will take regarding the space capabilities Defence will need to provide Australia with assured access to space and help advance our national interests in space are outlined in both. In early 2020 Defence adopted a new capability structure, recognising space as a dedicated warfighting domain and appointing Chief of Air Force as the Space Domain lead. In this role, Air Force is responsible for coordinating Defence's space activities and integrating space effects across the other domains. Defence is working to integrate more closely with the US and other Combined Space Operations initiative partners (Canada, Germany, France, New Zealand and the UK) to enhance national space capabilities and coordinate efforts in space defence. Australia has established Operation DYURRA as the ADF contribution to the US-led Operation OLYMPIC DEFENDER to strengthen allies' abilities to deter hostile acts in space.
Department of Foreign Affairs and Trade	DFAT co-chairs with Defence the National Security Space Inter-Departmental Committee (NSS IDC), which coordinates national security advice on civil space issues.
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.

Organisation	Summary of activity
	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.
Department of Infrastructure, Transport, Regional Development and Communications	DITRDC is working closely with government security agencies to manage the challenges presented by the interaction of drones and space activities to ensure the resilience of satellite-enabled emerging and future aviation technologies.

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 and high power rocket activities under the *Space (Launches and Returns) Act 2018* (the Act) and its associated rules, the Space (Launches and Returns) (General) Rules 2019 and the Space (Launches and Returns) (Insurance) Rules 2019. All three commenced on 31 August 2019.

The General Rules contain the application requirements for launch facility licences, Australian launch permits, overseas payload permits, return authorisations and authorisation certificates. The Insurance Rules set out the insurance/financial requirements, including the specified minimum amount of insurance. To support the commencement of the Act and Rules the Agency also released a refreshed Flight Safety Code and Maximum Probable Loss Methodology on 31 August 2019.

The *Space (Launches and Returns) (High Power Rocket) Rules 2019* commenced on 30 June 2020.

In November 2019, the Australian Government agreed to introduce partial cost recovery arrangements for assessment of applications made under the Act. Originally anticipated to commence on 1 July 2020, partial cost recovery was deferred by 12 months to 1 July 2021 in recognition of the impact that the COVID-19 pandemic has had on the Australian space industry. The Agency will consult on draft rules for fees prior to commencing any charges. This is expected to happen in early 2021.

From 2016 to July 2020, 21 authorisations were granted for overseas launches, mostly for small satellites with the aim of conducting experiments or demonstrating technology, under both the previous and current legislative framework. The Agency has also been working with those wanting to conduct launches from Australia, which require authorisation under the Act. Since the establishment of the Agency in 2018 until July 2020 there have been 10 such applications in the 2019-20 period. This has included 4 launch facility licence applications, 5 Australian launch permit applications, 1 high power rocket permit application. There was 1 return authorisation (under the *Space Activities Act 1998*).

The Agency also has responsibility for implementing Australia's obligations under the United Nations space treaties. This includes domestic implementation under the Act.

The Agency has worked closely with JAXA on Hayabusa2, JAXA's asteroid sample-return mission, with return and retrieval from Woomera, South Australia planned for 6 December 2020.

The Agency and other Commonwealth organisations are working to implement the Guidelines for the Long-term Sustainability of Outer Space Activities, which were endorsed by UNCOPUOS in June 2019.

The below table highlights the space-related regulatory activity of SCC members.

Table 13 – SCC Space regulation activities

Organisation	Summary of activity
Australian Communications and Media Authority	The ACMA manages access to the radiofrequency spectrum through the development and maintenance of a regulatory framework for satellite services in Australia, and through licensing of space services. The ACMA maintains a register of Statutory Infrastructure Providers and their service areas. The Minister for Communications, Cyber Safety and the Arts can also make standards, rules and benchmarks, with which SIPs must comply
Bureau of Meteorology	The Bureau attends the World Radiocommunication Conferences and the Asia Pacific Telecommunity (APT) Conference Preparatory Group meetings. It is also a member of the World Meteorological Organisation Steering Group on Radio Frequency Coordination (SG-RFC).
CSIRO	CSIRO is a key member of ACMA's space spectrum advisory group for space tracking and assists spectrum discussions to ensure consistency with the US/AUS Space Tracking Treaty. CSIRO also chairs two Working Parties (3M and 7D) of the International Telecommunications Union Radiocommunication Sector (ITU-R).
Department of Defence	Defence participates in International Telecommunication Union activities, and was part of the Australian delegation to the 2019 World Radiocommunication Conference in Sharm El-Sheikh. The World Radiocommunication Conference reviews and revises the Radio Regulations, the international treaty governing the use of the radiofrequency spectrum and the geostationary-satellite and non-geostationary-satellite orbits. Defence regulates the exports of goods and technology listed in the Defence and Strategic Goods List (DSGL), including goods and technology for launch into space. Where such goods or technology are launched from Australia with the intention that they will land in a foreign country, or are sent overseas for launch, an export permit will be required from Defence Export Controls.
Department of Foreign Affairs and Trade	DFAT was part of the Australian delegations to UNCOPUOS and its subcommittees. DFAT is also working with the Agency to implement the UNCOPUOS Guidelines for the Long-term Sustainability of Outer Space Activities.
Department of Infrastructure, Transport, Regional Development and Communications	<u>International Radiocommunications</u> DITRDC leads Australia's engagement in key policy making international radio-communications 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. In October/ November 2019, the Australian delegation to the ITU's World Radiocommunication Conference 2019 (WRC-19) negotiated with more than 3,000 international representatives on around 50 technical and regulatory issues. Australia played a significant role on several agenda items, including the development of a new regulatory regime for large satellite constellations and establishing the agenda for the next WRC in 2023. Other key issues dealt with at WRC-19 included:

Organisation	Summary of activity
	• revised satellite coordination procedures for non-geostationary orbit satellites and geostationary satellites • improved arrangements for Wi-Fi on ships, aeroplanes and trains using Earth Stations in Motion (ESIM) communicating with geostationary satellites; • additional spectrum for 5G mobile broadband services; • additional satellite system for the Global Maritime Distress and Safety System (GMDSS); • regulation of and spectrum allocation to short duration mission satellites. Australia's participation at WRC-19 was a success, with outcomes on all issues under consideration aligning with the Australian objectives and negotiating mandate. <u>Universal Service Guarantee</u> DITRDC is also responsible for the Government's Universal Service Guarantee (USG) to provide access to broadband as well as voice services. The USG is underpinned by the statutory infrastructure provider (SIP) laws, which take effect on 1 July 2020. These laws establish a default role for NBN Co to be the SIP for Australia. Other carriers will also be SIPs where, for example, they have been contracted to service an area such as a new development. SIPs must connect premises to their networks on reasonable request from a retail provider, and must supply wholesale services that allow retail providers to supply retail broadband services with peak download speeds of at least 25 Mbps and peak upload speeds of at least 5 Mbps. On fixed-line and fixed wireless networks the wholesale services SIPs supply must also be able to support retail voice services. While giving preference to the delivery of services by fixed line and fixed wireless infrastructure, the SIP regime does include the provision of services by satellite where appropriate. The ACMA maintains a register of SIPs and their service areas. The Minister for Communications, Cyber Safety and the Arts can also make standards, rules and benchmarks, with which SIPs must comply. The USG retains the Universal Service Obligation to ensure voice services continue to be available from Telstra where they cannot be supported by the NBN, particularly in NBN Co's satellite footprint. The Government is committed to continue to work with consumers and industry to identify better ways to deliver the USG over time. As part of this work, DITRDC will continue to monitor and assess the ability of new space technologies to deliver quality telecommunications services in a more cost-effective way that can meet consumer needs. <u>Civil Aviation Safety Regulations</u> CASA manages compliance with the Civil Aviation Safety Regulations 1998, which includes air risk regulatory responsibility for small model rockets, model rockets and amateur rockets. CASA's regulatory responsibility for air risk also extends to high power rockets and launches of space objects, but subject to the Agency assessing an application for, and granting, a launch permit for those latter two

