

School of Earth and
Environmental Sciences

Thursday, October 11, 2018

CRICOS PROVIDER NUMBER
00025B

State Development, Natural Resources and Agricultural Industry Development Committee
Parliament House
George Street
Brisbane Qld 4000
sdnraicd@parliament.qld.gov.au

Re: Submission to the Inquiry into job creation opportunities in Queensland arising from the establishment of an Australian space industry

To Whom it May Concern,

In response to the letter of request from Chris Whiting MP, Chair of State Development, Natural Resources and Agricultural Industry Development Committee on 18 September 2018, I am very pleased to provide a submission to this Inquiry.

The main messages of this submission are:

- **Earth Observation is one of the three central industries that underpin Australia's current and future space activities.** *Aside from space-based communication, it is the industry sector with highest predicted growth in Australia and globally over the next five and 10 year periods ^{1,2}.*
- **Earth Observation is the suite of activities used to gather data about the earth from satellites, aircraft, remotely piloted systems, and other platforms.** *It delivers information that underpins our daily weather and oceanographic forecasts, disaster management systems, water and power supply, infrastructure monitoring, mining, agricultural production, environmental monitoring and more.*
- **When building space related industries, Earth Observation (EO) will potentially deliver the highest return on investment for Queensland and Australia.** *This is due to its established industry and Queensland government base, and very large predicted market growth in Australia and globally ^{1,2,3,4}.*
- **The Queensland Government is recognised as Australia- and world-leading in its adoption and use of EO capabilities.** *Our small to medium EO based industries, and multi-national EO companies (e.g. DigitalGlobe) share similar reputation and capability. These provide a very strong competitive basis to grow industry and jobs.*
- **To take direct advantage of these opportunities there is a proposal in place to base a "National Earth Observation Analytics Hub" in Brisbane.** *This proposal responds to priorities identified by the Australian Space Agency⁹, CSIRO Space Roadmap¹⁰ and the Australian EO Community's 10 year plan⁵. The national Earth Observation Analytics hub has been designed to enable growth in uptake and use of EO data and analytics, in commercial and government sectors, requiring creation of new companies, expansion of existing companies and growth in Brisbane and other Queensland regional centres.*

I must also highlight a critical omission in the Australian Space Industry Capability Review ("The Review"), in relation to Queensland's activities in space. This Review did not acknowledge the full extent of EO capability and use in Australia that can support Industry. The Review only acknowledged activity in Commonwealth agencies and major companies in Canberra, Sydney and Melbourne, which missed the majority of current and future EO activities in industry, State and local government, and research in the other states and territories, especially Queensland. These sectors already deliver fully operational, world

leading science and applications for business and government and are a logical base to build on. This was a critical limitation that must be addressed urgently.

The Australia EO community, along with multinational companies and multiple recent global market projections, show that EO is the niche area of Australia's Space Capability that offers the most potential to use our established investments and expertise to deliver maximum returns including: building industry(ies) that create substantial amounts of new jobs and economic activity, strengthening our national security, and supporting a huge range of activities across all levels of government, science and industry. The EO sector has a plan⁵, a clear mechanism for national coordination and collaboration, and is ready to act, and will work effectively with developments in the upstream space capabilities, such as improved ground station, satellite development and launch facilities.

My comments in this submission are based on my roles as:

Director of Earth Observation Australia, the peak body representing industry, all levels of government, research institutions and academia, who collect and analyse data from EO satellites to deliver commercial and government services in Australia (www.eoa.org.au). This body was developed at, and operates from the University of Queensland. It is operating under a 10 year plan, 2016-2026, developed and delivered through consultation with our 420 members.

Director of the Remote Sensing Research Centre at the University of Queensland (www.rsrc.org.au), the largest and longest running earth observation research and training centre in Australia.

Director of the Joint Remote Sensing Research Program (www.jrsrp.org.au), part of Remote Sensing Research Centre, developed with the Queensland Government in 2005, which delivers EO research solutions to Australian State and Territory agencies.

Member of the Australian Government Attorney General's Department, Critical Research Infrastructure Program, Space Cross-Sectoral Interest Group, Australia's primary national engagement mechanism for business-government information sharing and resilience building initiatives on critical infrastructure resilience (www.tisn.gov.au).

