National Defence Défense nationale

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UNMANNED AERIAL SYSTEMS IN THE ARCTIC

Lieutenant-Colonel Leslie J. Rediger

JCSP 47

Service Paper

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CANADIAN FORCES COLLEGE - COLLÈGE DES FORCES CANADIENNES

JCSP 47 - PCEMI 47
2020 – 2021

SERVICE PAPER – ÉTUDE MILITAIRE

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By Lieutenant-Colonel Leslie J. Rediger

Word Count: 2,611

Nombre de mots : 2.611

UNMANNED AERIAL SYSTEMS IN THE ARCTIC

AIM

1. The aim of this service paper is to examine the employment of unmanned aerial systems (UAS) to fulfill domestic Royal Canadian Air Force (RCAF) arctic defence mandates. It will argue that building upon existing initiatives, leveraging new technologies and taking a whole of government approach, can result in a sustainable and effective defence capability.

INTRODUCTION

2. The term unmanned aerial system (UAS) is used in this paper because it encompasses one or more unmanned or remotely controlled aircraft, a control system and command and control links.[1] The Canadian Armed Forces (CAF) began examining the onboarding of UAS capabilities in 2000, when it stood up the Joint Unmanned Surveillance and Target Acquisition (JUSTAS) program,[2] and the longer term high-altitude long-endurance (HALE) program.[3] JUSTAS was aimed to "provide an all-weather, persistent, intelligence, surveillance, reconnaissance (ISR) and precision strike capability in support of [CAF] operations worldwide",[4] where HALE was aimed specifically at domestic operations.[5] These programs have yet to provide any domestic surveillance capabilities. However, in support of the war in Afghanistan the CAF purchased the Sperwer and Scan Eagle and later leased the Heron UAS.[6] These systems were relatively small, remotely controlled and provided real-time imagery to support land operations. Although capable of operational ISR tasks, these UAS were unsuited for the vast land mass and coastlines, inhospitable weather conditions, and communication and navigation challenges of domestic operations in Canada's Arctic.

3. In the decades since it first noted its interest in this capability, long strides in UAS technology have been made and the CAF has fallen behind other government departments, its allies and adversaries in their implementation.[7] In 2017, Canada's

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[1] Canada, *Drones in the Canadian Arctic,* last modified 7 December 2020, https://tc.canada.ca/en/programs/national-aerial-surveillance-program/drones-canadian-arctic.

[2] Branka Marijan, "Armed Drones on the Canadian Military Horizon," *The Ploughshares Monitor* 4,1 no. 3 (Autumn 2020), https://ploughshares.ca/pl_publications/armed-drones-on-the-canadian-military-horizon/.

[3] Michael Byers and Kelsey Franks, "Unmanned and Unnecessary: Canada's Proposed Procurement of UAVs," *Canadian Foreign Policy Journal* 20, no. 3 (2014): 271, https://www-tandfonline-com.cfc.idm.oclc.org/doi/full/10.1080/11926422.2014.934866.

[4] *Ibid.*

[5] *Ibid.*

[6] David Pugliese, "Heron and MQ-9 Drones Approved for Canadian Military Program," *Ottawa Citizen.* 17 October 2019, Heron and MQ-9 drones approved for Canadian military program | Ottawa Citizen.

[7] Branka Marijan, "Armed Drones on the Canadian Military Horizon," *The Ploughshares Monitor* 4,1 no. 3 (Autumn 2020), https://ploughshares.ca/pl_publications/armed-drones-on-the-canadian-military-horizon/.

defence Policy outlined the intent to invest in remotely piloted systems, but focused only on operational, expeditionary uses such as the ability to engage targets.[8] This paper will build upon existing initiatives, broadening the scope and integrating new technology for the potential use of UAS in CAF domestic roles, specifically in the arctic region. It will also discuss possible cooperation with other government departments (OGDs) and the opportunity to develop skilled UAS operators and technical support personnel.

