

Office of the Deputy Vice-Chancellor (Research
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Defence support to industry: UQ Submission to Senate FADT Legislation Committee



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Terms of Reference

The Senate Foreign Affairs, Defence and Trade (FADT) Legislation Committee will inquire into the performance of the Department of Defence in supporting the capability and capacity of Australia's defence industry, with particular reference to the department's:

- a) support to Australia's defence industry in meeting the current and future needs of the Australian Defence Force;
- b) role providing and supporting opportunities for adjacent industries to contribute to the sustainability and viability of Australia's defence industrial capability;
- c) work to address the reliance of Australia's defence industry on inputs, be they tangible or intangible, from abroad and key capabilities that could form the basis of targeted exports;
- d) assessment and response to the risks that interruptions to supply chains may present to the ready access to such inputs and the benefits of producing defence industry outputs in Australia;
- e) role in enhancing Australia's defence industrial base by pursuing greater advanced scientific, technological, and industrial cooperation through AUKUS and other defence partnerships;**
- f) design and implementation of programmes and initiatives that seek to improve the Australian defence industry's capability and capacity; and
- g) any other related matters.¹

¹ Senate Foreign Affairs, Defence and Trade Legislation Committee, Inquiry into the performance of the Department of Defence in supporting the capability and capacity of Australia's defence industry, Terms of Reference, email communication, 23 June 2023.

About UQ

Australian universities are key actors in the defence capability innovation ecosystem. At the University of Queensland (UQ), our research translation and partnerships with industry and Defence provide critical pathways for scientific precepts and technologies to find their way into the hands of ADF warfighters, as well as those of our allies and partners.

From fundamental scientific discoveries in biotech, quantum, neuroscience, and artificial intelligence (AI) to applied engineering, advanced testing facilities and development of deployable prototypes, UQ directly supports defence capability through longstanding partnerships with the Defence Science and Technology Group (DSTG), defence primes, small to medium enterprises (SMEs), and US defence research entities.

Moreover, the University's provision of policy advice, professional education and training uplifts the capacity of our Australian Defence Force (ADF) and Australian Public Sector (APS) personnel. We educate and train the pipeline of graduates that meet the needs of the current and future Australian defence industry workforce.

Advancing universities' ability to partner with Defence, primes and SMEs is critical to supporting the mobilisation of Australia's national industrial base and strengthening sovereign capability. Furthermore, the strategic objectives of AUKUS Pillar I and II, in the development of a nuclear-powered submarine capability and advanced technological cooperation respectively, will require a **step-change** in Defence's approach to partnering with the university sector.

UQ commends the Senate FADT Legislation Committee inquiry into the performance of the Department of Defence in supporting the capability and capacity of Australia's defence industry, including the university sector. We hope the information and recommendations in this submission will prove valuable to the Senate Legislation Committee and welcome the opportunity to discuss these issues in more detail.

UQ's Defence Partnerships

As a large Group of Eight (Go8) university with world-leading capabilities in hypersonic science and enabling technologies, UQ is already well-integrated into the Australian defence science and technological community. Our enduring partnership with DSTG underpins Australian hypersonic capability and forms a critical part of engagement with the US Government agencies and US-based defence primes.

UQ researchers are the recipients of a range of defence-focused or directly funded grant mechanisms. These include the Australian Research Council (ARC) grants with defence industry partners, including the ARC Linkage programs and Cooperative Research Centres. Our academics are also the recipients of DSTG STaR Shots, Next Generation Technology Fund (NGTF) and Defence Innovation Hub funding programs. UQ's St Lucia campus is home to embedded DSTG personnel working on advanced cyber, quantum, and hypersonic programs.

