Submission to the Joint Standing Committee on Foreign Affairs and Trade Regarding the 2023-24 Defence Annual Report.

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Dear Chair and Member of the Committee,

Thank you for the opportunity to contribute to an inquiry into the Department of Defence Annual Report by the Joint Standing Committee on Foreign Affairs, Defence and Trade (JSCFADT) – Defence Subcommittee. Some of the recent research in uncrewed systems that I have led include: the first evidence-based research investigating lessons learnt from the use of drones in the war in Ukraine (Australian Army Research Centre, Department of Defence) and the Defence Trailblazer project developing AI-assisted training for Mission Aircrew, focusing on the acceleration and commercialisation of innovative solutions that address the critical training and operational requirements of the Australian Defence Force (ADF). This submission will address the focus area of Uncrewed/ Autonomous Systems, advancing innovations at scale and at speed, as well as fostering collaboration between government industry and academia at the national and international levels.

I.   Uncrewed/ Autonomous Systems

Overall, multi- and cross-domain Uncrewed Systems (UxS) represent a transformative advance in military technology, reflecting significant investment and development worldwide. Uncrewed systems are disrupting the way modern warfare is being fought, and rapid technological adaptation and continuous innovation in UxS will be critical in future warfare. Uncrewed aerial systems (UASs) are being used for various purposes, including surveillance, reconnaissance, and targeted strikes. UAS has proliferated across air, land, and in the sea. For example, in the war in Ukraine, uncrewed systems operations have included uncrewed aerial vehicles (UAV) that track enemy forces, identify targets, guide artillery, and drop ordnance and other weapons; uncrewed combat aerial vehicles (UCAV) used for long-range strikes deep into Russian territory; uncrewed surface vehicles (USV) used to launch attacks on Russian naval forces in the Black Sea; and uncrewed ground vehicles (UGV) used for logistics and mining or de-mining purposes. (Molloy 2024). In my recent research, I highlighted key recommendations for the Australian Army and for the Australian Defence Force (see Appendix A; Molloy, 2024b).

The ADF recognises that UAV technology is changing the character of the modern battlefield, and this fact is well documented in relevant security studies and military literature. Overall, UAS warfare has

become less about technological sophistication and more about the ability to deploy 'high volume, low-cost' technology, as well as the need for multi-spectrum and layered combinations of both kinetic and non-kinetic countermeasures to achieve effective air defence. Systematically drawing lessons from Ukraine's use of UAS provides important evidence-based insights into the technology–security nexus. It addresses gaps in security studies and military literature about the current 'drone challenge', drone proliferation and the future of ongoing innovations. Australia must continue learn lessons from the conflict in Ukraine, which will be important for integrating this 'new weapon' into the ADF's operational and strategic strike concepts, as well as in efforts to adapt to the new epoch in warfare (Molloy 2024b).

The 2024 National Defence Strategy (NDS) and associated spending plan, the Integrated Investment Program, recognise the importance of enhancing Australia's drone and counter-drone capabilities.

'The Government has continued its unwavering support for Ukraine to resolve the conflict with Russia on its own terms. In April 2024, the Deputy Prime Minister and Minister for Defence, the Hon Richard Marles MP announced a new $100 million assistance package. As of June 2024, this took Australia's military assistance to $880 million since the start of Russia's full-scale invasion of Ukraine and brought Australia's overall support for Ukraine to over $1 billion' (Chapter 1, p.5, Defence Report 2023-2024).

Australian unwavering support for Ukraine, provides an opportunity for the joint collaboration in the area of uncrewed systems. This include direct support by the Australian Government via the military and humanitarian aid, as well as via engaging with the Australian defence industry as part of the 'Drone Coalition', where Australia is a member. This will enable not only support for Ukraine but also will develop and strengthen the industrial capability in Australia. For example, long range drones developed in Ukraine can operate up to the distance of 2,000km. This type of drone capability allows target the adversary's oil refineries and military targets that would prevent from using it in the war against Ukraine. Lon-range capabilities is well-documented in the DSR and could be looked into in the Indo-Pacific context.

