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An Assessment of Canadian Northern Capabilities

Lieutenant-Colonel François Fasquelle

JCSP 48

Exercise Solo Flight

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An Assessment of Canadian Northern Capabilities

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INTRODUCTION

Shortly before noon on 20 August 2011, the pilots of a Boeing 737 initiated landing procedures at the Resolute Airport, Nunavut, one of the most northern commercial airports in Canada. First Air Flight 6560 originated from Yellowknife with 15 people on board. On final leg, a series of issues prompted the pilots to overshoot the approach. A few seconds later, the aircraft impacted a mountain 2 kilometers east of the airport.[1] Three passengers survived, thanks to the extraordinary and coincidental presence of a Canadian Armed Forces (CAF) exercise in the immediate vicinity.[2]

Such a tragedy exemplifies the requirement for a robust Search and Rescue (SAR) system in Canada. "Canada has one of the world's largest areas of responsibility for SAR, covering 18 million square kilometers of land and water, more than 243,800 kilometers of coastline, [and] three oceans".[3] Repeatedly cited as "a no-fail mission",[4] it emphasizes the significance and role that national SAR holds as an institution and as a service to Canadians. Search and Rescue operations are missions "that must be undertaken and to which resources must be assigned and actions taken to minimize injury and loss of life".[5]

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[1] Simon Hradecky, *Crash: First Air B737 near Resolute Bay on Aug 20th 2011, impacted terrain*, (The Aviation Herald, 21 Aug 2011), accessed 23 Feb 2022, http://avherald.com/h?article=4419c56e&opt=0.

[2] Dany Poitras, "Search and Rescue in the Arctic", *Canadian Arctic Operations, 1945–2015: Lessons Learned, Lost, and Relearned*, edited by Whitney Lackenbauer and Adam Lajeunesse, (Fredericton: The Gregg Centre for War & Society, 2017), 387-425.

[3] Canada, Government of Canada, Public Safety Canada, *Quadrennial Search and Rescue Review*, Public Safety ADM(PA), (Ottawa, 2013).

[4] Canada, Office of the Auditor General, *Report of the Auditor General of Canada to the House of Commons, Chapter 7: Federal Search and Rescue Activities*, (Ottawa, Office of the 100 Auditor General of Canada Distribution Centre, 2013).

[5] Canada, Office of the Auditor General, *Report of the Auditor General of Canada to the House of Commons, Chapter 7: Federal Search and Rescue Activities*, (Ottawa, Office of the 100 Auditor General of Canada Distribution Centre, 2013).

It is therefore significantly paramount that the organizational structure and capabilities of the Canadian SAR institution be empowered as such.

Research Question and Thesis Statement

To that effect, this essay will attempt to answer the following thesis question: Is the Canadian SAR mandate, as delivered by the Royal Canadian Air Force (RCAF), adequately adapted to contemporary Arctic situations? Moreover, are there areas of concern in the SAR institution that must be addressed to provide a more reliable and responsive SAR system in the North?

This paper will endeavor to empirically assess the effectiveness and the pressure points of the Canadian SAR structure. The question and its answers are non-trivial and multi-faceted; pinpointing the SAR enterprise on a spectrum of efficiency is an intricate challenge and subject to many factors. At a glance, however, even though it is at the forefront of governmental policies, evidence suggests that the domestic SAR system is stretched to its limit, especially as it relates to the Arctic.

Presentation of the Structure

After a historical summary, the following pages begin by unfolding the elements of the SAR enterprise, deciphering the institution's policies and framework. With a focus on the RCAF's role as an aeronautical SAR prosecutor, this section covers multi-level components and interagency coordination, with a focus on the Command & Control (C2) and synchronization aspects of the Search and Rescue Regions (SRRs). The essay then describes the RCAF's SAR capabilities and tactical features such as crewing, reaction time and asset capacities. The following section continues by providing a high-level

comparative assessment of two other Arctic SAR nations; Norway and the USA (Alaska). The second half of the paper will amalgamate the multi-factorial aspects of Canadian Arctic SAR to evaluate the necessity of institutional improvement, providing recommendations to address such requirements.

SAR OVERVIEW

It must be noted upfront that the SAR institution relies heavily on the courage and commitment of the men and women at the operations level. Lives are not saved and people are not rescued by policies; they are saved and rescued by highly trained and competent personnel who chose to selflessly put their own lives at risk. *That Others May Live* is the motto of the SAR technicians (SAR Techs).[6]

Historical Summary and Context

The contemporary SAR framework in Canada dates back to 1942. An Air Sea Rescue Organization was introduced, mainly to enhance the search of crashed aircraft on Canadian territory during the Commonwealth training era.[7] An Air Rescue aspect was added in 1944, introducing a military paramedical component to the organization. In parallel, the Interdepartmental Committee on Search and Rescue (ICSAR) was formed, which would eventually lead to the foundation of the National Search and Rescue Program (NSP).[8] The RCAF took ownership of the ICSAR in 1947, endorsing the

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[6] Canada, Government of Canada, Royal Canadian Air Force, *Search and Rescue*, accessed 17 Apr 2022, http://www.rcaf-arc.forces.gc.ca/en/search-rescue.page.

[7] Canada, Department of National Defence, *Canadian Forces Search and Rescue: 50 Years of Service to Canadians*, (Ottawa: Art Direction CAFSU(O) Creative Services, 1997), 9.

[8] Sandy Babcock, *Operation Canon: A case Study of Early RCAF Arctic Search and Rescue Capabilities*, in Sic Itur Ad Astra: Canadian Aerospace Power Studies, Volume 4: De-Icing Required! The Historical Dimension of the Canadian Air Force's Experience in the Arctic, P. Whitney Lackenbauer and

provision and coordination of Canadian air rescue services. That same year, Rescue Coordination Centers (RCCs) were created, completing Canada's *modern* pillars of the SAR system known today. In 1976, the Minister of National Defence (MND) was assigned Lead Representative of SAR matters within the Government of Canada (GOC).[9]

The SAR Institution and its policies

"Unlike numerous other states, where SAR services are entirely privatized or governmentally funded through contracts, the jurisdiction of Canadian SAR operations is federal. Ultimately, it is the GOC's responsibility to provide guidance and, to a certain extent, assets".[10] Public Safety Canada being the administrating entity, the SAR institution is based on multi-agency synchronization, and is layered from the highest political levels down to tactical levels. Many policies govern SAR in Canada, and given its multi-layered facets, domestic SAR is a convoluted program. The overarching framework is the NSP (founded in 1986). A unified program that integrates federal, provincial and municipal entities, the NSP also encompasses other SAR organizations. With the ICSAR at the helm, the National Search and Rescue Secretariat (NSS) is the overall supporting agency, and has the responsibility to coordinate, promote and review the NSP.[11] The complexity of the SAR institutional nodes is seen at figure 1.

W.A. March eds. (Ottawa: Her Majesty the Queen as represented by the Minister of National Defence, 2012).

[9] Ibid.

[10] Canadian Forces College, LCol Francois Fasquelle, Joint Command and Staff Program 48, *Searching for Effectiveness: A Recommended Improvement to the Search and Rescue Regional and Command Construct*, Service Paper DS 545 Component Capabilities, (Toronto, 24 Jan 2022).

[11] Dany Poitras, "Search and Rescue in the Arctic", *Canadian Arctic Operations, 1945–2015: Lessons Learned, Lost, and Relearned*, edited by Whitney Lackenbauer and Adam Lajeunesse, (Fredericton: The Gregg Centre for War & Society, 2017), 387-425.

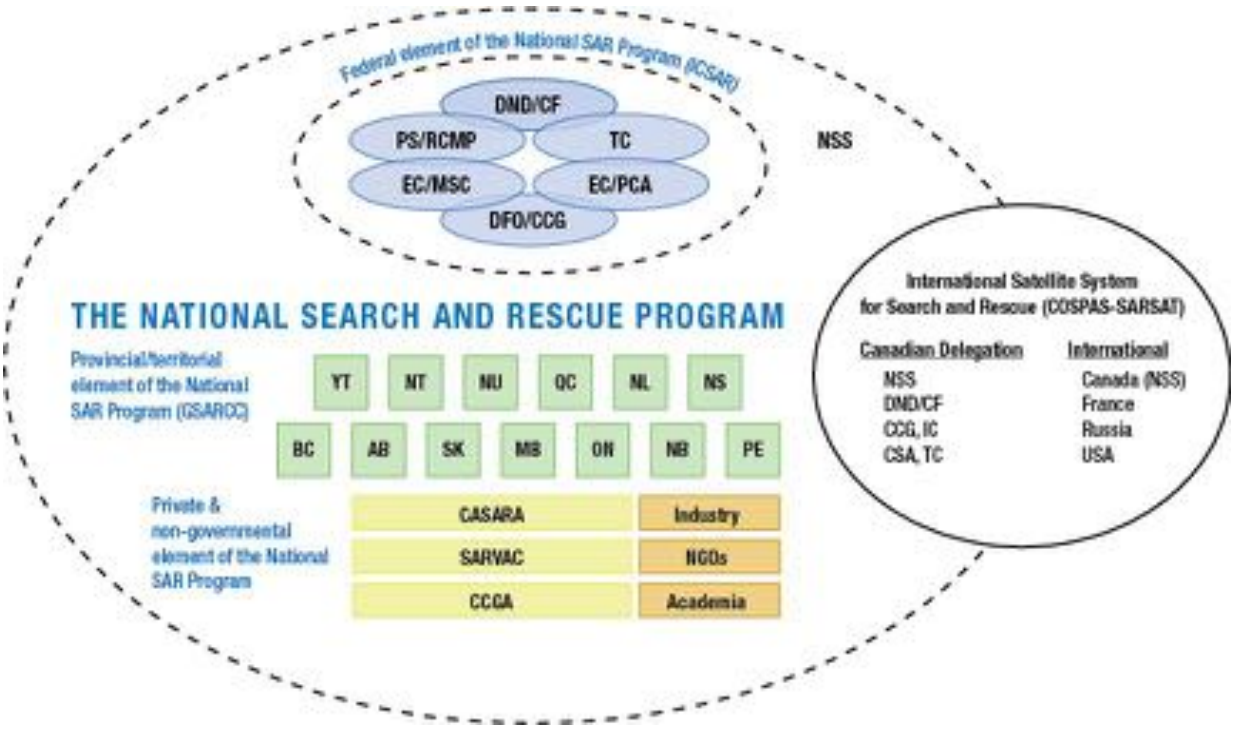

Figure 1: The National SAR Program (NSP) – Partners
Source: Public Safety Canada, Quadrennial SAR Review, 2013

"The responsibility to prosecute SAR relies primarily on the RCMP, the CAF, and the Canadian Coast Guard (CCG), with provinces, municipalities, Parks Canada and many other agencies playing a peripheral and vital role".[12] The responsibilities of the three major players are distributed as such:

a. **CAF**: Aeronautical SAR services and effective operation of the coordinated aeromedical and maritime SAR system.[13] The RCAF is the SAR instrument and executor for the CAF;

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[12] Dany Poitras, "Search and Rescue in the Arctic", *Canadian Arctic Operations, 1945–2015: Lessons Learned, Lost, and Relearned*, edited by Whitney Lackenbauer and Adam Lajeunesse, (Fredericton: The Gregg Centre for War & Society, 2017), 387-425.

