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CAF ARCTIC OPERATIONS WITH REMOTE AUTONOMOUS SYSTEMS

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AIM

1. The aim of this paper is to analyse the advantages that unmanned systems can bring to the CAF's Arctic presence. It will recommend that the CAF should invest in developing and employing Remote Autonomous Systems (RAS) in the Arctic.

INTRODUCTION

2. The Arctic is a scarcely populated barren landscape with a critical lack of infrastructure. Despite ongoing efforts by the CAF, it remains a challenging operating environment for our conventional military forces. Initiative 106 of *Strong Secured Engaged* states that the Defence Team will "Enhance the mobility, reach and footprint of the Canadian Armed Forces in Canada's North to support operations, exercises, and the Canadian Armed Forces' ability to project force into the region."[1] Currently, Canada does not possess either a deep water port for RCN ships, or a major operating base for RCAF aircraft or CA to operate out of year round. In order for Canada to show the international community that we can defend and maintain awareness over our sovereign territory, we will need a new generation of forces that can operate for long periods of time in harsh conditions, without significant replenishment needs, with no constraints on time spend away from home. In short, Canada needs robots in the Arctic.

3. RAS are defined as partially or fully unmanned systems consisting of a robotic and an autonomous processing system. RAS are becoming increasing important in military operations. All major military powers are currently investing heavily in the production of various RAS platforms to augment their current fighting forces, and create new types of combat units. The distinctive performance capabilities of RAS provide many advantages to Arctic operations that can help synergize efforts of conventional forces.

DISCUSSION

The Arctic

4. Canada faces an increasingly difficult challenge of asserting its sovereignty claim in the Arctic. There is growing interest from States and non-State actors in the region seeking to profit from new water ways and access to resources. Competing sovereignty claims between Canada, United States, Russia, Norway and other nations rare ongoing and have no clear end in sight as sea ice continues to recede.[2] This change in geography offers new economic opportunity, but also creates an increased potential for conflict. For example, China is demonstrating interest in the region by deploying Polar Research

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[1] Department of National Defence. *Strong, Secure, Engaged: Canada's Defence Policy.* (Ottawa: National Defence, 2017): 80.

[2] House of Commons. *Nation-Building at home, Vigilance Beyond: preparing for the coming decades in the arctic; Report of the Standing Committee on Foreign Affairs and International Development* (Ottawa: House of Commons, 2019), 50-55.

Vessels, thus establishing a regular presence in the Arctic, and challenging our territorial water claims.[3]

5. Nevertheless, it remains difficult for the CAF to operate and maintain a presence in the Arctic. Forty percent of Canada's territory is in the Arctic, with only about 110,000 inhabitants.[4] The new Harry DeWolf Class offshore patrol vessels will increase the RCN's ability to break through sea ice, but with a rating of Polar Class 5, it can only be expected to do so in medium first-year ice.[5] The Canadian Rangers add physical presence in the Arctic, but these soldiers face many challenges that limit their ability to achieve our national goals.[6] Additionally, sending additional troops for exercises and sovereignty operations such as Op Nanook takes a toll on already high-tempo units. Canada needs new strategies to bolster its presence in the Arctic.

Remote Autonomous Systems in the Canadian Arctic

6. RAS have unique capabilities that are suited for operating in austere Arctic landscapes. The Arctic encompasses a combination of mountains, tundra, lakes, rivers, and ocean. RAS can be tailored to optimize their manoeuvrability on these various terrains. Unmanned amphibious rovers can easily crawl across soggy tundra, and float across lakes or ocean ways to get to a remote island and observe ships that pass through our newly opened sea routes. They can photograph ships and attempt radio contact, or act a radio antenna for an operator at a distant operation centre. They can wait for days or weeks, or relocate to better vantage points. RAS could easily cross soft or broken sea ice, since it can drive on land and float across the water.

7. Various types of RAS can work together to provide joint effects in the complex Arctic environment. A rover can be cued to move to an area of interest by a UAV patrolling the Arctic Archipelago searching for air, surface, and maritime activity. Additionally, quick moving unmanned underwater vehicles can search for ships, or submarines that are navigating the depths of our territorial waters. Unmanned submarines can relay their findings in encrypted data bursts to a UAV who could collect and store the data for processing back at the operations centre. All these tasks can be completed nearly year round with little human support in the Arctic region.