Organisation	Summary of activity
	activities. CASA collaborates with stakeholders to ensure that high altitude aviation activities do not unduly impact the safety of airspace users. The OAR within CASA assesses Airspace Change Proposals for rocketry activities to determine the appropriate airspace solutions to mitigate the risks to other airspace users. CASA contributes, as required, to assist the Agency in implementing the relevant provisions of the <i>Space (Launches and Returns) Act 2018</i>, which came into force on 31 August 2019 <u>Global Maritime Distress and Safety System (GMDSS)</u> In accordance with Chapter V of SOLAS (International Convention for the Safety of Life at Sea, 1974, as amended), Australia as a Contracting government provides navigational warnings (Regulation 4), meteorological services and warnings (Regulation 5) and search and rescue services (Regulation 7). AMSA provides Australia's SAR service to anyone in distress, no matter where they are in the Australian Search and Rescue Region (SRR). This is a statutory function under the Australian Maritime Safety Authority Act 1990, and is provided for vessels at sea and aircraft. Inmarsat and Iridium provide Australia's satellite-based GMDSS services.
Department of Home Affairs	Critical infrastructure is increasingly interconnected and interdependent, delivering efficiencies and economic benefits to operations. However, connectivity without proper safeguards creates vulnerabilities that can deliberately or inadvertently cause disruption that could result in cascading consequences across our economy, security and sovereignty. Home Affairs is working with industry to introduce an enhanced regulatory framework, building on existing requirements under the <i>Security of Critical Infrastructure Act 2018</i> (the Act). The primary objective of the proposed enhanced framework is to protect Australia's critical infrastructure from all hazards, including the dynamic and potentially catastrophic cascading threats enabled by cyber-attacks. The enhanced framework outlines a need for an uplift in security and resilience in all critical infrastructure sectors, combined with better identification and sharing of threats in order to make Australia's critical infrastructure – whether industry or government owned and operated – more resilient and secure. This approach will prioritise acting ahead of an incident wherever possible. Government has agreed that the proposed enhanced framework will apply to an expanded set of critical infrastructure sectors, comprising of three key elements: 1. Positive Security Obligation, including: a. set and enforced baseline protections against all hazards for critical infrastructure and systems, implemented through sector-specific standards proportionate to risk. 2. Enhanced cyber security obligations that establish: a. the ability for Government to request information to contribute to a near real-time national threat picture; b. owner and operator participation in preparatory activities with Government; and

Organisation	Summary of activity
	c. the co-development of a scenario based ‘playbook’ that sets out response arrangements. 3. Government assistance for entities that are the target or victim of a cyber-attack, through the establishment of a Government capability and authorities to disrupt and respond to threats in an emergency. 4. These three initiatives will be underpinned by enhancements to Government’s existing education, communication and engagement activities, under a refreshed Critical Infrastructure Resilience Strategy. This will include a range of activities that will improve our collective understanding of risk within and across sectors.
Geoscience Australia	GA is appointed as a legal metrology authority under the <i>National Measurement Act (1960)</i> to provide legal chains of traceability for satellite-derived positions of GNSS tracking stations.

High Power Rocket Rules 2019

The Space (Launches and Returns) Act 2018 includes the regulation of the launch of high power rockets in Australia. The *Space (Launches and Returns) (High Power Rocket) Rules 2019* (High Power Rocket Rules) define the characteristics of a high power rockets and articulate the specific requirements for the permit.

During the review of the Space Activities Act 1998, it was noted that certain activities presented a higher risk profile which would be better suited to evaluation under the Flight Safety Code and the application of insurance requirements. The High Power Rocket Rules seek to ensure that a reasonable balance is achieved between industry participation and the safety of higher risk rocket activities whose altitude does not exceed 100km above mean sea level, including the risk of damage to persons or property.

The High Power Rocket Rules introduced a new definition for a high power rocket. The definition proposes both an impulse and a complexity characteristic to distinguish these higher risk activities from model rocket activity in Australia. CASA has prepared consequential amendments, expected to be made in December 2020, to clarify the operation of the Civil Aviation Safety Regulations 1998 to align with the Agency’s regulatory responsibilities for High Power Rockets and space objects.

Reform of the Radiocommunications Act 1992

Following the 2015 Spectrum Review, the Government announced that it would reform the spectrum legislative framework. The objective of the proposed reforms is to meet the current and future demands of spectrum users by streamlining the current arrangements, removing regulatory barriers to innovation, and promoting the efficient use of spectrum. In 2019-20, public consultation commenced on an exposure draft of the *Radiocommunications Legislation Amendment (Reform and Modernisation) Bill*.

Legislation will be introduced into Parliament in the second half of 2020. Implementation and transition to the amended framework, if the legislation is passed, will then take place over a number of months and is expected to involve ongoing consultation with stakeholders where appropriate.

DITRDC recognises the importance of space research activities and the protection from interference that these activities require. In developing the proposed draft legislation, DITRDC has considered input from the space industry, in order to provide the flexibility and support the industry needs.

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 2019-2028*, 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.

In 2020, news article related to the Agency were viewed 76,931,340 times. This number is over three times the Australian population, meaning that some Australians viewed Agency related content multiple times over the course of the reporting year.

Graduates at DISER commenced a three month major project to develop the Agency's inspiration plan to support STEM take-up and inspire a nation. This is due to be submitted at the end of 2020.

Case study: 50th anniversary of the Apollo 11 Moon landing (joint Agency/CSIRO)



Figure 16 – 50th anniversary celebrations at Questacon, Parkes NSW, and Geoscience Australia

On 21 July 1969 humankind made ‘one giant leap’ by taking its first steps on the Moon with the Apollo 11 mission. Australia played an important role in helping NASA share the technological feat with 600 million people around the world, cementing our nation's place in one of humanity's greatest achievements.

TV signals from the Moon were received by NASA's tracking stations at Goldstone in California and Honeysuckle Creek near Canberra in Australia, as well as CSIRO's Parkes radio telescope. Honeysuckle Creek tracking station brought the world Neil Armstrong's first footstep on the Moon. Eight minutes and 51 seconds into the broadcast the signals coming from Parkes took over and provided coverage for the next two-and-a-half-hours.

The Agency joined with Questacon and CSIRO for the promotion of the Apollo 11 50th anniversary in July 2019, with events and activities to honour the Australians who took part, highlight the current activities of the local space sector, and inspire future generations of STEM students.

CSIRO, Australia's national science agency, sponsored Apollo 11 exhibitions at Questacon and the Powerhouse Museum, Sydney, and created an immersive virtual reality experience at the CSIRO Discovery Centre in Canberra. It collaborated with GA on the Canberra ‘Moon Rock’ trail and developed a website [‘Australia and](#)

[Apollo 11](#)’ featuring historical information, a national event calendar, and resources for students and media. CSIRO also donated the only official copy of the Apollo 11 Moon landing footage held outside the US to the National Film and Sound Archive

The Agency participated in a wide range of commemorative events, commencing with a series of tweets presenting 50 lunar facts in 50 days, culminating on the anniversary date of the lunar landing. Across the month of July, the Agency was represented at the US Embassy’s 4th of July celebrations at Questacon, at Stargazing Live on the ABC, dozens of ABC Radio interviews, a NASA led panel at ANU, the launch of a Moon rock display at GA, a commemoration unveiling a new interpretive artwork at the site of the former Honeysuckle Creek Tracking Station in Namadgi National Park, and the CSIRO open days at Parkes and CDSCC, where the Honeysuckle Creek antenna now resides.