[13] Canada, Department of National Defence, Department of Fisheries and Oceans Canada. B-GA-209-001/FP-001, DFO 5449, *Canadian Aeronautical and Maritime Search and Rescue Manual*. (2018).

b. **CCG**: SAR operations for maritime incidents pertaining to federal authority; and

c. **RCMP**: SAR operations for *humanitarian incidents* (not otherwise classified as an aeronautical or maritime incident)[14] on land and inland waters, with the exception of the provinces of Ontario and Quebec, who have their own police forces employed for SAR provision.

Even though there exists a delineation between these three agencies, the RCAF and the CCG work together and provide support to the RCMP and other entities when required. However, the crossover in execution is not always clearly delimited. For instance, the responsibility for humanitarian incidents is assigned to the RCMP and other entities, but the CAF and CCG are also mandated to assist as complementary SAR tasks.[15] Coordination can become challenging.

At the operational and tactical level, members of the NSP share the SAR mandate with some overlap, even though each member have their own jurisdiction and expertise.[16] In addition, organizations such as the Search and Rescue Volunteer Association of Canada (SARVAC) and Civil Air Search and Rescue (CASARA) exist and operate exclusively for the purpose of SAR, while agencies such as the RCMP, the CCG and the CAF have other mandates in addition to their SAR responsibility.[17] Separately, each

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[14] Canada, Department of National Defence, Department of Fisheries and Oceans Canada. B-GA-209-001/FP-001, DFO 5449, *Canadian Aeronautical and Maritime Search and Rescue Manual*. (2018).

[15] Ibid.

[16] Jean G.R. Leroux *Canadian Search and Rescue Puzzle: The Missing Pieces*, (Canadian Military Journal 18, no. 2, 2018), 24-35.

[17] Jean G.R. Leroux, *Canadian Search and Rescue Puzzle: The Missing Pieces*, (Canadian Military Journal 18, no. 2, 2018), 24-35.

entity's effectiveness is resilient and well established.[18] Each have their respective policy, directive and/or doctrine.

However, as it pertains specifically to SAR in the Arctic, only a few documents cover the matter, explicitly or implicitly. Ranging from political levels such as the Prime Minister's Mandate letters[19] and the national SAR mandate,[20] [21] down to the operational levels such as the CAF and RCAF doctrines,[22] northern SAR is covered by piecemeal policy established by various partners.[23] As it relates to the North, two challenges can be highlighted: The synchronization and coordination of these policies amongst contributing agencies, and the absence of an exclusive and specific Arctic SAR policy.

One of the most applicable Arctic SAR policies stems from the Arctic Council. Founded in 1996 in Canada, the Arctic Council is an intergovernmental platform that addresses Arctic matters, and remains the dominant forum for cooperation on such policies.[24] The Council currently has eight member states.[25] In 2011, Canada apposed its signature on a legally binding agreement, which assigns geographic boundaries to each

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[18] Canada, Government of Canada, Public Safety Canada, *Quadrennial Search and Rescue Review*, Public Safety ADM(PA), (Ottawa, 2013).

[19] Canada, Government of Canada, Prime Minister of Canada Justin Trudeau, *Mandate Letters 16 Dec 2021*, (2021), accessed 5 Feb 2022, https://pm.gc.ca/en/mandate-letters.

[20] Canada, Government of Canada, Public Safety Canada, *National Search and Rescue Program*, accessed 21 Dec 2021, https://www.publicsafety.gc.ca/cnt/mrgnc-mngmnt/rspndng-mrgnc-vnts/nss/prgrm-en.

[21] Canada, Department of National Defence, Department of Fisheries and Oceans Canada. B-GA-209-001/FP-001, DFO 5449, *Canadian Aeronautical and Maritime Search and Rescue Manual*. (2018).

[22] Canada, Dept. of National Defence, B-GA-400-000/FP-001, *Royal Canadian Air Force Doctrine*, (Ottawa, Ont: Joint Doctrine Branch, 2016).

[23] Canadian Forces College, LCol Francois Fasquelle, Joint Command and Staff Program 48, *Searching for Effectiveness: A Recommended Improvement to the Search and Rescue Regional and Command Construct*, Service Paper DS 545 Component Capabilities, (Toronto, 24 Jan 2022).

[24] Arctic Council Organization, accessed 19 Feb 2022, Arctic Council - The Arctic Council (arctic-council.org).

[25] The member states are Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden and the United States.

co-signed nations for SAR responsibilities. The *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic* (referred to "the *Agreement*" herein) not only sets SAR Areas of Responsibilities (AOR) but also provides policy guidelines and expectations. Figure 2 depicts the boundaries assigned to each member. Recalling many previous SAR conventions and declarations,[26] the 2011 *Agreement* refers to "the increase in aeronautical and maritime traffic and other human activity in the Arctic".[27]

The *Agreement* mandates each member state to designate a national SAR institution and RCC to fulfill services in the Arctic; Canada assigned the MND as the Competent Authority, the RCAF and CCG as the Search and Rescue Agencies, and Trenton as the Joint RCC (JRCC).[28] The *Agreement* also outlines the operations that each co-signed nation will assume in their respective Arctic SAR regions.[29] Explicitly stated in Article 3: "Each Party shall promote the establishment, operation and maintenance of an adequate and effective search and rescue capability within its [Arctic] area […]."[30]

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[26] The Agreement takes foundation on the 1979 International Convention on Maritime Search and Rescue, as well as the 1944 Convention on International Civil Aviation, adapting their provisions to Arctic SAR.

[27] Arctic Council Organization, Government of Canada as Depositary, *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic*, (Signed 12 May 2011 at Nuuk, Greenland, 2011).

[28] Ibid.

[29] Bjorn Arp, *The Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic & the Treaty between Norway and Russia on the Maritime Delimitation and Cooperation in the Barents Sea and the Arctic Ocean*. (International Legal Materials 50, no. 6, 2011), 1110-1130.

[30] Arctic Council Organization, Government of Canada as Depositary, *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic*, (Signed 12 May 2011 at Nuuk, Greenland, 2011).

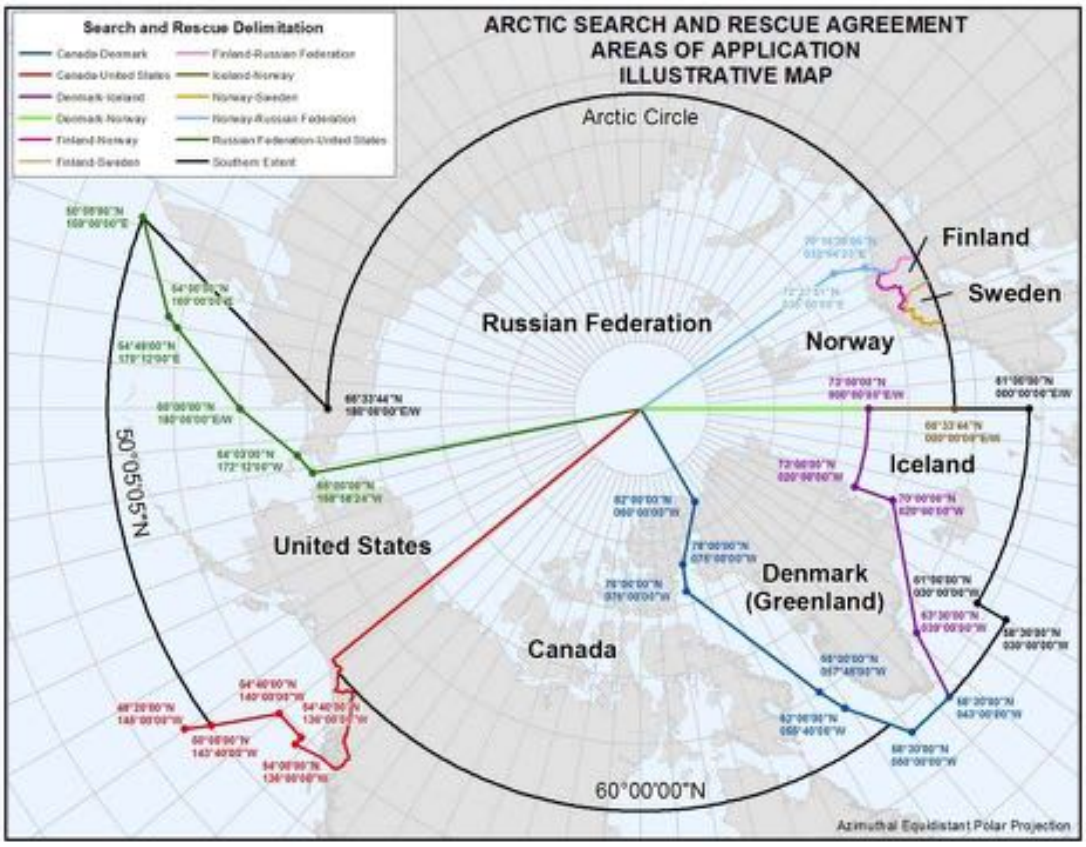

Figure 2: Artic SAR Agreement – Areas of Responsibility (AORs)

Source: Artic Council – Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic

Canada is separated into three distinct SRRs – Victoria, Trenton and Halifax – as depicted in Figure 3. "Their corresponding SRR Commanders are the Joint Task Force Pacific (JTFP) Commander, the Joint Force Air Component Commander (JFACC), and the Joint Task Force Atlantic (JTFA) Commander. A distinct JRCC manages each SRR as it pertains to aeronautical and maritime incidents, and is staffed accordingly with

RCAF and CCG personnel".[31] The Commander of the Canadian Joint Operations Command (CJOC) is the Force Employer of the CAF and operationalizes the SAR policies promulgated via the NSP.[32] The SAR Management Structure of the CAF is denoted in Figure 4.

Figure 3: Search and Rescue Regions (SRR)
Source: Report of the Auditor General of Canada, Federal Search and Rescue Activities

[31] Canadian Forces College, LCol Francois Fasquelle, Joint Command and Staff Program 48, *Searching for Effectiveness: A Recommended Improvement to the Search and Rescue Regional and Command Construct*, Service Paper DS 545 Component Capabilities, (Toronto, 24 Jan 2022).

[32] Canada, Department of National Defence, Canadian Armed Forces, Canadian Joint Operations Command, *Canadian Joint Operations Command Search and Rescue Directive 2020*, (Ottawa, Ont, 2020).

