

Strategy

Mobilising Australia for a Whole-of-Nation Defence Era

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Australia's evolving strategic environment, marked by accelerating technological competition and rising Indo-Pacific tensions, demands a shift from episodic defence planning towards a coordinated whole-of-nation defence posture. This paper argues that national resilience now depends on integrating government, industry, academia and civil society into a sustained capability framework. It proposes three interconnected initiatives designed to operationalise this approach: (1) a nationwide science, technology, engineering and mathematics (STEM)-to-Defence talent pipeline that builds the human capital essential for emerging air and space missions; (2) a sovereign space acceleration initiative that establishes rapid, sovereign space-launch, production and data infrastructure to secure Australia's access to space-based capabilities; and (3) an air and space reserve network that embeds civilian technical specialists directly into Defence operations through a legally enabled, scalable reserve model. Together, these initiatives synchronise people, platforms and partnerships to deliver enduring strategic advantage, reduce reliance on external suppliers and enhance national preparedness across air, space, cyber and autonomous domains. The paper concludes that adopting such a framework is vital if Australia is to shift from reactive capability development to proactive, long-term sovereignty in an increasingly contested regional environment.

1. Introduction

Australia's strategic growth has reached a turning point. Rising competition in the Indo-Pacific and policies that oppose 'grey zone' operations have sped up the integration of air, space, cyber and information operations, breaking down the barriers that used to separate these areas of protection (Bensahel, 2017; Kumar, 2024; Montolalu, 2022). The 2023 Defence Strategic Review (DSR) shows this trend, stating that Australia's strategic circumstances require a whole-of-nation approach to defence planning and preparedness (Department of Defence, 2023). Building up Australia's defences isn't just the job of the Australian Defence Force (ADF) anymore. It's a long-term national effort that includes the government, businesses, universities and regular people. Like other small states, such as Singapore, Israel and Norway, these initiatives are designed to build citizen preparedness by developing STEM and other essential skills from an early age, ensuring that all Australians have the opportunity to be equipped to support national security.

This whole-of-nation approach marks a departure from Australia's historic approach of developing capabilities in an episodic and reactive manner and reflects a more deliberate understanding of strategy itself. Strategy can be defined as the conceptual framework that connects limited resources to lasting national objectives, while effective defence planning requires linking strategic intent to operational capabilities over long-time horizons (Brands, 2014; Freedman, 2013; Gray, 2016). Australia's previous reactive

strategic stance has increased its vulnerability to shifts in power relations, particularly in an Indo-Pacific region which has been characterised by rapid military growth and technological integration in recent years (Dean & Raymond, 2017; Frühling, 2009; Lockyer, 2017). As a result, scholars are now emphasising that evaluating alternative strategic approaches is essential to strengthening Australia's long-term capability planning (O'Neil, 2011). The DSR also emphasises vulnerabilities in new areas – especially space, noting that secured access to space is vital – to national defence, and existing reliance poses a strategic threat (Department of Defence, 2023). Without an enduring capability strategy, Australia faces the danger of staying technologically reliant, financially vulnerable and strategically limited – just when sovereignty is most crucial.

To address these weaknesses, I propose three linked initiatives: (1) a science, technology, engineering and mathematics (STEM)-to-Defence talent pipeline that builds up human capital; (2) a sovereign space acceleration initiative; and (3) an air and space reserve network. Each initiative concentrates on a facet of power, cultivates curiosity and strategic mindsets. The space acceleration initiative aims to develop independent platforms and facilities while the reserve network merges civilian and military capabilities into a versatile mission-prepared reserve. While space is the primary lens for analysis and initiative design, the principles underlying these projects are broadly applicable to related domains such as uncrewed aerial systems (UAS), autonomous air platforms, and operations that produce grey-zone or non-kinetic effects. However, stressing space gives

a targeted vantage point for skill development, while cross-domain application improves strategic relevance without broadening the scope beyond viable implementation. In doing so, the initiatives not only address the space problems that are currently being faced, but they also provide conceptual frameworks that may be utilised in a variety of future operating situations, which is beneficial to Australia's overall strategy. These initiatives could, therefore, collaborate to establish a single, all-encompassing enterprise that has the potential to provide Australia with a long-term strategic advantage, strengthen the military ecosystem and bring the nation's sovereignty together.

