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Choosing Our Future:
Will Non-Humans Carry Canadian Colours Into Combat?

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Exercise Solo Flight

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The Canadian Armed Forces (CAF) finds itself at a significant crossroads, its major equipment has deteriorated to the point of near irrelevance and many of its critical programs are rapidly reaching their end of life. These legacy assets were originally purchased in an environment of slower technical development, which allowed the CAF to provide defence at a relatively low cost. However, time and society have begun to rapidly change leaving behind the low-tech weapons of the past and simultaneously embracing significant societal changes. Add in the lingering repercussions of the sexual misconduct crisis, significant changes in Canadian demographics and a general lack of desire for national service, and the result is that the CAF is now experiencing a near-existential personnel and capability crisis. Yet, through a twist of fate the CAF has been provided with an opportunity to reinvest in itself and return to the world stage as a well capitalized ally and modern combat force. The successful integration of robotics, and artificial intelligence (AI) is emerging as a third revolution in military affairs and is providing a beacon of promise for the CAF.[1] This environment can allow the CAF to make significant decisions at a critical moment in its history that will have the potential to remake and upgrade its ability to provide defence for Canada. These recent developments in AI and subsequently in Autonomous Weapon Systems (AWS) present an opportunity for the CAF to develop unique solutions to the challenges mentioned above, thereby allowing the CAF to address staffing shortfalls and revolutionize capabilities.

Understanding where AI came from and how fast it has developed is essential for understanding why the CAF must embrace it as rapidly as possible or risk missing out. Understanding the pace and scope of these advancements, will make it clear why many countries are rushing to integrate them now, rather than wait for less costly alternatives. A key consideration in the development of this amazing technology is the significant cultural and institutional changes that it brings with it. The complete mindset change that must occur within a rigid institution like the military will be difficult, but it is essential for the successful integration of these new capabilities. The potential programs, equipment and capabilities that are being developed will have significant costs but a glance at what is available and what they can offer will help orient leaders on the rapidly approaching future. Not all technologies will align with the CAF's interests or budget constraints and the institutional changes required may also prove to be beyond the current capabilities or desires of the CAF. This essay will only touch on the ethics and morality of AI and AWS, but a brief acknowledgment of these concerns and their future study is necessary.

Historical Context

Everyone seems to be talking about AI, and it appears the concept is straight out of a sci-fi novel. The truth is that this capability has been developing since the mid-to-late 1950s when a computer researcher named John McCarthy and four others referred to it as artificial intelligence.

[1] U.S. Naval Institute, 2024.

McCarthy and the team wrote a research proposal, that a study "proceed on the basis of the conjecture that every aspect of learning … can, in principle, be so precisely described that a machine can be made to simulate it." [2] The obstacle was the relatively immature technology available at the time, specifically the available computational power required to make the rapid calculations. Secondly, the ability to store the required data in sufficient enough volume and make it rapidly accessible so that it could be quickly recalled did not exist yet. However, time and funding would solve this issue in a few short decades. In 1997, Deep Blue beat a chess champion for the first time, then in 2011, IBM's Watson won Jeopardy, and in 2016, AlphaGo beat a human champion at the ancient game GO. It was the rapid development of cost-effective storage and computing power that enabled these historic moments. Incredibly, this rise in computer chip capability was predicted by Gordon Moore in 1965. In the phenomenon now known as Moore's Law, it is generally expected that the technological capacity to increase transistors on chips will double every year.[3] For this essay it "doesn't matter for us as users of computer equipment. But it matters for those aspects that we do care about, like the speed and cost of computing."[4] The increased density of transistors increases the capability of the chip, and the increased capability of the chip can lead to more powerful computational power. This observation by Moore has held for over 50 years and is an amazing part of AI's rapid rise. More importantly, if the law continues to hold, the increased capability will continue to accelerate and those who do not adapt risk getting left behind. The pace of advancement is now so fast that one can forget that these capabilities emerged from initial "dumb" automated weapons like mines and torpedoes. Paralleling developments in AI and computer technologies, these weapons have seen rapid progress, having initially been engineered to identify and engage targets autonomously, these basic systems have now advanced to the point where they can arm, disarm, and loiter while waiting for a target to appear before unmasking themselves.[5]