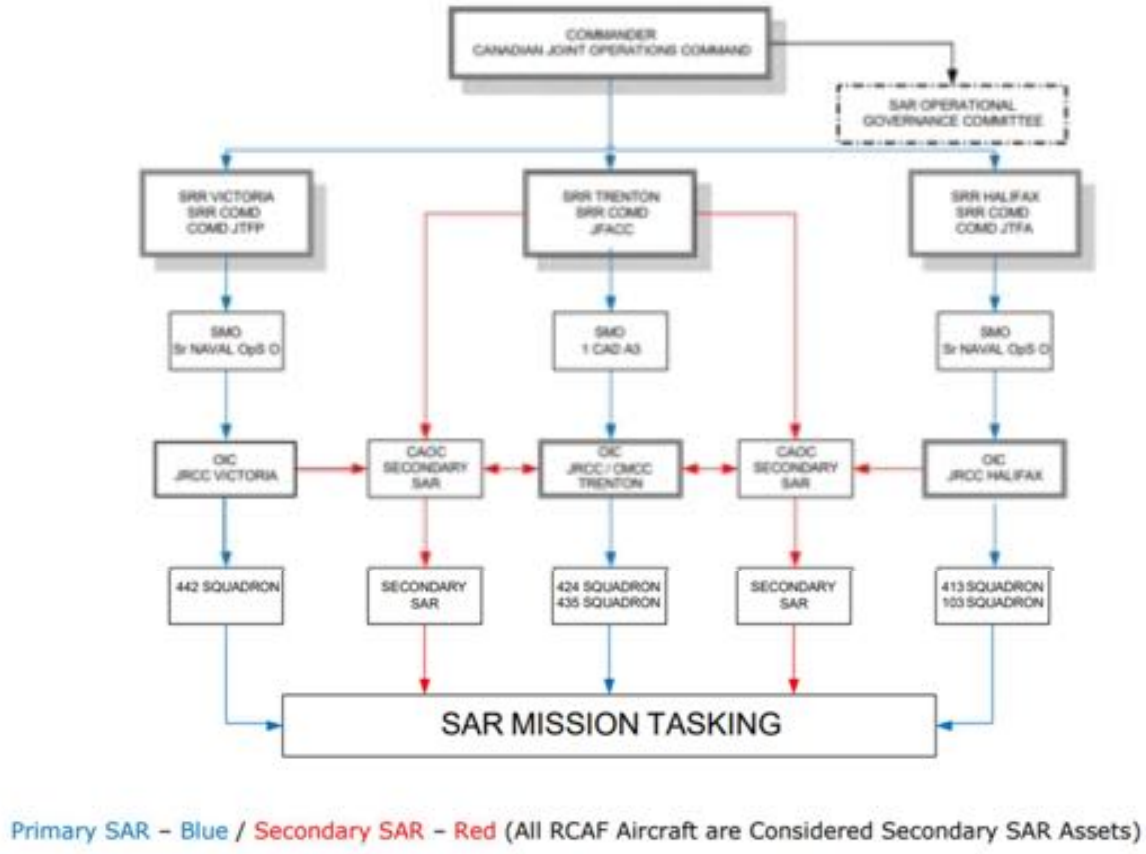

Figure 4: CAF SAR Management Structure
Source: Canadian Aeronautical and Maritime Search and Rescue Manual

The Trenton SRR is the largest of all three SRRs. It covers 10 million square kilometers, encompasses the Canadian northern territories and its Arctic archipelago, and extends to the geographic North Pole.[33] SAR operations face a variety of challenges in its

[33] Canada, Government of Canada, *Search and Rescue in Central Canada, JRCC Trenton*, accessed 12 Mar 2022, https://www.canada.ca/en/department-national-defence/services/operations/military-operations/types/search-rescue/central-canada.

northern regions, “due to intricate geography, severe meteorology, isolated demography, unique cultural habits, and the absence of infrastructure and communications systems”.[34]

RCAF Capabilities

Canadian SAR aeronautical assets are distributed along the coastal and southern regions of the country.[35] The Primary SAR squadrons are depicted in Figure 5.[36] It must be noted that 442 Squadron in Comox, BC, does not currently employ fixed-wing SAR platforms. This temporary operational gap is due to the acquisition project slippage of the CC295 Kingfisher that will replace the decommissioned CC115 Buffalo aircraft (and ultimately the entire CC130 Hercules SAR fleet).[37] [38]

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[34] Canadian Forces College, LCol Francois Fasquelle, Joint Command and Staff Program 48, *Searching for Effectiveness: A Recommended Improvement to the Search and Rescue Regional and Command Construct*, Service Paper DS 545 Component Capabilities, (Toronto, 24 Jan 2022).

[35] Canada, Office of the Auditor General, *Report of the Auditor General of Canada to the House of Commons, Chapter 7: Federal Search and Rescue Activities*, (Ottawa, Office of the 100 Auditor General of Canada Distribution Centre, 2013).

[36] As per the CAMSAR Manual, All CAF aircraft are subject to recall to meet SAR requirements.

[37] Canada, Government of Canada, RCAF, *CC295 Kingfisher*, accessed 6 Mar 2022, http://www.rcaf-arc.forces.gc.ca/en/aircraft-current/cc-295.page.

[38] Chris Thatcher, *King of the Northern Skies: The CC-295 Kingfisher*, (Skies Magazine, 15 Jan 2021).

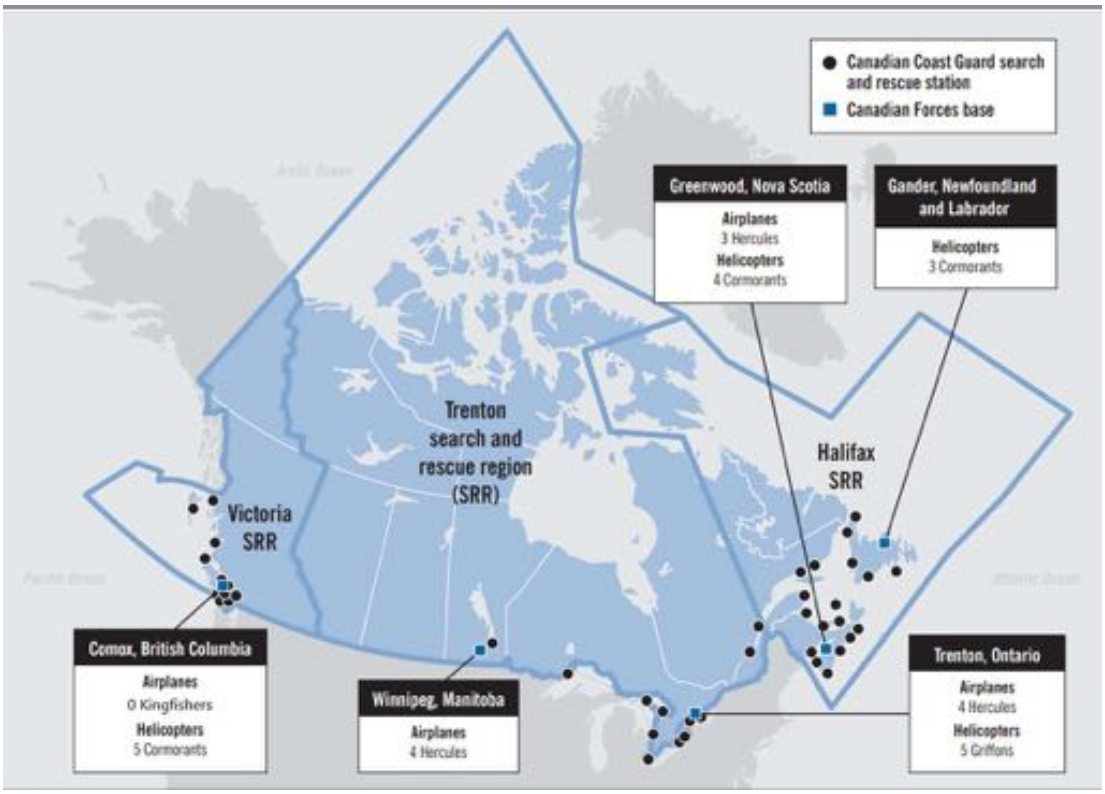

Figure 5: RCAF SAR assets distribution 2022 (Depicted CCG SAR stations do not hold permanent aeronautical SAR assets)

Source: Report of the Auditor General of Canada, Federal Search and Rescue Activities (modified by author to reflect the 2022 aircraft distribution)

The CAF operates two types of complementary aircraft: fixed-wing SAR (FWSAR) and rotary-wing SAR (RWSAR) assets. The airplanes are well suited for advanced searching (the CC295 Kingfisher will be equipped with modern search sensors),[39] and the helicopters are mainly rescue platforms. With the exception of CFB Trenton which employs CH146 Griffon helicopters, all RWSAR assets are CH149

[39] Airbus Industries, *C295FWSAR, Benefiting the Great White North From Coast to Coast*, accessed 3 Apr 2022, https://www.airbus.com/en/products-services/defence/military-aircraft/c295/c295fwsar.

Cormorant helicopters. The minimum aircraft state of readiness for each squadron is seen at figure 6.[40]

103 Search and Rescue Squadron, Gander, Newfoundland and Labrador	➢ 1 Rotary Wing
413 Transport and Rescue Squadron, Greenwood, Nova Scotia	➢ 1 Fixed Wing + 1 Rotary Wing
424 Transport and Rescue Squadron, Trenton, Ontario	➢ 1 Fixed Wing + 1 Rotary Wing
435 Transport and Rescue Squadron, Winnipeg, Manitoba	➢ 1 Fixed Wing
442 Transport and Rescue Squadron, Comox, British Columbia	➢ 1 Fixed Wing + 1 Rotary Wing

Figure 6: Minimum aircraft available on SAR readiness
Source: Canadian Aeronautical and Maritime Search and Rescue Manual

Crews are on a 30 min Response Posture (RP30) Monday to Friday from 0800h to 1600h and on 2 hrs notice (RP2) for all other times. The response posture is the minimum time the crew shall be airborne from the moment a SAR mission has been assigned.[41] FWSAR crewing is composed of two Pilots, one Flight Engineer, one Loadmaster, one Navigator and two SAR Techs. The RWSAR crewing is identical, without the Navigator and Loadmaster.[42]

Both platforms are all-weather aircraft – capable of sustained flight in icing conditions – and their respective operational range and corresponding flight time is 1700

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[40] Canada, Department of National Defence, Department of Fisheries and Oceans Canada. B-GA-209-001/FP-001, DFO 5449, *Canadian Aeronautical and Maritime Search and Rescue Manual*, (2018).

[41] Ibid.

[42] Defence Research and Development Canada, René Séguin, prepared for DG Air Force Development, *Search and Rescue Squadron Air Crew Manning Study, Preliminary results 413 Squadron*, (DRDC – Centre for Operational Research and Analysis, May 2020).

Nautical Miles (NM) and 7 hrs for the CC295,[43] and 500 NM and 5 hrs for the CH149.[44] These numbers take into account Visual Flight Rules (VFR) and a SAR payload configuration.

Observing other Artic Nations

This section provides a basis for high-level empirical comparison of aeronautical SAR in the Arctic, presenting Norway and the USA (Alaska), both signatory nations to the *Agreement on Cooperation on Aeronautical and Maritime SAR in the Arctic.*

Norway

As per the *Agreement*, Norway's SAR Competent Authority is the Minister of Justice and Police, and its SAR Agency is JRCC Northern Norway Region (JRCC NN Bodø).[45] The Norwegian services are fully integrated to coordinate and prosecute all types of aeronautical, maritime and humanitarian incidents. The mandate is delivered through a cooperative effort converging federal agencies with volunteer groups and private enterprise.[46]

Fixed-wing assets are mainly provided by the National Air Ambulance Service and dispatched by their Emergency Medical Communications Centers. Rotary-wing

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[43] Canada, Department of National Defence, *Statement of Operational Requirement for the Fixed-Wing Search and Rescue Aircraft*, (Final Report 12 Mar 2010), accessed 20 Mar 2022, https://www.canada.ca/en/department-national-defence/corporate/reports-publications/equipment/review-of-the-statement-of-operational-requirement-for-the-fixed-wing-search-and-rescue-aircraft.html.