2. Building human capital

To secure Australia's strategic edge in air and space power, I propose to establish a STEM-to-Defence talent pipeline envisioned as a Defence-aligned nationwide talent development framework intended to address the structural workforce deficiency identified in the DSR (Department of Defence, 2023; Matthews, 2019). One reason for this is that developing sovereign capability in these domains depends on long-lead human capital formation, yet current approaches rely on fragmented and episodic STEM outreach programs that fail to produce continuity, scale or strategic alignment across the sector (Marc, 2025). Without a more coordinated pipeline, Defence will remain locked into reactive recruitment cycles that cannot meet emerging capability demands (Mahoney & Thelen, 2015). However, Defence cannot resolve this challenge independently. The skills underpinning advanced aerospace, cyber and space systems are formed well before individuals become Defence-eligible, and are largely shaped by education systems, industry pathways and broader societal incentives. Competing directly with industry for scarce technical talent has proven costly and unsustainable, while Defence-only training models are poorly suited to rapidly evolving technological fields (Gray, 2016). Consistent with the DSR's whole-of-nation framing, the STEM-to-Defence talent pipeline would shift early capability formation outside of Defence while preserving Defence influence over the skills, problem-sets and strategic contexts that matter most for future operations.

The proposal for a STEM-to-Defence talent pipeline connects current education to career programs. Instead of replacing current standalone initiatives entirely, the talent pipeline would create a path that ties them together while also expanding them. This would allow students to start learning earlier in primary school, giving them an improved foundation. The pipeline would work to coordinate with programs like the Defence STEM Work Experience Program (Defence Science and Technology Group, 2024), AVISTA STEM outreach (Australian Remote Operations for Space and Earth [AROSE], 2025), and the Defence STEM Cadetship (Defence Science and Technology Group, n.d.) to make it easier for students to go from high school to higher education and then to work in defence-associated businesses after graduation. To achieve this, the talent pipeline would start by developing students ages 5 to 12 interest in STEM skills, encouraging them to think about systems, and cover-

ing topics in technology, space and national security. Short talks with Defence STEM ambassadors, university cadets or business leaders as mentors could help reinforce these skills. Digital badges or certificates could be used to show successes and encourage more participation by incorporating elements of gamification such as rewards, levels and challenges to make this learning more engaging and motivating.

In secondary school (Years 7–12), students can use the skills they learned in primary school in more organised lessons. Programs like AVISTA that have already built a foundation connected to the school curriculum could be leveraged on a grander scale to give students greater opportunities to learn about advanced technology and jobs in defence (Australian Remote Operations for Space and Earth [AROSE], 2025). Similar tactics could also be employed with the Defence STEM Work Experience Program, which gives students hands-on, site-based placements and classes to help them learn about careers and get ready for university or an apprenticeship (Defence Science and Technology Group, 2024). At the post-secondary level, the talent pipeline could be intertwined with the Defence STEM Cadetship to give students the chance to use what they've learned in real-life Defence science and technology settings while they are still in university (Defence Science and Technology Group, n.d.).

In this way, the main goal of the STEM-to-Defence talent pipeline is to build a workforce that is ready for the future and has technical knowledge, systems thinking and strategic awareness. This will improve Australia's national security, encourage innovation and maintain the country's control over key technological industries. That said, this approach does entail a number of deliberate trade-offs. Early workforce development would occur beyond Defence's direct control, and outcomes would be realised over longer time horizons than traditional recruitment initiatives. Additionally, there is the risk of a perceived militarisation of education, particularly in the context of educational institutions themselves. By promoting voluntary participation, establishing clearly defined goals, and placing an emphasis on dual-use skills that have clear civilian value, the talent pipeline could be used to help lessen these risks. It would not be considered a failure to migrate workforce into industry instead; rather, it would simply act as an extension of the national mobilisation base, which increases resilience rather than weakening the capacities of the defence sector.