The open days at the CDSCC and the Parkes radio telescope were the highlights of the anniversary campaign. Together, these events attracted 24,000 people including the US Ambassador to Australia, the Deputy Prime Minister and other key stakeholders.

CSIRO worked closely with the Royal Australian Mint on the packaging and promotion of commemorative coins, while the Agency produced a special commemorative patch recognising both the Parkes radio telescope and the Honeysuckle Creek antenna.

The Agency monitors the cumulative audience reach, through media, of Agency activities. Coverage of the 50th anniversary of the Apollo 11 Moon landing particularly boosted this reach in July, as can be seen from the graph below, outlining the volume against audience from 1 June to end July 2019. The 50th Anniversary of the Apollo 11 Moon landing had a number of keynote events and associated media resulting in 760 media items in June-July, with over 19.3 million audience cumulative reach.



Figure 17 – Cumulative audience potential reach of the 50th Anniversary coverage

Volume vs Audience. Source: Media Portal, iSentia.

CSIRO reached a cumulative audience of 56 million people in Australia alone, working with Australia’s leading metropolitan and regional media groups. It also hosted a media briefing on Apollo 11 and the future of Australia’s space industry with the Australian Science Media Centre.

Agency Activities

Communications market research

The Agency conducted market research throughout February and March 2020 to inform its communication activities. The research included engagement with current industry stakeholders and the community, including upper high school students, teachers and parents. A total of 1,830 people participated.

Findings included:

- Industry stakeholders – positive engagement, value events, face to face meetings and email communication. Further information is required on programs, grants and how to contact the Agency.
- Community (general) – there is low awareness of the Agency, the impact on the emerging space economy, current and future jobs, and on how space improves the quality of our everyday lives.

These findings have informed the development of a communication strategy to raise awareness and understanding among the Australian community about the importance of the space sector to the Australian economy and its potential benefits to Australians. This will include a campaign on how people are working in space today (real jobs) and a website to be the repository of information.

New social media accounts

The Agency launched two new social media sites in 2019-20 to help reach and connect with new audiences. In October 2019, it established an official YouTube channel, with its Facebook page officially launched in April 2020. Establishing these sites helps the Agency align with market research to increase awareness of the Australian space sector and the Agency, while also enabling it to share an exciting range of space related content including educational resources and activities.

The launch of the page was supported by a Facebook competition to win Agency merchandise. The competition reached more than 9,000 people and generated more than 200 entries. Promotion of both the page launch and competition in the fortnightly Agency newsletter resulted in a large increase in opens, clicks and number of subscribers.

A refreshed website for the Agency

Working with the DISER's Digital team, at the end of June 2020 the Agency launched a refreshed website for space.gov.au to enhance user experience, and deliver information that stakeholders want to access on our home page. Informed by the market research conducted in February and March, new content was created, including Agency funding and programs and inspiring the next generation with careers information, along with showcasing aspirational people working in space. As a result, the following quarter (May–July 2020) had 28,362 page views on the Agency's landing page, with the *Australian Civil Space Strategy 2019-2028*, careers and ISI grants the next highest visited pages.

World Space Week

World Space Week ran from 4-10 October 2019, with a theme 'The Moon: Gateway to the Stars'. The Agency shared a set of Moon facts on Twitter and also amplified the activities of other organisations and events.

NASA and Australian Government: Moon on to Mars (M2M) initiative

The Prime Minister's announcement of Australia's intention to join NASA's M2M program spearheaded extensive media and social media coverage. Work commenced on M2M communication activities, including a

Moon to Mars communication plan, key messages and ongoing liaison with NASA's M2M Communication and Media Manager on potential joint communication initiatives.

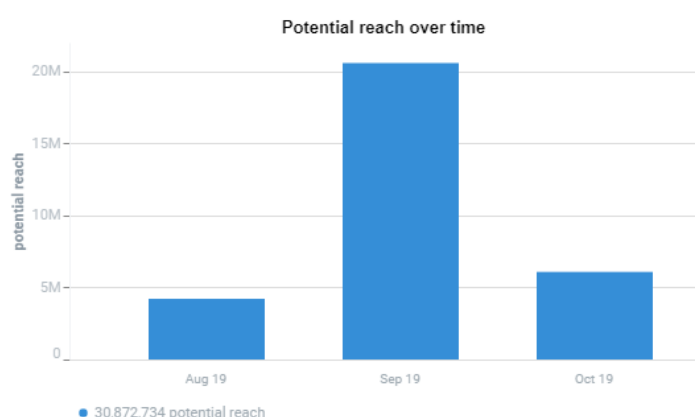


Figure 18 – Cumulative audience potential reach of the Agency and NASA announcement coverage.

The potential reach over the time of the NASA announcement saw 20 million of the 30 million views in this period. Source: Media Portal, iSentia.

A media campaign was conducted during February and March 2020 to promote the M2M face-to-face consultations and increase awareness of the initiative. The campaign included media interviews with the Deputy Head as spokesperson, social media, opinion editorials, newsletters, web and YouTube live. The campaign to end of April reached over 570,000 people, mainly through radio media reach.

A new case study video development is underway with four Australian space industry companies to show how SMEs are contributing to the space supply chain. These videos are anticipated to be in market in September 2020, due to restrictions on company operations and travel as a result of COVID-19.

Video messages

The Agency developed a video series that shares the critical role that space technologies plays in the lives of everyday Australians. Two videos were published in October sharing stories on how space helps 'People' and 'Farmers'. In November and December, videos covering 'Small Business' and 'Industry/manufacturing' were released, together with an overall 'Brand' video, which is a compilation of the four. Published on the Agency's new [YouTube Channel](#) the videos were also released on Twitter and LinkedIn.

Australian Space Agency HQ opening

On 19 February 2020, the Prime Minister officially opened the Agency's new home in Adelaide with the Minister for Industry, Science and Technology and Premier for South Australia.

The media coverage from 17-23 February had a potential cumulative reach of just over eight million with the largest reach being Channel 9 with 1.3 million.

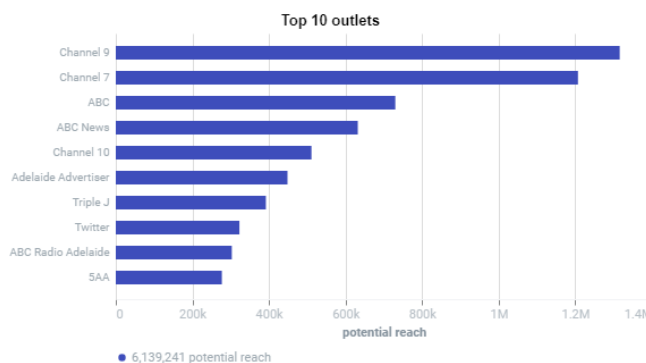


Figure 19 – Media outcomes – key words and media type of coverage for headquarters.

The opening was the catalyst for a series of events in Adelaide the week of 18 February, including: the signing of a joint SOI with ASI to consider a joint activity on the ISS; the second meeting of the Agency Advisory Board; a VIP Preview of HQ and the Space Discovery Centre area with over 200 stakeholders; a South Australian Space State Dinner with over 450 stakeholders and the 9th Australian Space Forum with 1000 participants.

