



SHOALTM

DEVELOPING AUSTRALIA'S SPACE INDUSTRY

HOUSE OF REPRESENTATIVES INQUIRY

***ADDITIONAL INFORMATION TO THE STANDING
COMMITTEE ON INDUSTRY, INNOVATION, SCIENCE AND
RESOURCES***

PREPARED BY

Dr Derek Rogers and Graeme Dunk

SHOAL-REPORT-136-2021-S002

ISSUED 29 MARCH 2021



SHOALTM

+61 2 6239 4288
shoalgroup.com

PO Box 7038 Hutt Street
SA 5000 AUSTRALIA

Shoal Group Pty Ltd
ABN 49 604 474 204



DEVELOPING AUSTRALIA'S SPACE INDUSTRY

ADDITIONAL INFORMATION TO THE STANDING COMMITTEE ON INDUSTRY, INNOVATION, SCIENCE AND
RESOURCES



**ISO 9001 QUALITY
Certified System**

Provider of systems thinking, engineering, and research; complex systems design; asset management systems design; modelling, simulation, and analysis; strategic and operational analysis; tender support services; and related professional services.

COPYRIGHT NOTICE

This material has been copied and communicated to you by or on behalf of Shoal Group Pty Ltd pursuant to Part VB of the Commonwealth of Australia Copyright Act 1968 ('the Act'). The material in this communication may be subject to copyright under the Act. Any further reproduction or communication of this material to you may be the subject of copyright protection under the Act.

DO NOT REMOVE THIS NOTICE

DEVELOPING AUSTRALIA'S SPACE INDUSTRY

ADDITIONAL INFORMATION TO THE STANDING COMMITTEE ON INDUSTRY, INNOVATION, SCIENCE AND
RESOURCES

PREFACE

After making a submission to the House of Representatives Standing Committee on Industry, Innovation, Science and Resources inquiry into developing Australia's space industry and presenting evidence on 10 March 2021, Shoal was asked to provide additional information. This report provides that additional information.

DEVELOPING AUSTRALIA'S SPACE INDUSTRY

ADDITIONAL INFORMATION TO THE STANDING COMMITTEE ON INDUSTRY, INNOVATION, SCIENCE AND
RESOURCES

CONTENTS

PREFACE	3
CONTENTS	4
1 INTRODUCTION	5
2 ADDITIONAL INFORMATION	6
2.1 RESPONSE TO QUESTION 1	6
2.2 RESPONSE TO QUESTION 2	8
2.3 RESPONSE TO QUESTION 3	8
2.4 RESPONSE TO QUESTION 4	9
3 SUMMARY	10
4 REFERENCES	11

1 INTRODUCTION

The Minister for Industry, Science and Technology, the Honourable Karen Andrews MP, asked the House of Representatives Standing Committee on Industry, Innovation, Science and Resources to inquire into and report on developing Australia's space industry, [1].

In response Shoal made both a submission and a supplementary submission to the Inquiry, captured as submission 5 and 5.1, available at reference [2]. On the 10th of March 2021, Dr Derek Rogers as the Engineering Lead for Defence and Space, and Mr Graeme Dunk as the Head of Strategy, attended a public hearing and gave evidence to the committee. At the completion of the provision of evidence, Shoal was asked to provide additional information.

As captured in Hansard, [3]:

"CHAIR: You mentioned sovereign capabilities. I just want to know what your view is currently of our sovereign capabilities. Can you just enlarge on what capabilities you believe we should be more attentive to and keeping? You cross that over with national resilience, and I imagine they're sort of one of the same thing, but it might be that resilience has a lesser level or broader scope. There's one thing I'm very interested in: you talked about the stop-start industry. I want to know why the industry, in your view, stopped from time to time, because there lie the problems that we wish to avoid, if we can. Also, your view on the Space Activities Act 1998. I've been having a peruse of that since I heard about it. There seems to be an excessive amount of regulatory requirements between division 1 and division 2, and this is putting us at a strategic disadvantage to other countries that don't have that. If you could express your views in that space-if we waved the magic wand and made you the boss in Canberra, what would you do to fix it so it worked in a better way to keep us in a competitive environment?"

