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Committee Secretary  
Standing Committee on Industry, Innovation, Science and Resources  
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Parliament House  
Canberra ACT 2600  
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**RE: Submission to the Inquiry into Developing Australia's Space Industry**

## Purpose

The purpose of our submission is to provide a recommendation to the House of Representatives Standing Committee on Industry, Innovation, Science and Resources inquiry into developing Australia's space industry, with specific comment addressing the following Terms of Reference:

1. Development of space satellites, technology and equipment;
2. The international collaboration, engagement and missions;
3. The commercialisation of research and development, including flow-on benefits to other industry sectors; and
4. Future research capacity, workforce development and job creation.

## Background

**FrontierSI** is a collaborative research and innovation not-for-profit social enterprise that operates across Australia and New Zealand. Using our deep expertise in spatial mapping, infrastructures, positioning, geodesy, analytics, and standards, we drive innovation through collaboration. Our partnership comprises private sector companies, universities, and federal and state government departments, and delivers significant benefits to governments, industry and the community. Our mission is to provide the connection point, partnerships, trusted collaborative model and expertise to provide high impact solutions to complex, multi-stakeholder challenges. FrontierSI has a 17 year history of working on large-scale national and international initiatives which use and distribute space based data, and remains an active participant in the space industry. Our relevant activities and achievements are summarised in the Appendix and online at [www.frontiersi.com.au](http://www.frontiersi.com.au).

## Key Points

FrontierSI makes the following key points in regards to the Inquiry into Developing Australia's Space Industry Terms of Reference:

## 1. Future research capacity, workforce development and job creation

1. *The space industry is already a critical enabler of Australia's digital infrastructure, providing essential communication, positioning, and imagery which underpin services within our economy. Space industry growth is vital to Australia's future. It will continue to drive economic prosperity, better health and well-being, improve our natural environment and ensure our national security.*

Space-based infrastructure is used by every business in Australia to manage the environment, provide health and education services, forecast weather, conduct financial transactions, communicate and locate assets and people. FrontierSI operates within the spatial sector, which as a sector, has experienced double-digit growth for the past 20 years, impacting all of Australia's major economic and export industries. The spatial industry provides services that aggregate, analyse and manage location-based data sets. Decision making using spatial information has a reliance on the use of space based technology such as satellite remotely sensed imagery, global navigation satellite systems (including GPS) and communications.

2. *There needs to be a focus on developing Australia's space workforce and technology to align with our strengths, industry requirements and future needs.*

Recent reports and reviews have highlighted our space capability strengths, priority areas and key industry sectors in which to target investment (e.g. [The Value of Earth Observations From Space to Australia](#) (2015); [Australian Government Earth Observation Data Requirements to 2025](#) (2016); [Australian Space Industry Capability A Review](#) (2017); [Advancing Space Australian Civil Space Strategy 2019 – 2028](#) (2019); [Current and future value of earth and marine observing to the Asia-Pacific region](#) (2019); and [SBAS Test-bed Demonstrator Trial Economic Benefits Report](#) (2019)). Further investment in developing Australian skill capacity in identified areas of strength within the space sector is required. This investment in skills is necessary to improve the productivity, export capacity and efficiency of downstream space companies in the energy, agriculture and mining industries, and is to be encouraged.

Australia must increase its technical expertise pool to establish a more extensive future workforce. Remote sensing scientists, application developers, space engineers, data scientists and positioning experts are required to underpin future industry growth. In this sector, Australia has traditionally grown its workforce through international recruitment, and this avenue is presently constrained due to COVID-19. The local training activity is increasing through new university degrees' growth focused on Space (e.g. [RMIT Space Science degree](#)), however there is still much work to do to develop additional opportunities for skilled people. Additional awareness of employment avenues is required to encourage people to undertake the training and education necessary to create a skilled workforce. This could be targeted through increased participation in programs such as Superstars in STEM, scholarships for targeted degree programs, and increased training opportunities both within and outside the university sector.

3. *Better collaboration between subject disciplines will help grow the future space workforce.*

Many of the skills required by the industry are present within other sectors, e.g. data science. However, the cross-disciplinary approach is often not taken concerning training. Industry ready data science graduates could be developed through relatively minimal training in earth observation and satellite data. By encouraging students to undertake 1-2 subjects as part of their degree that focused explicitly on space priorities, the number of graduates with appropriate training could be significantly increased. Universities should be encouraged to add computer science and engineering courses as official elective units to promote cross-disciplinary skill exchange. Additional PhD,

Masters Coursework and undergraduate scholarships could also be used to target graduate development.