[44] Canada, Department of National Defence, Canadian Armed Forces, *Canadian Search and Rescue Helicopter Statement of Operational Requirement*, (1999).

[45] Arctic Council Organization, Government of Canada as Depositary, *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic*, (Signed 12 May 2011 at Nuuk, Greenland, 2011).

[46] Norway, The Royal Ministry of Justice and Police Department of Civil Emergency and Rescue Planning, *The Norwegian Search and Rescue Services*, (2002).

assets are coordinated via the JRCCs and provided by the Ministry of Justice and Public Security.[47] Aeronautical assets are drawn from the Air Force (primary provider), the Navy/Coast Guard and civilian helicopter companies. Norway is divided in two SRRs with their respective JRCCs, the North Norway SRR starting at 65ºN. From their policy, SAR Service is a nationwide effort and an official designation, and the "principal of the *Cooperative Organization* is a prominent feature"[48] of SAR in Norway .[49] The integrated coordination structure of the RCCs, commanded by regional Chiefs of Police, incorporate several governmental agencies such as the Navy, the Air Force, the Air Traffic Services, Coast Radio and Health Authorities. This structure allows for a highly efficient system for all types of SAR incidents, including humanitarian.[50]

The Primary aeronautical SAR capability of Norway are helicopters operated by the Royal Norwegian Air Force, their fleet currently being upgraded with the AW101 SAR Queen helicopter – a modernized version of the Canadian CH149 Cormorant. Offering similar performances, it incorporates modern sensors such as a search radar and mobile phone detector, and is specifically designed to operate in Arctic conditions.[51] [52]

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[47] Anne Johnsen, Stephen J.M. Siri, Sollid, Trond Vigerust, Morten Jystad, and Marius Rehn, *Helicopter Emergency Medical Services in Major Incident Management: A National Norwegian Cross-Sectional Survey*, (PloS One 12, no. 2, 2017).

[48] Norway, The Royal Ministry of Justice and Police Department of Civil Emergency and Rescue Planning, *The Norwegian Search and Rescue Services*, (2002).

[49] Norway, *The Main Rescue Center – The Norwegian Rescue Service*, Ministry of Justice and Police, accessed 25 Mar 2022, https://www.hovedredningssentralen.no.

[50] Norway, The Royal Ministry of Justice and Police Department of Civil Emergency and Rescue Planning, *The Norwegian Search and Rescue Services*, (2002).

[51] Agusta Westland Helicopter Division, Leonardo Helicopters, *Tenth SAR Queen Successfully Delivered to Norway*, (17 Mar 2021), accessed 9 Mar 2022, https://uk.leonardocompany.com/en/news-and-stories-detail/-/detail/tenth-aw101-sar-queen-successfully-delivered-to-norway#:~:text=17%20March%202021,of%20Justice%20and%20Public%20Security.

[52] Agusta Westland Helicopter Division, Leonardo Helicopters, *SAR Queen Helicopters Are Now Operational in Norway*, (13 Nov 2020), accessed 10 Mar 2022, https://uk.leonardocompany.com/en/news-and-stories-detail/-/detail/aw101-sar-queen-helicopters-operational-in-norway.

The 16 helicopters are based in 6 different locations, the most northern one located on the Island of Svalbard (78ºN), north of the Arctic Circle. Figure 7 depicts the base locations.

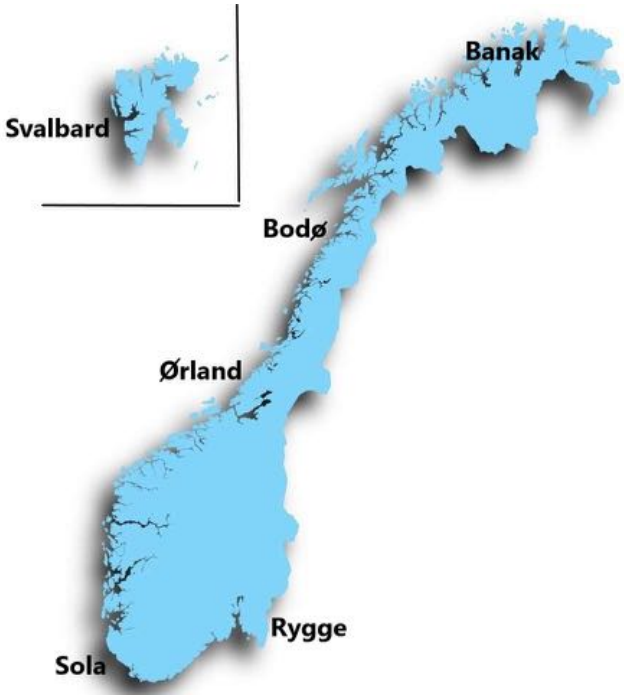

Figure 7: Primary SAR aeronautical bases in Norway
Source: Author, Student JCSP 48 (Data from the Norwegian Search and Rescue service)

Norway is adapting to the surge in Arctic activity and northern SAR demand; the country will increase its SAR Arctic capability by adding a 7th helicopter base in Tromsø (west of Banak in Figure 7). "This will provide responsiveness and flexibility in Norway's Arctic AOR, given the increase in ship traffic, fishing, oil & gas and military activity. Financed by the government, this added SAR helicopter capacity will not be

operated by the Norwegian Royal Air Force"[53] – it will be the first base operated by a private company, but still controlled by the NN RCC.[54]

Alaska (USA)

As per the *Agreement*, the USA's SAR Competent Authorities are the US Coast Guard (USCG) and US Department of Defense (DoD).[55] The main SAR responsibilities are vested in the Alaska Rescue Coordination Center (AKRCC) located at the Joint Base Elmendorf Richardson, and the USCG JRCC located in Juneau. These RCCs are staffed by air and maritime personnel (The USAF for aeronautical incidents, the USCG for maritime incidents). The two RCCs rely on their respective aeronautical SAR resources, the Alaska Air National Guard (AKANG) in Anchorage and the USCG based in Kodiak and Sitka.[56] Figure 8 depicts the main aeronautical bases capable of deploying SAR assets.

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[53] Thomas Nilsen, The Independent Barents Observer, *Norway's New Arctic SAR-Base Will Have Helicopters in Joint Operation With Svalbard, Eye on the Arctic*, (posted 12 Feb 2021), accessed 30 Mar 2022, https://www.rcinet.ca/eye-on-the-arctic/2021/02/12/norways-new-arctic-sar-base-will-have-helicopters-in-joint-operation-with-svalbard.

[54] Lee Raath-Brownie, *Norway to Increase SAR Capability in the Arctic*, Published on Linkedin, (26 Feb 2021), accessed 30 Mar 2022, https://www.linkedin.com/pulse/norway-increased-sar-capability-arctic-lee-raath-brownie.

[55] Arctic Council Organization, Government of Canada as Depositary, *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic*, (Signed 12 May 2011 at Nuuk, Greenland, 2011).

[56] Timothy William and James Smith, *Search and Rescue in the Arctic, Is the U.S. Prepared?*, (RAND, 2017).

Figure 8: Alaskan bases with Aeronautical SAR assets
(Circles are USCG bases, Stars are DoD bases)

Source: The Arctic Institute, The Intersection of U.S. Military Infrastructure & Alaskan Permafrost Through the 21st Century (modified by author to reflect Air bases and Kotzebue USCG base)

The USA does not hold designated military assets to prosecute inland civil SAR operations (military SAR assets are reserved for military incidents); the RCCs reach out to the SAR forces at the appropriate level of government (local or State assets). Specifically in Alaska, however, military aeronautical resources are usually the only

reliable SAR capability and are requested frequently. The Combat SAR Units of the AKANG execute most of the civilian SAR cases in Alaska.[57]

Similar to the RCAF, the USCG (the other SAR coordinator) assigns designated aircraft to prosecute civil and military aeronautical and maritime SAR in the Pacific and Arctic Oceans. Fixed-wing and rotary-wing assets are on 30 minutes alert status 24/7, and operate mainly out of Kodiak and Sitka. During the summer months, from July to October, the USCG deploys two MH60 Jayhawk helicopters to their most northern base of Kotzebue. This is to preposition aeronautical resources as north as possible to minimize the response time during the peak season.[58]

INADEQUACIES AND RECOMMENDATIONS FOR IMPROVEMENT

Canadian SAR in the Arctic is, to a certain degree, compromised. Without requiring a major overhaul, and staying within the realm of possibilities, the northern SAR system, specifically related to the RCAF, has room for improvement. An unanswered question remains: is there a necessity and political appetite to improve the Canadian aeronautical SAR organization pertaining to the Arctic. *Must* something be done?

A yearly average sees the three JRCCs coordinate approximately 8,000 SAR cases within the Canadian AOR (of these cases, nearly 1,000 require the launch of the

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[57] Timothy William and James Smith, *Search and Rescue in the Arctic, Is the U.S. Prepared?*, (RAND, 2017).

[58] Ibid.

RCAF aeronautical assets).[59] As a result, more than 20,000 people are provided assistance yearly, with more than 1,200 life saved.[60]

But how does the North fit in the picture? In the Arctic, the level of activity is continuously increasing commercially and privately. "Between 2013 and 2019, the quantity of vessels travelling via the Canadian Arctic has increased by 44%, and their covered distances increased by 107%".[61] Cross-Polar flights have also drastically increased. Figures 9, 10 and 11 represent vessel activity in the Arctic, cross-polar flight activity and projections of cross-polar flights (pre-pandemic projections) respectively.[62]

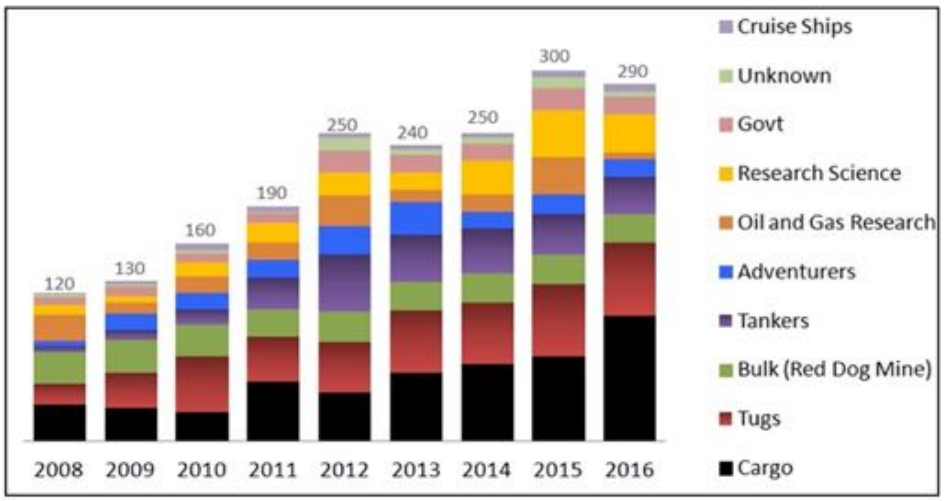

Figure 9: Total number of vessels in the Arctic by year

Source: Homeland Security Report to Congress

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[59] Canada, Canadian Coast Guard, *Search and Rescue Operations Governance Committee Annual Report 2020*, CAF and CCG, CCG GCDocs 21527742, (Jan 2021).