Comparable international models demonstrate the feasibility of this method. The Israel Defense Forces' geospatial intelligence branch (Unit 9900) exemplifies Israel's defence innovation paradigm by recruiting technically talented professionals for specific analytical tasks, many of whom later transfer into the civilian technology industry (Podmazo, 2019). The exchange of expertise between the military and the commercial sector has resulted in increased rates of defence-related start-up creation and dual-use innovation (Broude et al., 2013), illustrating how a deliberately permeable boundary between defence and civilian sectors can accelerate national innovation. The established permeability between the defence and civilian sectors, rather than scale

alone, is an important lesson for Australia. Indeed, Australia appears to have taken the opposite route with the moratorium imposed by Defence, which effectively hampers interoperability between defence areas, essentially punishing any recently separated Defence personnel or public servant for trying to enter defence industry, even if they are not decision-makers or entering defence areas unrelated to their previous role (Pittaway, 2023). The lesson from Israel is that it would be more beneficial for Australia to align education, industry and defence routes across extended time horizons rather than replicating scale, requiring compulsory service or limiting access.

Over time, the STEM-to-Defence talent pipeline would nurture a generation that possessed not only technical expertise but also strategic literacy and a concept of defence as a collective national responsibility. The initiative would aim to eliminate structural workforce fragility and strengthen Australia's sovereign innovation base by integrating education, industry paths and defence capabilities requirements. Crucially, the talent pipeline is not intended to internalise all talent within Defence, but rather to broaden the national mobilisation pool from which Defence might draw in times of crisis. In doing so, it would lay the human foundation for sovereign platforms and surge capacity, all of which the other initiatives, sovereign space acceleration initiative and the air and space reserve network, aim to operationalise.

3. Sovereign space acceleration initiative

While the talent pipeline addresses the human capital foundations of future capability, Australia's strategic exposure in space requires an equivalent focus on sovereign platforms and access mechanisms. I propose the establishment of a sovereign space acceleration initiative that would solve a number of significant vulnerabilities identified in the DSR. These vulnerabilities include Australia's growing reliance on space-enabled technologies as well as inadequate sovereignty over their availability, tasking and resilience (Martin, 2024; Moltz, 2019; North Atlantic Treaty Organization, 2019). Securing access to space is essential for almost all the functions that are now being performed by the military and civilian organisations. These duties include intelligence gathering, surveillance and reconnaissance, communications, navigation, logistics coordination, and management of critical infrastructure (Bowen, 2020). According to experts, Australia's existing reliance on allied and commercial systems puts it at risk of disruption, denial or prioritisation threats during times of strategic stress (Chow, 2017; Moltz, 2019). This poses a problem since it restricts the ability to make decisions at the national level precisely when autonomy is most required. Defence cannot mitigate this vulnerability independently. Capital intensity, industrial scale and technical pace of contemporary space systems often exceed the capabilities of defence acquisition and sustainment models (Carlo & Breda, 2024; Teer & Spatafora, 2025). This is particularly true given Australia's narrow and scattered domestic market, which, in comparison to other small states, possesses an even more restricted economic scale necessary to support major, capital-inten-

sive space missions. The national workforce, especially in specialised fields like aerospace engineering, systems integration and space domain awareness, is limited and intensely competitive across several industries. Therefore, being totally self-sufficient is neither a possibility nor a desirable goal for Australia.

