Empowering cyber defence talent in an age of automation.

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Introduction

Automation, powered by artificial intelligence (AI), is becoming increasingly intertwined with forging national resilience for Australia. While the last 100 years show how technology gradually automated repetitive tasks and processes, AI is exponentially more disruptive, automating non-routine tasks and impacting more complex roles in both the private and public sectors, particularly defence.[1]

The defence industry plays a key role in nullifying cyber and terrorist threats, and developing an agile, future-proof workforce that can deal with geopolitical instability. The ability to do this stands at a crossroads where government and academia must work closely together to innovate fragile supply chains and accelerate automated decision-making, while shielding workers from job loss and technological disruption.

The path forward lies in transitioning cyber talent to roles that harness automation while amplifying their problem-solving skills, critical thinking and creativity.

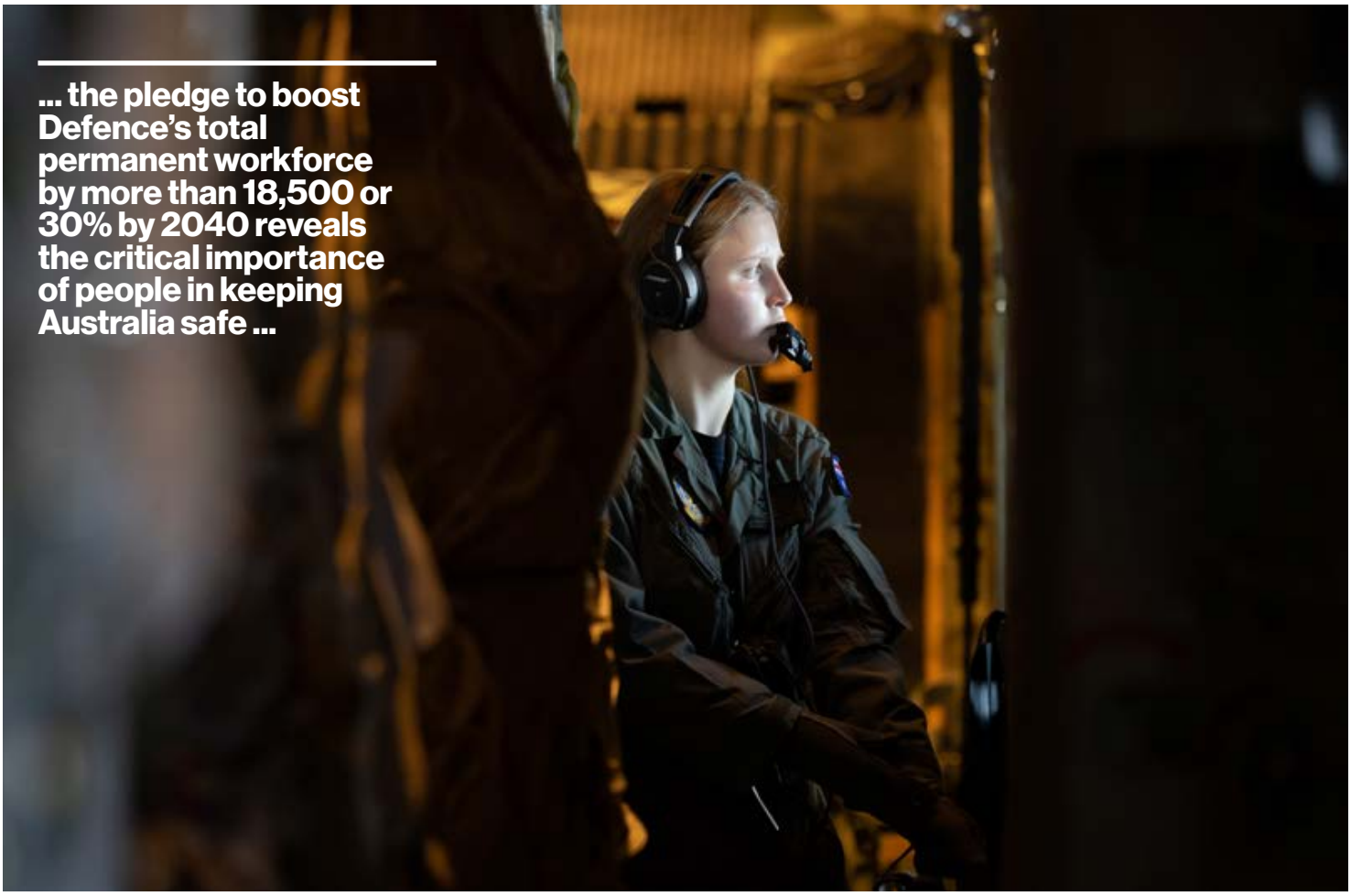
The end game makes Australia a world leader in artificial intelligence and automation.