[60] Canada, Government of Canada, Department of National Defence, *March 2020 Search and Rescue*, CAF Operations and Activities – Transition Binder 2020, (Ottawa, 2020), accessed 30 Mar 2022, https://www.canada.ca/en/department-national-defence/corporate/reports-publications/transition-materials/caf-operations-activities/2020/03/caf-ops-activities/search-rescue.html.

[61] Arctic Council Organization, Arctic Council Report, *Report on Shipping in the Northwest Passage Launched*, (2019), accessed 10 Jan 2022, https://arctic-council.org/news/report-on-shipping-in-the-northwest-passage-launched.

[62] US Department of Homeland Security, Fiscal Year 2017 Report to Congress, *Arctic Search and Rescue*, (Mar 2018).

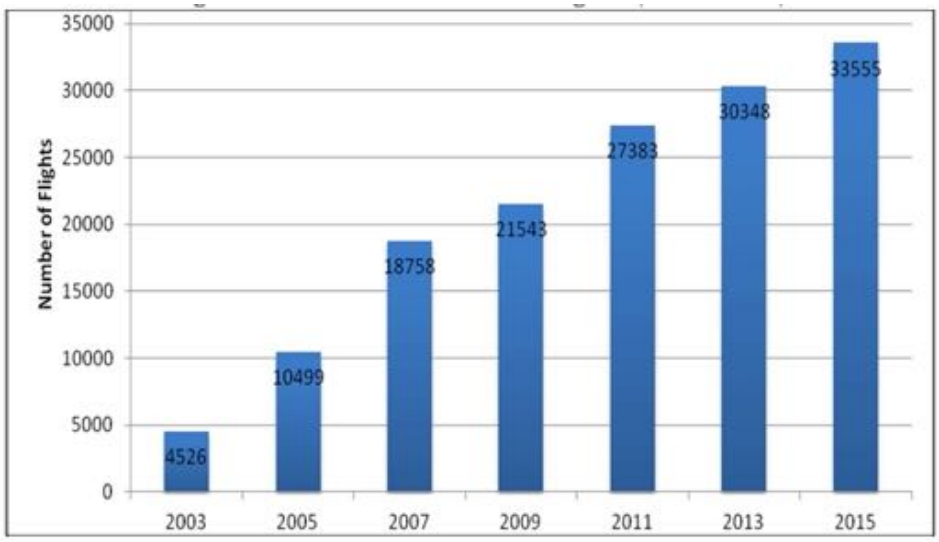

Figure 10: Total Cross-Polar flights

Source: Homeland Security Report to Congress

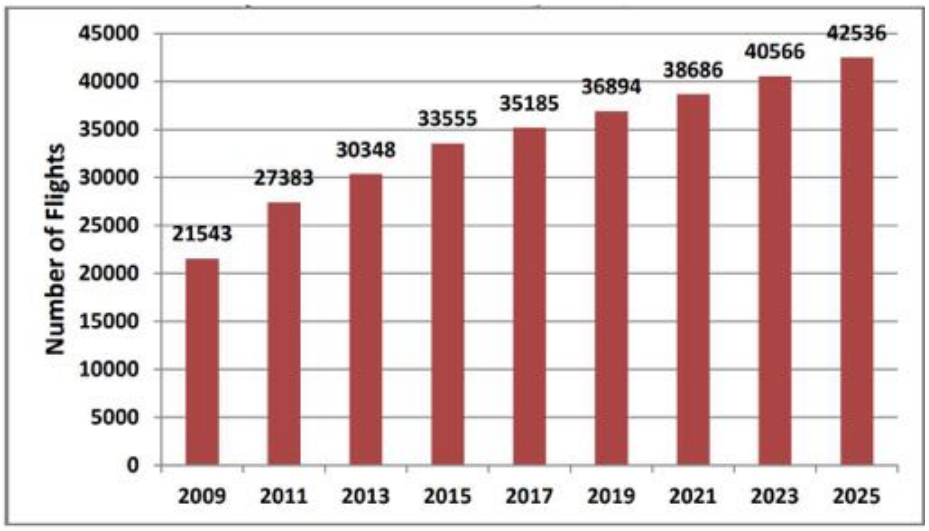

Figure 11: Total Cross-Polar flights Projection

Source: Homeland Security Report to Congress

Further to civilian activity, military movement is also increasing. Additional CAF northern manoeuvers are being conducted each year, and NATO and NORAD are

enhancing the exercise footprint in the Canadian Arctic.[63] "Sovereignty and sustainment tasks such as Op Nanook, Op Nunalivut and Op Boxtop depict the intensified Canadian military presence in the Arctic".[64] In 2040, it is estimated that Canadian military personnel and resources will have permanently increased by 18% and 10% respectively.[65]

Surprisingly, even though human activity has increased, evidence suggests no discernable and proportional trends in northern SAR incidents. This could be explained by the advent of preventive and safety policies, and the improvement of equipment and safety technologies.[66] [67] Figure 12 illustrates Canadian Arctic SAR trends, demonstrating that SAR demand has maintained constant over the years.[68]

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[63] Canada, Department of National Defence, *Arctic Security: Canadian Armed Forces Exercise Alongside U.S. Allies*, (News Release 28 Feb 2022), accessed 2 Apr 2022, https://www.canada.ca/en/department-national-defence/news/2022/03/arctic-security-canadian-armed-forces-exercise-alongside-us-allies.html.

[64] Canadian Forces College, LCol Francois Fasquelle, Joint Command and Staff Program 48, *Searching for Effectiveness: A Recommended Improvement to the Search and Rescue Regional and Command Construct*, Service Paper DS 545 Component Capabilities, (Toronto, 24 Jan 2022).

[65] Avascent Management Consulting Company, *Defence Air Mobility Requirements, Utility Transport Aircraft Replacement Study*, Prepared for Innovation, Science and Economic Development Canada, (March 2020).

[66] Dany Poitras, "Search and Rescue in the Arctic", *Canadian Arctic Operations, 1945–2015: Lessons Learned, Lost, and Relearned*, edited by Whitney Lackenbauer and Adam Lajeunesse, (Fredericton: The Gregg Centre for War & Society, 2017), 387-425.

[67] Timothy William and James Smith, *Search and Rescue in the Arctic, Is the U.S. Prepared?*, (RAND, 2017).

[68] Canada, Canadian Coast Guard, *Search and Rescue Operations Governance Committee Annual Report 2020*, CAF and CCG, CCG GCDocs 21527742, (Jan 2021).

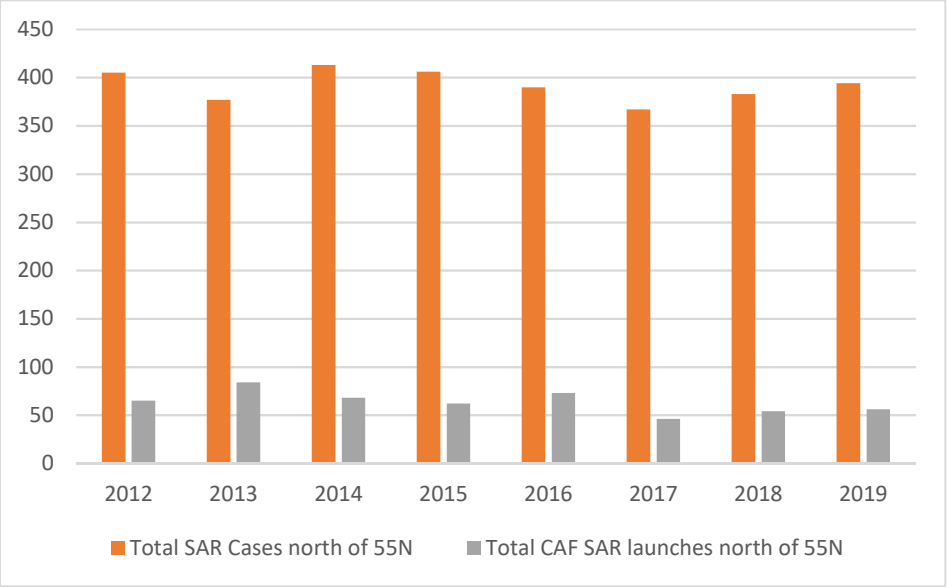

Figure 12: Number of SAR cases in Northern Canada

Source: Author, Student JCSP 48 (data from the Federal SAR Operations Governance Committee Annual Report 2012-2020)

While an argument could be made that northern SAR resources do not require further investment given the stable SAR demand, and due to the fact that only 0.4% of the Canadian population resides on 40% of its territory,[69] that notion is refutable. Canadian territory represents 25% of the global Arctic and encompasses international waters; Canada is liable to act as a major actor in accordance with the signed *Agreement*. In addition, its non-residential population cyclically increases by more than 500,000 people yearly, based on tourism alone.[70] Moreover, worldwide summer Arctic tourism footprint has quadrupled between 2006 and 2016, and increased by more than 600% in

[69] The Arctic Institute, Center for Circumpolar Security Studies, *Canada Facts and Figures*, (19 June 2020), accessed 24 Mar 2022, https://www.thearcticinstitute.org/countries/canada.

[70] David Huddart and Tim Stott, National Public Health Emergency Collection, *Adventure Tourism in the Canadian Arctic*, (PMC PubMed Central, Oct 2019), accessed 25 Mar 2022, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7123082.

the winter.[71] In absolute numbers, humans are more exposed to northern risks. On average, 16% of SAR cases north of 55ºN require the launch of CAF aircraft, as compared to only 10% in the southern AOR.[72] This can be explained by the isolation and complexity of the Arctic environment and the inaccessibility to conventional SAR means. Furthermore, even though less than 1% of Canadians live in the North, victims implicated in northern SAR incidents account for 5% of all SAR cases.[73] The Arctic is a precarious environment.

> Annually, there are more than 1000 people in Canada above 55ºN that require SAR assistance [of all categories], nearly 20% of whom are facing medical emergencies, and at a rate of 7.81 per 1000, SAR incidence is 16.4 times the Canadian average.[74]

> The status quo is not an acceptable course of action as the need for improving the current Arctic SAR capabilities has been made abundantly clear. Resource scarcity and constraints hinder depth and flexibility making the whole system rather fragile and, arguably, already working at its maximum capacity in a northern context.[75]

Many conclusions can be drawn. Nevertheless, evidence shows that Canada's RCAF Arctic SAR operations are confronted in three main areas. The three vulnerabilities that need to be addressed are the *Policies and Institutional* gap, the *Knowledge and Coordination* gap, and the *Capability and Capacity* gap. This final

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[71] Claire A. Runge, Remi M. Daigle and Hausner H. Vera, *Quantifying Tourism Booms and the Increasing Footprint in the Arctic with Social Media Data*, (PloS One 15, no. 1, 2020).

[72] Canada, Canadian Coast Guard, *Search and Rescue Operations Governance Committee Annual Report 2020*, CAF and CCG, CCG GCDocs 21527742, (Jan 2021).

