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The Effective and Ethical Development of Artificial Intelligence: An Opportunity to Improve Our Wellbeing

Defence, Security and Emergency Response

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**Horizon Scanning Report on AI – Implications, Opportunities and Risks for New Zealand
(Royal Society Te Apārangi)**

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What are the issues for New Zealand around AI in Defence, Policing and Emergency Response?

AI has the potential to act as a *technological enabler* of the New Zealand Defence Force (NZDF) across virtually the entire range of platforms and systems, with human-AI teaming eventually becoming the norm. This will have implications for intelligence collection and analysis, logistics, cyberspace operations, command and control, and AI-enabled robotic autonomy. Additionally, at the international level, it will have implications for military, information and economic superiority.[1] These changes will require new skills across the NZDF to harness advances in AI, with training doctrine, recruitment and organisation structures having to adjust as a result.[2]

Greater levels of robotic automation could act as a *force multiplier, generating greater efficiencies by improving soldier productivity.* It will augment or replace human soldiers, freeing them from simple tasks and allowing them to focus on more cognitively complex work. Tasks undertaken by AI will be conducted at superhuman speeds, with greater levels of precision and reliability, for durations that exceed human endurance and in dangerous environments, reducing the risk to soldiers in the field.[3]

Fully autonomous vehicles are already being deployed to the battlefield by states such as Israel.[4] Militaries are working on capabilities to 'pair' older vehicles with newer ones, tasking them with conducting tasks to support manned systems.[5] This could include carrying extra equipment and

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[1] Greg Allen and Taniel Chan, 'Artificial Intelligence and National Security,' Belfer Center, July 2017, https://www.belfercenter.org/sites/default/files/files/publication/AI%20NatSec%20-%20final.pdf, accessed 31 July 2018; Daniel S. Hoadley and Nathan J. Lucas, Congressional Research Service, 'Artificial Intelligence and National Security,' 26 April, 2018, http://www.crs.govr45178/, accessed 31 July, 2018;

[2] Brendan Nicholson, 'P.W. Singer: Adapt Fast, or Fail,' 7 July 2018, https://www.realcleardefense.com/articles/2018/07/07/pw_singer_adapt_fast_or_fail_113585.html, accessed 31 July 2018

[3] Paul Scharre and Michael Horowitz, 'Artificial Intelligence: What Every Policymakers Needs to Know,' 19 June, 2018, https://www.cnas.org/publications/reports/artificial-intelligence-what-every-policymaker-needs-to-know, accessed 31 July 2018

[4] The Israeli Defense Forces have deployed self-driving military vehicles to patrol Israel' border with the Gaza Strip; plans to equip these vehicles with weapons and deploy them in stages to Israel's frontiers; and unveiled two unmanned submarines. Judah Ari Gross, 'Unmanned subs, sniper drones, gun that won't miss: Israel unveils future weapons,' 5 September 17, https://www.timesofisrael.com/unmanned-subs-and-sniper-drones-israel-unveils-its-weapons-of-the-future/, accessed 31 July 2018

[5] The US Department of Defence Loyal Wingman program is being developed to pair unmanned F-16s with manned F-22s/F-35s. The F-16s 'Loyal Wingman' could autonomously react to environmental changes and accomplish supporting

ammunition on the battlefield, reacting to electronic threats such as jamming, conducting reconnaissance, surveillance and removal of explosives. On-board sensors are being developed to alert users when repairs are required, allowing individually customized maintenance on an 'as needed' basis, lowering maintenance costs.[6]

A key issue for liberal democracies like New Zealand will be *balancing moral concerns over autonomy with strategic imperative*s. For example, Lethal Autonomous Weapon Systems (LAWS) that independently identify targets and fire weapon systems with little or no human control are advancing rapidly.[7] At present, leaders in this field, such as the US, have regulations preventing deployment of fully autonomous LAWS on moral grounds.[8] However, as AI comes to outperform humans across a range of increasingly complex military tasks,[9] military necessities could increase pressure for adoption of fully autonomous technologies like LAWS, especially if strategic rivals deploy them, leaving non-adopters at a disadvantage.[10]