While immense, opportunities to do this are laced with risk if they are not framed within a long-term strategy that acknowledges that today's skills may be obsolete in the future, while newly acquired skills may have a limited shelf life.

Concerned thought leaders note that incomes often bend in favour of capital over employees, at the same time increasing inequality and discrimination in an industry that contributes over $9 billion to the Australian economy.[2]

There are numerous examples of private companies benefiting from automation to drive profits while cutting jobs or lowering wages. There's also a growing consensus locally and abroad that organisations preparing employees for future cyber roles with the right mix of automated support and technological skills will emerge as champions.[3]

Private defence contractors like Gilmour Space, Ghost Shark and Verizon are three examples where cyber talent is being nurtured and enhanced with the latest breakthroughs in data science, machine learning and automation technologies. These companies are driving innovation and scaling the next generation of mission-critical infrastructure, including new Industry 4.0 manufacturing facilities and processes.



While the Australian government may sometimes not match its political commitment to technological innovation with public action, the pledge to boost Defence's total permanent workforce by more than 18,500 or 30% by 2040 reveals the critical importance of people in keeping Australia safe in the uncertain and threat-laden global arena.[4]

Indeed, Australia's national prosperity and security depend on the government supporting the defence sector to unleash new automation technologies that provide high-paying jobs across AI, robotics, manufacturing and quantum computing. Research indicates that AI-driven automation could boost local economies by as much as 26% by 2030, with China a prime example. Australia's ability to influence the Asia-Pacific (APAC) and counter potential cyber threats from China depends on elevated human decision-making supported by automation.[5]

However, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) warns that by 2030, we may need more than 160,000 specialist AI workers to build and supervise new automation technologies. Projections based on current initiatives suggest that public and private sector job creation will fall well below this number.

In this white paper, we argue that people - not machines - provide the ultimate digital edge with data suggesting that organisations that arm cyber talent with the necessary skills (supported by automation) experience higher revenue growth over a three-year reporting period. Additionally, staff morale climbs, showing a remarkable propensity to unleash innovation and accelerate digital transformation.[6]

Striving for ethical public and private governance.

Ultimately, a framework for cyber talent empowerment falls under the remit of broader ethical governance in government and industry. In this ongoing process, leaders carefully consider the ethical implications of new skills and technologies and plan for their impact before being introduced into the defence sector.[7]

This strategic approach towards emerging automation and its supervising workforce has two influencing components: *productivity* and *imported technologies*. Both influence the future of work in Australia across manufacturing, especially in defence.

Productivity

"You cannot stop change. But, you can plan for it and make adjustments so that in the long-term, everyone gets a slice of the pie," said the Hon Ed Husic MP, Minister for Industry and Science, in 2022.

Taking a long-term view, driving down costs, including worker wages, should not be the goal of automation. Instead, some technology-driven profits must flow back into cyber talent pockets to improve their earnings and stimulate further innovation.

"Technology has often been good for profits but bad for jobs. It should be good for both - and can be," said Mr Husic. "Productivity and wages remain intimately linked. If we're serious about technology, we need a long-term strategy to share economic prosperity with staff and workers."[8]

The Brookings Institution, A US public policy non-profit, affirms Mr Husic's stance that countries that plan and structure arrangements for addressing distributional concerns have the edge over those that do not.[9]

Imported technologies.

In the past, the Australian government has primarily leaned on using foreign expertise to launch and scale new manufacturing infrastructure that extends into space initiatives, quantum computing and defence. While generally favourable to economic growth, these foreign initiatives do not grow local cyber talent at the pace needed to compete with the United States, Europe and China on a future AI-centric chessboard.

While foreign expertise will always have a place in a world where Australia has enduring and strong partnerships with its global allies, Australia also needs to invest in establishing sovereign primes that will boost economic growth, shrink economic complexity, and strengthen the defence sector's local talent and AI resources.