[73] Data provided by MWO Bryce Culver, Canadian Joint Operations Command – Search and Rescue Section, (Mar 2022).

[74] J. Ford and D. Clark, *Preparing for the Impacts of Climate Change Along Canada's Arctic Coast: The Importance of Search and Rescue*, (Marine Policy 108, 2019).

[75] Dany Poitras, "Search and Rescue in the Arctic", *Canadian Arctic Operations, 1945–2015: Lessons Learned, Lost, and Relearned*, edited by Whitney Lackenbauer and Adam Lajeunesse, (Fredericton: The Gregg Centre for War & Society, 2017), 387-425.

section will empirically analyze and demonstrate the areas of improvement and recommend mitigating factors.

Policies and Institutional gap

1st Recommendation: *NSP to formally endorse a Policy paper explicitly dedicated to Arctic SAR with a segment on RCAF and aeronautical responsibilities*.

Simply put, Canada lacks guidance in its implementation of aeronautical SAR operations in the North. The word *Arctic* is found 77 times in Canada's most recent Defence Policy, and the term *Search and Rescue* is seen 40 times. In such a pivotal strategic document, it indicates the importance of both the Arctic and the SAR enterprise.[76]

In his 2020 signed Operational SAR Directive, the Comd CJOC, Lieutenant-General Rouleau, states that "[t]he protection of Canadians is CJOC's highest priority. Through domestic SAR operations, CAF [are] in action, protecting those that find themselves in peril throughout the vast Canadian SAR regions […]".[77] There is an unequivocal requirement for a Canadian Arctic SAR Policy. However, other than the *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic* – an international document – there are no specific and explicitly formulated Arctic SAR policies at the national level. Many SAR guidelines and directives refer to the Arctic, but without deliberately implementing an Arctic SAR policy.

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

[77] Canada, Department of National Defence, Canadian Armed Forces, Canadian Joint Operations Command, *Canadian Joint Operations Command Search and Rescue Directive 2020*, (Ottawa, Ont, 2020).

Knowledge and Coordination gap

2nd Recommendation: *CAF to implement an Arctic Search and Rescue Region for enhanced northern SAR coordination*.

The distribution of regional jurisdiction needs to support Arctic SAR prosecution more resourcefully, even though the bulk of SAR cases occur south of 55°N.[78] One crucial difficulty stems from a weakness in northern familiarity, a knowledge insufficiency noted in the management and C2 structure of the JRCCs. "This deficiency is mainly caused by the lack of permanent northern SAR facilities; all Arctic operations are coordinated from JRCCs that are situated in southern extremities of Canada (primarily JRCC Trenton)".[79] These JRCCs do not incorporate Arctic regional experts; they are staffed and designed for southern-type operations, and are not adequately tailored to orchestrate complex Arctic SAR responses.[80]

> It is imperative to have a crystalized northern element embedded in the SAR C2 network. Assigning an *Arctic SRR* and its corresponding JRCC would allow concentration on northern context, provide SAR effects tailored to the Arctic environment, and focus assets to efficiently deliver the Canadian SAR mandate.[81]

An effective implementation option could utilize existing resources in Yellowknife, NT. This alternative would see the assignment of Commander Joint Task

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[78] Canada, Canadian Coast Guard, *Search and Rescue Operations Governance Committee Annual Report 2020*, CAF and CCG, CCG GCDocs 21527742, (Jan 2021).

[79] Canadian Forces College, LCol Francois Fasquelle, Joint Command and Staff Program 48, *Searching for Effectiveness: A Recommended Improvement to the Search and Rescue Regional and Command Construct*, Service Paper DS 545 Component Capabilities, (Toronto, 24 Jan 2022).

[80] Ibid.

[81] Ibid.

Force North (JTFN) as the SRR Commander, analogous to Comds JTFP and JTFA for the Victoria and Halifax SRRs.[82] JTFN is the most obvious option:

1. JTFN is already mandated to lead CAF continental operations north of 55°N;[83]
2. One of its roles relates to CAF assistance response to disaster relief, support of critical incidents, and Canadian Rangers support to ground SAR,[84] a mission statement in line with SAR Force Employment Concepts;[85] and
3. JTFN currently has an operational and C2 framework comparable to the existing SAR organization, and Commander JTFN also reports to CJOC.[86]

Furthermore, a robust *Arctic JRCC* needs to be assigned. As an epicenter of northern SAR occurrences, Iqaluit, NU, provides the opportunity to merge SAR resources efficiently. Iqaluit is the only Canadian capital unreachable by land, therefore the secluded nature of its extended area is vulnerable to intricate SAR conditions. With the increasing usage of the Northwest Passage and the surge in activities on Baffin Island and its adjacent regions, establishing the JRCC in Iqaluit is a necessary course of action.[87]

Instituting an Arctic SRR with its distinct JRCC mirrors the effectiveness of Alaskan and Norwegian models. By doing so, the RCAF will be adequately postured to

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[82] Canadian Forces College, LCol Francois Fasquelle, Joint Command and Staff Program 48, *Searching for Effectiveness: A Recommended Improvement to the Search and Rescue Regional and Command Construct*, Service Paper DS 545 Component Capabilities, (Toronto, 24 Jan 2022).

[83] Canada, Department of National Defence, Joint Task Force North, accessed 11 Jan 2022, https://www.canada.ca/en/department-national-defence/services/operations/military-operations/conduct/regional-task-force/north.

[84] Ibid.

[85] Canada, Department of National Defence, B-GJ-403-0XX/FP-001, DRAFT *Royal Canadian Air Force SAR Force Employment Concept*, (RCAF Aerospace Warfare, Trenton, Ont: 2021).

[86] Ibid.

[87] Canadian Forces College, LCol Francois Fasquelle, Joint Command and Staff Program 48, *Searching for Effectiveness: A Recommended Improvement to the Search and Rescue Regional and Command Construct*, Service Paper DS 545 Component Capabilities, (Toronto, 24 Jan 2022).

protect Canadians, contributing to domestic sovereignty. The integration of an Arctic SRR into the SAR system can transition seamlessly by absorbing the SAR C2 in the current JTFN Command structure, with a JRCC located in Iqaluit.[88] The topographic features of the suggested Arctic SRR are represented in figure 13.[89]

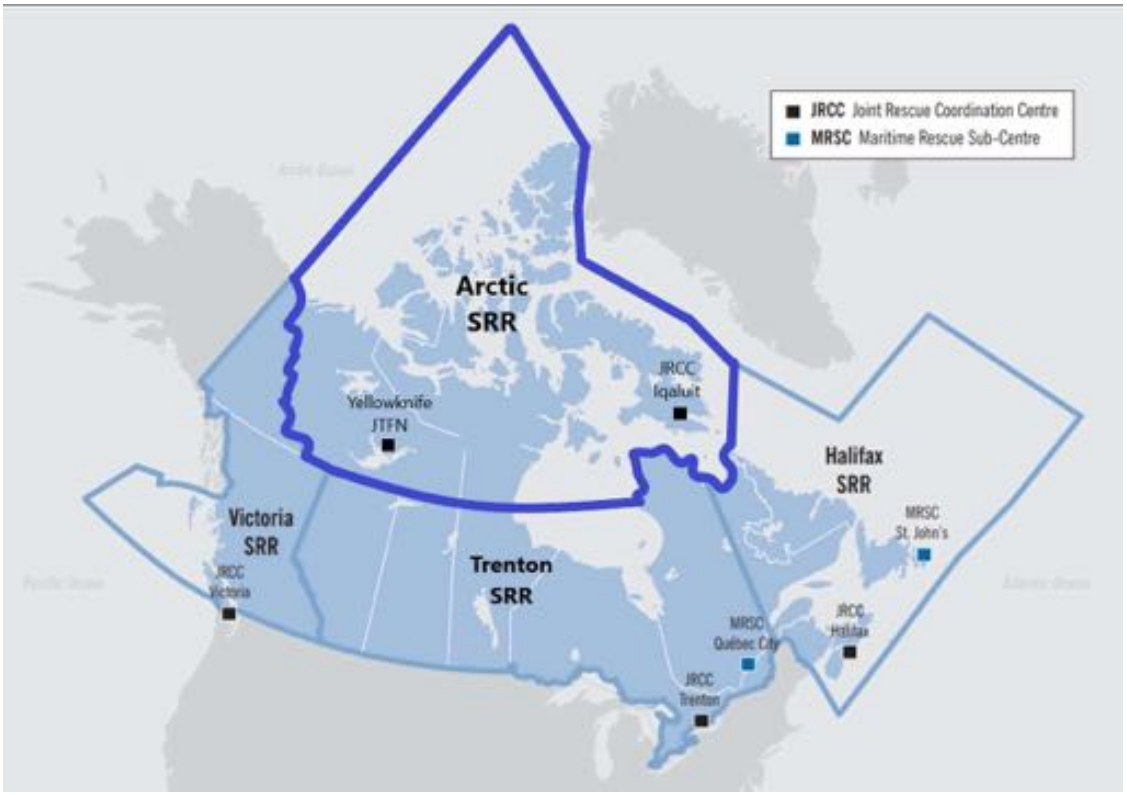

Figure 13: Recommended Arctic SRR
Source: Author, Student JCSP 48

Finally, to efficiently empower the Arctic JRCC, and to address the tri-environment of SAR (Air, Marine and Land), the composition of the JRCC staffing must

[88] Canadian Forces College, LCol Francois Fasquelle, Joint Command and Staff Program 48, *Searching for Effectiveness: A Recommended Improvement to the Search and Rescue Regional and Command Construct*, Service Paper DS 545 Component Capabilities, (Toronto, 24 Jan 2022).
[89] Ibid.

be integrated with regional specialists. As recommended by the SAR veteran Jean G.R. Leroux, in addition to the current RCAF and CCG staff, there is a necessity to augment the JRCC structure with the RCMP, regional police agencies and SARVAC personnel.[90] The argument is even more relevant for an Arctic JRCC, given the complexities of the North. Furthermore, the integration of Canadian Rangers, local authorities and indigenous expertise would prove essential and enable reliable coordination networks. This would allow the Arctic JRCC to be established as a holistic and multi-jurisdictional coordination center, alleviating existing collaboration challenges. This recommendation reflects the recent Public Inquiry report related to a tragic SAR incident in Labrador, which recommends more coordination in the SAR system, suggesting that Memoranda of Understanding should be put in place between the GOC helicopter resources (RCAF assets), the provinces, and the Ground SAR organizations.[91] It also sets footing on the Norwegian integrated coordination structure of their RCCs, which incorporate several governmental agencies, allowing for a highly efficient system for all types of SAR incidents, including humanitarian.[92]

Capability and Capacity gap

3rd Recommendation: *Increase SAR crewing resources tailored to contemporary requirement, and generate seasonal SAR detachment in the Arctic adapted to trends and surge necessities*.

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[90] Jean G.R. Leroux *Canadian Search and Rescue Puzzle: The Missing Pieces*, (Canadian Military Journal 18, no. 2, 2018), 24-35.

[91] Government of Newfoundland, James J. Igloliorte, Commissioner, *Public Inquiry Respecting Ground Search and Rescue for Lost and Missing Persons*, Final Report, (Nov 2021).

