EMBRACING AN UNCONVENTIONAL

FORCE STRUCTURE

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Key customers: *Strategists and capability planners in Defence, strategic analysts, and innovators in the Defence industry*

Past ways of developing capabilities for the ADF will constrain the effectiveness of the future force. Technological advancement has highlighted the potential for trusted autonomy, which will provide the greatest return if Defence integrates autonomous systems into the force and addresses eight requisite criteria. Policy makers, planners and innovators should recognise the value that an emerging Australian industry in autonomous systems could deliver to the force structure.

EXPERT VOICE

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INTRODUCTION

The Government's commitment to Defence has strengthened Australia's military capability, notably through the 2016 Defence White Paper and the associated substantial capabilities delivered by the Integrated Investment Program (IIP). The weapon systems that the Australian Defence Force (ADF) will possess, especially in the air and maritime domains, reflect the best capabilities available. These capabilities include the F-35 air combat fighter, Growler electronic warfare aircraft, Wedgetail airborne early warning and control, and P8 maritime surveillance aircraft, as well as the significant investment in the RAN through the landing helicopter dock (LHD) transport, air warfare destroyer, frigate and submarine programs.

Australia soon will have the most sophisticated military hardware that it has ever operated. Thus Defence analysts should have a level of confidence that Australia's interests will be well served by the strength in its military power to support other forms of national power.

Notwithstanding this unprecedented period of strong ADF capability, there has been debate about the vulnerability and suitability of our force structure for challenges that we may face in future. Such criticisms include that the force remains very conventional and this might represent vulnerability in the face of asymmetric and innovative threats. Similar debate is emerging in relation to the force structure of the US.

The strategy of achieving a comparative edge and deterrence through a small force with high training and sophisticated systems is nothing new, dating back at least to the Defence White Papers of 1987 and 1994. Concentrating capability is consistent with the ADF being a small professional force, equipped by advanced capabilities provided through privileged alliance arrangements, as well as attention to research and development (R&D) and capability development.

SO WHAT HAS CHANGED?

Behind the concern about emerging threats is a theme that Australia might be putting all our Defence eggs into one conventional basket. Several factors have emerged that demand we reconsider these fundamental precepts of our force structure. They include:

- the diminution of military R&D in leading technology transformation, with far greater advances now coming from commercial R&D;

- the duality of information technology being critical to capability, but also a critical vulnerability;

- the lack of confidence in supply chain assurance for key elements of the technology used in military systems;

- the increasing cost of sophisticated weapon systems, which results in provision of fewer systems;

- the long timeframes for Defence acquisitions compared to the shorter timeframes of technology and commercial development cycles;

- the global diffusion of the ability to access or manufacture advanced technologies;

- the emergence of regional powers, including their ability to acquire modern and highly capable weapon systems;

- potential uncertainty of alliance commitments; and

- the growth in technology associated with autonomous systems.

Of particular concern, our small but capable military force could be vulnerable against surprise: whether that be tactical, such as a cyber or other unanticipated attacks against our sophisticated assets, or strategic, such as facing a capable adversary without the support of allies.

The 2018 Air Power Conference featured discussions that questioned the ability of a traditional force to defend against an asymmetric threat such as an adversary that employs a swarm of autonomous sea or air assets.

DEVELOPING THE FUTURE FORCE

Australian military strategists often take the view that we need to deal with asymmetry rather than embrace it. If a network of low cost autonomous air, sea or land vehicles is potentially a threat to our security, might it not by the same token be of substantial value if part of our force structure? This question was well addressed by Thomas Hammes at the 2018 Air Power Conference.

The answer is, of course, yes. Yet the prospects of a significant change in force structure remain low with Defence's approach to the capability life cycle. The determinants for force structure are largely: *what do we have now*, *what can we afford in future*, *what adjustments can we make to our acquisition plans*, *what personnel do we need to operate in future*, as well as *what challenges might we face*?

This capability process has traditionally been subject to inertia, with systems incrementally modernised but the force structure maintaining a level of sameness due to the primacy of a 'replacement' approach. Changes introduced

from 2016 through the Defence First Principles Review may improve this process. For example, the specific identification and funding of next generation technologies and innovation programs may lead to fresh ideas influencing ADF capabilities.

Additionally, having a [joint organisation](#) under the Vice Chief of the Defence Force (VCDF), being responsible for the Needs Phase of the lifecycle rather than the Service Capability Managers, might result in a shift away from a replacement paradigm. At the same time, the Services taking on the requirements phase will result in smoother introduction of new capabilities into service.

