Submission to the Senate Economics Committee

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Submission to the provisions of the Space Activities Amendment (Launches and Returns) Bill 2018.

I welcome the opportunity to provide a submission to the Senate Standing Committee on Economics conducting an inquiry into the *Space Activities Amendment (Launches and Returns) Bill 2018* [Provisions] ('Bill').

Inovor Technologies *('*Inovor'), was founded in Adelaide in August 2012 to develop space and defence technologies with a particular focus on satellite platforms, Space Situational Awareness, Earth observation and Remote sensing. Uniquely our world class hardware is all manufactured in Australia making *Inovor* the only true Australian satellite manufacturer. Today, *Inovor* employs 14 highly specialised engineers and scientists, 13 of whom are Australian University graduates.

Inovor has collaborative research partnerships with the University of Adelaide, UniSA, ANU, UNSW Sydney, UQ and the International Space University (France) and commercial partnerships with Sitel (Italy), BAE Systems and Lockheed Martin. In 2018 I appointed corporate advisors, Enterprise Corporation Pty Ltd to assist with navigating the increasingly complex and competitive commercial space industry.

Amongst a number of scientific achievements, including some 20 peer reviewed publications (*Appendix 1*), I am proud to have led the launch of (one of) the first Australian-built satellites into space in 15 years in 2017. An *Inovor* nanosatellite, built in Adelaide with the help of University of Adelaide and UniSA students launched by NASA on the Atlas V rocket bound for and deployed from the International Space Station.

I completed a PhD in aerospace engineering at the University of Adelaide and the Space Systems Institute in Stuttgart Germany. I have spent a career in research and technology development working on defence and commercial projects for the Royal Australian Air Force, the Defence Science and Technology Group, the United States Navy Research Laboratories, US Air Force, Boeing and NASA.

I respectfully request the opportunity to present to the committee in person and engage on the matters raised herein.

Yours sincerely,

Dr Matthew Tetlow
Founder, CEO Inovor Technologies.

Introduction

The global space industry is valued at an estimated USD$360 billion and growing exponentially as access to space becomes more feasible to commercial sectors.

According to Euroconsult's 2016 report *Prospects for the Small Satellite Market* the industry is on the cusp of a major revolution for the 'new' space sector and overall space ecosystem. It forecasts that more than 3600 SmallSats, with a combined manufacture and launch value of $22 Billion, will be deployed over the next 10 years.

The unique technical advantages of *Inovor's* product are such that we are well positioned to break into this market. Notably, the flow on economic benefits from accessing this market will be significantly transformed if we have demonstrated capability and flight heritage. In terms of facilitating market access, it is worth noting that all of the current major players in this industry started in their respective domestic markets having been funded by domestic defence and government programs to de-risk the technology however soon thereafter competing on the international stage.

In terms of Australia's broader opportunity, we recognise that the expansion of the SmallSat sector will stimulate and support substantial flow on opportunities for artificial intelligence, spatial industries and other applications.

This submission discusses four key aspects of the *Bill*:

- Debris Mitigation Strategy
- Insurance
- Regulatory burden
- Overarching sentiment of the Legislation

Debris mitigation strategy

Context : Spacecraft orbital life

When discussing any Debris Mitigation Strategy ('DMS'), attributes of a space object, such as size, duration in orbit and altitude are key factors. For example, orbit life spans for a CubeSat:

- At 400 km altitude, 1-2 years;
- At 500 km altitude, 4-7 years.
- At 600km it would have a lifetime of ~25 years.

Also, it would burn up on re-entry to the earth's atmosphere leaving no trace.

For a broader perspective, the Hubble Space Telescope which orbits at about 530km, has been in orbit for over 28 years and is likely to come down no earlier than 2031 having served over 41 years in orbit. Hubble has its orbit boosted periodically. Another example would be The Tesla Roadster and Starman which left Earth in a hyperbolic orbit residing now in an elliptic orbit about 105 million km from Earth travelling at nearly 60,000 km/hr. It should have a close approach with Mars in mid 2020 and will never return back to Earth. Therefore, debris or not?

Inovor's missions presently are focused below 500km altitude so have a natural debris mitigation strategy. That stated, we may like to participate in a GEO mission or, even a Moon mission if the opportunity arose, however recognise that our responsible use of space expectations would have to vary from what is outlined above.

To whom would a debris mitigation strategy apply?