Program director for Earth Observation Analytics, which is one of three research programs in the just approved CRC Round 20 proposal bid – the "SmartSAT CRC" (www.smartsatcrc.com) with \$46 million in industry funding.

Director of Ozius Labs Inc, a research support company for Ozius (www.ozius.com.au), a Brisbane based EO analytics company (one of the 2018 Westpac Business of Tomorrow).

I have provided a separate file attachment on the "National Analytics Hub Proposal" to be based in Queensland, and request this is kept confidential as it represents significant IP contributions from a range of partners, and contains matters still under negotiation.

Details are given on the following pages in response to each of the Terms of Reference for the Inquiry.

I look forward to answering questions from the Committee on 19/10/18 in the Public Hearing from 3.00-3.45pm and providing any other required information. Please contact me at the addresses below if you need more details.

Sincerely,



Professor Stuart Phinn
Director, Remote Sensing Research Centre and Joint Remote Sensing Research Program
Director, Earth Observation Australia
School of Earth & Environmental Sciences, The University of Queensland, Brisbane, 4072
Queensland, Australia.

Responses to terms of reference:

a. The Australian Government's establishment of an Australian Space Agency (ASA) on 1 July 2018;

This is a positive and significant first step in enabling Australia to build space industry capability and generate jobs and economic growth. Specifically, it will enable national coordination and direct international engagement at government and whole of industry levels. It is of significant value to Queensland due to the national and international competitive advantage we have in developing business and industry solutions using EO applications.

- The Earth Observation Community in Australia, across government, industry and research welcomes the announcement of ASA. As a community we have lobbied for several years to establish such an agency to enable our industry to develop to its full capacity and better serve local Australian markets and access global markets. The 10 year plan for 2016-2026⁵ developed by Earth Observation Australia identified the establishment of such an agency as an essential first step in growing our industry.
- EO Services are recognised as one of the seven **National Civil Space Priorities**⁹ of the ASA. Multiple national and international market reviews and forecasts consider it to have a high established capability and very high potential for growth of market and industry in Australia and globally ^{1,2,6,8,11,12}
- Queensland is emerging as a major national hub for EO application development due to the extent of State government use of innovative EO products and services across all of government; development of large applied research programs; and development of national coordination activities. Private industry is now beginning to provide this capability and using government services to deliver business and industry solutions.
- Our State government EO and research capacities have underpinned national EO capability development, e.g. driving national land-use mapping, state-based cooperation to access European Union EO data, providing technical capabilities to establish national EO programs. These capabilities were missed and omitted in the documents used to establish the ASA, such as the The Review of the Expert Reference Group Report⁷.
- Despite this, our State agencies (e.g. Departments of Environment and Science, and Natural Resources, Mines and Energy), have all had long term engagement with precursors to the ASA in driving and enabling national coordination for government and industry access to EO data. We have a trusted role and reputation with other States, Territories and Commonwealth agencies.
- The ASA's National Civil Space Priorities, the Defence Innovation Hub (www.business.gov.au/centre-for-defence-industry-capability/defence-innovation/defence-innovation-hub), and the CSIRO's just released Space Roadmap (www.csiro.au/en/Do-business/Futures/Reports/Space-Roadmap) indicate a willingness to work with State Governments to build space industry capability, with EO based activities as a prime focus. In response to these requirements we have established a proposal to have a National EO Analytics Hub to build EO based industries, based in Brisbane (see Attachment).

- b. The space supply chain, which has been broadly categorised as, Space systems (including communication satellites), Ground systems, Applications and ancillary services, and End use (e.g. improved telecommunications, mapping and emergency management)***

This definition is appropriate, but is more effectively outlined in segments able to be related to industry-government-research sectors in the CSIRO Space RoadMap (www.csiro.au/en/Do-business/Futures/Reports/Space-Roadmap). In particular, more explicit recognition of the roles of the Positioning-Navigation-Timing and EO sectors is required. These are sectors Queensland has substantial competitive advantage in, and are crucial due to the role they play now and for the future of geospatial industry.