AI will be fundamental to *harnessing and integrating ever-greater amounts of data* across air, space, cyberspace, sea, and land domains.[11] This could transform command and control operations, enabling faster decisions and accelerating the speed of conflict.[12] In this context, opponents that rely on human capabilities and judgement may be overwhelmed, unable to understand a rapidly changing battlefield environment and react fast enough to adversary operations.[13] Additionally, identifying patterns across large data sets will allow improved image recognition, labelling and targeting.[14] Betterkur predictions of future events like terrorist attacks or civil unrest will also be possible.[15]

Some commentators contend that the next evolution in military operations will be forces shifting from fighting as a network to fighting as a *swarm*, with large numbers of highly autonomous systems coordinating their actions on the battlefield, enabling greater mass, coordination, intelligence and speed of operations.[16] This offers great asymmetric potential for small states like New Zealand, as

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tasks for the F-22/F-35 lead planes, reacting to electronic threats, jamming and carrying extra weapons. Hoadley and Lucas, 'Artificial Intelligence and National Security', p. 11

[6] Repairs of Boeing commercial aircraft have been successfully undertaken, and IBM has been contracted to develop sensors to perform customized maintenance. Ibid, p. 9

[7] Congressional Research Service, 'Lethal Autonomous Weapon Systems: Issues for Congress,' 14 April 2016, https://www.everycrsreport.com/reports/R44466.html, accessed 31 July 2018

[8] Ibid, p. 11

[9] For example, in June 2016 an AI defeated a retired Air Force colonel in a tactical air combat simulation. Sean Walsh, 'Autonomous Weapon Systems Raise Legal Questions,' *Jane's Intelligence Review*, 18 January, 2018

[10] Many weapons, such as crossbows, submarines, and bombers, faced moral objections only to be eventually widely adopted.

[11] The US Air Force is working with military contractors and AI start-ups to develop data fusion capabilities. Hoadley and Lucas, 'Artificial Intelligence and National Security', p. 11. Without new methods of filtering information, soldiers and commanders could find themselves overwhelmed by too and unusable information.

[12] Ibid, p. 27

[13] Ibid.

[14] Ibid, p. 1. The US military is using AI algorithms on the battlefield in Iraq and Syria through Project Maven. This project pours through terabytes of data captured by drones every day much faster than teams of human analysts, enabling improved target identification. Gregory C. Allen, 'Project Maven brings AI to the fight against ISIS,' https://thebulletin.org/2017/12/project-maven-brings-ai-to-the-fight-against-isis/, accessed 31 July 2018.

[15] Scharre and Horowitz, 'Artificial Intelligence: What Every Policymakers Needs to Know'

[16] Paul Scharre, 'Robotics on the Battlefield: Part I: Range, Persistence and Daring,' 1 May 2014, https://www.jstor.org/stable/resrep06404, accessed 31 July 2018; Paul Scharre, 'The Coming Swarm: The Cost-Imposing Value of Mass,' 25 September 2014, https://www.jstor.org/stable/resrep06138, accessed 31 July 2018; AirSource Military,

individual soldiers could command small relatively low-cost fleets of swarming drones capable of overwhelming comparatively expensive military systems. Additionally, swarms can conduct missions too dangerous for normal soldiers and thus at greater ranges, potentially addressing concerns over the growth of anti-access area denial capabilities in some regions. When synchronised and widely distributed over large areas, swarms will allow more efficient allocation of assets, with systems cooperating for sensing, deception and attack, and able to 'self-heal' in response to enemy attacks.[17]

Emergency Response and Policing

Owing to its ability to rapidly analyse large volumes of information, AI could enhance the ability of New Zealand's emergencies services to react to and prepare for national and humanitarian emergencies. For example, AI will enable planners and responders to analyse population and seismic data, physical infrastructure schematics, risk assessments and response plans. This information can be merged with data from citizens using social media, and first responder's feedback at the scene of emergencies, enabling command and control personnel to make effective decisions.[18] By being continuously updated with new information, algorithms can provide a constant picture of the changing needs on the ground and where resources should be prioritised.