A space acceleration initiative, on the other hand, acknowledges that sovereign competence in space is dependent on selective control rather than total ownership. This necessitates collaboration between the government, industry and allied partners, all while maintaining national authority on function that is vital (Australian Space Agency, 2018; Teer & Spatafora, 2025). By shifting from a dependent to a resilient state, Australia would be able to make significant contributions to the operations of the coalition while also maintaining its ability to function independently. Implementation would put speed, flexibility and durability ahead of custom optimisation. A space acceleration initiative would use distributed satellite architectures that are easy to construct, launch and replace quickly. This would reduce the need for single points of failure and speed up recovery times in contentious scenarios. Capability development would occur in iterative, spiral acquisition cycles, facilitating the progressive testing, deployment, evaluation and updating of technology due to this method's effectiveness (Davis, 2025). Defence would still be in charge of governance, but it would be set up in a way that encourages quick decision-making, modular procurement and quick launch partnerships. Data handling and tasking power would still be sovereign. Funding would mix the need for defence with co-investment measures like procurement assurances and challenge-driven awards. This would keep private capital in the country and support domestic business without putting all the financial risk on the government.

It is important to note that this model also entails explicit trade-offs. Smaller, modular systems may not perform as well as larger custom platforms, and bringing speed to capability may sometimes mean accepting capabilities at risk with the understanding that early technical failures may be more common. However, the capacity to recover, replace assets and adjust strategy in challenging circumstances more than offsets these trade-offs. In addition, shared investment frameworks impede the exclusive control of Defence over the development of new capabilities. However, they facilitate cost-sharing, growth and new ideas that would not be feasible otherwise. Independence for its own sake is less significant than interoperability with allied systems, which requires acknowledging integration challenges to maintain credibility and relevance as a deterrent.

Small-state space strategies provide relevant precedent for this strategy. For instance, Norway's satellite policy allows for the country to maintain sovereign control over essential data sources while leveraging private partnerships for launch services, satellite platforms and supporting infrastructure (Norwegian Government, 2021). This method strikes a balance between national authority and cost-effective private sector involvement. It also lets the government get advanced skills without having to depend only

on domestic businesses. Total industrial self-sufficiency is not a measure of success; what matters is ensuring that the whole-of-nation has access to important space-based knowledge, that operations are sustained, and that the nation can bounce back from any disasters or crises. The strategy also focuses on adding commercial data and tools to systems that monitor national security and the environment. This will create a hybrid model where the government can ensure that strategic priorities are met and commercial actors provide flexibility, new technology and the ability to grow. In this way, this model demonstrates how a small state can keep control of sensitive information and important decision-making processes while using the skills of both international and local private sectors to keep operations running smoothly.

Consequently, an accelerated space initiative would use this concept to shift space from a domain of strategic dependency to one of selective sovereign control. Rather than attempting full autonomy, the program would focus on ensuring national tasking authority, resilience in the face of disruption and interoperability across allied architectures. Defence would maintain strategic control over vital operations by anchoring local industry through co-investment and quick acquisition cycles, while harnessing private-sector innovation. In conjunction with human capital pipeline, the accelerated space initiative would provide the technological infrastructure required to sustain operations in contested areas, which the air and space reserve network could then scale during times of escalation.

4. Air and space reserve network: converting expertise into operational effectiveness

Apart from building the human pipeline and establishing an accelerated space initiative, Australia still requires a mechanism to convert dispersed technical expertise into operational effect at speed. I propose the establishment of an air and space reserve network to address a structural force-generation gap identified in the DSR that the ADF lacks a scalable, prepared reserve able to sustain advanced air, space, cyber and autonomous system operations during periods of escalation (Department of Defence, 2023; O'Neil, 2011). These domains demand highly specialised skills that evolve faster than traditional military career models can accommodate and which are increasingly concentrated in civilian industry and research institutions (Singer & Friedman, 2014).