Recommendations:

- **Continue drawing lessons from Ukraine and translating them into the Indo-Pacific context.** The war in Ukraine is making one observation very clear: uncrewed systems have a place in modern warfare. In Ukraine, drones have become an important weapon in the fight against Russian forces. Their availability, rapid development, and ease of deployment and use make them indispensable in military operations (Molloy, 2024b). Systematically drawing lessons from Ukraine's use of UAS provides important evidence-based insights into the technology–security nexus. It addresses gaps in security studies and military literature about the current 'drone challenge', drone proliferation and the future of ongoing innovations. It also offers important examples for the Australian Army and the integrated force as it considers Australia's own future capability and technology requirements. These lessons will be important for

integrating this 'new weapon' into the ADF's operational and strategic strike concepts, as well as in efforts to adapt to the new epoch in warfare.

- We need to continue monitoring and learning lessons from Ukraine. We need to innovate and do it quickly. Then translate into the Australian (and Indo-Pacific context) and action on it. Ukraine has already developed over 600 types of drones. How many drones has Australia developed?

- **Establish Australia-Ukrainian joint programs.** Similar to its allies, Australia should continue observe and learn the lessons from and with Ukraine, translate into the Indo-Pacific context. Australia can establish the Australia-Ukraine joint agreement for knowledge sharing, research and development, and testing and evaluation of uncrewed systems on the battlefield. Australia has to learn lessons from Ukraine and work collaboratively to strengthen innovations and capability that would be beneficial for supporting Ukraine and gaining relevant knowledge and capability in Australia. Specifically, the innovation cycle in Ukraine ranges from a few weeks to 3 months. Every 3 months you need completely new technology. It is important to understand that the current technology won't be used for the next 5-10 years. The future of autonomous and semi-autonomous systems, and robotics is here. Uncrewed aerial systems, as one of the examples of these technologies, represent the intersection of two important trends in military technology: the increasingly precise nature of weapons and the rise of robotics. There is an opportunity for Australia to step up and learn from Ukraine, work with Ukraine, innovate with Ukraine, invest in collaborative programs, provide opportunities for collaborative environment; this is in interests for both countries. For example, the UK has initiated Ukraine-UK uncrewed systems initiative, strategic partnership and coalition of opportunities, based on lessons learnt from the frontline (UK Ministry of Defence, 2024). Australia should follow this example.

II.   International Joint Programs and Exercises for Uncrewed Systems.

This Government is committed to accelerate efforts with uncrewed aerial systems and counter-aerial systems: *'We are also accelerating near-term investments in uncrewed aerial systems and counter uncrewed aerial systems, remote autonomous systems, over-the-horizon radar enhancements, pilot training capacity, the Defence targeting enterprise, and consolidating projects to release workforce for other priorities.'* (Chapter 1, p.7 Admiral David Johnston AC RAN – Chief of the Defence Force). However, this is not supported by the measurable outcomes and delivery.

ASCA projects is an example of the programs to accelerate sovereign capabilities. Some areas specifically are related to the uncrewed aerial systems. In November 2023, informed by the RFI as well as a range of market intelligence sources and subject matter experts, ASCA released a limited Invitation to Register for companies to enter into short development contracts to provide a production plan and prototype. Following a 'fly-off' demonstration in April 2024 with 10 companies, 3 companies signed contracts worth a total of $6.6 million to finalise development of their prototypes to a production standard

and produce **100 general purpose UAS.** ([Sovereign Uncrewed Aerial Systems Challenge | Advanced Strategic Capabilities Accelerator](#))

Recommendations:

- **Uncrewed systems must be prioritized.** The Australian government and Defence to must prioritise the uncrewed systems. They are here to stay and will play a role in the current and future conflicts. Globally, militaries are investing in these systems and integrate in their TTPs, revise strategies and deliver systems to their militaries. Application of asymmetric technology is a declared outcome of the Defence Strategic Review (DSR) to generate deterrence by denial, so these systems should be prioritised.
- **Create joint programs with international allies.** Joint program could be conducted to develop and test the capabilities according to the specific challenges and requirements. For example, the US-Singapore joint challenge (National Security Innovation Network, 2024).

