

To: House of Representatives Standing Committee on Industry, Innovation, Science and Resources

From: Gilmour Space Technologies, QLD

RE: Inquiry into Developing Australia's Space Industry

Gilmour Space Technologies is Australia's largest space manufacturer, with over 60 employees on the Gold Coast, QLD. We welcome the opportunity to share our feedback on how the Government can help to develop a significant, safe and sustainable Australian Space Industry.

Why Space, Why Now

As we head into 2021, Space is the next 'trillion-dollar opportunity'.

- The last five years has seen an explosion of New Space activities across the world, with **small satellites and new launch vehicles** turbocharging what is now an A\$488 billion-a-year global space economy.ⁱ
- Euroconsult predicts the 2020s will be 'the decade of small satellites',ⁱⁱ with thousands of smallsats forecast to be launched to deliver essential new data and applications from space, including low-cost high-speed communications and internet that could connect even our most remote communities.
- More than 15 new countries, including Australia, have established a space agency in the last decadeⁱⁱⁱ to tap into what global analysts forecast will be a **trillion-dollar space economy by 2040**.^{iv}
- Meanwhile, countries like China, Russia and India have demonstrated advanced warfare capabilities in space; and the US, France, Canada and Japan have established a dedicated space force or command within their Air Force.^v

In this contested and competitive world, there is no question that Australia will need to develop sovereign space capabilities. We currently spend over half a billion dollars a year on imported space data and capabilities.^{vi} The global commercial potential is huge. The national security risks are high.^{vii} And beyond just being inspiring, new space technologies will offer tremendous benefits to everyday Australians.^{viii}

What Next

Thanks to the Australian Space Agency (ASA) and a growing number of pioneer space companies (like Gilmour Space, Fleet, Myriota, Saber Astronautics), we now have the beginnings of a new Space Industry.

The next three years will be critical for Australia as focus shifts from growing a broad *Space Sector* (comprising of all players related to space) **to growing a globally competitive Space Industry, led by companies seeking commercial outcomes.**

To that end, we believe more industry-focused government and agency support will be needed – e.g., direct funding for space infrastructure and contracts (with Government as a first buyer in some cases) – to transform our new space sector into a significant and sustainable industry that will create 20,000 jobs and triple space revenues by 2030.

Moreover, we highlight the need for our Government to:

Be relentless in the push for national/sovereign space capabilities. Follow-through and execution will be key. Today's New Space revolution is being led by innovative, venture-capital-backed space companies. A higher risk tolerance by our regulators and agencies, particularly around launch, would

result in different decisions and outcomes for companies seeking funding from existing/new programs, and lead to valuable sovereign capability for Australia.

Focus more on advancing our sovereign space capabilities to high Technology Readiness Levels. Technology Readiness Levels (TRLs) are a method for understanding the maturity of a technology during its acquisition phase, with TRLs 1 – 3 defining a product as being in its research phase, TRLs 4 – 6 as its development phase, and TRLs 7 – 9 as its deployment phase. It is important to note that most space technology companies in Australia are between TRLs 1 to 3, and that the cost of advancing from TRL 5 to 7 is many multiples that of moving it from TRL 1 to 5. A greater focus on reaching higher TRLs would lead to timelier commercialisation of opportunities *on hand* whilst advancing our strategic long-term capabilities.

Support the champions of our industry. In a sector of mainly early-stage start-ups, government agencies and research organisations, these are the winning companies that are raising public interest, providing long-term jobs for STEM graduates, building new sovereign capabilities and supply chains with other Australian companies, bridging the gap between innovation/R&D and commercialisation, and bringing new revenues into Australia.

We address some of these points below in the context of the terms of reference provided.

DEVELOPMENT OF SPACE SATELLITES, TECHNOLOGY AND EQUIPMENT

As mentioned, small satellites (defined as those under 500 kg in mass) and the small launchers that enable them are the key drivers of growth in today's global space industry.

Benefits to Australia

Beyond the economics, small satellites are used for many Earth-based applications that benefit existing industries.^{ix} Below are just a few real-life examples of how **New Space technologies developed by Australian companies** are already helping to solve 'everyday' challenges here on Earth.