4. *Australia has significant R&D expertise in space-based applications. Continued government investment in infrastructure will facilitate applications and workforce development.*

Australia has built considerable research and innovation expertise in developing applications that work across satellite platforms. Solutions have been developed that mitigate the risk of technical failure, mission deprecation, or data policy changes that come from dependence on a single space data source. This means Australia has significant experience in understanding how to apply a variety of global data sources to address industry or government business needs.

As a result we have led the world in terms of open source or government based infrastructure such as [Digital Earth Australia](#) which are used to process and deliver satellite imagery to end-users. These open digital infrastructures drive economic benefits and GDP growth, provide excellent platforms for industry application development, and importantly are a tool for skills and capacity development. Commercial companies cannot provide these services at a cost-competitive price point for many end-users. Such investment yield benefits through the government and industry's use of open earth observation data to develop new business opportunities and support a growing workforce. With increasing satellite numbers, leading to an abundance of data, efficient access and processing of satellite imagery is important to allow quick transit time from image capture to decision intelligence information. This requires infrastructure that is open source, easy to use for a wide range of user maturity levels, and can be purposed for the tasks at hand. Existing government investment in Digital Earth Australia has put in place the building blocks to facilitate this image processing pipeline and ensure that data consumers can integrate this infrastructure into the current commercial pipelines.

Investments in digital infrastructure such as Digital Earth Australia for professional service delivery should continue. Where quality of data and service can be guaranteed, industry can build value-added products with confidence. The recent Australian Government investments in SBAS (SouthPAN) and [Positioning Australia](#) are other significant examples of infrastructure development, which will reap benefits for Australia in positioning and navigation.

One potential area for expansion which leverages our location, expertise and market is in calibration and validation. Providing calibration and validation as a service offers a significant economic activity and builds on our internationally recognised capabilities. It can attract overseas companies to enter the Australian market and generate new business for those offering these services. Currently, these services are limited in offering within Australia to government and research organisations. Investment in additional calibration and validation research development with the private sector through existing entities such as the SmartSat CRC may provide an opportunity to increase participation, and potentially borrowing from models used in the health sector in which the companies access infrastructure operated by public research institutes and/or government.

## 2. Development of space satellites, technology and equipment

1. *A commitment to future space missions to grow the Australian space industry, and provide a platform for increased competitiveness of Australia's existing industries through increased development and use of space technology. A robust Australian space industry will mitigate the risk of being too dependent on foreign-owned space assets, data sources and expertise in our critical supply chains, and infrastructure.*

Developing enhanced sovereign capability and assuring access to critical space assets focused on Australian-specific requirements would reduce global dependencies and continue to leverage Australia's well-regarded research capabilities.

Traditionally Australia's contribution to the international stage and missions has been through calibration and validation activities and leadership in developing digital infrastructures like the [Open Data Cube](#). It is timely with the Australian space industry's growth commencing in earnest that missions involvement be examined. Models for international collaboration which provide shared access to satellite systems should be further explored. As the demand for space-enabled products and services increases across governments and industry, Australia will likely need to access a more significant number of critical new streams of data, the majority of which are (and will continue to be) foreign-owned and operated. Using a range of cost-sharing models for space missions with friendly nations' consortia is one way forward. One recent example is the investment by CSIRO, through a 10% share of satellite tasking time on NovaSAR-1. This approach would complement the dominant market model in Australia, direct payment for existing data, analytics and services developed overseas. More innovative approaches also need to leverage Australian research to further develop both the upstream and downstream segments.

There is also an urgent need to prioritise Australia's critical data requirements which require either Australian sovereign control or arrangements to assure continued access. Strategic, coordinated planning and investment are necessary to ensure the Australian space industry has the required resources and infrastructure to address future needs. Although there is increased private sector investment in space, historically government investment has driven space infrastructure (eg GPS, Copernicus). Globally, this remains the case today. Australian industry requires continued and expanded government support to drive Australian space development. This support is essential to develop a strong space sector which can be used to underpin Australia's key industries.

### 3. International collaboration, engagement and missions

1. *Expansion of the Australian Space Agency's role in terms of investment and international engagement will enable the [Australian Civil Space Strategy 2019-2028](#).*

FrontierSI is highly supportive of the Australian Space Agency. Since its inception, we note the numerous achievements of the Agency with international engagement, strategic direction and nurturing of the space industry. These successes have occurred on a modest budget. Several alliance partners have significant Space Agency and mission-based assets that dwarf Australia's current commitments and it is timely that further priority driven funding towards strategic investments is considered.