National Careers Week and Reconciliation Week digital campaigns

Australia's National Careers Week ran from 19-24 May 2020. During the week, the Agency ran a digital campaign highlighting space careers and the various job opportunities in the industry. The campaign showcased jobs across engineering, computer science, space law, space medicine and stakeholder engagement by profiling real people working in the space industry.



Figure 20 – Social media examples for careers week

Reconciliation Week took place from 27 May – 3 June 2020. As part of this week, the Agency produced a 'Hidden in the Stars' content series, which highlighted the connection between the Agency's brand and Australian Indigenous culture. The campaign involved the Agency sharing several Indigenous constellations that sit within its logo and the story behind each. The Agency also engaged Aboriginal astrophysicist Kristen Banks to prepare a web article on Indigenous Astronomy. The campaign was a great opportunity to not only highlight this connection to our brand, but also educate our audiences too.

The results were very successful for a purely organic campaign, especially as the Agency's Facebook page had only been operational for just two months. The campaign generated more than 58,000 Twitter impressions and a Facebook reach of 10,700 with 1,128 engagements.

Australian Space Discovery Centre

The \$6.0 million Australian Space Discovery Centre (ASDC) was funded through the Adelaide City Deal, in conjunction with the development of the Agency Headquarters and the Mission Control Centre, the latter funded through the SIF. Funding for the ASDC was originally targeted for 2021-22, however, provisions were made to enable the project to commence in 2019-20.

The Implementation Plan for the Adelaide City Deal, led by the DITRDC was launched in late October.

Stakeholder workshops were held in Adelaide and Canberra to inform the development of a concept design for the ground floor of the McEwin Building, and a decision on the final concept was made in December 2019.

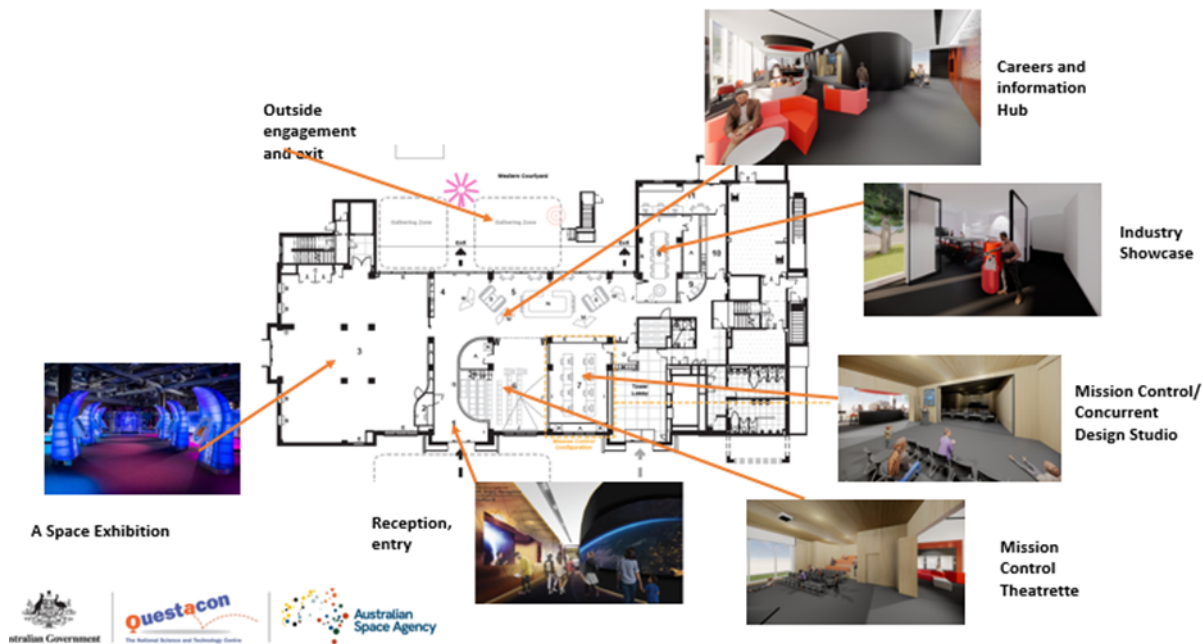


Figure 21 – Functional areas of the Ground floor of McEwin Building

The Agency has partnered with Questacon, the National Science and Technology Centre, to develop the concept design and educational content of the facility. The full design of the ASDC was finalised and tender documentation published on 4 June for the delivery of the Discovery Centre fitout. Construction commenced in September 2020.

The Parliamentary Standing Committee on Public Works confirmed the fitout of the Discovery Centre was medium works with notification received on 18 June 2020.



Figure 22 – Example of design of the Careers Hub within the Discovery Centre

Work is also progressing with Saber Astronautics, the successful SIF grantee who will deliver on the Mission Control Centre (MCC). As the MCC is situated within the Discovery Centre, there are close synergies to communicating the work of the MCC to members of the public.

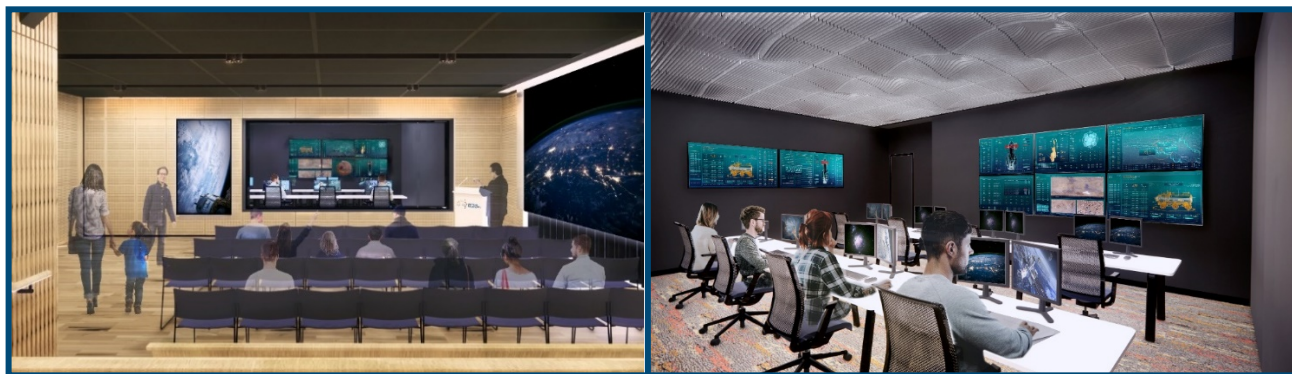


Figure 23 – Artist impression of mission control from the Australian Space Discovery Centre

Events

Notable events that the Agency has supported in 2019-20 are outlined below. These are representative of activities and do not represent an exhaustive list. From March 2020, events were either cancelled or conducted in a virtual setting.