Defence cannot resolve this gap through permanent force expansion alone. Attempting to internalise rapidly changing technical expertise would impose prohibitive cost, accelerate skill obsolescence and exacerbate retention challenges in competition with the private sector. The air and space reserve network therefore adopts an access-based model, recognising that national capability advantage increasingly resides outside uniformed structures. This approach reflects international practice in which civilian specialists are integrated through reserve service, preserving civilian careers while enabling Defence to draw upon current, mission-relevant expertise when required (Dean et al., 2014; Gray, 2016).

For the purposes of mobilisation, security screening and integration into existing command and control arrangements using a formal legislative and governance framework would be required. Additionally, a systematic cooperation between the Australian Space Agency and the Australian Signals Directorate would also need to be established to assure capability coherence and minimise fragmentation. Under this proposed framework the air and space reserve network would be directed by Defence. Instead of aiming for scale right from the beginning, the strategy would need to be developed through a series of phased pilot cohorts that are related within critical mission areas. These cohorts could then be supported by employer partnership frameworks and secure digital infrastructures, where training and readiness would combine using periodic in-person activities with virtual and remote operational integration, enabling national participation while maintaining operational standards. This means that funding would need to prioritise readiness and accessibility rather than continuous employment, which would need to be supported by targeted incentives that recognise dual-career participation and employer cooperation.

Singapore's defence governance and procurement model offers a useful parallel. Singapore's Total Defence model is a centralised, state-led environment that unites developing military capabilities, civil defence, digital resilience and getting the people involved (Bitzinger, 2018; Ministry of Defence, n.d.). In practice, this means that policy, planning and allocating resources are all handled by the same government department. This makes better use of limited staff and faster responses to new dangers. The procurement system is designed to be modular and lifecycle oriented. In this way, skills can be added over time without having to go through big procurement cycles or hire more people. Therefore, equipment and software are designed for gradual updates. The training and operational responsibilities of soldiers are divided between regular and reservists, with the latter able to capitalise on a robust national service system that cultivates technical and civic competencies that can be applied in the civilian sector. Businesses and research institutes are included in the civil-military partnership, which enables the testing and implementation of emerging technologies in defence operations as soon as feasible. Singapore's technological advantage is maintained by the cohesive governance framework that is established by the processes of centralised coordination, modular procurement, lifecycle adaptability and integrated civil-military interaction, despite the country's small defence force.

However, careful consideration is needed due to the inherent trade-offs of this approach. Reliance on reservists reduces peacetime predictability and requires acceptance of variable availability. Integration complexity and security risk are higher than in closed force models (Antai & Hellberg, 2025). However, these costs are offset by access to technically current expertise, surge capacity during crisis and reduced long-term personnel burden. The reserve network accepts depth over mass, prioritising relevance and adaptability rather than force size. Therefore, within this framework, workforce mobility between Defence and in-

dustry will need to be viewed as a strength rather than a weakness, enhancing national resilience while supporting, rather than undermining, Defence capability. Consequently, the reserve network would provide Defence with a systematic method for accessing technically current civilian skills while avoiding unsustainable force build-up. The strategy would increase surge capacity while maintaining economic productivity and innovation by institutionalising mobility between industry and uniformed services. This method embraces higher integration complexity in exchange for increased depth, adaptability and resilience across advanced operational domains. When combined with the long-term talent development pipeline and sovereign space acceleration initiative, the reserve network would result in a scalable whole-of-nation capability architecture that is consistent with the DSR's need for preparedness in an era of strategic rivalry.

5. Overcoming barriers and securing capability

The STEM-to-Defence talent pipeline, the sovereign space acceleration initiative and the air and space reserve network all have similar long-term goals, but they all have to deal with the same problems when it comes to money, leadership, possibility and managing risks. Taking these concerns into account is important for the project's long-term reputation and success. Because financial goals and election cycles change, steady, long-term contributions are becoming increasingly important. If the strategy depended on funding from Defence alone, it probably would not be sufficient for it to operate (Australian National Audit Office, 2023). Another option is to split the costs between the military, education, industry and innovation sectors and use a shared funding method. This method improves consistency, lowers risk, and is backed by co-investment tools like procurement guarantees, challenge grants and matched funds. Therefore, Defence investment should be a market anchor under the space acceleration initiative, not the main source of finance. This will encourage private sector participation and benefits that go beyond military uses.