DISCUSSION

75 percent of Canadian coastlines and 55 percent of its landmass is located in the Arctic.[9] According to the defence policy the CAF must defend it, be ready to assist in the case of a natural disaster and fulfill its search and rescue mandates within it.[10] Climate change is altering the arctic landscape, making natural resources more accessible. Canada's sovereignty is being questioned in this region by foreign interest groups wishing to exploit them.[11]Russia has already deployed arctic capable UAVs and China has been exploring ways of establishing a "Polar Silk Road".[12] Part of this change is the unlocking of a new maritime theatre with the thawing of northern transit routes and fishing grounds.[13] These changes demand an increase in surveillance to maintain Canada's sovereignty, ensure environmental security, deny criminal uses and assist with emergencies as they arrive.[14] Currently Canada's military presence is limited to occasional aerial and maritime patrols.[15] However, as the RCAF's Aurora fleet is tasked to support more pressing land operations, their presence in the arctic is steadily

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[8] Canada, *Strong, Secure, Engaged: Canada's Defence Policy*. (Ottawa: Department of National Defence, 2017), 39, https://www.canada.ca/en/department-national-defence/corporate/policies-standards/canada-defence-policy.html.

[9] Kevin M Baerson, "Canada's New Drone Can Better Surveil Its Challenging Arctic Environment," *Inside unmanned systems: Inside Engineering, Policy and Practice,* 4 January 2021, https://insideunmannedsystems.com/canadas-new-drone-can-better-surveil-its-challenging-arctic-environment/.

[10] Canada, *Strong, Secure, Engaged: Canada's Defence Policy*. (Ottawa: Department of National Defence, 2017), https://www.canada.ca/en/department-national-defence/corporate/policies-standards/canada-defence-policy.html.

[11] Kevin M Baerson, "Canada's New Drone Can Better Surveil Its Challenging Arctic Environment," *Inside unmanned systems: Inside Engineering, Policy and Practice,* 4 January 2021, https://insideunmannedsystems.com/canadas-new-drone-can-better-surveil-its-challenging-arctic-environment/; Guy D Williams, et al., "Drones in a Cold Climate," *EOS Science News by AGU,* 19 January 2016, https://eos.org/science-updates/drones-in-a-cold-climate.

[12] Kevin M Baerson, "Canada's New Drone Can Better Surveil Its Challenging Arctic Environment," *Inside unmanned systems: Inside Engineering, Policy and Practice,* 4 January 2021, https://insideunmannedsystems.com/canadas-new-drone-can-better-surveil-its-challenging-arctic-environment/.

[13] Guy D Williams, et al., "Drones in a Cold Climate," *EOS Science News by AGU,* 19 January 2016, https://eos.org/science-updates/drones-in-a-cold-climate.

[14] Paul Koring, "In the Arctic, Drones could Close the Gap," *The Globe and Mail*, 9 July 12, https://search-proquest-com.cfc.idm.oclc.org/newspapers/arctic-drones-could-close-gap/docview/1024089252/se-2?accountid=9867.

[15] *Ibid.*

decreasing.[16] Moreover, Canada's current maritime assets, both the Coast Guard and Royal Canadian Navy (RCN) are not able to efficiently operate in or under the arctic ice, severely limiting their contribution to arctic sovereignty operations.[17]

4. In addition to sovereignty concerns, search and rescue rates have more than doubled over the last decade due to uncertain and rapidly changing weather conditions.[18] Moreover, there has been a relatively consistent increase in arctic maritime traffic adding to this concern.[19] Finally, increasing resource exploitation in the north, demands environmental protection assurances as well as defence against illegal dumping, fishing and smuggling activities.[20] All these threats require more agile and persistent surveillance to enable domestic defence activities. To do this, the CAF could leverage UAS, lifting the burden on manned systems, and reducing the risk to personnel in this dangerous operating space, with more cost-effective operations.

5. High-altitude, long-endurance UAS are well suited for arctic surveillance as they are able to monitor large areas with persistence, much more so than manned platforms.[21] They are generally less costly to maintain and eliminate risk to personnel in dangerous, unpredictable environments such as the arctic. Specialized cameras and sensors can be fitted to capture imagery, mapping and research data.[22] Shorter range, more agile UAS are being used to assist ships navigating ice fields, replacing more costly helicopter missions. They are used to determine navigable routes and to avoid hazards such as icebergs that are too small to be picked up by satellite but big enough to damage ships.[23]

6. UAS have been successful in, not only spotting oil spills, but in monitoring hazard situations, inspecting long pipelines and tracking wildlife.[24] There have been

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[16] Michael Byers and Kelsey Franks, "Unmanned and Unnecessary: Canada's Proposed Procurement of UAVs," *Canadian Foreign Policy Journal* 20, no. 3 (2014): 273, https://www-tandfonline-com.cfc.idm.oclc.org/doi/full/10.1080/11926422.2014.934866.