[92] Norway, The Royal Ministry of Justice and Police Department of Civil Emergency and Rescue Planning, *The Norwegian Search and Rescue Services*, (2002).

Many capability gaps exist, the first stemming from personnel issues. The crewing establishment and sustainment for SAR aircraft is archaic and has remained essentially unchanged since 1958.[93] It does not reflect the existing tempo of SAR and does not incorporate the increase in northern activities. A study conducted by Dr Séguin from DRDC demonstrates that the crewing situation needs to be updated. Without specifically referring to Arctic tasks, it highlights the current operational pace of Primary SAR squadrons, which are responsible for northern operations. The study shows that an increase in aircrew is required (13% increase in pilots and 48% increase in SAR Techs) to meet all current lines of taskings and training requirements, including the Arctic assignments. The study presents alternatives, such as the reduction in SAR tasks, scope and training requirements.[94] This scientific analysis is in line with a 2013 Report of the Auditor General of Canada which identified that "6.5 is the minimum number of [qualified] air crews needed for each aircraft to sustain SAR operations",[95] a number that is still not implemented by any of the helicopter SAR bases.

Another issue pertains to base locations. Without permanently relocating SAR squadrons, there are justified arguments to intermittently relocate small SAR detachments to northern regions, reflecting seasonal demand. Figure 14 depicts northern hotspots of incident locations. These epicenters are derived from algorithmic computation of

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[93] L. Arseneau and L. Serré, Defence Research and Development Canada, *Search and Rescue Technician Establishment Study*, (Scientific Report, DRDC, 2016).

[94] Defence Research and Development Canada, René Séguin, prepared for DG Air Force Development, *Search and Rescue Squadron Air Crew Manning Study, Preliminary results 413 Squadron*, (DRDC – Centre for Operational Research and Analysis, May 2020).

[95] Canada, Office of the Auditor General, *Report of the Auditor General of Canada to the House of Commons, Chapter 7: Federal Search and Rescue Activities*, (Ottawa, Office of the 100 Auditor General of Canada Distribution Centre, 2013).

historical SAR incidents originating from 2014.[96] [97] All things being equal, this map is an unbiased predictor for future SAR needs. Consequently, seasonal SAR assets should be deployed in Iqaluit, where a Forward Operating Location (FOL) and airport infrastructure already exist, collocated with the Arctic JRCC.

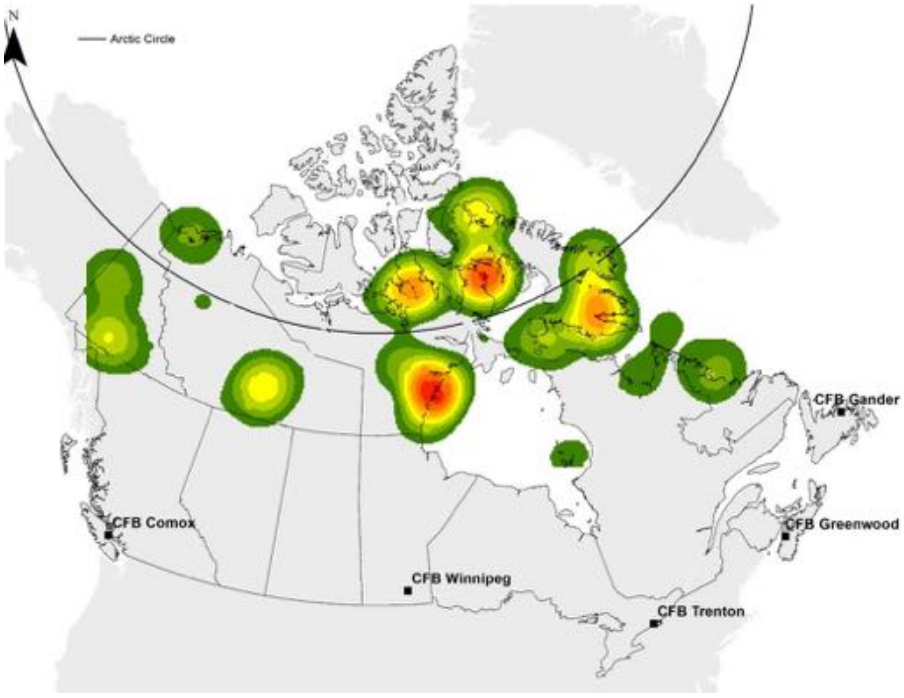

Figure 14: Centers of Gravity of Northern SAR incident locations

Source: NSS data and PLoS One: What Role can Unmanned Aerial Vehicles Play in Emergency Response in the Arctic: A Case Study from Canada (modified by author for conciseness)

Figure 15 tabulates the launches of Primary RCAF SAR platforms over the period of one year. Derivatively, northern deployed SAR assets should reflect the summer demand. The concept of rotating domestic air assets in the Arctic is not new to the

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[96] 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).

[97] Canada, Government of Canada, Public Safety Canada, *Search and Rescue Policies and Programs*, (Ottawa, Ont, 2020), accessed 2 Apr 2022, https://www.publicsafety.gc.ca/cnt/mrgnc-mngmnt/rspndng-mrgnc-vnts/nss/index-en.aspx.

RCAF; this SAR adjustment would be akin to the relocation of CF18s to northern FOLs in response to NORAD demands.[98] Moreover, this recommendation emulates the USCG procedure of deploying MH60 helicopters to their most northern FOL from Jul to Oct, prepositioning aeronautical assets during the high Arctic season.[99] It is also in line with the Norwegian Arctic SAR footprint and their improved aeronautical northern posture.

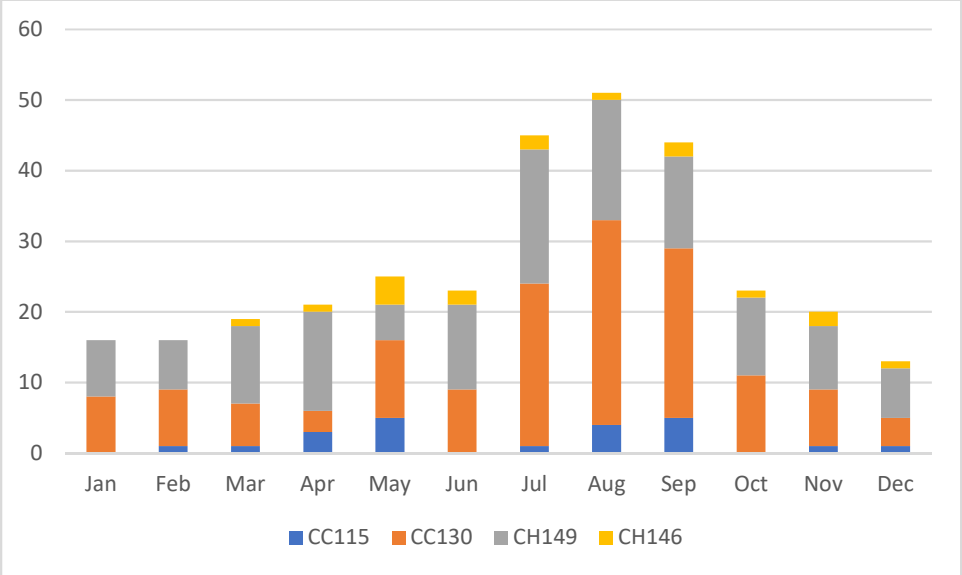

Figure 15: RCAF's Primary aeronautical SAR aircraft launches (2015-2020)

Source: Author, JCSP 48 (Data provided by Canadian Joint Operations Command – SAR Section)

This recommendation is justified based on many factors, one of which is range and response time. Figures 16, 17 and 18 paint a holistic and unfortunately grim portrait of the response deficiency, from a coverage perspective, as a function of available crew and flight time.

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[98] Ernie Regehr and Michelle Jackett, Senior Fellow in Defence Policy and Arctic Security, *Circumpolar Military Facilities of the Arctic Five*, (The Simons Foundation, 2017).

[99] Timothy William and James Smith, *Search and Rescue in the Arctic, Is the U.S. Prepared?*, (RAND, 2017).

Figure 16 portrays RWSAR range comparison between Canada, Norway and Alaska. The rings depict the ranges of initial coverage of the CH149 Cormorant, the CH146 Griffon (CFB Trenton), the AW101 SAR Queen and the MH60 Jayhawk, each country's primary rescue helicopters. The rings take into account maximum VFR range as departing from their respective Main Operating Bases (MOBs), configured and crewed for SAR, and includes 20 minutes of stationary work.

Figure 16: Ranges of Canadian, Norwegian and Alaskan SAR Helicopters
Source: Author, Student JCSP 48

The most striking conclusion from this map speaks to the fact that Canada is not well postured, from an aeronautical rescue perspective, to respond to northern incidents. In fact, for some areas such as the Yukon, Northwest Territories, western parts of the Arctic Ocean, the entirety of Ellesmere Island and most of the Canadian High Arctic, the assets of Norway and Alaska are better positioned to respond to a SAR incident on

Canadian territory, more so than Canada itself.[100] This disturbing information speaks poorly of Canadian sovereignty and its capacity to prosecute SAR.

The next figures depict the response time of the current RCAF aeronautical SAR assets. Figure 17 illustrates the response time of the RWSAR (CH146 Griffon and CH149 Cormorant) and FWSAR aircraft (CC130 Hercules) north of 55°N, assuming SAR launches from the closest MOB to the distress location.[101]

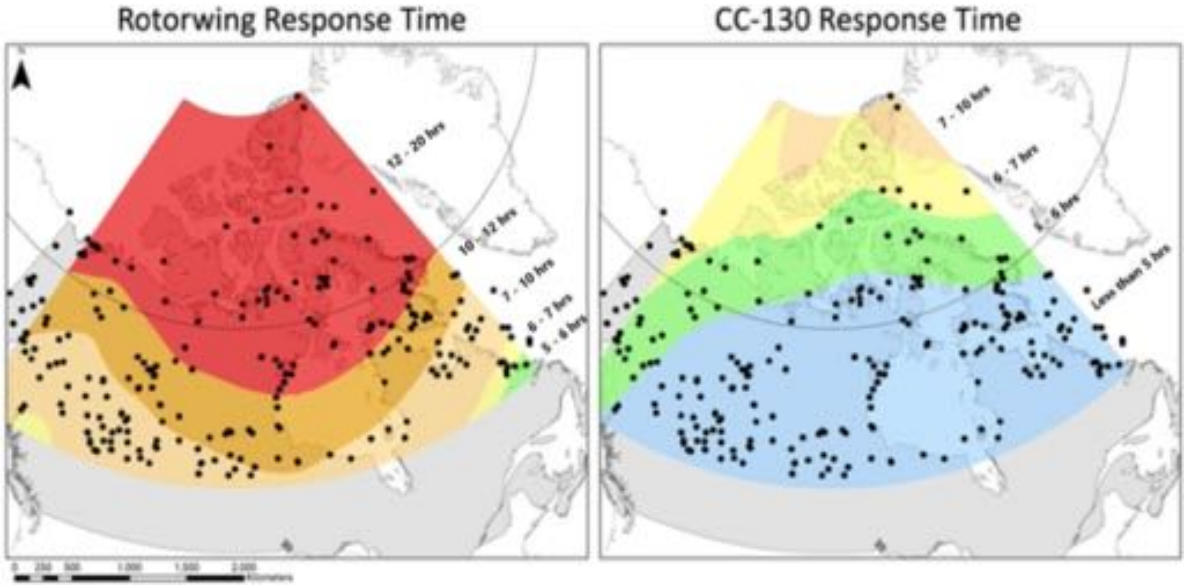

Figure 17: SAR Response times of Primary RCAF aeronautical platforms, north of 55°N (Black dots are 2014 SAR incidents)

Source: Marine Policy Vol 108, Preparing for the Impacts of Climate Change along Canada's Arctic Coast: The Importance of Search and Rescue (modified by author for clarity)

[100] Based on aircraft performance calculation, RCAF SAR aircraft can reach Mexico in less than half the time it requires to fly to CFB Alert.