"If we stimulate interest in AI but do not deliver the skilled workforce and technological advantage, all we will create is frustration," said The Kingston AI Group, made up of professors from eight Australian universities.[11]

Made in Australia (MIA) AI.

Forging national research and education strategies to realise Made in Australia (MIA) AI technologies driven by a well-paid, expert cyber workforce is the holy grail. Pursuing productivity under this model encompasses four tactical approaches succinctly put forward by the ADF:

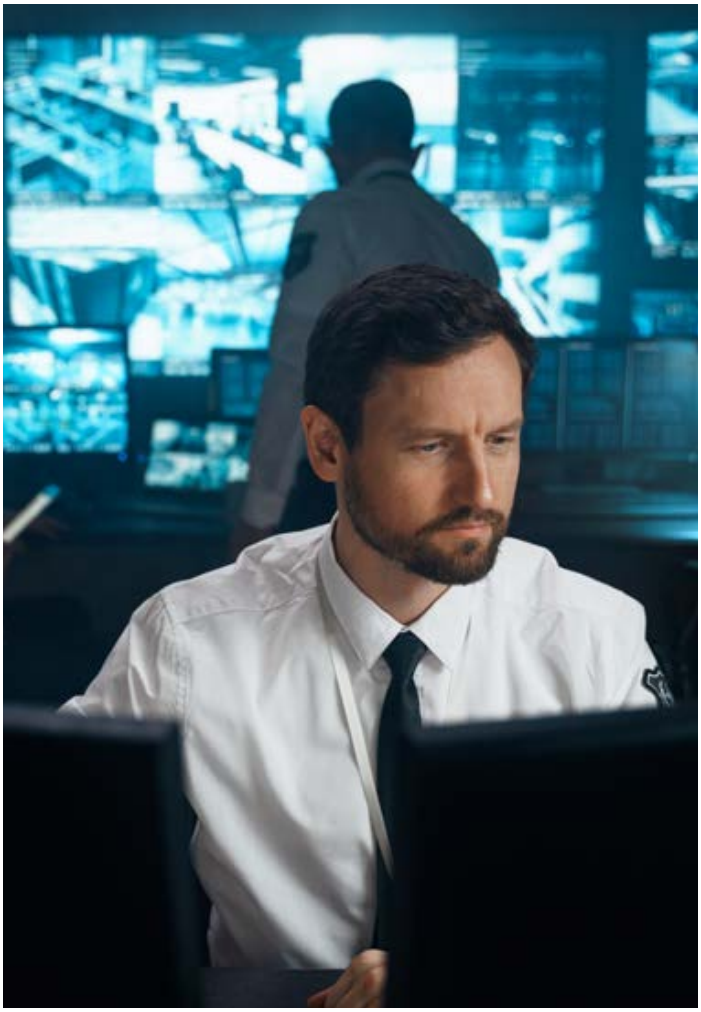
- **Engage:** Transparent, easy access to defence career opportunities with a particular focus on supporting STEM-based roles
- **Attract:** Encourage local federal contractors and businesses to grow and attract a national cyber talent pool
- **(Re)Train:** Invest in the local defence industry to train and sustain a national AI-cyber workforce
- **Collaborate:** Connect critical stakeholders, thought leaders and industry players to build the workforce of the future that responds with quicker agility to local, national and global threats.[12]

Aligning ethical public and private governance goals ultimately increases commercialisation opportunities. It encourages business diversification into new defence sectors and markets while aggregating their capacities and expertise at higher wage levels.[13]

Human decision-making at scale.

Outsourcing battlefield decisions to artificial intelligence are on the radar of all superpowers, including the US and China.[14] The rise of self-optimising plant driven by automation under Industry 4.0 is underway globally, including in Australia.[15] In both cases, the defence sector is wrestling with how to remove human bias without completely removing humans from the equation.