[17] Paul Koring, "In the Arctic, Drones could Close the Gap," *The Globe and Mail*, 9 July 12, https://search-proquest-com.cfc.idm.oclc.org/newspapers/arctic-drones-could-close-gap/docview/1024089252/se-2?accountid=9867.

[18] Dylan G Clark, James D. Ford, and Taha Tabish, "What Role can Unmanned Aerial Vehicles Play in Emergency Response in the Arctic: A Case Study from Canada," *PloS One* 13, no. 12 (2018): e0205299-e0205299, 1-4, https://search-proquest-com.cfc.idm.oclc.org/docview/2158231688?pq-origsite=summon.

[19] *Ibid.*,2.

[20] Michael Byers and Kelsey Franks, "Unmanned and Unnecessary: Canada's Proposed Procurement of UAVs," *Canadian Foreign Policy Journal* 20, no. 3 (2014): 272, https://www-tandfonline-com.cfc.idm.oclc. org/doi/full/10.1080/11926422.2014.934866.

[21] Canada, *Drones in the Canadian Arctic,* last modified 7 December 2020, https://tc.canada.ca/en/programs/national-aerial-surveillance-program/drones-canadian-arctic.

[22] Kevin M Baerson, "Canada's New Drone Can Better Surveil Its Challenging Arctic Environment," *Inside unmanned systems: Inside Engineering, Policy and Practice,* 4 January 2021, https://insideunmannedsystems.com/canadas-new-drone-can-better-surveil-its-challenging-arctic-environment/.

[23] Pilita Clark, "The Arctic: Drones Find Peacetime Role in the Frozen North," *FT.Com*, 28 January 2013, 1, https://search-proquest-com.cfc.idm.oclc.org/trade-journals/arctic-drones-find-peacetime-role-frozen-north/docview/1284668038/se-2?accountid=9867.

[24] *Ibid.*,1-2.

several documented cases were UAS were used for search and rescue, delivering medical supplies and communications devices, and emergency management. Even off-the-shelf, recreational UAS are faster than snowmobiles and are able to search over water, without the long waits for RCAF or Coast Guard assets.[25] The scientific community has been actively using UAS for research on "climatology, ecology, geology, geomorphology geophysics and oceanography",[26] as well as wildlife monitoring, and environmental mapping.[27]

7. Operating in the Arctic, however, is not simple nor easy. Extreme weather, including high winds, and very low temperatures as well as limited or unreliable satellite communication and navigation systems, months of darkness and a lack of ground infrastructure made sustained UAS operations in the Arctic unfeasible or impossible a decade ago.[28] The environmental challenges of the arctic require more robust UAS technologies than other climates.[29] Cold temperatures affect battery life,[30] high winds and icing conditions affect control and require robust construction,[31] and navigation systems can be compromised by cloud coverage, intense light and glare. Operating near magnetic north can cause magnetometer failure which affects orientation, attitude and position.[32] Geographical features and long distances can prevent or degrade communications and requires establishing reliable beyond line-of-sight (BLOS) links.[33] High latitude operations are impacted by a lack of line-of-sight satellite coverage, limiting command

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[25] Dylan G Clark, James D. Ford, and Taha Tabish, "What Role can Unmanned Aerial Vehicles Play in Emergency Response in the Arctic: A Case Study from Canada," *PloS One* 13, no. 12 (2018): e0205299-e0205299, 2, https://search-proquest-com.cfc.idm.oclc.org/docview/2158231688?pq-origsite=summon; Vadim Kramar, "UAS (Drone) Arctic Challenges - Next Steps," *Proceedings of the XXth Conference of Open Innovations Association FRUCT* 622, no. 25 (2019): 507-514, https://doaj.org/article/fe745147eebb4697b25968d6ec90d19e.

[26] Iain Sheridan, "Drones and Global Navigation Satellite Systems: Current Evidence from Polar Scientists," *Royal Society Open Science* 7, no. 3 (2020): 191494-191494, 2, https://doaj.org/article/a75fa613be1f423d907b570a35387189.

[27] Dylan G Clark, James D. Ford, and Taha Tabish, "What Role can Unmanned Aerial Vehicles Play in Emergency Response in the Arctic: A Case Study from Canada," *PloS One* 13, no. 12 (2018): e0205299-e0205299, 2, https://search-proquest-com.cfc.idm.oclc.org/docview/2158231688?pq-origsite=summon.