The other thing is, Dr Rogers and Mr Dunk, if you could just express what you think is required to take the Australian space industry from an engagement with components into the construction, in a more fuller form and near totality, of satellites that we could launch from Australia. Take us through a holistic process of what are our impediments and what we need to do there? If you could take those notice I would be very much appreciative of that."

Summarising the request into on four questions:

1. What are Australia's current sovereign space industry capabilities and which areas could Australia be more attentive to?
2. What lead to the stop-start nature of Australia's space industry?
3. In respect to the Space Activities Act of 1998 particularly Division 1 and Division 2 and the regulatory requirements, what can be done to fix it?
4. What is required to take the Australian Space Industry into the realm of constructing satellites and what are the impediments?

An address of these four questions is provided below.

2 ADDITIONAL INFORMATION

2.1 Response to Question 1

2.1.1 *Current capabilities*

In respect to Australia's current space industry capabilities, those directly identifiable with Space 2.0 in the areas of cubesats, the Internet of Things (IoT) from space, rockets, satellite propulsion systems, launch, mission control and space domain awareness, are emerging as evidenced by the capabilities of companies such as Myriota, Inovor, Fleet Space, Neumann Space, Skykraft, Gilmour, Southern Launch, Equatorial Launch Australia, Blacksky Aerospace, Sitael Australia, and others.

Other companies such as Silentium Defence, Solinov, and Daronmont, for example, have developed passive radar systems that can also be used for space debris monitoring. Likewise, Electro-Optic Systems, and a collaboration between Curtin University and Lockheed Martin, are organisations that have developed optical systems for space debris monitoring.

These organisations and others are indicative of Australia's strong capabilities in electronics and software development. The Electronics Industry Development Adelaide Inc. (EIDA) website reports, for example, that Adelaide's electronics industry has 11,000 staff employed in 300 mostly locally owned companies, [4]. The Defence Science and Technology Group (DST) and its precursor organisations played a key role not only in Australia's early space activities, but in the fostering of the electronics industry.

The establishment of the Motorola Australia Software Centre, which grew to approximately 400 people in Adelaide with smaller numbers in Sydney and Perth, before the closure of all centres around 2005, provided substantive stimulus to high maturity software development practices. The Collins Class submarine program also aided in the stimulus of the software industry as well as manufacturing capability.

When Motorola closed, many Australian employees moved into Defence, and Defence has for the most part retained a highly capable workforce across different projects and companies over many decades.

The relevance of this is that whilst Australia has seen a loss of volume manufacturing capability with the car industry, Australia has retained many engineering and technician skills that are directly transferrable to the space industry.

To be fair, Australian industry does not have the facilities for the manufacture, test and launch of large geostationary satellites, but with the emergence of cubesats, Australia does have relevant capabilities.

Australian industry also has a good level of expertise in telecommunications, which is again applicable to the development and operation of ground stations and in space industry parlance, Telemetry, Tracking and Control (TT&C).

However, the space industry is also about the use of data and information, from space. In this regard, Australia like many countries is developing capabilities in big data, data analytics, Artificial Intelligence and Machine Learning. Relevant organisations include the CSIRO, the Australian Institute of Machine Learning, and the Big Data Cooperative Research Centre that

DEVELOPING AUSTRALIA'S SPACE INDUSTRY

ADDITIONAL INFORMATION TO THE STANDING COMMITTEE ON INDUSTRY, INNOVATION, SCIENCE AND RESOURCES

completed in 2019, and trained 2000+ data scientists, created 2 spin out companies, and supported 71 PhD students, [5].

Australia is also home to major defence primes such as Boeing, Raytheon, Lockheed Martin, Thales, Saab, and BAE Systems that can call on their parent organisations for wide ranging relevant capabilities.

Likewise, the Australian Mining sector includes organisations that have good capabilities applicable to space in the areas of industrial control, robotics, and automation. Woodside Energy, for example, has a collaborative project with the National Aeronautics and Space Administration (NASA) where they have access to one of eight Robonaut systems, [6].