However, the true impact of these changes is constrained by two factors. Firstly, the way that the Department programs the IIP (and fully subscribes it for the following decade) creates an inherent lack of flexibility to adapt investments to emerging and innovative possibilities.

Secondly, the extent to which Defence experimentation and capability assessment activities test candidate force structures is constrained from a resource perspective. This means that Defence only considers incremental adjustments to the force, rather than testing radical alternatives. If these constraints were no longer in place, there is a case for considering radical change to Australia's Defence force structure.

QUANTITY AND ATTRITION

A military force serves a deterrence purpose and as an instrument of national power to achieve objectives. When a nation employs its military forces in conflict, their purpose is to protect our centres of gravity, affect an adversary's centres of gravity and, in order to achieve these aims, to survive attrition.

This last aspect of attrition is critical to the military force. The ADF seeks to minimise the effect of attrition on its small force by aspiring to higher lethality and survivability of its weapon systems. Even with a higher probability of success in a combat engagement, attrition will occur unless the probability of success is, in reality, certainty of success. Therefore, quality of assets may be matched by quantity of assets in an opposing force, just as quantity and quality can be a trade off in considering one's own force structure within a confined budget.

The downside of a small force focused on quality is that any losses disproportionately affect the overall capability. There is allowance within the force structure for loss of assets in battle or due to maintenance, but such provisions are quite

small. Hence, loss of an element in a small force will often impact the directed level of capability. Given the high cost of ADF systems in the maritime and air domains, any loss is also a substantial financial loss.

Of course, the greatest cost that we are concerned about in conflict is the loss of human life. Over the past century, the way that governments and the public care about the cost of human life has increased significantly, affecting military strategies, tactics and the risks that governments and commanders accept in committing forces. In addition to this welcome increase in care for human life in the modern era, there is the capability cost when a highly professional military loses its skilled personnel.

A NEW APPROACH TO FORCE STRUCTURE

Thanks to advances in communications, artificial intelligence, materials and energy, our force structure could be more effective, more tolerant of attrition and affordable – a possibility previously thought fanciful. Australia needs to augment our very capable force with networked, low-cost autonomous systems across the battlespace – whether in the air, maritime or land domain.

Critics of such an unconventional force might suggest that using low-cost systems is a step

backwards, that an asymmetric capability is for non-state actors or developing nations, and that it would be no match for 'fifth generation' forces that employ high levels of lethality and survivability.

There is a difference between unmanned systems and autonomous systems. Unmanned systems still tend to be under human control, even though they may be capable of some level of autonomy. Autonomous systems can act without such control, with a level of intelligence about the systems' expected behaviour under various conditions and desired mission outcomes.

A change to a more radical force structure that involves a mass of autonomous systems could be a significant enhancement to the ADF, so long as this shift embraces the following eight characteristics.

1. **Networked**: A meshed force, comprising connected platforms and systems, will facilitate collective awareness of the environment and support cooperative engagement. The network must be sufficiently robust to reduce susceptibility to electronic warfare. Hence, redundancy and new low probability of intercept forms of communication may be required.

2. **Flexible**: The systems should sense the environment but may also be fitted with

the ability to produce kinetic or non-kinetic effects, including the carriage of smart weapons. Options may also allow for a modest lift capability.

3. **Autonomous**: The systems should be able to operate with limited or no control, thus reducing workforce overhead. Human in the loop direction will still be possible and desirable, but limited to aspects such as weapons release or change of mission, with the humans largely acting to manage operational exceptions rather than managing the core elements of a mission. This reduced approach to control is termed 'Human on the loop'.

4. **Trusted**: Mechanisms must be in place to ensure the systems can be trusted to act in a predictable or at least reasonable way, consistent with the interests of the force.

5. **Enduring**: The systems should have reach and endurance in order to support missions described in their operational concepts, with at least the same endurance as manned systems in the force. Refueling and recharging options during missions should be available, which themselves should be drawn from advances in energy generation and management (such as solar, laser or enhanced fuel cells).

6. **Cost effective**: Industry should manufacture the system platforms locally, quickly and cheaply.

7. **Homogenous**: The system platforms should be of a standard design within each domain, with characteristics such as speed, radar and electronic signatures being similar not only with each other, but also with manned platforms. This would make it difficult for adversaries to distinguish between high and low value assets without exposing themselves to attack.

8. **Resilient**: While not designed for high survivability, the autonomous systems should be sufficiently survivable so that an adversary would need to expend significant resources, ideally more resources than the worth of the targeted asset, and take risks to destroy them. Disaggregating a capability across multiple platforms would also contribute to resilience.