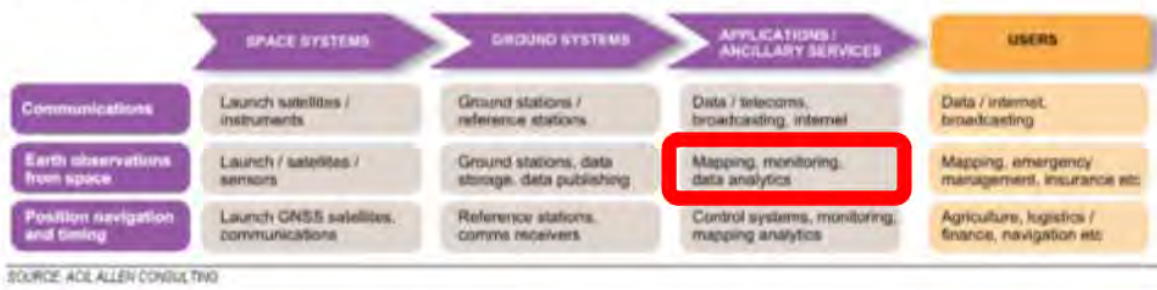
- The supply chain components provide clear demarcation of industry areas Queensland has a competitive advantage in (Applications and ancillary services, and End use), specifically Positioning-Navigation-Timing and Earth Observation sectors. If built properly, these can be used to generate new industry in the more 'upstream' sections of the space supply chain, e.g. Space and Ground Systems.
- The predicted growth in the geospatial business sector, in terms of demand for geospatial information services for industry and all levels of government, in Australia and globally, is significant in short (2-5 years) and long (10-20 years) as identified in multiple Australian and global market projections ^{1,2,3,4,6,10,11}
- Addressing this demand is directly dependent on our Earth Observation, Positioning, Navigation and Timing Services capabilities, often referred to as EO Analytics, and an ability to expand existing companies and establish new ones to deliver these services – this is the primary driver for development of an industry focused space capability ^{1,2,3,4,6,}
- Queensland and Australia have the basis for building on and linking into the forecast market growth in EO analytics both in Australia and globally – we just need help at State and national level to do this. Our EO Analytics Hub proposal for co-Federal and State Investment will do this (Attachment 1). A first step towards funding this hub is our role as the EO Analytics lead in the Commonwealth's Cooperative Research Centre (CRC), current grant, where we are one of eight final projects to be evaluated. This SmartSAT CRC bid currently has \$46 million industry co-investment, (www.smartsatcrc.com) and we aim to base the EO analytics hub in Queensland.
- Our focus on developing EO analytics can also create increased demand for enhanced upstream space capabilities to be established in Queensland, such as ground receiving stations and dedicated satellite systems. This presents a significant opportunity to reduce national risk and increase sovereign capabilities that support industry by starting new space systems and ground station investment.

c. The review of space supply chain capability released by the Australian Government prior to the Agency being announced;

Although quite thorough, this review (www.industry.gov.au/data-and-publications/review-of-australias-space-industry-capability) was biased in its geographic, government and industry focus to Canberra, southern states and Commonwealth Agencies.

- Earth Observation was one of the supply-chain areas significantly under-represented in this review document. Specifically, it under-represented the current and future capacity of State governments and private industry in EO – this was most notable in the omission of Queensland Government and private industry. Instead, the Review focused primarily on Commonwealth Government activities.
- Queensland’s State government EO capabilities have consistently driven development of national scale Commonwealth EO capabilities, outside the Bureau of Meteorology. There is now a greater capacity to build on Queensland’s EO capacity to deliver data and information to support a growing multitude of industries in Australia and overseas. These capabilities could be effectively built through a Queensland based program, in collaboration with the co-investment programs being provided by the Australian Space Agency, other Commonwealth agencies, and Defence (e.g. Defence Innovation Hub) and industry funded research (e.g. CRC SmartSAT).
- As noted above, the proposal to establish a national “Earth Observation Analytics Hub” in Queensland has been established in direct response to the opportunities identified in the “Review of Australia’s Space Capability”⁷, and the gaps apparent in that Review (See separate file Attachment).
- A more effective outline of the space industry supply chain is given below³ – with the earth observation analytics area highlighted in red.