Tasmania is also the Australian hub of space medicine and life sciences of the Australian Antarctic Division, and actively collaborating with NASA, [7].

Australia also has a long history of involvement in, and expertise in Space Law as evidenced by, for example, submissions by the University of Adelaide and history covered in Kerrie Dougherty's book "Australia in Space", [8].

2.1.2 Capabilities Australia could be more attentive to

It is important in the development of the Australian space industry that we do not just seek to replicate what has been achieved elsewhere, as that is merely playing catch-up and hoping to acquire an adequate market share. A potentially more satisfying, and lucrative, strategy is that we identify areas where Australia can differentiate our space industry from that being undertaken elsewhere and hence reap the benefits thereof.

The deliberate matching of space capabilities with resilience in Australian society is one area where both the "in space" and the "from space" elements can make a substantial difference.

So, we should (i) endeavour to build on our many strengths described in the previous section and (ii) consider exploring emerging areas such as:

- space tourism, and
- quantum communications.

Space Tourism

Submission number 33 to the House of Representatives Inquiry by Virgin Orbit included a recommendation on spaceport development. Whilst the submission did not directly discuss space tourism in that context, as progress is made, at some stage spaceports are likely to become as common as airports; or airports, subject to other considerations, may evolve for dual use.

However, airports attract a significant number of complementary and supportive businesses and so Australia could consider becoming involved with the spaceport sector sufficiently early to capitalise on this opportunity.

Australia could consider what is required in terms of the regulatory environment, and then at the right time consider private-public partnerships with respect to infrastructure development.

If Australia is to pursue a position with respect to space tourism it would need careful investigation and consideration, not purely for itself, but for the wider industry stimulus this may provide.

Quantum communications

Another emerging area that could be considered that would benefit the space industry and other industries is quantum communications. There is significant effort into the science of quantum communications but translation to practical devices is in simple terms a long way away. Nonetheless when realised quantum communications will have a significant technological impact on our lives.

2.2 Response to Question 2

An excellent discourse on the history of Australia with Space is given by Kerrie Dougherty's book "Australia in Space", [8]. Dougherty highlights Australia's stop-start history with space from the 1950's to just before the formation of the Australian Space Agency.

In simple terms, despite great successes with Australia as the seventh nation to launch a satellite and the third country to support a satellite from our own soil, support of the Apollo moon landing, and later Aussat, the political support of Australia has been fickle over more than half a century. For example, the National Space Program of the Hawke and Keating Governments in the 1990's was abolished when the Howard Government came to power in 1996. But there are many earlier and surprising examples that Dougherty's book covers.

Certainly, it could be suggested that politicians of the times viewed other things as more important. However hopefully today there is a greater awareness of Australia's dependence on space, and a greater understanding of disruptive and emerging technologies regarding longer term industry development and societal benefit.

This is where Shoal's submission on resilience applies, encouraging the development of an understanding of how space capabilities and space products affect key sectors of a functioning Australian society.

2.3 Response to Question 3

Division 1 and Division 2 of the Space Activities Act 1998 address the areas of space activities that require approvals, and space licenses, respectively. This Act has been superseded and Division 1 and Division 2 addressed by the Space (Launches and Returns) Act 2018. Shoal supports the Australian Space Agency in the independent assessment of launch permits and also assists organisations with launch facility licenses.

Submission 16 by the University of Adelaide summarises many of the pertinent topics with respect to regulation of the space industry in Australia, and importantly also covers the history of reviews and commentary.

Shoal has nothing specific to add with respect to the regulations but does note that the industry may benefit from the development and publications of guidelines by the Australian Space Agency to assist those organisations that have to work with the regulations seeking various permits and licenses. It is understandable that the Agency wishes to provide flexibility that is not be overly prescriptive with respect to for example, specific templates, because whilst this would benefit new Australian startups, they can equally prove a cost to more experienced international organisations. The development of guidelines may be the right happy median between being too prescriptive and too flexible.