The biggest leap forward in the acceptance of these capabilities occurred during the 2020 conflict between Armenia and Azerbaijan. The Second Nagorno-Karabakh War (2020) ignited and burned brightly for a short period of time, but the conflict saw the employed use of AI and AWS, marking a significant shift in modern warfare. During this conflict Azerbaijan utilized drones and loitering munitions to great effect, many of which used AI for target identification and engagement. These technologies allowed for precision strikes and continuous surveillance, significantly impacting the war's outcome, and highlighting the capabilities growing role in war. As important as this conflict was to the development AWS, it has turned out to be just a small glimpse into the future. Once we started to witness the war in Ukraine and the massive employment, integration, and widespread adoption of AWS and AI in combat, we started to see the future of modern conflict. Furthermore, this conflict has also highlighted the partially unexpected pace of capability evolution. The Ukraine war is demonstrating the use and counter-

[2] McCarthy et al, 2006, 13.
[3] Roser et al, 2023.
[4] Abid.
[5] Work 2021, 5.

use of drones and AI at all tactical levels and reports coming out of the front lines indicate that strategies or capabilities are constantly evolving. Headquarters and frontline units are constantly assessing the use of these systems and deem them essential tools for the fight. However, it is critical to remember that there is a lot of static in the reports, as both sides of the conflict want to demonstrate that they are successful.[6]

Potential Offerings

The world is entering a new epoch in military development, one that will advance rapidly and be punctuated with short periods of exponential growth. This revolution has been termed the third revolution in military affairs, coming after gunpowder and nuclear weapons. AI and AWS are transforming the battlefield in several key areas, requiring a shift in military thinking, strategy, and culture. The CAF, in response, has recently released its AI Strategy, and within it, the CAF highlights five lines of effort (LoE) that give grounding and pace to the strategy[7]. In the foreword from the Deputy Minister and the Chief of Defence Staff, they highlight that "[f]alling behind now in our adoption of AI will risk the loss of our operational advantage."[8] The thought of falling further behind allies and competitors is concerning but it is no small task of orienting a military and country towards a new and uncertain future that seems to risk placing our future in the hands of technology.

The capabilities and products available are diverse but starting with non-kinetic, logistical improvements, AI can help in predictive maintenance and logistical train efficiencies. The Royal Canadian Navy recently used predictive analytics from a system they trained in cooperation with Defence Research and Development Canada (DRDC) to predict when equipment or systems would break or fail on board ship.[9] When AI can predict maintenance needs and optimize the logistics of repair parts or services before they are needed, time savings and safety can be achieved. Furthermore, this predictive capability can significantly improve operational readiness and extend the lifespan of equipment. This type of AI is reaching maturity, and there are a number of different companies out there that can help provide it, many are based in Canada and employed in Canadian governments. This is an opportunity for DND/CAF to reach out to domestic providers and developers and potentially partnering with them in development and implementation.

The crunching of logistical and maintenance data is a corporate/business function that can be integrated into the CAF with little controversy, but for a modern military organization, the black box that holds the most promise from AI is the enhanced decision-making applications and the subsequent efficiencies that develop. Some of the critical use cases for this type of AI are its ability to do dull tasks such as combing through the massive databases of information gathered by sensors. Algorithms like those developed and used as part of Project Maven can search for

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[6] Kofman, 2024, 44:15.
[7] Canada, 2024, 1.
[8] Canada, 2024, iii.
[9] Abid, 3.

common trends and occurrences through images and full-motion video. In this case the massive amounts of raw footage received from the drone program in Iraq and the Middle East would have never been able to be properly viewed by humans. However, when AI and humans were paired, the AI applications were able to forward potential leads to human operators who could then focus on specific intelligence rather than overwhelming amounts of product.[10] These types of AI can see patterns and make links that humans cannot, and they can do it significantly faster and more accurately. In Canada's case, the RCAF has recently been very successful in its procurement processes, and the GoC has decided to push ahead with the F-35, P-8 and RPAS programs. These new capabilities will bring in massive amounts of new data that must then be processed. The only realistic way this will occur will be through AI and Canada must have these tools ready when the data flow begins. By engaging with developers and allies Canada has the potential to partner with Allies or spark further development in domestic enterprises. These types of analytic programs have multiple uses and could potentially be used in managing climate-sensitive areas such as the north or the vast forested areas that cover the country.