The quantum of defence investment in UQ is not insignificant. Since 2017, the University has been awarded \$31.5M in defence funding (and over \$83M when the non-defence aspects of these projects are included). Approximately \$24.6M of this funding has been directed to research on Emerging Defence Technologies. Over 100 UQ staff are/have been involved in defence projects that were active between 2017-2023; and UQ has received funding from 44 funding bodies since 2017, including the Department of Home Affairs, Boeing, and Defence Materials Technology Centre (DMTC). Additionally, UQ has collaborated with researchers from 64 organisations on defence projects since 2017, including industry and government partners such as IBM, Toshiba, Hypersonix, Lockheed Martin, BAE Systems, and the European Space Agency.

Although UQ's engagement is principally with DSTG as the science and technological capability lead in Defence, UQ also partners with other parts of the Australian Defence Organisation, including Joint Health Command, Air Force, Army, Navy, Defence Strategic, and International Policy Divisions, and the Australian War College.

Our partnerships with defence and aerospace primes, including Lockheed Martin and Boeing Defence Australia, are expanding and becoming more strategically important as these companies position themselves for the partnership opportunities proffered by the Defence Strategic Review (DSR) and updated Defence Integrated Investment Plan. The ability of defence companies, both large and small, to tap into our STEM pipeline, moreover, is critical to maintaining their innovation edge and future viability.

Through UQ's hypersonic research and flight-testing programs, local industry talent such as Hypersonix Launch Systems, Stryder Defence and Black Sky Aerospace, are integrated with DSTG and defence primes into a single ecosystem which can enhance sovereign counter-hypersonics capability and meet the shared technology objectives of AUKUS Pillar II.

Recommendations

Recommendations (6) for Senate FADTLC as outlined in this document:

1. **Translation of strategic urgency into higher education policy clarity.** Recommend Defence provide greater clarity on priority research programs; undergraduate and postgraduate course offerings; and secure facilities and include defence research considerations in the Terms of Reference for the Australian Universities Accord.
2. **Improved communication and strategic guidance.** Recommend greater Defence support for the Australian Program Office for Advanced Hypersonics (APOAH) as a university-industry model which can be replicated across other AUKUS-related advanced technology areas.
3. **Improved funding certainty.** Recommend stronger demand signals from Defence and a sustained, multi-year funding approach to support university research capability for achievement of DSR and ASCA priorities.
4. **Greater agility in contracting processes.** Recommend Defence supports greater agility and flexibility in its defence contracting processes and this be achieved in Defence Science and Technology Group's (DSTG) review of the Defence Science Partnering Deed.
5. **Improved support for secure and sensitive research.** Recommend improved responsiveness and quality of the Defence Industry Security Program (DISP) information service, publication of university specific guidance for implementing DISP requirements, and co-investment in university-based secure Zone 4 (SECRET) facilities.
6. **Investment in research infrastructure vital to sovereign manufacturing capability.** Recommend further guidance from Defence with respect to national infrastructure priorities critical to sovereign defence capability, including a National Arc-Jet and High Energy Plasma facility.

Response to individual Terms of Reference

UQ is best placed to respond on the performance of the Department of Defence in supporting the capability and capacity of Australia's defence industry, with particular reference to the Department's:

- **role in enhancing Australia's defence industrial base by pursuing greater advanced scientific and technological and industrial cooperation through AUKUS and other defence partnerships.**

UQ acknowledges that Defence is undergoing a significant reform process following the release of the Defence Strategic Review (DSR). However, for Government to achieve the key priorities² of the DSR and the Advanced Strategic Capabilities Accelerator (ASCA), UQ recommends that Defence could enhance its support to universities through the following areas:

- Translation of strategic urgency into higher education policy clarity
- Improved communication and direction
- Enhanced funding certainty
- Greater agility in contracting processes
- Streamlined support to enable secure and sensitive research
- Investment in sovereign advanced manufacturing and testing capabilities.