Table 14 – Agency events 2019-2020

Event	Date	Comment
YMCA Canberra Space Squad	12 July	Presented to 30 students on a school holiday program.
Australian Youth Aerospace Association	16-19 July	Presenting to over 300 students and young professionals.
Various Apollo 50th Anniversary events	July	Saw more than 25,500 members of the public at over 10 events across the country
Science Alive! Adelaide	3 August	More than 18,000 members of the public over two days at the Adelaide Showgrounds
Australian American Leadership Dialogue	8 August	Led a roundtable on Australia-US collaboration in the space industry
Group of Eight	13 August	Addressed representatives of participating universities on how they can help the Agency achieve its goals
Governor-General's Design Challenge 2019	16 August	Engaged with and spoke to 120 students about careers in space and the importance of STEM
AWS Student Track Day	21 August	Presented to 100 students about space careers and the role of the Agency
SA Space Forum and Australian Space Research Conference	30 Sept to 2 Oct.	Keynote speech, exhibit booth and presented to academics, students and industry professionals
D61+ Live	3 October	Panel on the future of the space industry to 100 people
UNAA Space Summit	4 October	Partnered with the United Nations Association of Australia to support this event and presented to 100 young people on space careers
70 th International Aeronautical Congress	21-25 October	Hosted states, territories and businesses from Australia to connect with international partners and agencies

Event	Date	Comment
GEO Week 2019	4 – 8 November	Co-sponsored the first Industry Track component and engaged with more than a thousand attendees from the Agency's booth.
Royal Society of NSW Annual Forum	7 November	Presented at Government House in Sydney on the growing space industry in Australia and the Agency's progress so far.
Tectonic: Shaping Australia's AI Future	15 November	Addressed participants at the Minister's inaugural artificial intelligence summit on how the space industry is utilising AI.
International Space University (ISU) Executive Course	18-22 November	Three Agency representatives participated in the first course with a total of 20 participants in Canberra. This course outlines the key areas of space activity for those new to the industry. The Agency sponsored this course.
SouthStart	21 November	The Head of Agency provided a keynote address at this technology conference and participated in a forum on space entrepreneurship
CEDA – Australia's race for space	22 November	The Head of the Agency delivered a keynote address as part of CEDA's future of work series.
26th Asia-Pacific Regional Space Agency Forum (APRSAF)	26 – 29 November	Represented Australia on multiple unilateral panels regarding space policy and practice. The Deputy Head of the Agency represented the Agency.
10th Asia Oceania Meteorological Satellite Users Conference	4 December	Provided the opening address to 100 satellite data users from meteorological agencies and research groups across Asia-Oceania.
International Space University's 2020 Program Opening Ceremony	5 January	Welcomed students from all over the world to the commencement of the Southern Hemisphere Space Studies Program.
Australian Space Design Competition	18-19 January	During the school holidays, the Agency participated in a number of school space-themed camps, including the 14th Annual Australian Space Design Competition Finals at UQ.
Agency HQ and Australian Space Discovery Centre VIP Preview	18 February	The Agency organised and hosted a VIP preview of its new Adelaide headquarters and the site for the future Space Discovery Centre. The event welcomed more than 200 stakeholders from across the country. The Minister for Industry, Science and Technology, the Hon Karen Andrews, and Agency Deputy Head Anthony Murfett both gave welcoming speeches, which was followed by networking and tours of the site.
9 th Australian Space Forum	19 February	The Agency sponsored this key industry event, which included a keynote address by our Agency Head as well as a panel discussion facilitated by the Agency's Deputy Head on space education and inspiring the next generation. More than 1000 people attended this event.
CEDA Trustee boardroom briefing – Innovation in Space	16 March	The Head of Agency presented at this event, covering the Agency's strategy and activities to transform and grow the space industry and our support of NASA's M2M program.

Sponsorships

In its second year of operation, the Agency commenced sponsorships of organisations and activities that align with the Agency's Inspire pillar, particularly in the support of STEM education. This sponsorship may be through funding or in-kind support.

Table 15 – Agency sponsorships

Organisation/Activity	Comment
Deadly Science 'Junior Scientist Awards'	Engagement with students and schools in remote communities via individual awards, telescopes, books, Agency merchandise and opportunities for Agency representative to talk to students.
The Frontier Development Lab Disaster Prevention Challenge	Agency co-branding of the FDL Wildfire Challenge Research Sprint.
Impact Tech Ventures - Australian Technologies Competition	Contributed funding to support new Space category in the competition (part of larger Department sponsorship of this activity), and provided feedback on applications.
One Giant Leap - JAXA Kibo-ABC program	Sponsored One Giant Leap to act as the Australian point of coordination for JAXA's Kibo-ABC program.
Aviation/Aerospace Australia	Women in A/AA careers campaign and SPACE MISSION 2040
2020 National Awareness Raising Women in STEM initiative (NARI)	Partnering with the Office of the Women in STEM Ambassador by sponsoring one of 12 characters that highlight careers in STEM
Gravity Challenge 2.0	Program supporter, developing solutions to real industry, social and environmental problems using space data and capabilities. The Agency provided technical review of proposals.
ALIA National Simultaneous Storytime 2021	National Simultaneous Storytime is held annually by the Australian Library and Information Association (ALIA). Along with Scholastic, the Australian Space Agency and the Office of the Chief the NSS 2021, Give me some space will be read by astronauts on the ISS.
Australian Space Research Conference	Significant program targeted at women space science leaders, university students and school students.
OSCAR 5 50 th Anniversary	Recognition of a significant historical milestone for an Australia satellite developed by students.
10 th Australian Space Forum	Major conference for the Australian space industry.
WA-UK Space Vector Engagement Forums for SMEs	Engagement seminars for small and medium enterprises with interests in the UK and WA.
Impact Tech Ventures Technologies Competition	Competition supporting small and medium enterprises.

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

Table 16 – SCC inspirational activities

Organisation	Summary of activity
Bureau of Meteorology	The Bureau is a member of CSIRO's STEM Professional in Schools program. Bureau alumni on the Superstars of STEM program include Dr Sue Barrell and Dr Linden Ashcroft. The Bureau of Meteorology Space Weather Services (SWS) regularly hosts university level interns to work on space science projects.
CSIRO	CSIRO has carried out numerous education and outreach activities related to space throughout 2019-20. In particular: • The visitors' centres at the Parkes and Compact Array radio telescopes and at CDSCC together attracted over 155,000 public visitors to their sites, inspiring students and families to understand astronomy and space sciences. This is despite local bushfires in the ACT that closed the CDSCC centre 29 Jan – 10 Feb 2020 and closure of all the centres from March 2020 due to COVID-19. • Regular space-related stories are published in CSIRO's 'Double Helix' magazine for children aged 8-14 years. • CSIRO worked closely with the Agency, US Embassy and other partners to celebrate the 50th anniversary of the Apollo 11 Moon landing in July 2019. As part of these celebrations CSIRO sponsored exhibitions at the Powerhouse Museum in Sydney, and Questacon, Canberra, while commemorative events at Parkes and CDSCC over the Apollo 11 50th anniversary weekend together attracted more than 20,000 visitors. CSIRO also donated the only copy of the restored television footage of the Apollo 11 Moon landing to reside outside the US (which had been presented to CSIRO) to the National Film and Sound Archive. Further details on CSIRO and Agency Apollo 11 anniversary activities can be found in the case study enclosed. • CSIRO supported the 8th (September 2019) and 9th (February 2020) Australian Space Forums, including the Student Passport sessions. CSIRO also supported the July 2019 Aerospace Futures conference. • CSIRO supported the United Nations Association of Australia's New Space summit, in October 2019, focused on inspiring and outreach to young entrepreneurs in the space industry. • CSIRO participated in a 2019 National Science Week event, 'Australian Space Frontiers', at the Powerhouse Museum. • As part of CSIRO's D61+ LIVE event, in October 2019, CSIRO hosted a panel discussion on space that included representatives from the Agency, CSIRO and small businesses working in the space sector. • CSIRO participated in KPMG '30 Voices' panel event on space data, which followed CSIRO's contribution to the release of the '30 Voices on 2030: The Future of Space' document.