Figure 1: Space industry supply chain, with earth observation analytics highlighted in red³



- While EO was identified in the review of space supply chain capability as one of Australia’s six main areas of competitive advantage, the Review only mention Commonwealth programs in detail.
- As noted in Earth Observation Australia’s response to the Review:

“There is a major limitation to the current SCR [Space Capability Review] process, which is reflected in the issues document, and this is that the full extent of EO capability and use in Australia that can support Industry is not acknowledged. The document only acknowledges activity in Commonwealth agencies, which means it misses the majority of current and future industry, state and local government, and research EO activities in upstream and downstream sectors. These sectors already deliver fully operational, world leading science and applications for business and government, yet seem to have been ignored in the SCR so

far. The review needs to properly assess and recognize existing activities before moving forwards. This is a critical limitation that must be addressed urgently."

- The review of space supply chain capability did point out the need to build industry capability in Australia for EO analytics as a priority, due to the consistent large growth predicted in market demand for the information derived from satellite data sources^{1,2,4,6} and our strong base in government and research, and growing industry base. However, we need to encourage growth of industry to deliver these services through Government-industry-research partnerships that include multiple levels of government.
- The table below⁶ highlights the relative opportunity in EO based space activities as highlighted in red: there are significant positive growth trends, a relatively low barrier of entry, significant base activity in Australia, and a prime growth opportunity for Australia.

Table 1: Future space industry market opportunities for Australia, with Earth Observation analytic activities highlighted⁶.

Markets	Examples	Growth Trend	Required Per Venture Investment	Barrier to Entry	Significant Current Activity in Australia?	Prime Australia Growth Opportunity?
Satellite Servicing	MDA/SSL, Orbital ATK	+	~\$500M+	High	N	
Suborbital Human Spaceflight	Virgin Galactic, Blue Origin	+	~\$1B+	High	N	
EO Smallsat	Planet, Spire Global	++	~\$100M+	Low	N	
EO-Driven Data Analytics	Orbital Insights, HexGeo, Geolmage	++	~\$10M+	Low	Y	✓
Orbital Global Broadband	OneWeb, SpaceX	++	~\$3B+	High	N	
Commercial SSA	AGI, Schaefer, EOS, US military infrastructure in Australia	+	~\$10M+	Medium	Y	✓
Dedicated Smallsat Launch	Vector, Virgin Orbit, Rocket Lab	+	~\$100M+	Medium	N	
Smallsat Manufacturing	Clyde, Pumpkin, Spaceflight Services	+	~\$1M+	Low	N	✓

- The discussion of how to build EO Analytics capability for Australian industry should be directed to our emerging companies, or combined State and Commonwealth capabilities. Currently, this discussion is consistently directed in Australian Space Agency publications to Geoscience Australia’s Digital Earth Australia (DEA) program which received \$15.7 million in 2017 and \$36.9 million over three years from 2019-20 and \$12.8 million ongoing. In 2016-2017 this was presented as a capability being built for Commonwealth Agency use only. In 2018 this has been completely re-focused on supporting private industry capability (www.ga.gov.au/dea).

This may be part of Australia’s EO analytics capability, but it ignores the reality that:

- (1) the base capability planned to be provided in DEA by 2020 (on-line, weekly updated archive of fully corrected satellite images for the continent) already exists and was established by the Queensland government as early as 2012. This capability continues to be recognised as world leading example of fully-operational satellite based environmental monitoring;
- (2) Google, Amazon and other multi-national EO analytics companies (e.g. Maxar-DigitalGlobe, Planet Inc, Airbus Industries), and a growing range of new companies (Radiant Earth, Tellus,