This tension between humans and machines prompts the creation of frameworks such as the *A.I. Bill of Rights* in the US for the responsible use of emerging technologies and sparks new debates around how to elevate human decision-making in the automation age.[16] It's also spawning innovative transdisciplinary research programs to address national defence with the integration of social science.[17]



In this golden age of automation, the ADF has created the Human and Decision Sciences Division to support human situational awareness, decision-making, control, and protection.[18] Operating in a grey zone "where clear distinctions between peacetime and declared warfare are rapidly evaporating," the division specialises in helping humans cope with growing cyber-attacks and disinformation campaigns. These grey zones spread across key defence sectors, including space, information and cyber, maritime, land and air and call upon a range of specialities, covering anthropometry & biomechanics, cognitive enhancement and augmentation, physical augmentation and physiology.[19] Moonshot applications of this program intend to scale human decision-making in ways unimaginable a decade ago. It includes, for instance, recent reports that the ADF may be testing an artificial intelligence (AI) brain interface that allows human operators to control robotic dogs telepathically on future battlefields.[20]

Using biosensors on the brain to decode brain waves, amplify them and transmit them to an AI decoder on a robot dog are extreme examples of how humans are being removed from the battlefield and placed in creative, supervisory roles. Reaching this level of innovation requires a cross-sector collaboration of defence organisations and government innovation hubs.

More complex problems exist on the horizon for the human sciences division. These include domains where trusted decision-makers disagree and no correct answer exists. These may be life-and-death decisions compounded by context: uncertainty, pressure, resource limitations and differing value systems. Counterpart divisions in the US, including Darpa, are exploring how trusted algorithms can support decision-making during these critical moments.[21]

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Global standards in the age of the Fifth Domain.

With global defence security growing at an annual rate of 3.6% (CAGR), governments are jockeying for pole position to become leaders in cybersecurity innovation, especially as cyber-attacks become more sophisticated and devastating to public and private networks.[22]

Civilian and military networks share many similarities in approach, investment and threats, however, government systems need extra hardening layers to ensure national security on an industrial scale.

While automating security and networking is a priority to free up human-decision making and creativity, standards frameworks are the bedrock for future-proofing the defence industry from vulnerabilities and emerging security gaps.

These standards allow cyber talent to navigate complex technical landscapes and deal with the future of cyber warfare, often referred to as *the Fifth Domain* after air, sea, ground and space. In particular, the adoption and adherence to global standards have helped make Australia a rising leader in cybersecurity technology, with the support of global defence primes and emerging players on the local scene.

Strategically, Australia shares best practices with friendly international counterparts to give its cyber defence talent an edge. A member of the Five Eyes intelligence alliance with Canada, New Zealand, the United Kingdom, and the United States, Australia recently joined the Pentagon in discussing how to harness a Zero Trust approach to security.

In this framework, Zero Trust Networks (ZTN) assume no party is trustworthy at any point, requiring ongoing verification before access is permitted.

"It is not a product or program but a paradigm shift for the US in response to vulnerabilities exposed by high-level breaches. It is also essential to delivering secure, data-centric Joint All-Domain Command and Control (JADC2) capabilities," said the US Department of Defense (DoD).[23]

Several Australian government departments and agencies pursue the quest for Zero Trust automated interoperability between government and private networks to ensure the highest level of security.

The Australian Cyber Security Centre (ACSC)'s *Essential Eight Maturity Model* attempts to give small, medium and large organisations a consistent baseline from which to approach the philosophy of ZTN in their operations. The eight mitigation strategies cover a range of security protocols, including user application hardening and multi-factor authentication.[24]