Strategic Urgency and Policy Clarity

The higher education sector is operating in a more complex national and international strategic context with the 2023 DSR highlighting the destabilising impacts of Russia's invasion of Ukraine, growing strategic tensions in the Indo-Pacific region, and the challenges of online disinformation, cyber disruption and foreign espionage. Leading strategic analysts have pointed to the prospect of armed conflict in the Indo-Pacific region within a three-to-five-year timeframe.³

In the face of strategic uncertainty, universities are responding to the shifting defence and national security landscape through improved regulatory compliance, policy adjustments, and internal investment decisions. But this is challenging without greater clarity on how the Government's sense of strategic urgency will be translated to higher education policy settings that can better support universities' ability to engage in defence research and contribute to sovereign capability objectives.

Integrating higher education policy into a whole-of-government approach to 'national defence' as articulated in the DSR is essential to enable universities like UQ (strong in many of the critical technologies areas of advanced cyber, hypersonics, quantum, AI, key to ASCA and AUKUS Pillar II) to **plan with certainty**. The ongoing stasis and uncertainty around implementation of the DSR compounds the eight-month delay of the initial DSR drafting process.

Specifically, Defence could better support universities like UQ by providing further guidance on:

- a) priority research programs;
- b) undergraduate and postgraduate course offerings; and
- c) secure facilities to enable sensitive research.

² List 6 priorities of DSR.

³ Derek Grossman, 'Taiwan Is Safe Until at Least 2027, but with One Big Caveat', *The Rand Blog*, 10 November 2021, <https://www.rand.org/blog/2021/11/taiwan-is-safe-until-at-least-2027-but-with-one-big.html>

In addition, there may be a strong case for including defence and national security considerations in the Terms of Reference for the ***Australian Universities Accord***, which will help facilitate the DSR's focus on whole-of-government national effort.

Communication and Consultation

At UQ, we see great enthusiasm by academics to contribute their research expertise to Australian defence capability, but frequently there is a lack of clear direction or responsiveness from Defence, which serves to frustrate research collaborations and ultimately the translation of Australian science and technological know-how into capability.

UQ acknowledges that key reforms in the defence innovation ecosystem are underway and appreciates the excellent relationship forged with our designated DSTG university relationship executive. However, we recommend greater responsiveness more generally from Defence and more frequent and ongoing dialogue between parts of the Australian Defence Organisation (ADO) and university partners on how we can work and plan together going forward.

Furthermore, to meet the commercialisation and capability acceleration priorities of the ASCA, Defence partnerships with universities, primes and SMEs are essential. Currently, Defence does not have direct visibility of university engagement with the primes and the broader defence innovation ecosystem appears somewhat disjointed and disconnected.

In broad terms, UQ defence-focused researchers and professional staff have found that Defence doesn't always know what it wants and there is benefit in universities and industry in proffering solutions. For example, UQ has led the way in the establishment of an inter-university coordination mechanism in hypersonics entitled the Australian Program Office for Advanced Hypersonics (APOAH), which connects the primes, Defence (DSTG & Air Force), SMEs and US and UK university and industry partners into a coherent whole.

UQ welcomes greater Defence support for the APOAH, and recommends this model be replicated across other AUKUS-related advanced technology areas.

Counter-Hypersonics: Australian Program Office for Advanced Hypersonics (APOAH)

The APOAH, housed at UQ, provides a single gateway into the Australian university hypersonics ecosystem.

The role of the APOAH is to identify and rapidly demonstrate technology emerging from the academic sector (TRL 6) which can be integrated with existing or future ADF platforms.

It develops the sovereign workforce pipeline in hypersonics by providing students and postgraduates with practical experience on flight vehicle production and testing.

The APOAH is governed by a Strategic Advisory Board comprised of eminent former industry figures, Defence scientists and ADF officers.

Its technical programs are guided by a Technical Working Group representing University of Southern Queensland, University of New South Wales, RMIT University and UQ.

As the APOAH matures, it will constitute a valuable forum for coordination with our US and UK government and industry partners under AUKUS Pillar II and ASCA.