Police use of AI is on the agenda internationally and in New Zealand. AI systems can have a positive impact on police work in several ways. These include the use of big data to predict crime and map where crime hotspots are, and thus to allocate responses and resources more effectively. For example, recent research on crime around stadiums has revealed that social media data can enhance the police's ability to identify where trouble hotspots might be when there are major sporting or entertainment events.[19]

The police's role in counterterrorism could also create uses for AI. As the UK's highest counterterrorist officer has stated, AI could help tracking the tens of thousands of people on terrorist watchlists.[20] AI could also be deployed to map organised crime and cybercrime and see the digital connections that exist within and between complex criminal networks.

The prospect of police using AI for law enforcement purposes comes with an abundance of ethical and practical concerns, however. What if the data is wrong and leads to the surveillance of people not involved in criminal behaviour? These concerns have surfaced in the US, where predictive policing and offender management algorithms have been criticised for unfairly targeting African

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'Perdix Drone Swarm – Fighters Release Hive-mind-controlled Weapon UAVs in Air,' https://www.youtube.com/watch?v=ndFKUKHfuM0, accessed 31 July 2018

[17] Scharre, 'Robotics on the Battlefield'; Scharre, 'The Coming Swarm'

[18] For example, the open-source platform Artificial Intelligence for Digital Response (AIDR) combines machine learning and human intelligence (crowdsourcing) during a crisis by filtering and classifying relevant tweets posted during emergencies. By continuously ingesting rapidly growing amounts of data from twitter, AIDR filters this information according to predefined categories of information. AIDR has been successfully tested to classify informative vs. non-informative tweets posted during the 2013 Pakistan Earthquake. It was also used to Nepal in April 2015 and Chile in September 2015. Artificial Intelligence for Digital Response, http://aidr.qcri.org/, accessed 31 July 2018; also see Patrick Meier, *Digital Humanitarians: How Big Data Is Changing the Face of Humanitarian Response* (Florida, US: CRS Press, 2015)

[19] Alina Ristea, Justin Kurland, Bernd Resch, Michael Leitner and Chad Langford, 'Estimating the Spatial Distribution of Crime Events around a Football Stadium from Georeferenced Tweets,' *ISPRS International Journal of Geo-Information*, Vol. 7, No. 2 (2018), http://www.mdpi.com/2220-9964/7/2/43, pp. 1-25, accessed 31 July 2018

[20] Josh Loeb, 'AI and the Future of Policing: Algorithms on the Beat,' https://eandt.theiet.org/content/articles/2018/04/ai-and-the-future-of-policing-algorithms-on-the-beat/, accessed 31 July 2018

Americans and those from disadvantaged backgrounds.[21] Similarly, 'feedback loops' might be created, whereby increased police resources in a particular area generate increased crime identification and an eventual over-allocation of resources.[22]

Challenges to New Zealand

The *bulk of AI development is happening in the commercial sector*, presenting unique challenges for military acquisitions and raising issues about transparency related to police operations. Militaries will have to acquire and, in many cases, significantly modify AI-enabled platforms for use in less structured environments, and according to higher standards of safety and performance.[23] Additionally, tech companies can often generate greater profits by selling software on the open market rather than exclusively to military forces, and have moral concerns over their software being used for government surveillance and lethal applications.[24] For law enforcement, information about how algorithms function is proprietary, which might create problems for law enforcement being open about methods used in crime prevention and detection.

AI could *accentuate the challenge to the NZDF of remaining interoperable* with other nation's armed forces, especially if it is a late adopter of AI software or key nations restrict access to it.[25] The New Zealand Ministry of Foreign Affairs and Trade's strategy will need to pursue free trade agreements and manage strategic international relationships in a way that guarantees access to cutting-edge AI software. Ultimately, it may even require New Zealand to reconceptualise what is in its vital national interests.