III.   Innovate at speed and develop at scale

The Government underscores the importance of the uncrewed systems. Australian Defence is doing well in their appreciation of the ways the uncrewed systems are changing the modern warfare and can provides asymmetric advantage as one of the outcomes of the DSR.

However, the challenge remains that the current efforts do not allow to move fast enough to achieve their integration, and with only limited opportunities to scale up their production. In my recent article in *the Strategist, I highlight the need to accelerate the delivery of uncrewed systems into service across air, land and sea. 'The rapidly deteriorating strategic environment necessitates a shift in defence strategies and capabilities. The Australian Defence Force (ADF), like many military forces globally, must acknowledge that uncrewed systems will play an important role in future conflicts. It must accelerate its processes for developing their capability.' (Molloy, 2025).*

This narrative has been notable from other experts in the field. That said, application of asymmetric technology is a declared outcome of the Defence Strategic Review (DSR) to generate deterrence by denial, so these systems should be prioritised. Uncrewed systems are needed to provide numbers and breadth of coverage in a large area of operations, The National Defence Strategy should accelerate these developments in any way possible. For example, future maritime battle space expected to involve the extremely large distances and wide areas of the Indo-Pacific. Australia doesn't have the workforce, the funding or the time to do that with only crewed platforms. The ADF should produce significant numbers of the uncrewed systems to contribute to the DSR's demand to generate asymmetric effects from a focused force that deters by denial (Joyce, 2024).

As an example, the Integrator project was announced in March 2022 (Department of Defence, 2022). While Russia's war against Ukraine started in the same time frame, the pace of innovation, speed and scale of the UxS has been impressive. In 2024, Ukraine have contracted, between 1.3 to 1.6 mln of drones, most of them were FPV drones. Within this timeframe, UAS of different

classification have undergone multiple modifications development to meet the new challenges on the battlefield.

Recent announcement of the C-UAS plans in December 2024 underscores the appreciation that the threat from UAS requires the capabilities that will protect against them. "*As the threat from small Uncrewed Aerial Systems (sUAS) evolves the ADF needs to respond by acquiring a suite of CsUAS capabilities. These capabilities will be used to protect deployed forces, domestically and internationally, to secure infrastructure, expeditionary bases, dismounted personnel and all classes of ADF vehicles. The mature CsUAS capability will necessarily need to be agile to respond to threat evolution and be scalable for multiple large-scale deployments." - aid the Assistant Secretary in the Electronic Warfare and Intelligence Systems Branch Joint Systems Division of Capability Acquisition and Sustainment Group. However, drones have matured in Ukraine and will surely be encountered by the ADF in any future operations, employed by malign or nuisance actors. Drones are also likely to be increasingly encountered flying over mainland Australian bases and there's very little Defence can do about it. Almost three years into the Ukraine war, where drones have proliferated, the Australian Defence Force (ADF) is seeking a counter-drone system that will deliver a minimum viable capability by the end of 2032*. (Blenkin, 2024).

While Australian allies, UK, US, NATO countries, Ukraine as well as 'the adversaries' are concerned with this issue at present and seeking for employing these capabilities in high numbers (i.e., in some countries in millions), the Australian Government's plan is to deliver a minimum viable capability by the end of 2032**.** Some of the dedicated Australian defence industries are well prepared to work with the Australian government and provide the capabilities that are needed now. These systems have been successfully employed in the service with Ukrainian forces. (Nien Network, 2025). More defence industries are capable and ready to collaborate. These steps need to be made to accelerate Australian readiness in integrating these systems in service.

Recommendation:

- Australia must keep pace in the space of UAS/C-UAS as adversaries are leveraging these technologies. Develop opportunities to speed up the development of the UAS/C-UAS that work and the opportunity to scale them up. Delivering 4 systems or 24, or 100 prototypes of the systems, or developing of a minimum viable product by 2032 'just not large numbers and fast enough'. Countries are developing UAS in millions now, invest in the joint collaborative programs, conducting hackathons where systems could be developed in days or weeks.
- Ensure that legislation, policies and regulations are in place to practically implement these systems into the service.