[28] Kevin M Baerson, "Canada's New Drone Can Better Surveil Its Challenging Arctic Environment," *Inside unmanned systems: Inside Engineering, Policy and Practice,* 4 January 2021, https://insideunmannedsystems.com/canadas-new-drone-can-better-surveil-its-challenging-arctic-environment/.

[29] Vadim Kramar, "UAS (Drone) Arctic Challenges - Next Steps," *Proceedings of the XXth Conference of Open Innovations Association FRUCT* 622, no. 25 (2019): 507, https://doaj.org/article/fe745147eebb4697b25968d6ec90d19e.

[30] *Ibid.*,508.

[31] Guy D Williams, et al., "Drones in a Cold Climate," *EOS Science News by AGU,* 19 January 2016, https://eos.org/science-updates/drones-in-a-cold-climate.

[32] Guy D Williams, et al., "Drones in a Cold Climate," *EOS Science News by AGU,* 19 January 2016, https://eos.org/science-updates/drones-in-a-cold-climate.

[33] Vadim Kramar, "UAS (Drone) Arctic Challenges - Next Steps," *Proceedings of the XXth Conference of Open Innovations Association FRUCT* 622, no. 25 (2019): 509-511, https://doaj.org/article/fe745147eebb4697b25968d6ec90d19e.

and control links, due to the curvature of the earth.[34] This necessitates the use of more complex multi-sensor positioning systems than needed in southerly locations,[35] including back up satellite links, and autonomous backup modes.[36] Moreover, infrastructure in the north, for basing, controlling and maintaining UAS is limited.[37] Finally, security of command and control links is also a concern and difficult to harden due to the long distance and complex configurations. An electronic or cyber attack could result in a UAS being rerouted, or information and imagery being redirected.[38]

8. New technological advances over the last decade have surmounted these challenges. Although there are still a limited number of arctic capable UAS on the market, that number is growing. Low orbiting and polar satellites are being leveraged for communications and GPS links.[39] Complex sensor packages, ground facing radar, and visual recognition software is enhancing non-GPS dependant navigation, and overcoming magnetic interference.[40] The use of multiple global navigation systems has improved redundancy.[41] High resolution still and video cameras can penetrate dense cloud cover and create detailed maps while live streaming or recording surveillance feeds.[42] Multi-sensor vision has been adapted to operate in extreme light, and dark environments, leveraging use of the non-visible spectrum.[43] The cost of these technologies, including the semi-conductor components used in positioning, velocity and timing systems in UAS

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[34] Paul Koring, "In the Arctic, Drones could Close the Gap," *The Globe and Mail*, 9 July 12, https://search-proquest-com.cfc.idm.oclc.org/newspapers/arctic-drones-could-close-gap/docview/1024089252/se-2?accountid=9867.

[35] Vadim Kramar, "UAS (Drone) Arctic Challenges - Next Steps," *Proceedings of the XXth Conference of Open Innovations Association FRUCT* 622, no. 25 (2019): 511, https://doaj.org/article/fe745147eebb4697b25968d6ec90d19e.

[36] Paul Koring, "In the Arctic, Drones could Close the Gap," *The Globe and Mail*, 9 July 12, https://search-proquest-com.cfc.idm.oclc.org/newspapers/arctic-drones-could-close-gap/docview/1024089252/se-2?accountid=9867.

[37] Pilita Clark, "The Arctic: Drones Find Peacetime Role in the Frozen North," *FT.Com*, 28 January 2013, 2, https://search-proquest-com.cfc.idm.oclc.org/trade-journals/arctic-drones-find-peacetime-role-frozen-north/docview/1284668038/se-2?accountid=9867; Vadim Kramar, "UAS (Drone) Arctic Challenges - Next Steps," *Proceedings of the XXth Conference of Open Innovations Association FRUCT* 622, no. 25 (2019): 511, https://doaj.org/article/fe745147eebb4697b25968d6ec90d19e.

[38] Vadim Kramar, "UAS (Drone) Arctic Challenges - Next Steps," *Proceedings of the XXth Conference of Open Innovations Association FRUCT* 622, no. 25 (2019): 512, https://doaj.org/article/fe745147eebb4697b25968d6ec90d19e.

[39] Paul Koring, "In the Arctic, Drones could Close the Gap," *The Globe and Mail*, 9 July 12, https://search-proquest-com.cfc.idm.oclc.org/newspapers/arctic-drones-could-close-gap/docview/1024089252/se-2?accountid=9867.