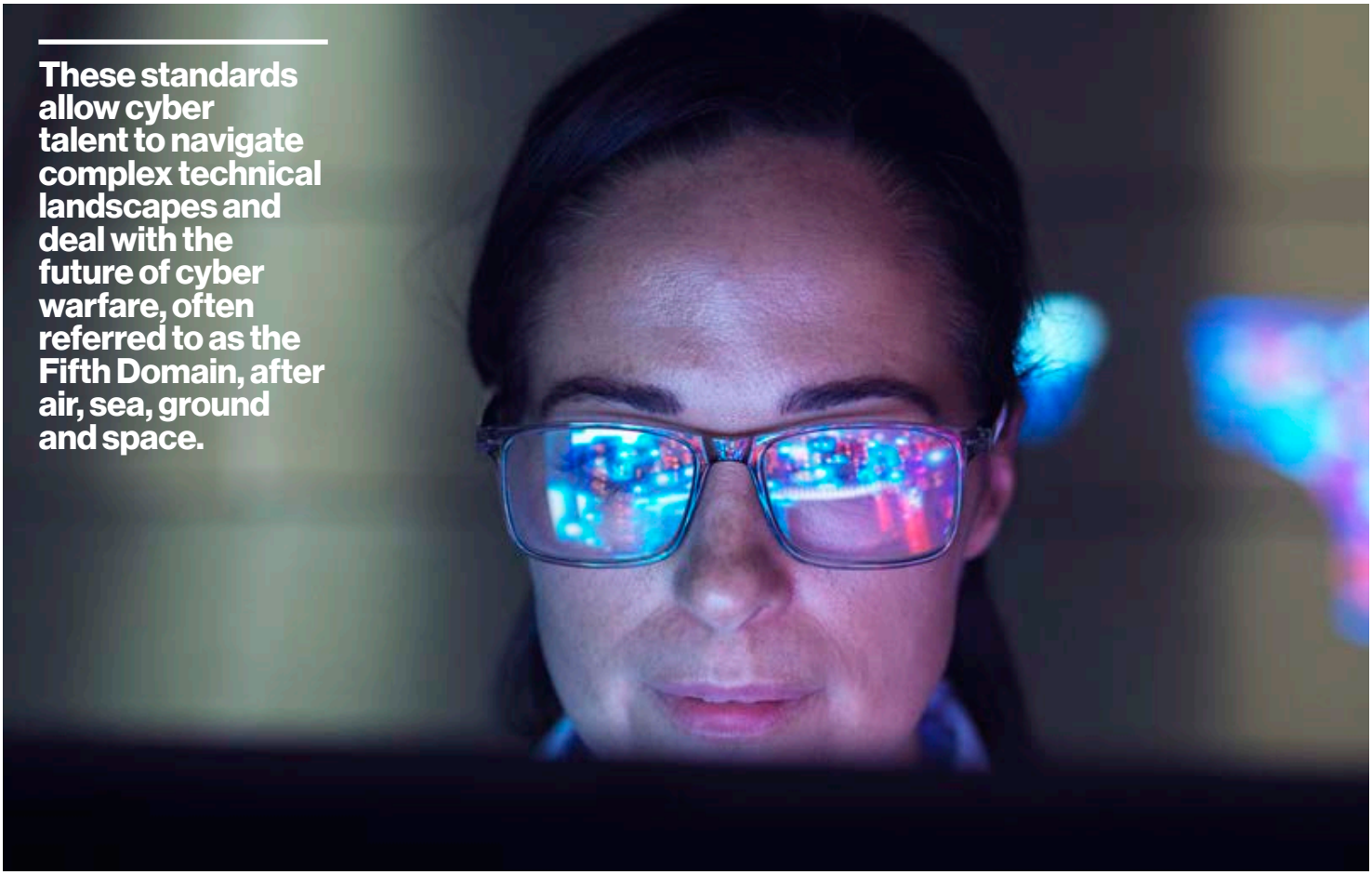
While the *ACSC Essential 8* currently has mixed adoption, it's crucial in helping free cyber talent from legacy software restrictions and enhancing automation while limiting privacy concerns.

By moving towards a ZTN, companies can protect themselves against various cyber threats and vulnerabilities.

Additionally, the emerging ZTN model supports many critical standards that govern public and private infrastructural networking operations, including but not limited to the following:

- **ISO27001:2** is a standard that meets information security management system (ISMS) requirements, a framework for managing and protecting sensitive information
- **PCI** is a set of security standards developed by the payment card industry to ensure that merchants who accept credit card payments maintain a secure environment
- **CSF** is a National Institute of Standards and Technology (NIST) framework to help organisations manage cybersecurity risks and protect against cyber threats
- **NIST SO800-53** is a set of security controls and guidelines developed by NIST to help federal agencies and organisations protect their information and systems
- The **CSA Cloud Control Matrix** is a framework for evaluating and managing security risks associated with cloud computing
- The **Cybersecurity Capability Maturity Model** is a framework for assessing an organisation's cybersecurity capabilities and maturity
- **COBIT** provides an IT governance and management framework helping organisations align their IT strategies with business goals and objectives

While the plethora of standards and frameworks often challenge the technical capabilities of federal contractors and smaller businesses in the defence supply chain, it helps ensure that future innovation in automation has solid foundations for success.



Gilmour Space

Australian space startups are rapidly closing the gap with counterparts in the United States. Sovereign prime Gilmour Space is no exception, set to launch Australia's first commercial rocket, Eris, into orbit in 2023. Aerospace achievements like these unlock new opportunities for cyber talent while building cutting-edge automation technologies to support breakthroughs in building and launching rockets into orbit.