- Each ADF officer needs to know how to operate a UAS to increase situational awareness in the constraint environments and be aware how to defence against them. Hence, each unit should identify the needs and challenges that they may face in the conflicts and how the UAS/C-UAS may complement these capabilities. Having experience in combating a threat, learning the sights/sounds of approaching propellers and knowing how to react under pressure is highly valuable in today's battlefield.
- Improved synergies are required. How to create mechanisms so that safely the ADF can do faster, taking not months and years but days.
- Invest in R&D projects between defence, industry and academia to develop and accelerate sovereign capabilities. (i.e., Defence Trailblazer).

IV.   **Implement more balanced approach is needed between large and complex systems and less expensive and expandable systems.**

The ADF must recognise the need to balance between investing in complex, highly capable systems and high-volume, low-cost technologies that can provide quick and simple solutions for a range of security challenges. This includes investment in developing uncrewed systems. For example, along with investments into Boeing's Ghost Bat program, designed to fly into battle with manned fighter jets; investments in small UAS (i.e., FPV) will meet the requirements of cost-effective and fast delivery, as well as value for money.

The Integrated Investment Program includes spending on a range of uncrewed and autonomous systems. The ADF plans to spend more than $10 billion on drones, with at least $4.3 billion on uncrewed aerial systems and $690 million on uncrewed tactical systems for the army. So far, Australia's spending on UASs has focused on complex aircraft, such as the Boeing MQ-28A Ghost Bat, designed to operate alongside crewed aircraft or to independently increase aircraft numbers in combat. The air force has begun receiving MQ-4C Tritons, an unarmed, high-altitude and long-endurance uncrewed aircraft. The ADF will spend more than $100 million on 110 drones from the Australian manufacturers SYPAQ and Quantum-Systems. While it considers the delivery of the limited number of systems in 2025 to express 'an intent to enhance at speed', other nations spend far more on ensuring that war fighters have such systems and, most importantly, are protected against them.

Developing large and expensive platforms requires investments in resources, including workforce, associated ground stations, high-cost and extended time periods. This may well be the case that after spending all these resources, these systems may become outdated or no longer provide that initially planned asymmetric advantage, or just fail at the end, where expectations do not meet the reality. Announced in 2022, the Integrator Tactical UAS which is expected to provide the enhanced aerial intelligence, surveillance, target acquisition and reconnaissance capability. In 2025, not only this program has experienced time and budget overrun, but some test flights also failed to deliver. While US

Marine Corps opting to withdraw its version from service, the Australian army is persisting with the Integrator (Tillett, 2024).

Recommendation:

- A balanced approach to uncrewed systems is needed between large and complex and less expensive and expandable systems. This includes investment in developing uncrewed systems. For example, along with investments into Boeing's Ghost Bat program, designed to fly into battle with manned fighter jets; investments in small UAS (i.e., FPV) will meet the requirements of cost-effective and fast delivery, as well as value for money.

V. Develop/ Revise Strategies for UAS/C-UAS

The 2024 National Defence Strategy (NDS) and associated spending plan, the Integrated Investment Program, recognise the importance of enhancing Australia's drone and counter-drone capabilities. The Australian Army includes uncrewed aerial systems (UASs) as part of the 'Robotic & Autonomous Systems Strategy' (RICO; 2022), one of its sovereign industrial capability priorities, but this covers only limited aspects of UASs, not the technology's full breadth of capability and the need for large-scale manufacturing. Moreover, since 2022, these systems have undergone a rapid proliferation and change, as evident by the Russia's war against Ukraine and fights in the Red Sea. Updates to more detailed strategies to UASs and C-UASs are needed.

By contrast, Australia's allies, including the United States, Britain, France and South Korea, have already developed or revised their strategies. These are based in part on observations of the use of drones in Ukraine and understanding the need to protect against them. For example, the US released a C-UAS strategy in early December 2024. Britain launched a new UAS strategy in February 2024 highlighting clear directions for enhancing UAS capabilities and for spending for the next decade. The ADF can similarly provide clear directions to accelerate access to UASs and C-UAS across air, land and sea by developing its own strategies. Importantly, set clear goals to deliver against the goals.