It is critical to develop certain operational principles and governance in order to keep policies from collapsing and spreading. This is especially true for national-scale government undertakings. Defence would be in charge of monitoring a permanent inter-agency steering committee that would include representatives from the Australian Space Agency, the Australian Signals Directorate, education authorities and industry. Furthermore, a centralised governance system would be required to ensure that the plan continued to progress. Having this committee in place will guarantee that decisions are made honestly and transparently. Furthermore, the planning process must include a thorough assessment of the potential risks involved as well as the chances of successful completion. A thorough assessment is needed because phased implementation reduces execution risk by allowing for the piloting, modification and progressive rollout of modular and scalable programmes across the entire country (Mahoney & Thelen, 2015; Senge, 2006). The Bridgestone World Solar Challenge ((Australian Academy of Technological Sciences & Engineering,

2020; Bridgestone, n.d.)), Healthy Harold (Australian Council for Educational Research, 2021) and Rock Eisteddfod (Rock Eisteddfod Challenge Foundation, 2012), among other Australian programs, show that it is possible to adapt the necessary organisational frameworks rather than building them from the ground up. This is something that can be accomplished. Clear goals, strong ethical oversight, voluntary participation and a focus on dual-use civilian outcomes can all help to avoid big problems like worker fatigue, minimise the belief that education is becoming militarised, address weaknesses in space or cyberspace and the tendency to over-rely on new technology. Using dispersed systems, redundancy and working with friends all make technology more reliable. This enables the Government to continue overseeing critical missions while strengthening its resilience. Despite the complexity of the projects, these indicators suggest that risks can be managed and that the strategic benefits of the initiatives are worthwhile. The proposed initiatives are not autonomous projects in and of themselves. On the contrary, each of them is part of a national capacity structure. The goal of this framework is to encourage collaboration among individuals, platforms and partnerships in order to achieve long-term strategic goals.

6. Conclusion

My proposal to build a STEM-to-Defence talent pipeline, a sovereign space acceleration initiative, and an air and space reserve network could form the basis for a national capability framework that is consistent with the DSR. The talent pipeline would develop a group of technologically skilled and strategically aware Australians ready to strengthen national resilience from their earliest years. An accelerated space initiative would help to build the air and space infrastructure needed to support this workforce in generating operational benefits. And lastly, an air and space reserve network would incorporate civilian expertise straight into Defence operations, facilitating swift deployment and ongoing capability expansion within the most technologically advanced fields. Together, these initiatives could move Australia beyond a reliance on acquisition and towards a proactive framework for capability growth. These initiatives are based on similar small-state experiences while being customised to Australia's strategic geography, alliance setups and workforce constraints. Crucially, they establish sovereignty as a national concept by aligning persons, platforms and relationships over long-term perspectives rather than short political cycles. For this endeavour to be successful every initiative needs to be enacted, financed and managed as a lasting dedication. Temporary trials or fragmented efforts will not be adequate in a time of increasing threats. Herein, Australia requires a whole-of-nation approach that harnesses national intelligence, fortifies sovereign industry and integrates resilience, within both civil and defence organisations. Through these proposed initiatives, Australia can transform its traditional limitations, small population, vast geography and constrained budgets into sources of strategic advantage. In addition to serving as an informed consumer of allied capacity, the nation has the ability to independently contribute

to the region's stability and security. To capitalise on this opportunity, it is necessary to possess a long-term perspective, be determined and prioritise integration. Incrementalism is no longer an option. Australia must establish long-term national capabilities frameworks that safeguard sovereignty and fortify the nation for future generations.

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