- *Fire management:* **Fireball International** has developed a satellite- and ground-based system that can detect fires within the first three minutes, thus enabling faster response on the ground. This tech is already being used to detect fires in the US.^x
- *Mining:* **Fleet Space**, together with OZ Minerals and University of Adelaide, are leveraging on satellite-based Internet of Things (IoT) technology to develop a new method of heat mapping for mineral exploration that would reduce impact to the environment.^{xi}
- *Logistics & Transport:* **Myriota** is partnering with Future Fleet International in Australia to provide an intelligent vehicle and asset tracking system using their low-power IoT technology and satellite connectivity.^{xii}
- *Agriculture:* **FluroSat** has developed a toolkit using remote sensing, satellite data and imagery to provide insights that help farmers manage their crops (e.g., water monitoring, measuring nutrition levels) and improve performance.^{xiii}
- *Defence:* **Inovor Technologies** will be helping to develop South Australia's first 6U satellite, which will collect data that can be used to inform decisions around the state's water use, climate change and emergency management response, among others.^{xiv}
- *Space:* **Saber Astronautics**, which has operations in the US and Australia, has won a NASA Small Business Innovation Research grant to explore the development of a drag sail for deorbiting spacecraft at the end of their life, helping with space debris management.^{xv}

All these capabilities are being enabled by smallsat launch providers like Australia's **Gilmour Space**, which has signed contracts with Australian and international customers for its dedicated launches into low earth orbits from 2022.^{xvi} In Australia, these launches would be supported by government or domestic launch site providers like **Southern Launch** and **Equatorial Launch Australia**.^{xvii}

Sovereign Capability, Global Opportunity

Looking ahead, we note that: (1) most satellites being launched to space are under 250 kilograms (kg); (2) there is no leading manufacturer of smallsats, with only about 10 major players globally; and (3) the market is still quite expensive with a limited production run cost of over US\$5 million for a 100 kg satellite.

This offers a significant smallsat opportunity for Australia. Despite being a relatively new entrant into the global space scene, Australia has a number of high-TRL space companies that have attracted global venture capital funding.

Gilmour Space, for one, is working on designing and building a 100-kg satellite with local partners like Griffith University^{xviii} and local suppliers of high-TRL components. This class of smallsats is a step-up from the micro- and nanosatellites that Australia has traditionally focused on and will be more relevant to future market needs.

From next year, Australian defence, satellite and component manufacturers will have the significant 'home advantage' of Sovereign Access to Space. Gilmour Space's new launch vehicles will be providing more accessible and affordable commercial launches into low earth orbits, helping to alleviate a major bottleneck for smallsat companies globally and provide valuable capability for Defence.

Our Government could play a critical role in fast-tracking the development and production of small satellites and small launch vehicles by:

1. **Providing funded technology roadmaps** for small satellites and small launch vehicles, with the view of increasing TRLs and bridging that risky period between TRLs 4 and 7.
2. **Recognising that higher risk comes with the development of sovereign space capabilities**, and accepting the implications of this in existing/new programs and decisions.
3. **Becoming a first or early customer** of Australia's small satellite and rocket manufacturers, as is the case with most leading space nations that are home to today's global space primes. The USA, Japan and Europe, among others, have policies which preference their own sovereign capability, e.g., if government funding is used for developing a payload, a domestic launch provider is preferred. Australia could consider the same course of action.
4. **Ensuring that grants/contracts are 'fit for purpose'** in supporting Australian companies as they develop new sovereign space capabilities (*see next section*).
5. **Supplying adequate space infrastructure and competitive regulatory frameworks** (such as for space testing and launch facilities) in Australia. Example: given the number of Australian companies engaged in the launch sector here, perhaps the one-year moratorium on launch fees (already high according to global standards) could be extended or abolished.^{xix}

COMMERCIALISATION OF RESEARCH & DEVELOPMENT (R&D), including flow-on benefits to other industry sectors

Commercialisation is the step that monetises R&D and grows the industry. As a company that has partnered with many universities, research organisations, local and international companies to develop our rocket technology, we wish to highlight the points below:

<p>Prioritise TRLs and commercial outcomes.</p>	<p>Most Australian space companies are in the early to growth stages and have different needs to an international prime contractor. Given the lack of space development funding to date in Australia, we believe priority should be given to Australian headquartered private-sector companies that are developing valuable sovereign capability. Furthermore, government corporate entities, departments and agencies should be excluded from such funding programs.</p> <p>Australia’s space technology roadmaps could be more commercially oriented, aimed at increasing the TRL of sovereign space capabilities (as is the case with the Defence Innovation Hub (DIH)). With more grant monies going into projects with <i>firm commercial plans</i> for their technology/ products, our Government will be helping to inject funds where it is needed most, closer to market.</p>
<p>Provide meaningful funding.</p>	<p>We have observed that space grant funds are being divided between a large number of research entities, agencies and companies. However, we believe that concentrating more funds to fewer companies would be a better strategy for enabling an increase in Australia’s space capabilities.</p> <p>Allow headcount to be counted. The majority of deep tech funding is required for headcount, however, most Government funding programs cover mainly capital equipment. We propose that government grants/contracts include funding for both capital equipment and headcount, which can be tied to milestones for accountability.</p> <p>N.B. The R&D tax grant should be continued as it is one of the only/main sources of funding for commercial space companies here today.</p>
<p>Fast-track the programs.</p>	<p>The timeline communicated to approve and deliver grant monies is not realistic for many start-ups and commercial enterprises – e.g., DIH grants generally take 7 to 9 months to approve, and the distribution of the majority of the Moon to Mars funds isn’t expected until 2024.</p> <p>Bringing forward funding streams would help Australian space companies (mostly start-ups with limited cashflow) to speed up their space tech development, shorten their time to market, increase headcount, leverage on monies for further investments, and in our case, allow us to onshore the manufacturing of more space hardware at a critical time of our development.</p>

<p>Consider a better model for Research-and-Industry collaboration.</p>	<p>Understand that there is a big difference between ‘Discovery’ and ‘Commercialisation’. Universities and research organisations are typically valued for their “discovery” efforts that lead to recognition and research reports. Discovery-related R&D tend to be at TRL 0-3. “Innovation” takes a discovery and makes it into a commercial product (TRL 7-9), and is what companies are better at. Supporting research is not the same as supporting companies.</p> <p>The Government has historically mandated that commercial companies partner with universities/research organisations to be eligible for R&D grants. This model has its challenges as both parties have their different strengths (companies are committed to achieving higher TRLs), key objectives (companies are driven by commercial outcomes), and financial time frames (companies are more time constrained).</p> <p>Future Research-and-Industry collaborations should reflect these realities – e.g., by allowing companies to lead projects where funds will be used for commercialising tech between TRLs 4 and 9.</p>
<p>Recognise that VC - funded companies need funding too.</p>	<p>Over the last four years, Australia's venture-capital-backed space companies have secured new global customers, booked revenues in-country, grown sovereign space capabilities where none existed, and created hundreds of new jobs for the future (200 jobs among just the largest four VC-backed space companies). VC-backed companies also tend to be unsuccessful in government grants, perhaps based on the mistaken perception that they no longer need funding. However, space development requires significant resources to develop and should not be the responsibility of the private sector alone.</p> <p>We would also argue that government funding should favour relevant VC-backed companies as they will leverage any assistance to accelerate growth. This leverage is often at a ratio of 1 to 5.</p>

Flow-on benefits

We provided some examples above of how New Space technology is benefitting different sectors of the Australian economy. Other examples of flow-on benefits are:

- Launch vehicles and satellite technologies are used extensively by Defence at total system and/or sub-component levels. For example, the guidance navigation and control systems of a satellite or launch vehicle can be modified to fit into many tactical defence platforms.
- There are also many civilian applications of space tech. The machines and processes used to make composite pressure vessels for spacecraft can be used for chemical storage and transportation on Earth. The software that controls the robotic systems of rockets and satellites can be used on Earth-based autonomous systems. 3D printing techniques used for space components can be applied in other fields, such as medicine and precision machines. Laser communications designed for space can also work on Earth and have been demonstrated to have orders of magnitude faster data transmission than fibreoptic cables.
- Perhaps the greatest spin off from the space industry is when ‘space’ engineers and technicians move into other industries, bringing their problem-solving skills and resilience with them. It is

often said that the technological challenges of getting to, and living in, space are some of the most difficult to solve for humanity.

INTERNATIONAL COLLABORATION, ENGAGEMENT AND MISSIONS

International engagements are part and parcel of the global space industry, particularly when executing difficult or expensive missions or projects. They can be very inspiring to the public and a great source of collaboration for Australia's world-leading universities and research organisations.

However, while international missions can be good for lifting technology to world standards, they are **difficult to originate, slow to develop, and have very long lead times to their conclusion**. This contrasts with today's New Space industry, which is developing technology rapidly.

Importantly, from an industry perspective, there is often no follow-on commercial outcomes from such missions. While Australia's broad participation in NASA's Moon to Mars efforts is commendable, there will be significant challenges for any new entrant to meet NASA's stringent, high-TRL and competitive space supply chain requirements.