Funding Certainty

Queensland's **strategic geography** is critical to Defence capability and force structure considerations. The state is home to more than 43% of the Australian Army and hosts Australia's largest Air Force base numbering more than 5000 personnel located at RAAF Base Amberley. With far-north Queensland's proximity to strategically important Pacific Island and Southeast Asian nations and ready access to the Western Pacific, our state also presents important forward basing, sustainment, and combined training opportunities for the ADF and its regional counterparts.

Although the ADF presence in Queensland will be augmented with the DSR's emphasis on the hardening of northern bases, **only 9%** of Defence funding goes to Queensland universities.⁴ This belies the fact that Queensland is home to an increasingly dynamic defence industry, hypersonic and aerospace community, and has universities with world-leading expertise in tropical diseases, defence health and human performance –critical to sustaining personnel in the Indo-Pacific and in littoral theatres of operation.

Although Defence is recalibrating its defence research funding priorities, previous funding has been somewhat piecemeal, with a noticeable disconnect between universities and the designated ADF capability leads, including ADF warfighters. UQ recommends stronger demand signals from Defence and a **sustained, multi-year funding approach** to support university research capability for achievement of DSR and ASCA priorities. Universities require greater certainty on where they should focus their defence research investments for strategic planning purposes. For example, many universities, including UQ, have appointed specialist defence advisors, funded security clearances required of staff working on defence projects, and invested significant capital in the construction or refurbishment of secure facilities mandated by Defence contracts.

Further consideration might also be given by Defence to better supporting Queensland's university research ecosystem. UQ is a founding member of the **Queensland Defence Science Alliance (QDSA)** which forms part of the Australian Defence Science and Universities Network (ADSUN). QDSA constituent members include DSTG, the Queensland Government, UQ, Griffith University, and James Cook University. In the DSR's recognition that State Governments are also important to national defence, UQ recommends enhanced Defence guidance and financial support for the QDSA by the ADO, as a gateway into the Queensland defence policy and research community.

Agile Contracting

Currently, defence-related agreements administered by DSTG are settled template agreements under the Defence Science Partnering Deed (DSP). Although there is a great deal of efficiency using the agreed templates, there is no ability within the suite of agreed documents to shift the perspectives of DSTG.

For example, DSTG agreements are based on DSTG funding a project and directing the objectives, obligations and ultimately owning the outcomes of that project. These agreements are not designed to adapt to other arrangements where DSTG is a **junior partner** or where a university is the administering organisation managing ARC and industry funding obligations.

The consequences of this means that current contracting processes administered by DSTG are not fit-for-purpose in achieving the research translation objectives of the ASCA, where Defence may be party to an

⁴ Figure cited in DSTG brief 'Defence science and technology in Australia', Edinburgh, June 2022. This figure compares with 28 per cent to Victoria and NSW respectively, and 16% to South Australia.

agreement but not the contracting authority. For example, in hypersonic and counter-hypersonics, a key priority of both the DSR and AUKUS Pillar II, this means that it is difficult for DSTG to join an existing and highly strategic partnership between UQ and a defence prime.

UQ recommends Defence engenders greater agility and flexibility in its defence contracting processes with universities and that this be achieved in DSTG's review of the DSP.

Secure and Sensitive Research

The Defence Industry Security Program (DISP) was designed for private sector companies rather than large, open, and publicly funded universities. As a result, achieving DISP certification has been an incredibly complex and protracted process for universities increasingly engaged in defence and national security research.

One measure that would greatly assist defence industry is to improve the responsiveness and quality of the **DISP information service** (disp.info@defence.gov.au). Interpreting and applying security requirements as per the Protective Security Policy Framework (PSPF) is challenging, particularly in a university environment, and it is often necessary to seek advice on how they apply in specific circumstances. At present it is difficult to get support from Defence. Quite often emails go unanswered or responses do not adequately address the question or contradict other advice that has been provided. Often the only way to get clear advice is to leverage contacts within higher levels of Defence.