Recommendations:

- Develop/ revise strategies for UAS/C-UAS (i.e., RAS Strategy, 2022) with more detailed approach to the uncrewed systems, with clear emphasis on delivery at scale and at speed across air, land and sea, as well as its integration in the Joint forces.
- Develop and implement strategies on the C-UASs;
- Define clear terminology regarding uncrewed systems to be used across three service.
- Define roles, responsibilities, and ways how the Australian Government can protect against UAS, if required.

VI.   Increase education on UAS/C-UAS to all units.

UAS must be integrated in ADF officers' training. Each unit should communicate their challenges and create initiatives of drone operations. FPV drone racing team. Approximately 60% of drone operations are not successful due to lack of training (Molloy, 2024a). Every soldier needs to have an experience to take on the drones. Think about ways to engage them in exercises so that they all can learn. This should be part of every exercise. Think of activities in each unit, how these could be implemented.

Educate and train ADF personnel to use UAS, as well as identify and response to drone threats. Prepare well-educated Mission aircrew officers and trainers. Initial education can be obtained via relevant degrees for Trainee Officers, as well as specialised developed courses to support the ADF personnel.

For example, in October 2024, basic combat training at the US Army's Fort Sill has introduced C-UAS training to better prepare new soldiers for the tactical challenges of modern warfare. As part of a field training exercise, recruits will now gain hands-on experience in identifying and responding to drone threats. Capt. Malachi Leece, commander of Alpha Battery, 1st Battalion, 40th Field Artillery said the inclusion of live UAS assets is vital as they are something the trainees will encounter in future conflicts. According to one of the US Commanders: "It's one thing to simulate drone threats, but having live systems in play makes a world of difference. The trainees are able to experience firsthand the difficulty of tracking and engaging drones, from mini quadcopters to larger systems." (Herrick, 2024).

Recommendations:

- Re-consider how ADF approaches risk in relation to the UAS. These systems are different from conventional aircraft. Revise the UAS terminology around it, risk assessment and risk tolerance, risk responsibility, approvals to operate a UAS (i.e., CO).
- Educate and train ADF personnel to use UAS, as well as identify and response to drone threats.
- Introduce drones in regiments and get feedback for future developments. Each soldier must know how to operate a drone for the purposes needed in their operations. Army, Navy, Air Force needs to introduce common approval process for operating UAS.
- First Person View (FPV) drones have been reported by the Ukraine Armed Forces as the most frequently used drones by their units. The ADF can train their staff (and or those in reserve) how to construct and operate an FPV drone, via competitions, Innovations Days. There are great specialists in this area in Australia (i.e., the ADF Drone Racing Team; Department of Defence 2024)
- Facilitate expertise in reserve workforce. The ADF reserves can learn how to operate a UAV and how to protect against them.

VII.   Centre of Excellence/Expertise in Uncrewed Systems.

Establishing a Centre of Excellence (CoE) in uncrewed systems would provide Australia with a strategic advantage by consolidating expertise, resources, and innovation in this critical domain. A CoE would serve as a hub for advanced research and development in uncrewed systems across air, land, and sea domains. It would enable the Defence sector to pioneer innovations in technologies like uncrewed aerial systems (UAS), autonomous ground vehicles, and autonomous maritime systems. The Centre would foster cross-disciplinary collaboration between researchers, industry experts, and Defence personnel. By focusing on domestic development and manufacturing of uncrewed systems, the CoE would reduce reliance on foreign suppliers and improve Australia's sovereign capability. It would support the Integrated Investment Plan by accelerating the deployment of locally developed, cost-effective, and reliable systems.

The CoE may host state-of-the-art testing facilities to evaluate uncrewed systems in diverse and challenging environments. This would ensure operational readiness by refining the performance, interoperability, and reliability of these systems. A Centre of Excellence in uncrewed systems would strengthen Australia's defence posture by consolidating innovation, fostering domestic capability, and aligning technological advancements with strategic objectives. It would empower Australia to maintain a competitive edge, address emerging threats, and support a sustainable and skilled defence workforce.