- Descartes Labs) already provide more advanced, commercially accessible versions of what the DEA aims to provide by 2020, and these companies will continue to advance ahead of DEA's capabilities.
- As a result of the change of the DEA program to focus predominantly on private industry from 2018, it is now:
 - o setting itself up to compete with Amazon, Google and Maxar-DigitalGlobe, Planet Inc, Airbus Industries in Australia;
 - o creating confusion that it will provide access to earth observation analytics services that a significant number of Queensland and other Australian SME's have established growing national and global market presence for; and
 - o potentially limiting growth and investment in the private EO sector in Australia, by creating the impression that the "problem has been solved" for EO analytics.
 - If the DEA program can be used to provide "Access to assured 24/7 data streams from a variety of satellite image data sources that will allow industry and application specific service development of monitoring tools," it will help build our EO analytics capabilities. However this will only be true if DEA operates in association with global and Australian industries and other levels of government in Australia.
 - The proposed EO Analytics Hub is in a position to effectively tackle this challenge to ensure that the Commonwealth's significant investment in DEA complements and Supports state government activity; delivers services to Australian companies not able to be provided by other global EO analytics companies (Amazon, Google); and can be used effectively to build Queensland and Australia's small to medium EO Analytics companies.

d. Queensland's areas of competitive advantage in relation to identified capability which, at a high level, have been identified as communications, earth observations, position, navigation and timing; and

Based on my experience in Australia and internationally, I agree with the Inquiry's assessment that these are areas of high competitive advantage in Queensland.

The comments I have made in my submission so far reflect this, and other inquiry submissions from Earth Observation Australia, Maxar-DigitalGlobe, SIBA, and a range of Queensland companies reflect this. Unfortunately the true nature of these areas of competitive advantages at State levels were not established in the reports used to establish the Australian Space Agency (e.g. ACIL Allen, Bryce Space, Expert Reference Group) – possibly due to the need to deliver a national scale assessment that focused on and justified Commonwealth activities.

- Queensland's EO analytics capabilities have a competitive advantage into Australian industry, government, defence markets and global markets. They link directly with, and are dependent on positioning navigation and timing capabilities as well. The proposed EO Analytics Hub (Attachment 1) can build on this advantage to establish new jobs and economic growth in Brisbane, regional centres and lead Australia – in association with the Australian Space Agency – to attract significant Australian and overseas investment.

- Although I cannot comment directly on Queensland's competitive advantage as a growing space industry capability, I can comment directly on our competitive advantage in EO, position, navigation and timing. These capabilities, are intrinsically linked in the collection and delivery of any form of geospatial information that now underpins a large and growing set of activities in industry, local to state and national government, and defence activities in Australia and globally. Reviews of the market potential of geospatial information industry development show the requirement for tightly linked EO, position, navigation and timing capabilities^{1,3}. This requirement is also clearly defined in the national 10 year industry agenda developed by the geospatial industry – "2026 Spatial Industry Transformation and Growth Agenda" (<https://2026agenda.com/>)
- The extent of Queensland capability and competitive advantage in EO analytics was outlined in the Earth Observation Australia submission to the establishment of the Australian Space Agency:
 - "- Downstream applications development to provide analytics and information across a broad range of private industry and government sectors using analysis of time series data derived from satellite image archives (current examples in horticulture and agriculture);and*
 - Integration of upstream and downstream services to deliver end to end solutions using small/cube-sats and on-ground measurements*

We suggest a key strategy should be the introduction of a program to enable more effective research-industry partnerships using government and industry EO Infrastructure. This must sit outside the context of existing mechanisms such as the CRC Program and ARC-Linkage, and use a new more flexible research to operations structure. Examples of this from other countries include the UK Catapult – Earth Observation, or the European Space Agency/European Commission- EO Innovation Europe programs and the US National Science and Technology Council's, "National Plan for Civil Earth Observations 2014". The proposed Earth Observation Analytics Hub would be a start in right direction to address this.