Several submissions discussed the split of the regulatory role from the industry development role. If done, the industry development role can then provide services to assist emerging Australian ventures with the regulations, whilst ensuring the regulatory role is not compromised with regard to ensuring public safety.

2.4 Response to Question 4

To address the question of what is required to take Australia into the realm of constructing satellites and what are the impediments we need to consider the three classes of satellites – geostationary satellites, small satellites, and cubesats. Australia can and does construct cubesats as shown by the work of Inovor and SkyKraft, for example.

With respect to small satellites, Sitael has established a presence in Australia and over time would be capable of manufacturing small satellites.

Whether Australia needs to manufacture the large and heavy geostationary satellites is, perhaps, more the question. To do so we lack industry experience, which can be obtained, and we lack the large and specialist test facilities, which can be built

Private enterprise is unlikely to have the will to establish such facilities in Australia without a sustainable market need, such as a reasonable satellite telecommunications or earth observation capability. So, Australia is perhaps better to acknowledge our vulnerability and dependence on systems from our allies, such as the US Global Positioning System.

The Australian military, like many modern militaries, despite a heavy reliance on space-based GPS systems, also trains for operations under GPS-denied situations. Financial and other systems are also heavily reliant on GPS, but rather than establishing sovereign systems, perhaps we should focus on alternate resilient solutions.

3 SUMMARY

Australia has both a history in the development of space capabilities, and existing capabilities that can provide the foundation for the reinvigoration of a space industry. This industry can:

- Contribute to the Australian economy through industrial activity across the full spectrum of space-related activities, and in the development of exports. These activities can include both those activities required to place into orbit and to monitor them when there, and the utilisation of data obtained from these satellites once place.
- Contribute to national resilience by understanding how space capabilities and space products affect key sectors of a functioning Australian society

Government can stimulate and foster the growth of new industries. It is not necessarily that Australia needs a vision such as that provided by John F Kennedy in the 1960's, but Australia could instead decide on a vision as a resilient Space 2.0 age society, and craft that vision in terms of inclusiveness and benefits to all Australians.

4 REFERENCES

- [1] House of Representatives Standing Committee on Industry, Innovation, Science and Resources, "Inquiry into Developing Australia's Space Industry, Terms of Reference," 2020. [Online]. Available: https://www.aph.gov.au/Parliamentary_Business/Committees/House/Industry_Innovation_Science_and_Resources/SpaceIndustry/Terms_of_Reference.
- [2] House of Representatives Standing Committee on Industry, Innovation, Science and Resources, "Inquiry into Developing Australia's Space Industry, Submissions," [Online]. Available: https://www.aph.gov.au/Parliamentary_Business/Committees/House/Industry_Innovation_Science_and_Resources/SpaceIndustry/Submissions. [Accessed 12 3 2021].
- [3] C. o. Australia, "Proof Committee Hansard, House of Representatives," 10 March 2021. [Online]. Available: https://parlinfo.aph.gov.au/parlInfo/download/committees/commrep/937f4569-3e36-46f8-8d69-6cc9d30376da/toc_pdf/Standing%20Committee%20on%20Industry,%20Innovation,%20Science%20and%20Resources_2021_03_10_8555.pdf. [Accessed 26 March 2021].
- [4] Electronics Industry Development Adelaide Inc., "Welcome to EIDA," [Online]. Available: <https://www.eida.asn.au/>. [Accessed 12 3 2021].
- [5] Data to Decisions Cooperative Research Centre, "D2D CRC legacy website," [Online]. Available: <https://www.d2dcrc.com.au/>. [Accessed 12 3 2021].
- [6] Woodside Energy, "Intelligent Assets & Robotics," [Online]. Available: <https://www.woodside.com.au/what-we-do/innovation/intelligent-assets-robotics>. [Accessed 12 3 2021].
- [7] Centre for Antarctic, Remote and Maritime Medicine, "Space Medicine," [Online]. Available: <https://www.carmm.org.au/space/>. [Accessed 12 3 2021].
- [8] K. Dougherty, Australia in Space: a history of a nation's involvement, ATF Press and the Space Industry Association of Australia, 2017.