Another measure that would assist universities is to publish **university-specific guidance** for implementing DISP requirements. Given the complexity and size of universities it is not possible to apply DISP measures to the entire organisation. The only feasible approach is to carve out a part of the university for Defence research and apply DISP measures to that. However, this creates difficulty with applying certain security measures that current guidance does not address. Working with universities to develop and then publish FAQs or a set of common scenarios would greatly assist this process. Similarly, educating sponsors within Defence on the unique challenges universities face in implementing DISP requirements would help facilitate more effective collaboration.

Finally, Defence **co-investment** in DISP-certified facilities up to Zone 4 (SECRET), would accelerate the scale-up of sensitive university research and vital industry collaborations. University policy and procedures developed to meet DISP requirements also promote International Traffic in Arms Regulation (ITAR) and Controlled Unclassified Information (CUI) compliance, with the effect of further facilitating critical technology cooperation with the US, both bilaterally and through AUKUS.

Enhancing Sovereign Capability: National Arc-Jet Proposal

While the Covid-19 pandemic highlighted Australia's supply chain vulnerabilities, Russia's invasion of Ukraine has demonstrated the importance of ongoing access to munitions and advanced weapons systems. As military capabilities accelerate across the Indo-Pacific region and strategic competition becomes heightened, the prospect of high-end warfare becomes more likely, with resulting risks to Australia's munitions and ordnance **supply chains**.

By investing in areas of critical sovereign manufacturing capability, Defence can better support national resilience in times of crisis. UQ is currently exploring the feasibility of a National Arc-Jet and High Energy Plasma Facility leveraging South East Queensland's strengths in high-speed flight and advanced materials.

The provision of greater guidance from Defence to university and industry partners on critical sovereign manufacturing and testing facilities would support the sovereign capability objectives of the DSR and prevent vital manufacturing capabilities in hypersonics going offshore. An Arc-Jet facility would also help build Australia's industrial base with additional broader applications for the energy and space sectors.

Sovereign manufacturing: National ARC-Jet Facility

Australia is already a world leader in short duration hypersonic testing facilities, which are generally used for low TRL testing (TRL 1-3). At the same time, Australia is one of the few nations that has successfully performed hypersonic flight testing (TRL 6-8).

A large gap exists between these two capabilities as Australia does not currently possess any long duration, high-enthalpy test facilities, such as arc-jets, which are essential for the testing and qualification of high temperature materials, structures and designs.

Arc-jets fulfill an important role in the hypersonic testing space as they are the only type of hypersonic test facility which can fulfill both long duration and high-enthalpy testing requirements. They can simulate the heating associated with hypersonic flight and the associated time scales and flow speeds. This makes them the ideal type of facility to test and qualify the specialist materials used to survive hypersonic flight and to test scaled versions of complete hypersonic systems.

With the current emphasis on accelerated development and industrialisation, facilities that can help to bridge the TRL 4-6 'valley of death' are an essential sovereign capability. With the cost of even a basic flight test exceeding 20% of the cost of a proposed arc-jet facility, this represents a cost-effective way to de-risk flight test programs and accelerate development.

The DSTG Hypersonic precinct, Gilmour Space Technologies, Rocket Technologies International, Hypersonix Launch Systems, as well as experimental hypersonics and materials research faculties of UQ and University of Southern Queensland are all situated in a radius of less than 100 km. With so much critical mass in close geographic proximity, south-east Queensland is the perfect location for the proposed facility.

Besides their tremendous utility in the aerospace domain, high energy arc-jets are also being investigated for a wide range of applications ranging from de-toxification, propulsion, materials science, and hydrogen production.

UQ is seeking funding for a National Arc-Jet facility, which could include co-funding from Queensland universities, Defence, the Queensland Government, academic partners, and industry partners. We welcome further guidance from Defence with respect to national infrastructure priorities critical to sovereign defence capability.

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