The cross-over potential of space-related industry capabilities in EO to the rest of the Australian technology/manufacturing sector is very large, specifically:

- *Upstream: development of sensors, satellites, and ground components can be built up as a capacity within Australian private industry, and not necessarily by large foreign aerospace. We have the opportunity to be more agile and develop applications that are multi-use and tied to Australian capabilities and will keep the investment and returns in Australia.*
- *Mid-stream: development of appropriate data storage, processing and distribution capabilities can also be done by Australian companies.*
- *Downstream: This is the area where we have most existing strengths and base capabilities, but also one where the potential for growth is very broad, stretching across small start-ups and SME, to large national environmental, mining-engineering and agricultural companies. This would be supported by the extensive use of EO across all levels of government, agriculture, horticulture, mining, water resource, infrastructure/asset management.*
- *Specific space services that provide greater opportunities for the Australian space industry sector within Australia or the Australian region?*
- *EO downstream applications for advanced environmental measurement and monitoring from building to continental scales. Note our response to the consideration above. We have world leading state based and whole of country analytics delivered on environmental conditions for terrestrial and marine applications from non-Commonwealth agencies. This is also the area with greatest private*

sector interest now in start-up SME scale activities linked to agriculture, horticulture, and urban utilities.”

- The proposal for a national EO Analytics Hub to be based in Queensland (Attachment 1) reflects the recognised strengths and competitive advantage Queensland has in EO
- The hub proposal has been developed throughout 2018 in close consultation with: Queensland Department of State Development, Manufacturing, Infrastructure and Planning - Space Industry Development Working Group, Queensland Department of Environment and Science (Science Development, Remote Sensing Centre), acting Queensland Chief Scientist, and Department of Natural Resources, Mines & Energy.
- The proposed EO Analytics Hub will provide the missing piece of national infrastructure enabling us to take on new and expanding Australian and global markets.

e. Areas of regional Queensland where supply chain capability exists, particularly in areas of competitive advantage.

- Currently there are a number of EO analytics providers operating as small-medium enterprises located in regional centres across Queensland such as Toowoomba, Sunshine Coast, Gold Coast, Townsville, Cairns, and Longreach. This is also reflected in the statewide distribution of geospatial analysis and EO analytics capabilities in local and state government regional offices.
- Earth Observation Analytics does not require access to extensive physical infrastructure and can be carried out using high end personal computers with consistent broadband internet access. This would allow development of regionally specific industry support EO analytics industries in areas where they can visit work sites, e.g. for agriculture, horticulture, aquaculture, renewable energy production, and to build effective business models able to be exported internationally.

Reference List:

1. Geospatial Media and Communications (2018) GeoBuiz: Geospatial Industry Outlook and Readiness Index, 2018 Edition. <https://geobuiz.com/geobuiz-2018-report.html>
2. AlphaBeta (2017) The economic impact of geospatial services: how consumers, businesses and society benefit from location-based information. https://alphabeta.com/wp-content/uploads/2017/09/GeoSpatial-Report_Sept-2017.pdf
3. ACIL ALLEN (2017), Australian Space Industry Capability, Department of Industry, Innovation and Science, Canberra.
4. ACIL Allen Consulting (2015) 'The Value of Earth Observations from Space to Australia: Report to the CRC for Spatial Information.
5. Earth Observation Australia (2016) Australian Earth Observation Community Plan 2026: Delivering essential information and services for Australia's future, www.eoa.org.au/aeocp-the-plan/
6. Bryce Space 2017 - Global Space Industry Dynamics - Research Paper for Australian Government, Department of Industry, Innovation and Science by Bryce Space and Technology, LLC .
7. Clark, M. et al (2018). Review of Australia's Space Industry Capability - Report from the Expert Reference Group for the Review.
8. Symbios (2015) Risks of Data Supply from Earth Observations from Space for Australia. Report to the CRC for Spatial Information.
9. Australian Space Agency (2018) Welcome to the Australian Space Agency. www.industry.gov.au/sites/g/files/net3906/f/welcome-to-the-australian-space-agency.pdf
10. CSIRO Futures (2018) Space: A Roadmap for unlocking future growth opportunities for Australia. www.csiro.au/en/Do-business/Futures/Reports/Space-Roadmap
11. Department of Industry, Innovation and Science (2017). 2017 State of Space Report, Canberra.
12. Asia Pacific Aerospace Consultants (2015). A selective review of Australian Space Capabilities: Growth opportunities in global supply chains and space enabled services. www.spaceindustry.com.au/Documents/APAC%20Report%20on%20Australian%20Space%20Capabilities%20Revised.pdf

End of Submission