We strongly support the implementation of a *DMS*. As an environmentally responsible company we see it as vital that the global space industry addresses the issue of space debris. Thereafter we raise the following matters in this context of clarity and competitiveness.

The requirement as drafted, appears to apply to all applicants i.e. for an Australian launch permit or overseas launch certificate and is silent on the nature of a *DMS* and to whom it applies? Is this intended to be mandatory? or, specific to Australian launch permits for certain space operations that fall into pre-determined high-risk mission categories within their control?

To mandate a one size fits all *DMS* would thwart Australia's globally competitive ambitions however we support a risk-based approach to certain space operations.

What would a *DMS* look like?

Where is a *DMS* required? Is it to adopt the UN Space Debris Mitigation Guidelines ('*UN Guidelines'*) which are (i) not legally binding however are (ii) evolving as the high-water mark particularly for post operational retirement of space assets.

Australia would not want to impose a requirement that cannot be verified, enforced or places us at a commercial disadvantage internationally. Further, for the avoidance of doubt, a *DMS* must place no responsibility on any Australian participant for any space object over which it has no control. The *UN Guidelines* are increasingly referenced by commercial operators similar to a Corporate Social Responsibility statement indicating that market forces will drive adherence to such guidelines.

For *Inovor*, in terms of nanosatellite launches, greater selection of launch service providers, ideally in Australia, will in and of itself enhance our capacity to be role models in *DMS.*

For Australia to support the significant opportunities for Australian companies in the area of space situational awareness technology which, we are active in, it will do well to lead in a principles-based approach to *DMS* rather than a regulatory approach.

Recommendations

1. That the *Bill* devolves the *DMS* to the Rules.
2. Any *DMS* is limited to only those space objects over which a company has direct control.
3. Australia to take a market driven approach to the responsible use of space.

Insurance

Context

The legal liability insurance market is limited globally and all but non-existent in Australia, due to low premium volumes, an estimated nil claims and little case law at a commercial level. Further, the probability of a monetary claim against the Australian government is low having regard to the *Convention on International Liability for Damage Caused by Space Objects, 1972* ('Liability Convention') against any Government, having been invoked only once with no official claim.

Competitiveness

How jurisdictions approach the matter of international liability in their domestic laws is key to the competitiveness of its industry.

We are encouraged that the reduction of indemnity required for insurance cover or financial responsibility to the Commonwealth has been reduced in the *Bill* to a maximum of $100 million.

Notably, other jurisdictions are increasingly omitting to specify a capped $ figure in their Space Legislation tending to reserve the right to determine any such indemnity on a case by case basis and or, by devolving to their Regulations and specifically the Space Law's Objects, articulating their ambitions to foster and grow the economic competitiveness of the industry. In terms of methodology, we look to see insurance requirements that would vary significantly depending on the launch vehicle, launch site, and launch trajectory, amongst other parameters.

Of note, a commercial satellite manufacturer bears the risk of the launch malfunctioning and accordingly will contract with a preferred supplier who carries the insurance required. In the event a company launched in a country that did not require insurance to the level commensurate with Australian policy we would accept that it would be only in such instances that an operator should need to indemnify the Australian government.

Notably, by having regard to a pre-approved register of launch service providers such as, NanoRacks or Space Flight whose technical and insurance bonafides have already been assessed and verified; we would propose additional administrative assessment is un-necessary duplication and non-competitive. Similarly, for an overseas launch certificate.

Recommendations

1. A pre-approved register of launch service providers to make for expeditious administrative approval. These providers will be accepted onto the register based on their adherence to the Australian Government's requirements.
2. Regularly review the insurance practices against each Category based on cover that is customary in the respective space activities given that Categories of space activity differ markedly by risk (i.e. rocket, SmallSat constellation or CubeSat) and proportionality (i.e. mass).
3. Expanding on (2) have regard to industry component suppliers such that their liability be considered in the context of risk Categories and proportionality.

4. We support the retention of Ministerial discretion in relation to waiving insurance requirements for overseas payloads and would welcome greater guidance having regard to the circumstances in which it might be exercised.