Great interest in these systems, enthusiasts should be engaged.

Recommendations:

- Establish a Centre of Excellence for the UAS/C-UAS capabilities to continuously innovate and develop low-cost high-value technology that can provide an asymmetric advantage in the future conflict with larger adversary.
- Invest in research and development (R&D) projects to stay at the forefront of the UAS/C-UAS technology.
- Revise the Defence workforce who is responsible for these efforts. Without dedicated force, this would be difficult to achieve.

Conclusion

One thing that Australia must agree is that the war fighter should be at the centre of these efforts, and it is important to equip them with the tools they need for specific types of operations. Every soldier must be aware of UAS threats, learn how to use a UAS, how to counter them for self-defence and to protect others and costly equipment. As UAS technologies evolve, so do C-UAS capabilities. As evident from Russia's war against Ukraine, the UAS are already threats, and they are here to stay. Australia must keep up with the rapid pace of innovation in this field. It needs to demonstrate commitment to stay ahead

in the development of drone technology and ensure that its armed forces are prepared in the fast-changing security landscape.

Each conflict is unique, characterised by different participants, military capabilities, organisations, and strategic objectives. Rapid technological adaptation and continuous innovation in uncrewed systems will be critical in future warfare. By maintaining an accelerated cycle of innovations Australia have the opportunity to stay ahead of their adversaries, and to meet contemporary and future conflict strategic challenges.

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Appendix A

Recommendations for the Australian Army and the Australian Defence Force (ADF) (Molloy, 2024 b).

The conflict in Ukraine has demonstrated the transformative impact of drones on modern warfare, highlighting their strategic, operational, and tactical advantages. Based on these lessons, the following recommendations are made for the Australian Defence Force (ADF):

1. **UAS is changing the character of war**:

- Re-evaluate the attitude towards UAS/ C-UAS based on the benefits and effect it has demonstrated on the battlefield in Ukraine. The biggest lesson learned is that the drone technology is showing us that it remains constant in warfare, and when facing existential threats, it can and have saved lives. However, UAS alone will not and cannot win the battle. Although UAS cannot reduce the importance of legacy systems such as artillery, armoured vehicles and tanks, their unique characteristics may enable the ADF to fight differently. The disruptive effect of UAS depends on their operational concept and their integration with other weapons systems.

- Integrate UAS in the TTPs (i.e., artillery, UAS, intelligence) to enhance team's tactical and operational effectiveness. For example, UAS has shown the improved pace and precision of artillery and provided intelligence to individual soldiers. The information provided by drones and share on new digital battle command networks, greatly increases the speed of decision and action.

- Develop the ADF strategy for the use of UAS/C-UAS. Integrate UAS into the military doctrine, ensuring that all levels of command understand how to effectively employ UAS/C-UAS in joint and combined arms operations.

2. **Prevalence of small UAS:**

- Acquire UAS of different types Small UAS (sUAS) dominate the battlefield in Ukraine. Proliferation of FPV drones allows them to have relatively low signature, fly low and fast and remain hard to detect and destroy.
- Equip each ADF personnel with sUAS for ISR purposes.
- Invest in development of C-UAS technology to counteract the sUAS.

3. **Counter-Drone Systems:**

- Develop and deploy different types of counter-drone technologies (i.e., jamming systems, laser weapons, and interceptor drones to neutralise threats) that can detect, track and neutralise the UAVs.
- Develop, coordinate, and deploy different types of counter-drone technologies – EW capabilities/ C-UAS systems – in modern combat environments without compromising own-force communications to disrupt enemy UAS operations.
- Be ready to counter the UAS threats and to install C-UAS on various means/ levels of operation.

4. **Multidomain Use of UAS**:

- Develop a diverse fleet of UAS that can be used for various purposes, including small tactical drones for reconnaissance, larger UAVs for long-range surveillance, and armed drones for precision strikes. The versatility of drones in Ukraine, used for various missions, underscores the need for a multi-faceted approach.
- Develop capabilities for multidomain operations where UAVs can support air, land, and sea operations, enhancing overall mission effectiveness and saving lives.
- Strengthen UAS capabilities in the air, land, and sea.