Coupled with the ability to analyze data and enhance the decision-making skills of humans is the ability of AI to optimize operational capabilities, such as autonomous navigation, target identification, and threat assessment. This leads to more precise and effective missions for surveillance, reconnaissance, or direct action. Again, AI programs can do the dull, tedious work of moving a drone from A-B over a significant period of time/distance and then notify its operator of its arrival at the target location or if a target has appeared. The AWS can provide continuous, real-time surveillance and intelligence while on target, thereby improving a Commander's situational awareness and enabling them to feed accurate information to their sub-unit commanders to make better-informed decisions and the system can do all of this without human intervention. L3Harris, Northrop Gruman and Boeing all have these types of capabilities and are advancing their capabilities. However, our adversaries are also leveraging advanced drone technologies to extend their country's reach. Canada must become engaged in this development so that it can develop and then maintain a strategic and tactical edge. The risk of falling behind is the risk of becoming disengaged from the advancements and ignorant of the threats they pose.

Institutional Culture and long-term vision

Many world leaders have spoken on AI and its impact on their capability, however, on 1 September 2017, Russian President Vladimir Putin made a speech in which he told a group of schoolchildren that:

> "Artificial intelligence is the future, not only for Russia, but for all humankind. It comes with colossal opportunities, but also threats that

[10] Doubleday, 2017.

> are difficult to predict. Whoever becomes the leader in this sphere will become the ruler of the world,"[11]

This is a stark reminder that Canada's competitors are looking at AI development and starting to indoctrinate their youth with the hope of building on domestic competencies as well as nationalistic patriotism. The rapidly advancing field of AI and AWS will significantly impact Canada and the CAF no matter what depth of engagement the CAF ultimately undertakes. Canada's allies and competitors are already heavily engaged in the field, and as rapidly as new tech or capabilities arrive, it is often countered just as fast. Hence, the rise of "a key question … which nation can most rapidly and effectively adapt to this revolution."[12]

In the UK, the Royal Navy has completed trials to launch and recover UAS from the deck of one of its aircraft carriers. This move allowed crewed planes to focus on high-priority, critical tasks and leave the lower-priority, surveillance-type tasks to UAS.[13] The compounded savings from this experiment could reduce the stress on aircrews over the long term and potentially reduce demand on the ship's crew. This demonstration of a culture of experimentation must be encouraged to develop, and the CAF must be open to experimenting with new concepts and concurrently willing to accept some failure.[14]

The launch of the Department of National Defence AI Strategy document is a first step in identifying an institutional culture that embraces technological innovation. This document provides a vision from leadership and demonstrates verbally that the Department and the CAF desire a commitment to innovation. It highlights the need for education and training programs to develop the necessary skills and mindset to embark on this new path. The Department of National Defence Data Strategy document released in 2019 calls out the department for its poor data management. Our culture must adjust to the reality that data is only as valuable as it is available and accessible.

The AI Strategy focuses on the use and implementation of policies and guidelines for the integration of responsible AI capabilities. A note of caution, however, is that inflexible policies and bureaucratic obstacles will inhibit the rapid adoption of new technologies.[15] Pilot programs may fail and require robust feedback from all stakeholders, but shunning failure or pushing for the perfect solution before implementation will not create the environment for experimentation that is needed to remain at the cutting edge of this developing capability. Specifically for the CAF open communication across the L1s will be critical in keeping everyone informed, engaged, and aligned. The establishment of the Defence and CAF AI Centre (DCAIC) will be important for advancement along this line. Two other concepts have the potential to ignite a department-wide renaissance, the first being the creation of a dedicated AI Research and Development Fund

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[11] RT World News, 2017.
[12] Hammes, 2020, 121.
[13] Willet, Naval News.
[14] Canada, 2024, 49.
[15] Canada, 2024, 17.

that would partner with small domestic Canadian companies to help spark research and growth through the issuance of grants or product development partnerships. This idea could help balance the cost risk of concept development across government and industry. Additionally, deep integration of people will help benefit the department beyond the potential of new products but also with an infusion of a culture of experimentation and acceptance of failing forward. Commensurate with this concept is the idea put forth in LoE Four in the AI Strategy[16]. DND/CAF should work to develop its current team members' understanding and their capabilities around AI, as well as look at industry partnerships that allow personnel exchanges between the department and civilian organizations and enterprises. The idea here is the rapid development of understanding, culture, and capability would act as a boost to the CAF to jump ahead in the application of this Third Revolution in Military Affairs.