8. These previous examples are not far-fetched future concepts. RAS that perform these functions already exist within the current realm of functional technology and are becoming commonplace in military operations.[7] The capability and reliability of these systems in many ways surpass what humans can achieve. Major military powers are

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[3] Ibid, 48.
[4] Andreas Østhagen, G.l. Sharp & P.S. Hilde. "At Opposite Poles: Canada's and Norway's approaches to security in the Arctic." *The Polar Journal*, 8:1 (2018), 166.
[5] Canada, "Polar Classes," last modified January 14, 2010. https://www.tc.gc.ca/eng/marinesafety/debs-arctic-shipping-operations-polar-classes-1352.htm
[6] The Office of the National Defence and Canadian Forces Ombudsman. *Canadian Ranger: A Systemic Investigation of the Factors that Impact Health Care Entitlements and Related Benefits of the Rangers*. (Ottawa: The Office of the National Defence and Canadian Forces Ombudsman, 2017), 6-9.
[7] P.W. Singer. *Wired for war: The robotics revolution and conflict in the twenty-first century* (New York: Penguin Press; 2009), 41.

recognizing the utility of RAS and are investing heavily in their development. In July 2017, Russian defence contractor Kalashnikov announced it was developing a line of autonomous weapons system that could track and engage targets using an artificial neural network.[8] Russian General Gerasimov recently told Russian press that the military is seeking to completely automate the battlefield.[9] Additionally, the 2018 National Defence Strategy for the United States emphasizes the importance of developing modern forces that harnesses the capabilities of advanced autonomous systems. [10] In March of this year, the Pentagon set aside nearly one billion dollars to fund artificial-intelligence programs for the coming fiscal year, up from $800 million in 2018.[11]

9. RAS in the Arctic could provide Canada and the CAF with the increased ability to conduct:

a. Surveillance and patrols in the air, land, and sea domains. RAS can explore regions of the Arctic for long periods of time with little risk of succumbing to the harsh environment. They can focus more time in areas less prone or suitable to human presence, but of strategic concern.

b. Shows of presence. RAS can simply be in the Arctic. They can broadcast radio messages, interrogate ships or aircraft. And, they can make their presence known, and they can support human forces doing the same thing.

c. Mobile C3. RAS can act a mobile C3 nodes that can support conventional entities and act as stand alone nodes. They can extent areas or radar and radio coverage. They can act a redundant links in existing C3 architecture, thereby increasing the robustness of our current capabilities.

d. Search and Rescue. RAS can help locate stranded people in need of help, they can carry emergency supplies and pre-position themselves in area that are at high risk of SAR events, or in places where SAR assets have difficulty accessing.

e. Sustainment. RAS can act as supply mules. They can pre-position themselves in areas where forces will be, or may need replenishment.

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[8] David Gilbert. "Russian weapons maker Kalashnikov developing killer AI robots," *Vice News*, last modified: Jul 12, 2017. https://www.vice.com/en_us/article/vbzq8y/russian-weapons-maker-kalashnikov-developing-killer-ai-robots

[9] Noel Sharkey. "Killer Robots From Russia Without Love," *Forbes,* last modified: Nov 28, 2018. https://www.forbes.com/sites/noelsharkey/2018/11/28/killer-robots-from-russia-without-love/#58b847e2cf01

[10] Mattis, James. *Summary of the 2018 National Defense Strategy of the United States of America Sharpening the American Military's Competitive Edge*. (Department of Defence, 2018), 7.

[11] Zachary Fryer-Biggs. "Coming Soon to a Battlefield: Robots That Can Kill," *The Atlantic*. Last Modified: September 3, 2019. https://www.theatlantic.com/technology/archive/2019/09/killer-robots-and-new-era-machine-driven-warfare/597130/.

Advantages

10. Autonomous system provides flexible options, and allow for an increased amount of concurrent tasks. They also remove humans from tasks that are too dull, dangerous or that require solutions that human not well suited to perform.[12] This means that simple tasks that do not require human interaction can be delegated to the RAS, while other tasks can be retained by the operator. Additionally, the level of autonomy can be variable. Certain tasks can be either human directed or autonomous depending on the situation. This provides the operators with flexibility. For example, on a clear day, the operator may choose the remote drive a rover to specific location in order to get better radio coverage, or a better vantage point for its sensor suite. In poor visibility, the rover may be given a way point to navigate to on its own since it can use it own navigational sensors to determine the fastest and safest route for itself.

11. One of the most attractive features for CAF Arctic operations is that such systems can operate autonomously for long periods of time in harsh conditions with very little support. One of the most compelling examples of RAS that have operated independently for extended periods of time in harsh environments are NASA's Mars rovers. The scientists who designed these rovers knew that they could not send transit instructions in a timely manner from Earth, so they created purpose build sensors to allow the rovers to navigate on its own for several years.[13] This type of independent functionality is ideal for our Arctic region.