5. **Financial Imperative of UAS:**

- UAS are cheaper alternative to traditional military system, allowing adversaries to leverage limited resources to achieve disproportionate effect.
- UAS serves as an asymmetric response to the adversary's cost imposition strategy. This cost imposition strategy is critical in modern warfare, where financial constraints play a significant role in the longer term.
- In a long and large conflict, cost is key: the fewer resources used to destroy a target, the better.
- Focus on sustainable UAS production, supply chain, maintenance

6. **Rapid Innovation and Adaptation:**

- The TTPs that worked for the first six months of the war no longer work today. Need to maintain adaptation battle.
- The rapidly evolving nature of modern warfare in Ukraine necessitates an accelerated cycle of innovation, which currently ranges from a week to approximately three months. New solutions or significant modifications to existing technologies are continuously required to maintain a competitive edge over the adversary;

- The rapid development and deployment of UAV technology requires constant adaptation, innovation and evolution in military doctrines;
- Invest in collaborative programs, working with defence industry and academia to accelerate and scale up sovereign capabilities;
- Foster a culture of rapid innovation and continuous learning to adapt to evolving threats and technological advancements.

7. Importance of Training:

- The rapid development and deployment of UAV technology requires constant adaptation, innovation and evolution in military doctrines. It is essential to learn from both sides in conflicts like Ukraine and integrate those lessons into tactics, techniques and procedures.
- Enhance training programs for drone operators, focusing on both manual control and autonomous operations.
- Ensure high levels of training for UAV operators and maintain robust maintenance programs to keep the technology operationally effective. Training should cover various scenarios, including urban warfare, counterinsurgency, and high-intensity conflicts.
- Train all ADF staff to operate a UAS, based on the nature of their operations.
- Develop and seek for advanced training for instructors and operators for various conditions of operation and with various teams.
- Update TTPs based on the lessons learnt from Ukraine.

8. Importance of R&D and Investment in Sovereign Capabilities:

- Strengthen partnerships with allied nations and Ukraine to share knowledge, technology, and best practices related to UAS operations and TTPs.
- Together with Australia's allies, collaborate with Ukrainian government and defence, industry and academia to foster innovations and cutting-edge UAS/C-UAS technologies.
- Establish a Centre of Excellence for the UAS/C-UAS capabilities to continuously innovate and develop low-cost high-value technology that can provide an asymmetric advantage in the future conflict with larger adversary.
- Invest in research and development (R&D) projects to stay at the forefront of the UAS/C-UAS technology.

9. The future of robotics and autonomous systems has arrived:

- Robotics and autonomous systems have been shown to be effective at providing lethality at range, at low cost, and with economy of effort.
- If Ukraine are consuming over 10,000 drones per month, and UAS are likely to be used in the future conflict, then Australia needs to consider how we would reconstitute these systems.
- Develop the ecosystem in which robotics and autonomous systems, artificial intelligence, and swarm technology can enable a single operator to control multiple drones.

- Invest in the development of future UAV capabilities, including AI-driven autonomous operations, advanced sensors, and improved endurance and stealth features.

10. UAS displace rather than replace a human:

- UAS, whether ground-based, aerial, or maritime, are still controlled by humans but displace their roles in the surveillance chain, removing them from frontline exposure and risk.

- Recognise UAS as a force multiplier that enhances combat effectiveness by providing superior situational awareness and precision strike capabilities.

11. Other:

- Integrate UAS with advanced battle management systems to enhance coordination and efficiency during operations.

- Move towards the standardization of UAV systems and develop a comprehensive UAV ecosystem that supports maintenance, supply chain management, and operational readiness.

- Utilise UAS in information warfare to gather intelligence, conduct psychological operations, and influence enemy decision-making.

- Exploit social media platforms for real-time intelligence gathering and dissemination, leveraging the broad reach and immediacy of these tools.

- Develop programs/mechanisms to mobilise civilian drone operators for support roles in defence operations, expanding the pool of skilled personnel available for UAV missions.

The final and most important recommendation is to continuously draw on the lessons learnt from the war in Ukraine.