Decision makers may adopt a risk-averse approach and be loath to accept AI-generated analysis and recommendations. Furthermore, governments and militaries may incorporate AI incrementally and use it to improve existing systems and processes, rather than focus on harnessing the technologies potential to produce breakthroughs. The history of revolutions in warfare suggests that the winner of technological revolutions are not states that get the technology first but those that are best able to innovate and use it in novel ways.[26] Given the potentially low barriers to acquiring some AI

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[21] Dan Robitzski, 'The LAPD's Terrifying Palantir-Powered Policing Algorithm Was Just Uncovered and Yes It's Basically 'Minority Report,' 10 May 2018, https://futurism.com/lapd-documents-show-their-policing-algorithms-continue-to-target-minorities-and-past-offenders/, accessed 31 July 2018

[22] Loeb, 'AI and the Future of Policing'

[23] Unmanned commercial vehicles feed on immense amounts of data and GPS systems, while military unmanned vehicles could operate in data-poor environments and off-road terrain.

[24] For example, Google has cancelled their participation in Project Maven and pledged not to produce AI for use in weapons. Daisuke Wakabayashi and Scott Shane, 'Google Will Not Renew Pentagon Contract That Upset Employees,' 1 June 2018, *New York Times*, https://www.nytimes.com/2018/06/01/technology/google-pentagon-project-maven.html, accessed 31 July 2018; Google News, 'Google bans AI for weapon use,' https://www.bbc.co.uk/news/technology-44412028, accessed 31 July 2018

[25] The New Zealand Government's *Strategic Defence Policy Statement 2018* states that autonomous systems are "becoming ubiquitous across the spectrum of military operations," and AI "becoming "more powerful and integrated". It notes that these (amongst other advanced military technologies) will make it "more challenging [for the NZDF] to remain interoperable with sophisticated partners". New Zealand Government, *Strategic Defence Policy Statement*, July 2018, http://www.nzdf.mil.nz/downloads/pdf/public-docs/2018/strategic-defence-policy-statement-2018.pdf, p. 19

[26] Scharre, 'The Coming Swarm,' p. 19. For example, the British were first to develop aircraft carriers in 1918, intending to use the airplanes it could carry as 'spotters' for destroyers. Yet, it was the Japanese and US navies that were the first to use them as mobile airfields, revolutionising naval warfare in the 20th century. Michael C. Horowitz, 'Artificial Intelligence, International Competition, and the Balance of Power,' *Texas National Security Review*, Vol. 1, Iss. 3, https://tnsr.org/2018/05/artificial-intelligence-international-competition-and-the-balance-of-power/, accessed 31 July 2018

systems, such as autonomous swarms, there is no reason why innovative uses of these technologies could not come from small states like New Zealand.

Bureaucratically, the NZDF may resist the expansion of unmanned systems into traditional combat roles, fail to adjust training recruitment and organisational changes, and defence acquisition processes might not be agile enough to adopt AI software. There are some grounds for this caution. AI algorithms can fail in unexpected ways, produce unpredictable results, and the 'reasoning' between their decisions often remain opaque to users, which can reduce trust in the systems performance and recommendations.[27]

Large public and private *data pools are the key fuel for building effective AI systems*. Setting culturally acceptable standards for collection and use of private and public data will be essential to balance the need for data with cultural concerns over privacy. Government-held data sources could prove important for military AI applications, yet are generally classified by government bureaucracies. Some solutions, such as cloud computing, raise inherent security issues,[28] while algorithms are vulnerable to theft, hacking, data manipulation and spoofing. This makes it essential that high cyber security standards are set.

Internationally, AI could have profound implications on the balance of power, requiring deft diplomacy by New Zealand.[29] At present, it is an open question whether liberal democracies or authoritarian political and economic systems will be best able to use AI. Some states, such as China and Russia, that do not have significant cultural concerns over accessing and harnessing their citizen's data may gain an advantage relative to liberal democracies that maintain or develop stringent regulations around private data, or that are unable to forge coherent AI strategies.[30] Additionally, as the costs of AI and robotics decreases over time, the potential for proliferation to hostile non-state actors (criminals, terrorists and militant groups) will grow, creating new and unexpected sources of threat to New Zealand from domestic and international sources. As such, monitoring and countering the proliferation of these technologies could become a key task for New Zealand and its ally's intelligence agencies, and efforts in the multilateral arena to restrict the most lethal applications of AI and related technologies become more important.

Are there distinct opportunities for New Zealand?