[40] *Ibid.*

[41] Iain Sheridan, "Drones and Global Navigation Satellite Systems: Current Evidence from Polar Scientists," *Royal Society Open Science* 7, no. 3 (2020): 191494-191494, 2, https://doaj.org/article/a75fa613be1f423d907b570a35387189.

[42] Paul Koring, "In the Arctic, Drones could Close the Gap," *The Globe and Mail*, 9 July 12, https://search-proquest-com.cfc.idm.oclc.org/newspapers/arctic-drones-could-close-gap/docview/1024089252/se-2?accountid=9867.

[43] Vadim Kramar, "UAS (Drone) Arctic Challenges - Next Steps," *Proceedings of the XXth Conference of Open Innovations Association FRUCT* 622, no. 25 (2019): 511, https://doaj.org/article/fe745147eebb4697b25968d6ec90d19e.

is also steadily decreasing as production increases. To deal with arctic weather, UAS are being developed with de-icing and anti-icing capabilities.[44] Battery life in cold environments is also evolving to increase persistence and payloads.[45]

9. NASA has successfully operated the Global Hawk within 500 kilometres of the North Pole.[46] Kalashnikov has designed a UAS, complete with a self contained deployable command centre that is specifically adapted to Arctic conditions. The ZALA Arctic UAV is equipped with AIS, which can identify a ship over 100 kilometres away. It uses its own unique navigation system, calibrated specifically for the arctic, is jamming resistant and can operate effectively in total darkness.[47]

10. Advancements in artificial intelligence (AI) has revolutionized data processing. The vast amount of data collected by UAS can now be processed on board and be mission tailored. 3D mapping can also be used to facilitate AI navigation for autonomous operations when command and control links are temporary unavailable, or for long range patrols.[48]

11. The biggest challenge employing UAS domestically are legal and regulatory. Rights should not be violated by the use of UAS in the arctic,[49] but there should be no restriction to the surveillance of public spaces, where there is no expectation of privacy. Ethics and privacy concerns are being debated by legislatures around the world,[50] because there is societal push-back on the use of UAS with camera systems in public spaces. It is odd that the same concerns for outward facing private security camera systems, or the use of cameras on manned platforms are not as prevalent. The federal

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[44] Kevin M Baerson, "Canada's New Drone Can Better Surveil Its Challenging Arctic Environment," *Inside unmanned systems: Inside Engineering, Policy and Practice,* 4 January 2021, https://insideunmannedsystems.com/canadas-new-drone-can-better-surveil-its-challenging-arctic-environment/.

[45] Vadim Kramar, "UAS (Drone) Arctic Challenges - Next Steps," *Proceedings of the XXth Conference of Open Innovations Association FRUCT* 622, no. 25 (2019): 509, https://doaj.org/article/fe745147eebb4697b25968d6ec90d19e.

[46] Paul Koring, "In the Arctic, Drones could Close the Gap," *The Globe and Mail*, 9 July 12, https://search-proquest-com.cfc.idm.oclc.org/newspapers/arctic-drones-could-close-gap/docview/1024089252/se-2?accountid=9867.

[47] "Kalashnikov Designs Drone for Arctic," *Interfax: Russia & CIS Military Newswire*, 6 December 2018, https://search-proquest-com.cfc.idm.oclc.org/wire-feeds/kalashnikov-designs-drone-arctic/docview/2151197103/se-2?accountid=9867.

[48] Vadim Kramar, "UAS (Drone) Arctic Challenges - Next Steps," *Proceedings of the XXth Conference of Open Innovations Association FRUCT* 622, no. 25 (2019): 509, https://doaj.org/article/fe745147eebb4697b25968d6ec90d19e.

[49] *Ibid.*,511.

[50] Vadim Kramar, "UAS (Drone) Arctic Challenges - Next Steps," *Proceedings of the XXth Conference of Open Innovations Association FRUCT* 622, no. 25 (2019): 511, https://doaj.org/article/fe745147eebb4697b25968d6ec90d19e.

government is already in consultations with Indigenous communities to address any concerns.[51]

12. Most of the world's aviation regulatory bodies enforce rules for recreational users and require certification and training for commercial, governmental and research operators.[52] This is important considering the risks and liabilities inherit in large, heavy UAS, carrying droppable payloads in sensitive environments.[53] For instance, in order to use UAS for search and rescue the CAF will need to be able to get timely authority to carry droppable payloads such as first aid equipment, automatic external defibrillators (AEDs) or communication devices, to fly near airports, and outside line-of-sight.[54] These restrictions make sense for recreational operators, but experienced, trained, military operators will need to be able to safely navigate these challenges in a polar environment, working with local authorities.