12. Robotic systems are affordable. Global robotic industry has blossomed over the past twenty years. Currently, the industrial robotics industry is seeing record growth as economies of scale and technological innovation make for cheaper and more effective robots. Global management consulting firm McKinsey and Company stated in a report realised this year that the average cost of robotic systems has decreased by more that 50% since 1990.[14] Additionally, the industry projects a 14% annual growth for the next three years signalling a steady increasing demand for robots.[15]

13. Investing in Canadian RAS will benefit Canada's robotic industry. By creating a RAS strategy for the Arctic, the CAF can address issues of the Arctic's growing strategic importance stated in SSE and support Innovation, Science and Economic Development Canada's (ISEDC) mandate to generate technology jobs in Canada and develop an innovation driven economy tied to the science and technology sector.[16] There are many Canadian companies that already design and build some of the world premiere industrial

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[12] Singer PW. *Wired for war: The robotics revolution and conflict in the twenty-first century.* …63.
[13]Zachary Fryer-Biggs. "Coming Soon to a Battlefield: Robots That Can Kill".

[14] McKinsey & Company. *Industrial robotics: Insights into the sector's future growth dynamics* (Munich: McKinsey & Compan, 2015), 13.
[15] Ibid, 26.
[16] Innovation, Science and Economic Development Canada. *Building a Nation of Innovators* (Ottawa: Innovation, Science and Economic Development Canada, 2019), iv.

robotic systems.[17] Many of Canada's universities have highly specialized programs that focus on technological innovation that could potentially serve as a test bed for budding programs such as military RAS. The Defence Advanced Research Programs Agency (DARPA) successfully funds university research teams to advance technology that could have practical application to the military.[18] The CAF could apply similar strategies, focus on specific areas of interest to increase Canada's science and technology sector.

14. By operating RAV domestically, the CAF will be better prepared to use them in an expeditionary capacity in the future. There is no doubt that the CAF will increase the number and variety of RAS it operates in the future. In order to remain interoperable with our closest Allies, and to minimize unnecessary risk, we will need to develop these capabilities sooner rather than later.

Risks and Challenges

15. If the CAF continues to delay in investment in RAS, it will put its forces in situations where they may face unnecessary risk. Therefore, in order to gain the required expertise and to modernize our organization to properly train, maintain, and operate RAS, we will need to slowly build up our understanding of what these machines can do and how best to use them. This critical process of learning and development should not happen in high-intensity operations in an expeditionary setting where the adversary may already be utilizing these capabilities effectively against our forces. The CAF needs to field these systems at home and gain real lessons about their employment now, so that we can be ready for the next conflict.

16. There are many ongoing ethical issues associated with the employment of military RAS. Autonomous systems depend on programming and increasingly artificial intelligence (AI) that can make decisions based on programmed logic. Errors in logic programming, or purpose build RAS that can attack people create the potential for collateral damage that can negatively impact the CAF's legitimacy on operations. AI challenges our orthodox rules and sensibilities towards the legal and moral use of deadly force. Non Government Organizations (NGOs) and States who both oppose and support the use of lethal automated weapons systems (LAWS) have increasingly been lobbing the UN.[19] The UN has tried, and so far failed, to update the Convention of Certain Weapons (CCW) in a way that prohibits, or legitimizes the use of LAWS. Russia is the most obstructive nation engaged in the fight to allow or ban LAWS.[20]

17. Canada may never support the use of LAWS, but it will most certainly face States or non-State actors who will use this technology, therefore, Canada must become

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[17] Electronic Products and Technology Magazine. "Four leading robotics companies to represent Canadian innovation," last modified: May 17 2019. https://www.ept.ca/2019/05/four-leading-robotics-companies-to-represent-canadian-innovation/
[18] Singer, 140-142.
[19] Noel Sharkey. "Killer Robots From Russia Without Love".
[20] Ibid.

comfortable with RAS in order to better prepare itself for the use of, or defence against LAWS.

CONCLUSION

18. In conclusion, autonomous systems are becoming the norm for tasks considered too dull, dangerous, or different for convectional forces.[21] Canada has unique sovereignty challenges in the Arctic that could be overcome with autonomous robotic systems. It is now cost effective for the CAF to invest in RAS. There is already a Canadian robotics industry that could provide the CAF with uniquely Canadian systems to meet our unique challenges. Cooperation with the Canadian private sector would contribute to the ISEDC's goal of building technological innovations industry in Canada. Furthermore, in order to be ready to use these systems in the next conflict, the CAF must start learning how best to employ RAS as quickly as possible. We are already behind many of our closest Allies, and all the major global military powers.

RECOMMENDATION

19. In order for Canada to better protect its Arctic interests, and maintain an equal technological footing in modern RAS technology, the following is recommended:

a. The CAF should develop a strategy to create and develop purpose build RAS that can increase our Arctic operational effectiveness.

b. The CAF should engage with Canadian industry to develop and build these systems.

c. The CAF should field RAS for Arctic operations and derive lessons that can be used to create new units comprised of RAS, operators, and maintainers in order to prepare for future conflicts and position itself to have a direct influence over the legal use of RAS and LAWS in war.

[21] Singer, 63.

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