AI technologies that lend themselves to asymmetric offensive and defensive operations will offer great deterrent capabilities to small states like New Zealand at a time when changes to the Asia-

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[27] Former Director of the US Defence Advanced Research Projects Agency, Dr. Arati Prabhakar has stated "When we look at what's happening with AI, we see something very powerful, but we also see technology that is still quite limited… the problem is that when it's wrong, it's wrong in ways that no human would ever be wrong." Hoadley and Lucas, 'Artificial Intelligence and National Security,' p. 28. Also see pp. 29-33.

[28] Ibid, p. 8

[29] Nicholas Wright, 'The Coming Competition Between Digital Authoritarianism and Liberal Democracy,' *Foreign Affairs*, 11 July 2018

[30] China announced an AI strategy in 2017 and stated its intention to become the world leader in AI. In contrast New Zealand's closest international allies, Australia and the US, have yet to announce strategies, and nor has New Zealand. See William Carter, Emma Kinnucan and Josh Eliot, 'A National Machine Intelligence Strategy for the United States,' CSIS, March 2018, https://www.csis.org/analysis/national-machine-intelligence-strategy-united-states, accessed 31 July 2018; Georgia Taylor, 'New Zealand Seriously Needs a National AI Strategy,' https://aiforum.org.nz/2018/05/07/new-zealand-seriously-needs-a-national-ai-strategy/, accessed 31 July 2018

Pacific balance of power are underway. An AI-enabled force may also offset demographic challenges to future NZDF recruitment.[31] New Zealand could focus on making niche AI contributions that support allied nations intelligence and defence capabilities, ensuring New Zealand remains a vital partner. Additionally, a flexible bureaucracy and national security sector that embraces change could lead to fast track adoption of AI technologies, generating operational insights, innovative applications and doctrine that is valued by New Zealand's allies. In the multilateral space, New Zealand will need to remain abreast of the issues and expand its expertise so it can credibly contribute to emerging debates in major international forums over lethal and potentially destabilising AI technologies, such as LAWS.[32]

Ultimately, AI could decouple national power from population base and economic size, benefiting small states that are 'high tech and high capital'.[33] In this context, the metrics of international influence, economic success and military power may come down to the quality of a state's digital systems, sensors, high-speed networks, data protocols, and their ability to sustain or create a strong technological and science base supported by interdisciplinary teams of researchers. It is debatable whether New Zealand fits the 'high tech and high capital' category, and thus if is it adequately positioned to take advantage of AI. For example, it is sliding downwards on the rankings of the Global Innovation Index (in 2012 it was the 13th most innovative economy, in 2018 it ranked 22nd).[34] Additionally, the New Zealand Government's recent 2018 *Defence Policy Statement* only mentions AI once, suggesting that the potential importance of AI to New Zealand's defence and security interests is underappreciated.[35]

In any event, New Zealand and the NZDF will need to compete for top-tier international AI talent and balance government and commercial funding for AI development. Developing a national AI strategy would seem a logical initiative, as would creating a government agency with oversight of security, defence, and emergency response. This could engage industry, academics, and partner nations and allies with the intent of forging a whole-of-government and whole-of-society approach that maximises New Zealand's chances of establishing itself as a world leader in AI.

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[31] New Zealand's *Defence Assessment 2014* notes that demographic challenges could impede New Zealand's ability to rapidly increase the size of the Defence Forces in the future if necessary. Ministry of Defence, *Defence Assessment 2014*, May 2015, https://www.defence.govt.nz/assets/Uploads/defence-assessment-2014-public.pdf, accessed 31 July 2018

[32] On this topic, see Aiden Warren and Alek Hillas, 'Lethal autonomous weapons systems: Adapting to the future of unmanned warfare and unaccountable robots', (*Yale Journal of International Affairs*), Vol. 12, No. 1, pp. 71-85.

[33] During a research trip to Washington DC in April 2018, more than one expert on AI and emerging technologies conveyed this point to Dr Steff.

[34] Liam Dunn, 'Dumbing down - New Zealand Economy not Getting Smarter,' 22 July 2018, https://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=12091676, accessed 31 July 2018

[35] New Zealand Government, *Strategic Defence Policy Statement*, p. 19

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