13. One specific problem with employing, large, high-altitude, long endurance UAS in the arctic, close to neighbouring countries, is that they are currently considered missiles under the "Missile Technology Control Regime".[55] Created in 1987 with the aim of limiting the spread of certain weapons systems, it classifies any delivery system that can carry a payload of more than 500 kilograms, 300 kilometres a restricted missile. UAS are included in this definition but the policy is under review.[56]

14. Transport Canada has already begun leveraging UAS capabilities in the north. Following several trials, they have announced the procurement of the Hermes 900 StarLiner.[57] This medium-altitude long-endurance UAS can "operated up to 72 degrees north and has a range of more than 1,400 nautical miles".[58] It is certified to operate in

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[51] Levon Sevunt, "Canada buys Israeli Drone for Arctic Maritime Surveillance," *Radio Canada International,* 22 December 2020, https://www.rcinet.ca/eye-on-the-arctic/2020/12/22/canada-buys-israeli-drone-for-arctic-maritime-surveillance/.

[52] Guy D Williams, et al., "Drones in a Cold Climate," *EOS Science News by AGU,* 19 January 2016, https://eos.org/science-updates/drones-in-a-cold-climate.

[53] *Ibid.*

[54] Dylan G Clark, James D. Ford, and Taha Tabish, "What Role can Unmanned Aerial Vehicles Play in Emergency Response in the Arctic: A Case Study from Canada," *PloS One* 13, no. 12 (2018): e0205299-e0205299, 11, https://search-proquest-com.cfc.idm.oclc.org/docview/2158231688?pq-origsite=summon.

[55] Dean Beeby, "Transport Canada's Arctic Drone Project Delayed 2 Years by Arms-control Rules," *CBC News*, last modified 14 July 2017, https://www.cbc.ca/news/politics/arms-control-uav-drone-transport-canada-missile-technology-control-regime-arctic-1.4203070.

[56] *Ibid.*

[57] Kevin M Baerson, "Canada's New Drone Can Better Surveil Its Challenging Arctic Environment," *Inside unmanned systems: Inside Engineering, Policy and Practice,* 4 January 2021, https://insideunmannedsystems.com/canadas-new-drone-can-better-surveil-its-challenging-arctic-environment/.

[58] Kevin M Baerson, "Canada's New Drone Can Better Surveil Its Challenging Arctic Environment," *Inside unmanned systems: Inside Engineering, Policy and Practice,* 4 January 2021, https://insideunmannedsystems.com/canadas-new-drone-can-better-surveil-its-challenging-arctic-environment/.

civilian airspace and from civilian airfields and includes “detect and avoid systems, redundant datalinks and an advanced terrain avoidance warning system”.[59] It also has the capacity to automatically take off and land in near-zero visibility, and to sustain deicing procedures and direct lightning strikes” making it ideal for the Arctic’s extreme weather challenges.[60] It is "equipped with back-up command and control and navigation systems, electrical optical infrared cameras, synthetic aperture radar and a mapping camera system",[61] remote control and autonomous capabilities.[62]

15. The Hermes 900 will become part of the National Aerial Surveillance Program which “watches the Canadian Arctic to: detect oil spills, survey ice and marine habitats, and monitor activity on oceans”.[63] It will also assist with “search and rescue, humanitarian efforts, illegal fishing enforcement, and the development and regulation of Canada’s drone Industry," according to the Minister of Transportation.[64] This same UAS is being employed by the UK Coast Guard.[65]

16. OGDs including Fisheries and Oceans Canada, Energy Canada and Northern Affairs will be seeking data collected by UAS for their mandates.[66] UAS are being looked at to replace the three manned aircrafts, currently used by Fisheries and Oceans Canada to monitor Arctic summer shipping seasons and the department of fisheries and oceans and transport Canada looks to replace its modified Beechcraft King Air used for additional maritime surveillance.[67]

17. These developments highlight that the CAF is behind the technological curve when it comes to Arctic surveillance and with the employment of UAS capabilities. Procurement of these complex systems takes years and catching up is extremely challenging. However, there is currently an opportunity to economize, taking advantage of UAS interest by OGDs and agencies. There are many overlapping arctic mandates within the Canadian government that could be economized with a shared effort.