Organisation	Summary of activity
	• CSIRO sponsored The Economist's Space Forum in Sydney, which was unfortunately cancelled due to COVID-19. • CSIRO's educational program, PULSE@Parkes, designed to give school students the opportunity to observe with the Parkes radio telescope, saw more than 160 students and 25 teachers from 25 schools take part.
Department of Defence	Defence continued to implement the 2019 Defence Industry Skilling and STEM Strategy. A skilled workforce for defence industry is critical with the increasingly vital role industry will play in the modernisation of Australia's Defence capability. The measures outlined in the Strategy include a focus on increasing student interest in STEM related career pathways and therefore may have beneficial spill over effects for parallel industries, including Australia's space industry.

Appendices

Appendix 1 - Australian Government departmental functions

Australian Antarctic Division (AAD)

The AAD is part of the Department of Agriculture, Water and the Environment (DAWE). The AAD leads, coordinates and delivers the Australian Antarctic Program. It trains and equips all Australian Antarctic expeditioners and its staff undertake operational, medical, science, policy and support functions. The AAD leads the Australian Government's scientific program in Antarctica. Its research addresses critical issues including: climate change, the human footprint in Antarctica, the conservation of Antarctic and Southern Ocean wildlife and the sustainable management of Southern Ocean fisheries in the face of increasing demands for fish and krill caused by human population growth.

Key space-related activities

The AAD's Frontier Science projects include research in astronomy, geosciences and space weather. The use of the Antarctic as a space analogue for human biology and medicine research has recently become of interest to the international polar medicine community.

The [AAD](#) is a member of the SCC.

Attorney General's Department (AGD)

The AGD 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.

Australian Space Agency

The Agency is a non-statutory, whole-of-government entity located within the DISER 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 [Agency](#) is the Chair of the SCC and a member of the Space Cross-Sector Interest Group.

Australian Communications and Media Authority (ACMA)

The ACMA is a statutory authority responsible for the regulation of radio communications services, including the radiocommunications licensing of space-based communications systems in Australia and International Telecommunications Union (ITU) satellite filing coordination.

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. ACMA leads the Australian Radiocommunications Study Groups (ARSGs).

Australian Trade and Investment Commission (Austrade)

The 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 Sector Centre of Excellence for Defence, Advanced Manufacturing and Space Team manage Austrade's space initiatives and engagement with national and international clients and stakeholders.

[Austrade](#) is a member of the SCC.

Bureau of Meteorology

The Bureau of Meteorology is Australia's national weather, climate and water information agency. The Bureau relies on high quality, real time space-based and in-situ observations to deliver forecasts, warnings, analyses and advice covering Australia's atmosphere, water, ocean, and space environments. The Bureau is also responsible for sustaining the intergovernmental relationships, including with the World Meteorological Organization (WMO), essential to the global exchange of 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 and Co-chair of the Australian Government Earth Observations from Space Working Group (AGEOSWG). The Bureau is also represented on the Australian Academy of Science National Committee for Space and Radio Science.

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

CSIRO is Australia's national science agency, 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; and 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.

The organisation employs approximately 350 staff involved in space activities. CSIRO has developed extensive capability in space-related areas that include Earth observation, spacecraft tracking and communications, space technologies, 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 CDSCC on behalf of NASA, the New Norcia station for ESA, and will add Australian science access to the NovaSAR-1 satellite in 2020-21.

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

- Earth observation from space; this includes: joint responsibility for national EO capabilities with the Bureau of Meteorology and GA, development of advanced EO processing methods, applications and services, partnership in the NovaSAR-1 satellite, EO satellite data calibration/validation, fostering collaborative international scientific relationships, and providing national representation on international organisations such as CEOS and GEO.
- Radio astronomy, including operation of the Australian Square Kilometre Array Pathfinder telescope, the Parkes radio telescope and the Australia Telescope Compact Array, preparations for the Square Kilometre Array, and development of associated big data management infrastructure and expertise (including operation of the Pawsey Supercomputing Centre).
- Spacecraft tracking and communications, including 'Follow the Sun' operation of the Deep Space Network, management of key treaty-level agreements with NASA, and managing ESA's New Norcia tracking station.
- Development of new space technologies and capabilities through the CSIRO Space Research Program and the CSIRO Space Technology Future Science Platform.

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.

[CSIRO](#) is a member of the SCC.

Further information on the CSIRO Centre for Earth Observation can be found through this [link](#).

Further information on the [Space Technology Future Science Platform](#) can be found through its website.

Department of Defence (Defence)

The mission of the Australian Defence Force is to defend Australia and its national interests. Space is a critical capability for the Australian Defence Force (ADF) 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 these space capabilities that play a vital role in all ADF and coalition operations.

Key space-related activities

Defence space-related activities include: contributing to space domain awareness; engaging with international partners on the military use of space; managing radiofrequency spectrum access to secure radiofrequency spectrum resources for Defence satellite networks; space-based imagery collection; space R&D programs.

Under Defence's Sovereign Industrial Capability Priorities, greater support is being delivered to the space sector. Surveillance and intelligence data collection; analysis dissemination and complex systems integration, which includes developing and upgrading sensors and software; and space domain awareness systems to enhance data collection, analysis or dissemination 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, the Earth Observation Working Group, the National Security Space Interdepartmental Committee, Critical Infrastructure-Systems of National Significance (CI-SONS) Space Working Group and the Space CSIG. Defence is represented on the Agency's Technical Advisory Group for Communications and Earth Observation and the SmartSat CRC Defence and National Security End User Advisory Board.

Department of Foreign Affairs and Trade (DFAT)

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 on space security, peaceful uses of space and development matters, multilateral and bilateral space-related agreements and commitments, space issues that affect bilateral and regional relationships, developmental applications of space-based capabilities 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. DFAT co-chairs with Defence the National Security Space Inter-Departmental Committee.

Department of Home Affairs (Home Affairs)

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 Critical Infrastructure Centre, 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.

Key space-related activities

The CIC manages national security risks from foreign involvement in Australia's critical infrastructure, including space-related infrastructure. 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 within the TISN and the PNT Working Group. Home Affairs is also a member of the National Security Space Inter-Departmental Committee and leads the Critical Infrastructure-Systems of National Significance (CI-SONS) Space Working Group.

Department of Finance (Finance)

The Department of 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.

[Finance](#) has observer status on the SCC.

Department of Industry, Science, Energy and Resources (DISER)

The Department of Industry, Innovation and Science was merged with the part of the Department of Environment and Energy in the Machinery of Government changes in 1 February 2020 to create the DISER.

The Agency is a non-statutory, whole-of-government entity located within the DISER as a separately branded function. The Secretary of DISER is the relevant Accountable Authority.

[DISER](#) provides policy advice on broader linkages between space and other industry sectors, such as defence and advanced manufacturing. The department has an ex-officio position on the Agency's Advisory Board and is a member of the SCC.

Department of Infrastructure, Transport, Regional Development and Communications (DITRDC)

The Department of Infrastructure, Transport, Regional Development and Cities was merged with the Department of Communications and the Arts in the Machinery of Government changes in 1 February 2020 to create the Department of Infrastructure, Transport Regional Development and Communications. DITRDC provides policy oversight of radiocommunications services and spectrum management (including satellite communication) in Australia. This includes supporting the Minister for Communications, Cyber Safety and the Arts to make policy and regulatory decisions to facilitate major spectrum allocations, and progressing reforms to the legislative framework for spectrum management. DITRDC also leads Australia's engagement in international forums on use of radiofrequency spectrum and satellite orbits, including the World Radiocommunication Conference (WRC).

DITRDC is responsible for the development of the Universal Service Guarantee (USG), which is the future arrangements for delivery of basic telecommunications services nationally, including use of space-based systems in rural and remote areas.

DITRDC is also 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.

DITRDC'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 DITRDC and its transport portfolio agencies: the Australian Maritime Safety Authority; the Civil Aviation Safety Authority, and Airservices Australia.