No matter in which domain these systems are employed, they would provide enhancements to the force that include: increased reach of sensors and weapons to enhance the awareness,

manoeuvre and effect of the force; higher tolerance of attrition and reduced cost of losses; and confusing an adversary and protecting high value assets.

This expanded force would not only reduce risks to the force, but would enable military tactics that prospective losses currently inhibit. Military commanders could put an unmanned low-cost asset into a dangerous situation without concern for its loss.

SOME CAUTIONS

There are serious considerations associated with such an approach: the ethical question of committing hostilities without needing to consider harm to one's own forces may tempt a government to enter a conflict more readily, or to hastily considered adoption of pre-World War 1 "sacrifice strategies" that, while not costing human lives, may have other unintended consequences. Military leaders should exercise care in how such capabilities are developed and used, as even with the prospect of reducing the risks to those involved in combat, all forms of war represent a broader danger to populations.

Another consideration is that of trust. As systems become capable of greater autonomy, the way that they respond to situations is more complex and difficult to assess, compared to the way we

have traditionally established system trust through validation of predictable behaviour. Autonomous systems that do not act in the way we expect can constitute a significant risk, especially to safety. The source of these risks range from inadequate definition of behaviour under unexpected conditions to the more concerning prospect of malicious code.

Comprehensive testing programs will mitigate these risks, as will maintaining some level of human on the loop oversight of the systems. As we will increasingly expect less human involvement in the actions of these systems, an essential requirement in the development of autonomous systems will be to shift to a new way in which we think of trust.

A PLAN OF ACTION

The choice of trusted autonomous systems as the theme for Defence's first Cooperative Research Centre (CRC) will provide substantial impetus for introducing radical changes to the force structure. Its focus on low technical readiness level development of the associated technologies will help demonstrate the value of these capabilities within an integrated force. The Trusted Autonomy CRC should ensure that work is progressed not only through individual project proposals, but also through an overarching

program that develops a new approach to ensuring trust and regulation in future systems.

There is substantial innovation in autonomous and unmanned systems evident in Australian small- and medium-sized enterprises, universities and research organisations such as STELaRLab, extending far beyond the participants in the CRC. Industry and academia are investing in research and development, which they justify by the perceived value of these technologies in Defence and in commerce.

Unmanned system initiatives by Australia's Army are consistent with the view that we need to embrace such technologies. The ubiquitous autonomy enabled by their small unmanned aerial system program perhaps is a precursor that will seed considerations of the more strategic structural change that I am proposing. Indeed, all three Services are embracing innovative possibilities that include autonomous systems, with the RAAF seeking to integrate fifth generation weapon systems through Plan Jericho and the Navy having a leading role in the Autonomous Warrior 2018 activity.

Such initiatives indicate that the Services are embracing the possibility of radical change to future capabilities. The inertia against introduction of radical change may come from long lead times in planning processes and

inflexibility inherent in Defence's IIP. The IIP currently has options for unmanned systems, but the respective projects largely are associated with higher cost, overseas manufactured platforms.

POLICY IMPLICATIONS

The development of low cost networked autonomous systems represents a tremendous potential for local industry to support the ADF through production and regeneration of systems. In any conflict that involves high risk of attrition, local regeneration of these capabilities would be vital. With the anticipated innovation of these capabilities, it would also represent immense export potential for Australian industry.

To reinforce the importance of Australian industry delivering these capabilities, listing of autonomous systems as a Sovereign Industry Capability Priority would be appropriate. This inclusion would recognise the emerging operational criticality to the Defence mission, as well as the advantages of local production and support of such systems.

Two decision points are key to the inclusion of trusted autonomy in the future ADF. In 2019, VCDF should commit his Force Design Division to an experimentation program that specifically addresses the concept of augmentation of the force with low cost networked autonomous

systems. In 2020, following the conduct of such experimentation and the validation of innovative capabilities being progressed through such mechanisms as the CRC, the Defence Investment Committee should consider a plan for realising such capabilities. Specifically, this should include needs analysis and associated revision of the IIP, and inclusion as a sovereign industry capability priority.

Should the promises in technology development, together with an expanded approach to experimentation, demonstrate that the concept has merit, the IIP investments should take autonomous capabilities to higher technical maturity levels and into service. Critically, the development must include a strong focus on assurance of autonomous systems. While Defence may not need these capabilities now, the warning times may be shorter than we think and reducing R&D lead times would be a very prudent hedging strategy.