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[59] *Ibid.*

[60] *Ibid.*

[61] Levon Sevunt, “Canada buys Israeli Drone for Arctic Maritime Surveillance,” *Radio Canada International,* 22 December 2020, https://www.rcinet.ca/eye-on-the-arctic/2020/12/22/canada-buys-israeli-drone-for-arctic-maritime-surveillance/.

[62] *Ibid.*

[63] Canada, *Drones in the Canadian Arctic,* last modified 7 December 2020, https://tc.canada.ca/en/programs/national-aerial-surveillance-program/drones-canadian-arctic.

[64] Levon Sevunt, “Canada buys Israeli Drone for Arctic Maritime Surveillance,” *Radio Canada International,* 22 December 2020, https://www.rcinet.ca/eye-on-the-arctic/2020/12/22/canada-buys-israeli-drone-for-arctic-maritime-surveillance/.

[65] *Ibid.*

[66] Paul Koring, "In the Arctic, Drones could Close the Gap," *The Globe and Mail*, 9 July 12, https://search-proquest-com.cfc.idm.oclc.org/newspapers/arctic-drones-could-close-gap/docview/1024089252/se-2?accountid=9867.

[67] Michael Byers and Kelsey Franks, "Unmanned and Unnecessary: Canada's Proposed Procurement of UAVs," *Canadian Foreign Policy Journal* 20, no. 3 (2014): 275-276, https://www-tandfonline-com.cfc.idm.oclc.org/doi/full/10.1080/11926422.2014.934866.

18. A whole of government approach to UAS procurement and employment, spearheaded by the CAF could allow it to fulfill its arctic commitments while facilitating a more secure and integrated northern approach. These highly adaptable and complex systems are capable of housing combinations of multiple sensors, easily multi-tasking to fulfill several missions with a single flight. High and Medium-altitude long-endurance UAS could be operated from existing RCAF forward operating locations (FOLs) to execute multi-layer surveillance missions; fulfilling the CAF's mandate of maintaining Canada's sovereignty and detecting threats, while measuring changes in the coastlines and ice thickness for Environment Canada, or monitoring the seasonal waterways for Transport Canada. This type of data sharing has precedence with the RadarSat Constellation where two ground stations, owned by DND, receive and process data that is used by the CAF Regional Joint Operation Centers and OGDs and agencies.[68]

19. This arrangement could also put the CAF at the controls during emergency search and rescue operations in the north, being able to deploy unmanned assets immediately without having to wait for manned platforms to transit from main operating bases. By having RCAF operators control these assets, the CAF would be able to force generate capable and experienced UAS operators with skills that could be easily transferred to expeditionary ISR missions with similar platforms, all while providing these skills to OGDs. The whole of government approach to procurement would allow the CAF to leverage research and procurement avenues already being leveraged by transport Canada and to create cost saving on the initial purchase price, rather than having each department purchase their own assets.

CONCLUSION

20. The CAF is responsible for defending the arctic, assisting in the case of natural disaster and conducting search and rescue. All of these tasks would benefit from efficient employment of UAS. There are many challenges to employing these systems in an arctic environment but technology has evolved to conquer them. UAS has the potential to reduce the risk to personnel and reduce the cost of arctic operations.

21. Spearheading a whole of government approach to artic surveillance, has the potential to make the RCAF the operator of choice for UAS, building up an experienced, highly skilled cadre of operators and maintainers. These experts would be ready to employ their skills in the defence of Canada and in expeditionary operations, defending Canada's interests and allies abroad.

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[68] Michael Byers and Kelsey Franks, "Unmanned and Unnecessary: Canada's Proposed Procurement of UAVs," *Canadian Foreign Policy Journal* 20, no. 3 (2014): 274-275, https://www-tandfonline-com.cfc.idm.oclc.org/doi/full/10.1080/11926422.2014.934866.

RECOMMENDATION

22. It is recommended that the CAF approach and work with OGDs to establish and define surveillance and other UAS capability requirements for the Arctic. Multi-purpose platforms should be identified that are able to fulfill all or most of those requirements. A concept of operations should be established and joint procurement should be explored. The RCAF needs to take ownership of arctic security, leveraging its existing FOLs as possible bases of operations for these assets. RCAF operators and technicians should be identified for training on these systems with the intent of creating a cadre of subject matter experts in their operation and maintenance.

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