The long-term impacts of AI and AWS on military tactics, strategy and culture will be immense. These technologies can enhance operational efficiency, decision-making speed, and adaptability in complex scenarios, and they can also provide significant strategic advantages through improved intelligence, surveillance, and reconnaissance capabilities. However, there will need to be ethical and moral conversations held. Leaders need to be open and accepting of the developments that occur as a result of the employment of these new capabilities.

Ethics

The category of ethical implications of using AI and AWS in warfare is as broad as it is deep. Top of mind is the accidental killing of innocents, the ability of the AI or AWS to follow the Laws of Armed Conflict (LOAC) and the need to be reminded that the loss of human life is tragic no matter the mechanism that causes it. Furthermore, an AWS will be built and programmed by a human; it is almost enviable that bias will creep in, and mistakes will be made. This can lead to innocent people being harmed.[17] Looking at history, there have been numerous incidences of humans behaving badly in war and mistakes being made that cost lives and irreparable damage to international reputations. Conversely, there are examples like the actions of former CAF Captain Rob Semrau in Afghanistan in October 2008.[18] This complex event highlights that ethics and morality are intricate, and a black and white computer decision will be challenging to get right every single time.

The complexity of military operations and war is almost limitless but the concern surrounding AI and human employment also crosses over into the civilian environment, where the risk of rapid development in AI without the corresponding development and understanding of the human side of the keyboard could be devastating. A robust debate about the impact of robotics on human employment and the future of human purpose and meaning is ongoing.[19] We need to be concerned about human involvement in all things that involve humans. However, the

[16] Abid, 1&20.
[17] Abid, 5.
[18] Landry, 2010, 54.
[19] Allen & Chan, 2017.

military use case is primarily about removing humans from the dirty, dangerous and dull jobs that can be fulfilled by machines.[20] The ethics and morality of this topic is beyond the scope of this essay, but it is important to raise the issues and highlight the need to engage in the topic sooner rather than later. If we can save the lives of our warfighters, then we must engage in technology and we must engage in the philosophic discussion about machine participation in war. A strong balancing tool that should be employed here is an ethics and oversight committee that allows the participation of personnel from all ranks and trades up to and including a senior board that works to keep DND/CAF on the right side of this development.

Conclusion

The third revolution in military affairs has begun and the influence of AI and the subsequent development of AWS is standing at the doorstep of the CAF, by answering the knock at the door and pushing forward with the integration of AI and AWS Canada has the potential to inject new energy into DND/CAF and many its domestic industry partners. Faced with worn-out equipment, critical shortages in personnel, and new threats to its allies and homeland, the CAF has the opportunity to embrace new technologies and capabilities that will re-energize its people and allow it to retake its position as a middle power. The recent conflicts in Ukraine and Israel demonstrate that countries that fail to adapt and embrace AI, risk being left out or face a steep learning curve in the event of war. As President Putin clearly laid out in his 2017 speech, the Russian position on AI success and leadership in AI is global dominance. Canada should not secede this ground extraordinary ground to hostile nations. Furthermore, Canadian engagement in this area will be just as important in the future as the Ottawa Treaty on landmines was in the past.

Canada has taken some tentative steps to acquire new capabilities, and they will drastically increase the flow of raw data. To stay ahead of its adversaries and make the most of these new capabilities, the CAF must turn to AI's ability to process these new data flows. The use of AI and its advanced algorithms will allow Canada to optimize its new assets and adapt to the new battlefield. It will require a shift in mindset and institutional culture, and it will be critical for the CAF to create an environment that encourages experimentation and accepts failure and adaptation as part of business. Lastly, the CAF must embrace data-driven decision-making while balancing it with human input and interpretation. The Department of National Defence's AI Strategy and Data Strategy are steps in the right direction, emphasizing the need for education, training, and collaboration with technology companies and academic institutions.

The adoption of AI and AWS offers the CAF a path to renewed operational effectiveness and strategic advantage. By embracing these technologies, the CAF can overcome its current demons, ensure its future readiness, and maintain Canada's defence posture in an increasingly complex world. The future of the CAF, and indeed the future of Canada's national defence, lies

[20] Etzioni, 2017, 72.

in the integration of AI and autonomous systems. This action will ensure that Canada remains a trusted ally and valuable team member on the global stage.

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