Gilmour is pioneering the Autonomous Flight Termination System (AFTS). The intelligent electronics unit features an independent decision-making capacity responsible for aborting a flight if severe issues arise. The collaborative effort with SENER Aeroespacial uses software processing algorithms that collect and analyse the Eris flight parameters identifying deviations from the nominal trajectory with the power to terminate the mission if necessary.

According to both parties, improving the versatility of launch vehicle operations enables "more launches from places other than traditional launch centres; and their efficiency, by lowering the cost of operations."[25]

The launch of Eris - a watershed moment in the Australian defence sector - is a byproduct of strategic thinking under the Queensland Aerospace 10-Year Roadmap and Action Plan.[26]

Nurturing affordable access to space for small and medium-sized payloads has propelled defence technology spinoffs into hypersonics, ultra-hightemperature composites, astrophysics, airborne Earth re-entry observations and robotic vision in uncontrolled environments. Automation stacks steered by AI algorithms while supervised and improved by human-decision making help strengthen Australian national resilience and supply chains. Gilmour sources material and expertise from local suppliers and hires and upskills local talent while ensuring intellectual property is not foreign-owned.

Aerospace achievements like these unlock new opportunities for cyber talent.

Ghost Shark

One success story coming out of Australia's Next Generation Technologies Fund is Ghost Shark, an autonomous robotic undersea warfare vehicle designed and manufactured in Australia for the Royal Australian Navy by Anduril Australia.

The co-funded project cost around $100 million and utilises edge computing, sensor fusion, propulsion and robotics in the technology stack. Built to carry heavy loads over long periods and long distances, it's another example of AI-driven automation freeing up human labour while reducing the risk to life.

While these innovations are examples of uncrewed or unmanned military applications controlled tactically by AI, the supervisory aspects still require human supervision to ensure successful outcomes.

Plans are underway to hire skilled workers in maritime engineering, software development, robotics, propulsion design and mission operations.[27]

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Attack surfaces increase as digital transformation grows. The deep domain expertise needed to deliver military-grade security gateways on new 5G platforms offers an opportunity to grow sovereign primes for mission-critical infrastructure. However, partnering with global managed security services and networking solutions like Verizon allows local cyber talent to develop new skills and sensitivities to manage complex technology frameworks that extend into ZTN, mobile edge computing, identity management and virtual simulation software like digital twins.

One possible future collaboration area lies in using 5G drones to capture real-time intelligence, surveillance and reconnaissance (ISR) data from aircraft in flight to geolocate military targets. The technology - recently demonstrated to the United States Department of Defense (Dod) - showcases advanced signal processing algorithms executed at the tactical edge of 5G infrastructure. Using open, secure standards, it illustrates 5G.MIL delivering accurate information to support human-decision often called "integrated deterrence".[28]

Conclusion

Automating scalable, secure ethical decision-making doesn't compete with human talent; it unleashes creativity, problem-solving and critical thinking. The symbiotic partnership between artificial intelligence and human cyber talent opens up a real opportunity for Australia to become a global leader in technology by 2040.

Overlaying ethical governance insights put forward by government leaders such as Minister Husic, with breakthrough progress in Zero Trust Networks and established global security standards, empowers cyber talent to pursue technological progress. Further, it promises to reset the balance sheet and finally links productivity to wage growth, arguably missing from historical technological change in Australia.

"Made in Australia" AI is possible and should be pursued strategically.

Sovereign primes like Gilmour Space show us the spectacular rewards of local space innovation - up and down the national supply chain.

Meanwhile, connectivity and managed solutions linked to 5G reveal the power of harnessing data at scale, opening new doors to safer and faster decision-making through global operators like Verizon. Recent ADF advancements in uncrewed submarines like Ghost Shark via Anduril Australia show us a brave new world where humans are freed from high-risk environments to explore more exciting data-centric supervisory roles.

The path forward to national resilience is clear. Still, bold decision-making is needed to empower our defence workforce with the tools and skills to tap artificial intelligence's supportive powers in the automation age. Putting people first - not machines - is the key to building the future workforce in the military-industrial defence landscape.

Automating scalable, secure ethical decision-making doesn't compete with human talent; it unleashes creativity, problem-solving and critical thinking.

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