There is also an increased need for coordination to ensure the range of current and planned programs optimise and leverage investments into priority areas. Enhanced coordination between state, federal government and international investments is required. Funding announcements like the Australian Government's Modern Manufacturing Initiative and [Strategy](#) and the identification of space as an area of strategic importance offer this opportunity.

Australia has only recently begun actively developing its space industry. As a nation, we are still reliant on international relationships and space assets and our existing data infrastructures are being developed largely based on other nations' satellite capabilities (the US and EU). Australia must also continue to reinforce and strengthen its international partnerships with NASA, the United States Geological Survey, the European Space Agency, and Space Agencies in the UK, Canada, New Zealand, Germany (DLR), India (ISRO) and Japan (JAXA). This will ensure ongoing access to future data supply from these foreign satellites.

The Agency could also expand its role in co-operation with Australia's traditional owners. Space scientists working collaboratively with traditional owners, create positive impacts on land management and strengthen Australia's space industry. The integration of indigenous land knowledge with Australia's internationally recognised capability for calibration would enhance our national earth observation datasets. There are existing examples (eg the Square Kilometre Array)

#### 4. Commercialisation of research & development, including flow-on benefits to other industry sectors

1. The Australian space and spatial industries are evolving from new businesses based on the provision of imagery alone, whether from satellite, aircraft or drone, to providing data and information for making better decisions and managing risk. The focus must be on developing tools that answer fundamental business problems in easy to use formats.
2. Government agencies such as Geoscience Australia, the Bureau of Meteorology, and CSIRO lead the way in championing Earth observation and positioning in many areas such as agriculture, mining, climate modelling and response and weather prediction. Their common challenge is to effectively transfer the knowledge, skills, and information they create from space operations into industry. This challenge comprises several factors:
  - User maturity levels for earth observation and positioning within industry, outside space/spatial sector, are generally low, but with pockets of high-level expertise
  - The private sector has significant expertise in the use of current commercial technology, however the systems used in government and research organisations do not align well with commercial infrastructure
  - As the industry undergoes digital transformation space can have a significant role to play in data-driven decision making, and the value is substantial, but space and spatial sector needs to collaborate with the broader industry at the level of workflows and processes where digital transformation is occurring in the workplace; and
  - 'Space' needs to be made a tool that is intentionally designed for industry to use and easily create value from – 'space' needs to fit into the sector's workflows.
3. To promote and increase research outcomes being translated into market applications, increased government-based incentives for collaboration between private and research sectors are required. With possible exceptions in agriculture, energy and mining, the addressable market size in Australia is limited. Companies continue to need assistance to address the current local markets with Space related products and services, to provide them with the opportunity to scale to global markets. The [Moon to Mars initiative](#), the Defence Innovation Hub, and the CRC Program (e.g. [SmartSatCRC](#)) are critical planks in developing international collaborations to facilitate world-leading R & D outcomes. Targeted use and increased awareness of other government grant programs such as the innovation voucher system (state government based) and Business Research and Innovation Initiative administered through the AusIndustry program would benefit the industry. Specific priorities could be developed within a national business agenda program structure that encourages collaborative partnerships. This model's advantage is that it can promote long-lasting partnerships and increased research movement from universities into the private sector, furthering the development of business opportunities.

## Appendix: About FrontierSI

FrontierSI delivers significant benefits to governments, industry and the community using our deep expertise in spatial mapping, infrastructures, positioning, geodesy, analytics, and standards. The mission of FrontierSI is "*to provide the connection point, partnerships, trusted collaborative model and expertise to deliver high impact solutions to complex, multi-stakeholder challenges*". Our partners include research agencies, government departments and private sector companies global leaders in spatial information in positioning and applied geodesy, spatial infrastructure, and rapid spatial analytics. Our work is improving location information, increasing data accessibility, improving service delivery, and delivering new ways to generate answers through automation.

FrontierSI is the successor organisation to the Cooperative Research Centre for Spatial Information (CRCSI), through which submissions were also provided to the [2017 Review of Australia's Space Industry Capability](#) and 2016 Review of the 1998 Space Activities Act and 2001 Space Activities Regulations.