[DITRDC](#) is a member of the SCC. DITRDC and AMSA are members of the Position, Navigation and Timing Working Group (PNT-WG) chaired by GA. DITRDC also participates in the Australian Radiocommunications Study Groups (ARSGs) led by ACMA.

| Further information on communication services can be found at this [website](#).

Australian Maritime Safety Authority (AMSA)

AMSA is Australia's national maritime regulatory body. AMSA promotes the safety and protection of Australia's marine environment. AMSA provides the infrastructure for safety of navigation in Australian waters and uses satellite technology for land, aviation and maritime search and rescue, pollution surveillance, oil spill and disaster response, ship and navigation safety and ad-hoc imagery.

[AMSA](#) is a member of the Space Cross-Sectoral Interest Group (Space CSIG)

Civil Aviation Safety Authority (CASA)

CASA is Australia's aviation safety regulatory body that is responsible for the regulation of Australia's civil aviation safety and Australian-administered airspace.

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

[CASA](#) contributes, as required, to implementing relevant provisions of the amended *Space Activities Act*. CASA collaborates with the required stakeholders to ensure that all high-altitude aviation activities are conducted with the safety of aviation navigation as the highest consideration.

Airservices Australia (Airservices)

Airservices provides air navigation and radio telecommunication services, including air traffic management for civil aviation, from the surface to the limit of atmospheric flight. Airservices' facilitates tactical air space management during launch and recovery operations, Civil aviation is a significant user of space based technology and Airservices facilitates the use of Communication Navigation and Surveillance applications using space technology.

[Airservices](#) Australia is a member of the Position Navigation and Timing Working Group (PNT WG).

Department of the Prime Minister and Cabinet (PM&C)

The 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, and public service stewardship.

[PM&C](#) has observer status on the SCC.

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: building Australia's resource wealth; ensuring Australia's community safety; securing Australia's water resources; managing Australia's marine jurisdictions; providing fundamental geographic information, and 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 Digital Earth Australia. 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 Station Technical Team (ANGSTT). 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 Sectoral Interest Group.

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.

References

List of Figures

Figure 1 – Summary of the Australian Civil Space Strategy	8
Figure 2 – All staff at the Agency’s 5 December 2019 planning day, held at Geoscience Australia	9
Figure 3 – Agency Accomplishments for 2019-20	10
Figure 4 – Opening of the Agency Headquarters	12
Figure 5 – The Agency Advisory Board, meeting at Agency headquarters, February 2020	14
Figure 6 – Signing of ASI MOU at IAC 2019	19
Figure 7 – Booth at IAC	20
Figure 8 – Agency representation at UNCOPUOS	33
Figure 9 – Taskforce Summary results	35
Figure 10 – Indigenous artwork on satellite antenna	42
Figure 11 – NSW State Seasonal Update: July 2020 showing average parish-level farm dam extents 20/6- 19/07/2020	52
Figure 12 – Signing of memorandums of understanding with Tasmania and Western Australia	59
Figure 13 – Signing of statements of strategic intent (Maxar and Thales)	60
Figure 14 – Map of SIF projects	62
Figure 15 – M2 Mission, due to launch in 2021	66
Figure 17 – 50 th anniversary celebrations at Questacon, Parkes NSW, and Geoscience Australia	74
Figure 18 – Cumulative audience potential reach of the 50 th Anniversary coverage	75
Figure 20 – Cumulative audience potential reach of the Agency and NASA announcement coverage.	77
Figure 21 – Media outcomes – key words and media type of coverage for headquarters.	78
Figure 22 – Social media examples for careers week	78
Figure 24 – Functional areas of the Ground floor of McEwin Building	79
Figure 25 – Example of design of the Careers Hub within the Discovery Centre	79
Figure 26 – Artist impression of mission control from the Australian Space Discovery Centre	80

List of Tables

Table 1 – Progress against measures of success from 2018-19	18
Table 4 – SCC international engagement activities	24
Table 5 – SCC Communications technologies and services activities	36
Table 6 – SCC Space situational awareness and debris monitoring activities	42
Table 7 – SCC Position, navigation and timing activities	44
Table 8 – SCC Earth observation activities	46
Table 9 – SCC Research and development activities	52
Table 10 – SCC Robotics and automation activities	58
Table 11 – SCC Access to space activities	59
Table 12 – Summary of SIF Projects and Funding allocation	63
Table 13 – Summary of ISI Projects and Funding allocation	64
Table 14 – SCC National security activities	66
Table 15 – SCC Space regulation activities	70
Table 15 – Agency events 2019-2020	80
Table 17 – Agency sponsorships	82
Table 18 – SCC inspirational activities	83

List of acronyms

AAD	Australian Antarctic Division	APG23	Asia-Pacific Telecommunity Conference Preparatory Group for WRC-23
AARNet	Australian Academic and Research Network	AP-RARS	Asia-Pacific Regional ATOVS Retransmission Service
ABC	Australian Broadcasting Corporation	APRSAF	Asia-Pacific Regional Space Agency Forum
ACCESS	Australian Community Climate and Earth-System Simulator	APT	Asia-Pacific Telecommunity
ACFJ	Australia, Canada, France, Japan	ARSG	Australian Radiocommunications Study Group
ACMA	Australian Communications and Media Authority	AsA	Airservices Australia
ACT	Australian Capital Territory	ASBF	Alice Springs Ballooning Facility
ADF	Australian Defence Force	ASDAF	Australian Space Data Analysis Facility
ADS-B	Automatic Dependent Surveillance – Broadcast	ASDC	Australian Space Discovery Centre
ADS-C	Automatic Dependent Surveillance – Contract	ASDSS	Australian Defence Satellite Communications System
AGEOSWG	Australian Government Earth Observation from Space Working Group	ASKAP	Australian Square Kilometre Array Pathfinder
AFDRS	Australian Fire Danger Rating System	ASRC	Australian Space Research Conference
AGD	Attorney-General’s Department	ATNF	Australia Telescope National Facility
The Agency	Australian Space Agency	ATOVS	Advanced TIROS Operational Vertical Sounder (see TIROS)
AGO	Australian Geospatial-Intelligence Organisation	AusTender	Australian Government online tendering system
AGP	Asia-Pacific Telecommunity Conference Preparatory Group	Austrade	Australian Trade and Investment Commission
AHT-SDG	Ad Hoc Team on Sustainable Development Goals	AYAA	Australian Youth Aerospace Association
AI	Artificial Intelligence	Beidou	Global navigation system developed by China
AIS	Automatic Identification System	BMM	Buccaneer Main Mission
AmCham	American Chamber of Commerce in Australia	The Bureau	Bureau of Meteorology
AMOS	Advanced Maui Optical and Space Surveillance Technologies	C2G2	Combined Communications Gateway Geraldton
AMSA	Australian Maritime Safety Authority	C5	Critical Five
AMVs	Atmospheric Motion Vectors	CASA	Civil Aviation Safety Authority
ANGSTT	Geoscience Australia is a member of the Australian National Ground Segment Technical Team	CASR	Civil Aviation Safety Regulation
ANZSRICA	Australia New Zealand Science, Research and Innovation Cooperation Agreement	CASS	CSIRO Astronomy and Space Science
AOMSUC	Asia Oceania Meteorological Satellite Users Conference	CCEO	CSIRO Centre for Earth Observation
		CDIC	Centre for Defence Industry Capability