Regulatory burden

The *Bill* proposes to reduce barriers to participation by streamlining the process, however, the criteria for an overseas payload permit appears substantially unaltered.
By way of relevant background, the time, cost and duration taken to meet the regulatory criterion of the current *Space Activities Act 1998* (Cth) ('Act') in 2017 was;

- 50 days spanning legal, technical and administrative experts
- estimated preparation time valued at $200,000 and
- duration of application from commencement to conclusion was 2 years

These costs *do not* include the Space Licence fee of $10,000 as per currently specified in the *Act*, for the equivalent commercial use. To the Space Licence fee, a considerable concern to *Inovor* is that the fee applies equally to a nanosatellite start-up as to an established player such as Optus.

Recommendations

Ensure that the *Bill* balances compliance with opportunity for Australia's international competitiveness to flourish, specifically;

1. Contain the time taken from commencement of the application to approval to launch to approximately one month.
2. That licence fees be scaled in accordance with Categories of space operations.
3. Have regard to the time (and value of said time) to complete an application.

Overarching sentiment of the Legislation

The *Bill* makes few material changes to the existing *Act*. Therefore, given that much has changed since 1998, it is incumbent on industry participants to note its tenor in light of:

Acts Interpretation Act 1901 (Cth)
Noting that any Preamble to an Act is a part of the Act and that any Interpretation of a provision should be that which would best achieve the purpose or object of the Act; the Act in its current form appears to have not taken such matters into account.

Market signals
The tenor of the *Bill* will signal whether Australia is open for business in the new space industry. In contrast to recently passed space legislation by the UK Government (March 2018) and Luxembourg (July 2017) our legislation is singularly underwhelming with a heavy emphasis on compliance without the counter balance of holding ourselves out to offering a competitive regulatory regime that encourages innovation and investment in the industry.

Recommendations

1. Include a Preamble in the Bill that talks to Australia's openness to the space industry. A *Preamble drawn from the strong bipartisan statements could read as per below.*
2. Expand the Objects of the *Bill* to talk to Australia's international competitiveness.

Indicative Preamble

> *"We have an extraordinary opportunity to increase our share of the growing global space economy. Space technologies are not just about taking people to the moon, they open up opportunities for many industries, including communications, agriculture, mining, oil and gas. An Australian space agency will support the long-term development of space technologies, grow our domestic space industry and secure our place in the global space economy".*[1]
>
> *"It is in Australia's national interest to build our own capabilities in these areas, not only to meet current and future needs, but also to mitigate the risk of these services becoming unavailable. Australia has the science, technology, infrastructure and skills to punch significantly above our weight in the global space industry".*[2]

[1] Senator, The Hon Michaelia Cash, Minister for Jobs and Innovation, May 14, 2018.
[2] Senator, The Hon Kim Carr, Shadow Minister for Innovation, Industry, Science and Research, July 2017.

Appendix 1.

T.J. Chin, H. Do, N. Moretti, and M. Tetlow, "Robust Geometric Algorithms for Space Object Detection", International Astronautical Congress, September 2017

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A. Medon*, M.R. Tetlow and B. Dally "CFD Analysis of the Tigerfish Retractable Float System on a DHC-Twin Otter", SAE intl. Journal of Aerospace, Vol 1, No. 1, 2008, pp619-629.*

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M.R. Tetlow*, U.M. Schöttle, G.M. Schneider and M.E. Evans, "Monte Carlo Analysis for a Booster Flyback Guidance System", 43rd AIAA Science Meeting and Exhibit, Reno, NV, USA, January* 2005.

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M.R. Tetlow*, U.M. Schöttle, G.M. Schneider and M.E. Evans, "Predictive Guidance for Booster Flyback", 10th Australian International Aerospace Congress, Brisbane, Australia, August 2003*

M.R. Tetlow, U.M. Schöttle, G.M. Schneider and M.E. Evans, "Predictive Guidance for Upper Stage Ascent", World *Space Congress, Houston, Texas, October 2002*

M.R. Tetlow, U.M. Schöttle and G.M. Schneider (2001) "Comparison of Glideback and Flyback Boosters", AIAA Journal *of Spacecraft and Rockets, Vol. 38, No. 5, 2001, pp. 752-759*

M.R. Tetlow*, U.M. Schöttle and G.M. Schneider, "Optimisation of a Reusable Launch Vehicle Concept", AIAA Modelling and Simulation Technologies Conference, Denver, Colorado, August 2000*

M.R. Tetlow*, J. Burkhardt and G.M. Schneider, "Post Flight Analysis of the MIRKA Re-Entry Capsule", 8th International Aerospace Congress, Adelaide, Australia, September 1999*