We believe the Moon to Mars initiative and other **government programs would have more positive impact from directly supporting and growing Australia's leading space companies** who would, in turn, work (and grow capability) with other Australian companies.

The ASA has signed numerous Letters of Strategic Intent over the past two years, however, there has been no tangible commercial outcome and no process for commercial companies to engage or leverage on these agreements. Foreign space agencies, including USA, Japan and Europe, have policies which preference their own sovereign capability, e.g., if government funding is used for developing a payload, it must then be launched by a domestic launch provider.

Australian companies need to benefit from the various agreements that ASA has signed with international space agencies and companies as part of their international engagement. We hope that these 'bridges' will strongly reflect Australia's intention to develop and grow our new space sector into a sustainable and significant sovereign space industry.

FUTURE RESEARCH CAPACITY, WORKFORCE DEVELOPMENT AND JOB CREATION

Australia has always been known for our best-in-class space scientists, researchers and ground station support. What has changed in recent years are the innovative companies that have emerged to tap into new global opportunities.

In regard to the workforce and jobs, we have used Gilmour Space as an example of how one Australian company could have a positive multiplier effect on our new space industry:

- **Jobs for our STEM graduates; training the next generation:** With over 60 employees on the Gold Coast, Gilmour Space is the largest private space employer in Australia. Our staff include new graduates from multiple disciplines across Australia; scientists, engineers and technicians employed from other Australian industries (e.g. defence, mining, aerospace, automotive, healthcare); and experienced rocket engineers from around the world. As the company grows, we hope to be hiring over 1000 employees in the next five years, some of them in regional Australia.
- **Advanced manufacturing and supply chains:** Our efforts to grow a space manufacturing sector here will provide local supply chain and upskilling opportunities in areas like satellite and launch vehicle development, testing, manufacturing, assembly, integration, space launch site operations, and more. We already work with 300 local suppliers, and that number will only increase as we move from R&D into the manufacturing phase.

- **Private and Public sector partnerships:** Gilmour Space is actively partnering with Australian research organisations, universities and companies to develop sovereign launch capability within the next 2-3 years. Our partners include the Defence Science and Technology Group (DSTG), the Advanced Manufacturing Growth Centre (AMGC), Griffith University, University of Queensland and Northrop Grumman.
- **Enabling New Space:** As the first Australian company to show significant sovereign launch capability, Gilmour Space's success will enable the growth of New Space companies, e.g., in Australian-made satellites for communications, earth observation, the Internet of Things, and more; and provide local supply chain opportunities to adjacent industries.

Now what if there were 10 or 50 more of these 'champion' companies?

OTHER MATTERS

The next two years will be vitally important for promising Australian space companies scaling up to serve the global space industry. Some final thoughts:

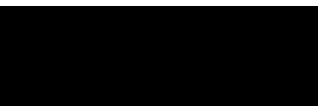
- **Invest in the future.** Right now, lack of government funding is biggest obstacle for space companies in Australia. Yet today's global primes were once minnows under the Apollo program.
- **Leverage on our innovative companies to build sovereign space capabilities.** Other nations are working with the private sector to grow their industry. There needs to be a better understanding here that space technology development comes with more risk and will require more investment and a longer view for deep tech development.
- **Launch is an Opportunity, not a Risk.** From our perspective, there has been an overabundance of caution around launch or 'Access to Space' in Australia. Certainly, rockets are not what most people would normally expect Australians to be 'good at'; but as can be seen from the number of launch-related start-ups emerging in Australia, and world-leading companies like Gilmour Space, this is no longer true.

As our Federal and State governments roll out initiatives such as ASA's \$150 million Moon to Mars program, \$7 billion Defence spending for space, and the \$1.5 billion Modern Manufacturing Strategy, it is more important than ever to ensure that these and future programs will drive desired outcomes.

Indeed, with sufficient support from the government and ASA, **today's space technology start-ups could well be tomorrow's space primes** – creating more jobs, exporting and diversifying revenues, and enabling a significant and sustainable future industry for Australia.

To the stars.

Yours sincerely,



Adam Gilmour

CEO, Gilmour Space Technologies



End Notes

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- iii Patel, N.V. (2019, November 26). MIT Technology Review. There has never been a better time to start a small space agency. Retrieved on 28 January 2021 from <https://www.technologyreview.com/2019/11/26/131822/why-its-now-the-perfect-time-to-start-a-small-space-agency/>
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