CDSCC	Canberra Deep Space Communication Complex	DHFCS	Defence High Frequency Communications System
CEOS	Committee on Earth Observation Satellites	DISER	Department of Industry, Science, Energy and Resources
CIC	Critical Infrastructure Centre	DITRDC	Department of Infrastructure, Transport, Regional Development and Communications
CIPMA	Critical infrastructure Program for Modelling and Analysis	DLR	Deutsches Zentrum für Luft- und Raumfahrt (German Aerospace Center)
CIR	Critical infrastructure Resilience	DMTC	Defence Materials Technology Centre
CNES	Centre National d'Etudes Spatiales (National Centre for Space Studies-French space agency)	DORIS	Doppler Orbitography and Radiopositioning Integrated by Satellite
CoE	Centre of Excellence	DSS	Deep Space Station
COPOUS	United Nations Committee on the Peaceful Uses of Outer Space	DST	Defence Science and Technology
COSMIC-2	Cosmic Observing System for Meteorology, Ionosphere and Climate-2	EM-Link	Emergency Management Link
COSPac	Climate and Oceans Support Program in the Pacific	EMSINA	Emergency Management Spatial Information Network Australia
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	EOA	Earth Observation Australia
CVQKD	Continuous Variable Quantum Key Distribution	EOS	Earth observation from space
CRC	Cooperative Research Centre	EM	Emergency management
CSIG	Cross Sectoral Interest Group	ERG	Expert Review Group
CSIRO	Commonwealth Scientific and Industrial Research Organisation	ESA	European Space Agency
CSpO	Combined Space Operations	ESIMS	Earth Stations in Motion
DAMS	Defence, Advanced Manufacturing and Space	EU	European Commission
DAWE	Department of Agriculture, Water and the Environment	EWS	Emergency Warning Service
DBNet	Direct Broadcast Network for Near Real-Time Relay of Low Earth Orbit Satellite Data	Five Eyes	Intelligence alliance between Australia, Canada, New Zealand, UK, USA
DEA	Digital Earth Australia	FSP	Future Science Platform
DEAfrica	Digital Earth Africa	FTE	Full-time Equivalent
DEC	Defence Export Controls	FY	Financial Year
DEE	Department of Environment and Energy	FYSO	Five Year Spectrum Outlook
Defence	Department of Defence	GA	Geoscience Australia
DFAT	Department of Foreign Affairs and Trade	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

GHRSSST	Group for High Resolution Sea Surface Temperature	ISWI	International Space Weather Initiative
GMDSS	Global Maritime Distress and Safety System	ITU	International Telecommunication Union
GNSS	Global Navigation Satellite System	ITU-R	ITU Radiocommunication Sector
GOES-R	Geostationary Operational Environmental Satellite-R series	IVS	International VLBI Service
GPM	Global Precipitation Measurement Mission	JAXA	Japan Aerospace Exploration Agency
GPS	Global Positioning System	JORN	Jindalee Operational Radar Network
GRALLE	Galileo-based Reliable Automatic and Low Latent EWS	JPL	Jet Propulsion Laboratory
GSO	Geosynchronous Orbit	Kibo-ABC	Asian Beneficial Collaboration through "Kibo" Utilisation
HF	High Frequency	Kibo-RPC	Kibo Robot Programming Challenge
Home Affairs	Department of Home Affairs	LGN	Landsat Ground Network
IAC	International Astronautical Congress	LEO	Low Earth Orbit
IAG	International Association for Geodesy	LEOSAR	Low-altitude Earth Orbit Search and Rescue
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities	LEOSAT	Low Earth Orbit Satellite
IC2N	International Small-Satellite Command and Control Network	LINZ	Land Information New Zealand
ICAO	International Civil Aviation Organization	LRIT	Long Range Identification and Tracking
ICG	International Committee on GNSS	LTS	Long-Term Sustainability
ICSU-WDS	International Science Council World Data System	M2M	Moon to Mars
IDS	International DORIS Service	MASTREP	Modernised Australian Ship Tracking and Reporting System
IGS	International GNSS Service	MDBA	Murray-Darling Basin Authority
ILRS	International Laser Ranging Service	MEOSAR	Medium-altitude Earth Orbit Search and Rescue
IMEWG	International Mars Exploration Working Group	MILAMOS	Manual on International Law Applicable to Military Uses of Outer Space
IMO	International Maritime Organisation	MCC	Mission Control Centre
IoT	Internet of Things	MOU	Memorandum of Understanding
IPT-SWeISS	WMO Inter-Programme Team on Space Weather Information, Systems and Services	MSI	Maritime Safety Information
ISECG	International Space Exploration Co-ordination Group	MTCR	Missile Technology Control Regime
ISES	International Space Environment Service	MWA	Murchison Widefield Array
ISI	International Space Investment initiative	NASA	National Aeronautics and Space Administration
ISRO	Indian Space Research Organisation	NavIC	Navigation with Indian Constellation
		NEA	Near Earth Asteroid
		NBN	NBN Co Limited
		NCI	National Computational Infrastructure
		NCRIS	National Collaborative Research Infrastructure Strategy

NGO	Non-Governmental Organisation	SIAA	Space Industry Association of Australia
NOAA	US National Oceanic and Atmospheric Administration	SIP	Statutory Infrastructure Provider
NPI	National Positioning Infrastructure	SIT	Strategic Implementation Team
NPIC	National Positioning Infrastructure Capability	SKA	Square Kilometre Array
NSAT	National Situational Awareness Tool	SLR	Satellite Laser Ranging
NSS IDC	National Security Space Inter-Departmental Committee	SOLAS	International Convention for the Safety of Life at Sea
NSW	New South Wales	SOI	Statement of Strategic Intent
NT	Northern Territory	SSA	Space Situational Awareness
NWP	Numerical Weather Prediction	SSI	Statement of Strategic Intent and Cooperation
NZ	New Zealand	SST-VC	CEOS Sea Surface Temperature Virtual Constellation
OAR	Office of Airspace Regulation	STaR	Science, Technology and Research
ODC	Open Data Cube	STSC	State and Territory Space Coordination
OOSA	UN Office of Outer Space Affairs	STEM	Science, Technology, Engineering and Mathematics
OPP	Overseas Payload Permit	SuomiNPP	Suomi National Polar-orbiting Partnership satellite
PM&C	Department of the Prime Minister and Cabinet	SWS	Space Weather Service
PNT	Position, Navigation and Timing	TARS	Turn-Around Ranging Station
PNT-WG	PNT Working Group	TAS	Tasmania
QLD	Queensland	TCBM	Transparency and Confidence Building Measures
QZSS	Quasi-Zenith Satellite System	TERN	Terrestrial Ecosystem Research Network
RAAF	Royal Australian Air Force	TIROS	Television Infrared Observation Satellite
R&D	Research and Development	TISN	Trusted Information Sharing Network for Critical Infrastructure Resilience
RFI	Request for Information	UAE	United Arab Emirates
RIMPAC	Rim of the Pacific	UK	United Kingdom
RPAS	Remotely Piloted Aircraft Systems	UN	United Nations
SAR	Synthetic Aperture Radar	UNGGIM	The UN Committee of Experts on Global Geospatial Information Management
SARP	Standards and Recommended Practices	UNSW	University of New South Wales
S&T	Science and Technology; also State and Territory	UNOOSA	United Nations Office for Outer Space Affairs
SATCOM	Satellite Communications	US	United States
SBAS	Satellite-based Augmentation System	USG	Universal Service Guarantee
SBAS-IWG	SBAS Interoperability Working Group	USGS	US Geological Survey
SBS	Special Broadcasting Service	USO	Universal Service Obligation
SCC	Australian Government Space Coordination Committee		
SDA	Space Domain Awareness		
SG-RFC	World Meteorological Organisation Steering Group on Radio Frequency Coordination		

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