Through a strong track record in downstream space applications research and development with Australia's key industry sectors, FrontierSI has practical experience in-house and within our partner base to develop user-based solutions using satellite imagery to a range of industries and markets – from agriculture to mining, to banking – and provide real-life examples of how space-derived information and services can offer growth opportunities to businesses. Also, we have a track record in engaging with industry and end-user communities, working through a design thinking approach to better help them identify their problems and pain points, and how these can be addressed through space-related services and technology. A selection of our Space related activities and achievements is highlighted below:

- **Joint Statement of Strategic Intent and Cooperation with the Australian Space Agency.** In August 2019 FrontierSI signed a [Strategic Intent and Cooperation Agreement](#) with the Australian Space Agency which sets the shared objective of growing a globally responsible and respected space sector in Australia, promoting investment and development in national space capability – particularly in areas of competitive advantage, helping open the door internationally for our research and industry sectors, supporting the creation of jobs, and enabling industry growth through the adoption of Space derived services that will improve the day-to-day lives of all Australians.
- **Next Generation Positioning, Navigation and Timing (PNT) Infrastructure.** FrontierSI and its partners are assisting Geoscience Australia in creating the next generation of robust, reliable, ubiquitous positioning systems. [Positioning Australia](#) is an integrated national positioning capability to accelerate the adoption and development of location-based technology and applications in Australia. It builds upon world-leading research that has focussed on the system and sensor integration; development of error models and error mitigation systems; quality assurance and signal integrity; technology testing and evaluation; and the demonstration, implementation and benefits measurement of these technologies in cross-sector applications. Positioning Australia builds upon previous work of the SBAS (Satellite Based Augmentation System) Testbed, and the National Positioning Infrastructure Capability (NPIC). FrontierSI also has active international collaborations, such as the QZSS satellite augmentation signal demonstration with JAXA (Japan).
- **Earth Observation.** We are a global leader in remote sensing demonstrated by our role in developing industry-leading reports and training materials on Earth Observation with the Australian Government. FrontierSI has coordinated the development of the [Digital Earth Australia \(DEA\) Industry Strategy](#), which engaged more than 500 individuals, and led to the creation of the DEA Labs, aimed to open an avenue to help the private sector to develop EO-related services and applications. DEA is a world-class analysis platform for satellite imagery and other Earth Observations hosted by Geoscience Australia which provides Australian

businesses with access to standardised analysis-ready-data (ARD), analytic capability and tools to innovate to produce new products and services. Through our industry partners, we have engaged in capacity building across the Pacific and South-East Asia through the Pacific Island Sea Level Rise Capacity Building project in Tonga, Papua New Guinea, Samoa Vanuatu, which was awarded a United Nations Award at the Paris COP21 Climate Change Congress in 2015. FrontierSI was a stakeholder contributor to the development of the [Bushfire Earth Observation Taskforce Report](#), which examined the decisions required to undertake bushfire risk management and analysed the satellite imagery data needed to support those decisions.

- **Investment in Space-based Research (LeapFrog R&D).** FrontierSI is a Core Partner of the [SmartSatCRC](#), formed in July 2019 to conduct translational research in advanced telecommunications and IoT connectivity, intelligent satellite systems and Earth observation next-generation data services to create game-changing technologies and generating know-how that will make Australian industry more competitive. FrontierSI became actively involved in the initial stages of the bid development process for SmartSatCRC, shaped research program and user definition and plays a lead role in the earth observation program leading several EO based projects.
- **National Engagement.** FrontierSI has coordinated national engagement at a sectoral level. We led the development and continue to drive the implementation of the 2026 Spatial Industry Transformation and Growth Agenda (2026 Agenda), a 10-year national industry growth roadmap to grow the spatial sector across the economy. We are working group members of the newly formed [2030 Space and Spatial Working Group](#) which aims to develop a space and spatial roadmap that highlights the strategic importance of a robust Australian space and spatial capability, outlines the steps required to realise an integrated area and spatial ecosystem that will be a critical national asset, and identifies industry growth opportunities and actions to grow the Space and spatial sectors.
- **Strong Partnerships** with crucial Government and international bodies in space, spatial and application sectors such as [SIBA|GITA](#), [SSSI](#) (the spatial sector peak bodies), Space Industry Association of Australia (SIAA), and the European Association of Remote Sensing Companies (EARSC). FrontierSI is a participating organisation of the [Group on Earth Observations](#) (GEO) GEO is an intergovernmental partnership of 105 Member governments, 127 Participating Organisations and thousands of passionate individuals and businesses that improve availability access use of Earth observations for a more sustainable planet. Through CRCSI, we became a founding partner in the United Nations (UN-GGIM) Committee of Experts [private sector network](#).