[101] J. Ford and D. Clark, *Preparing for the Impacts of Climate Change Along Canada's Arctic Coast: The Importance of Search and Rescue*, (Marine Policy 108, 2019).

Figure 18 complements previous figures and captures the response time of the recently acquired CC295 Kingfisher. Even though not yet in operation, it will replace all FWSAR platforms in Canada and will remain the only Primary FWSAR aircraft of the RCAF.[102] The red area on the map represents a region inaccessible by the CC295 in a single crew-day (more than 15 hrs), as a result of limited speed and range of the aircraft. The dark-grey area to the east of the AOR is beyond the return range of the aircraft.[103]

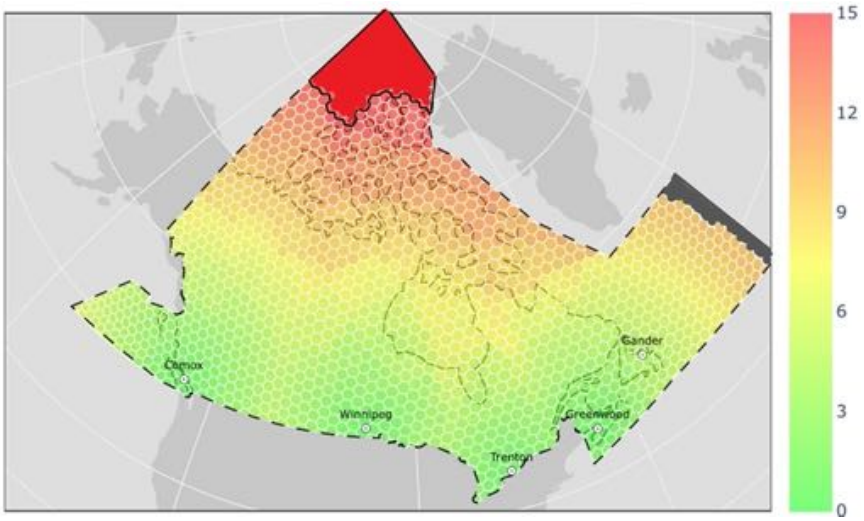

Figure 18: Response time (in hours) of the CC295 Kingfisher, Canadian AOR

Source: Defence Research and Development Canada, New Planes on the Block - An Assessment of the Newly Acquired CC295s in CONPLAN SOTERIA (modified by author for clarity)

Figures 16, 17 and 18 speak for themselves. They expose the obvious weakness in northern capability and validate the compelling evidence that, short of acquiring new

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[102] Canada, Department of National Defence, Fixed-Wing Search and Rescue Procurement Project, *CC-295 Kingfisher Aircraft*, accessed 13 Apr 2022, https://www.canada.ca/en/department-national-defence/services/procurement/fixed-wing-search-and-rescue-procurement-project.html.

[103] Defence Research and Development Canada, Nicholi Shiell, prepared for Canadian Joint Operations Command Search and Rescue, *New Planes on the Block - An Assessment of the Newly Acquired CC295s in CONPLAN SOTERIA*, (DRDC – Centre for Operational Research and Analysis, Nov 2021).

assets and establishing permanent Arctic bases, the most reasonable course of action is to reposition SAR assets in Iqaluit on an *as-required-basis*, adapting to seasonal SAR demand.

The case in point was demonstrated in 2021 during a live SAR exercise, when the icebreaker ship *Le Commandant Charcot*, in the vicinity of the North Pole (89º54'N/175º39'W – 920 NM north of Resolute), evacuated 67 crewmembers on the ice, simulating an accident in the Arctic. A Mayday call was broadcasted to the JRCCs of Russia, Norway, Iceland, Greenland, Canada and the USA. The radio transcripts provide a shocking insight on the extreme complexity of Arctic SAR. With the exception of Norway, no other nations had the capability of sending any aeronautical rescue assets on-scene. In addition, only JRCC Juneau (Alaska) were able to send a fixed-wing aircraft to para-drop survival equipment, without any rescue capacity. Finally, only Russia was able to assist in the rescue of the remaining crewmembers, using a nuclear Russian icebreaker. The rescue would require several days.[104]

The grounding of the *Akademik Ioffe* vessel on 24 Aug 2018, near Kugaaruk, NU, is another example that highlights the necessity to have responsive aeronautical SAR capabilities in the Arctic. With a total of 263 people on board,[105] this accident could have been disastrous. JRCC Trenton dispatched five RCAF aircraft (FWSAR and RWSAR from two different SRRs) and two CCG vessels. It required two entire aircrew teams and

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[104] Captain Patrick Marchesseau, *Report of the SAREX Nearby the North Pole with LE COMMANDANT CHARCOT & Russian, Norwegian, Greenlandic/Danish, Canadian, US SAR*, (7 Sept 2021).

[105] Ed Struzik, Yale School of the Environment, *How a Russian Vessel's Grounding Highlights Perils of Arctic Shipping*, (Yales Environment 360, June 2021), accessed 17 Mar 2022, https://e360.yale.edu/features/how-a-russian-vessels-grounding-highlights-perils-of-arctic-shipping.

17 hours for the RWSAR aircraft to simply arrive on the scene of the accident.[106] Luckily, the vessel was able to self-refloat many hours after breaching its hull, and all passengers were evacuated to the sister vessel *Akademik Sergey Vavilov*. This grounding accident is only one of the 74 other grounding incidents that occurred in the Canadian Arctic from 2000 to 2018.[107]

Many additional recent SAR incidents expose the need for enhanced and responsive aeronautical capability in the Arctic.[108] It is the CAFs responsibility to act accordingly, by deploying RCAF assets where and when it is the most required in the North.

CONCLUSION

Incidents like the Akademik Ioffe, the crash of First Air Flight 6560 and Boxtop 22 [109] are infrequent occurrences, but rarity is not a valid reason to forego SAR adequacy. This essay has dissected the current Canadian Arctic SAR situation, with lenses on the RCAF and aeronautical capabilities, and evaluated its institutional relevance and capacity. The analysis highlights the obvious need for enhancement and adaptation to the contemporary northern SAR environment; compelling evidence demonstrates that the existing status quo is unreliable.

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[106] Canadian Joint Operation Command, 103 Squadron SAR Mission Reports, RCC Case Number T2018-01907, Unit Mission Number 18-0100A and 18-0100B, *Grounding Akademik Ioffe*, (Aug 2018).

[107] Canada, Transportation Safety Board of Canada, *Marine Transportation Safety Investigation Report M18C0225*, (24 Aug 2018), https://www.tsb.gc.ca/eng/rapports-reports/marine/2018/m18c0225/m18c0225.html.

[108] Canadian Joint Operation Command, *SAR Mission Reports,* 2015 to 2021, accessed Mar 2022.

[109] Canada, Royal Canadian Air Force, *Remembering the Crash of Boxtop Flight 22*, (News Article, RCAF PA, Oct 2017), accessed Apr 2022, http://www.rcaf-arc.forces.gc.ca/en/article-template-standard.page?doc=remembering-the-crash-of-boxtop-flight-22/ig9v1k0t.

Three chief recommendations have been emphasized and explained herein, addressing unmistakable gaps in the system. The three vulnerabilities that need to be corrected are the *Policies and Institutional* gap, the *Knowledge and Coordination* gap, and the *Capability and Capacity* gap. These weaknesses can be rectified by explicitly endorsing a specific Canadian SAR Arctic Policy, by creating an Arctic SRR, and by cyclically rotating RCAF SAR assets in the North to respond to peak activity in the summer months.

Many other vigorous alternatives exist, some of which are politically and economically unviable at the moment. Nevertheless, peripheral options can be considered. For instance, the CAF sponsors the CASARA, which has member organizations throughout Canada. However, with the exception of scarce northern-based commercial operators stationed in the Arctic, the vast majority are located closer to populated centers in southern Canada.[110] Yet, akin to Norway, additional government funding could be unlocked for the North.

Additionally, Transport Canada is currently in the process of purchasing a long-range drone capability for its National Aerial Surveillance Program. Still in its infancy stage of acquisition, the remotely piloted aircraft will be equipped with sensors that may assist the RCAF aeronautical search capabilities, but range and weather will be a limiting factor.[111] This however will not provide a rescue component to the SAR enterprise.

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[110] Canada, Department of National Defence, *Search and Rescue Northern Canada*, accessed 22 Mar 2022, https://www.canada.ca/en/department-national-defence/services/operations/military-operations/types/search-rescue/northern-canada.html.

[111] Pierre Leblanc, *Strengthening Canada's Arctic Search and Rescue Capabilities*, (The Maritime Executive, 4 Mar 2021), accessed 21 Mar 2022, https://www.maritime-executive.com/editorials/strengthening-canada-s-arctic-search-and-rescue-capabilities.

Canada owes a resilient Arctic SAR system to its citizens and visitors, one that stems from the existing institution, with added functionality and responsiveness in the North. The security and well-being of the people, and the sovereignty, depend on it.

BIBLIOGRAPHY

Agusta Westland Helicopter Division. Leonardo Helicopters. *Tenth SAR Queen Successfully Delivered to Norway*. 17 Mar 2021. https://uk.leonardocompany.com/en/news-and-stories-detail/-/detail/tenth-aw101-sar-queen-successfully-delivered-to-norway#:~:text=17%20March%202021,of%20Justice%20and%20Public%20Security.

Agusta Westland Helicopter Division. Leonardo Helicopters. *SAR Queen Helicopters Are Now Operational in Norway*. 13 Nov 2020. https://uk.leonardocompany.com/en/news-and-stories-detail/-/detail/aw101-sar-queen-helicopters-operational-in-norway.

Arp, Bjorn. *The Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic & the Treaty between Norway and Russia on the Maritime Delimitation and Cooperation in the Barents Sea and the Arctic Ocean*. International Legal Materials 50: no. 6. 2011.

Arctic Council Organization. Arctic Council - The Arctic Council (arctic council.org).

Arctic Council Organization. Arctic Council Report. *Report on Shipping in the Northwest Passage Launched*. 2019. https://arctic-council.org/news/report-on-shipping-in-the-northwest-passage-launched.

Arctic Council Organization. Government of Canada as Depositary. *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic*. Signed 12 May 2011 at Nuuk, Greenland: 2011.

Airbus Industries. *C295FWSAR, Benefiting the Great White North From Coast to Coast*. https://www.airbus.com/en/products-services/defence/military-aircraft/c295/c295fwsar.

Avascent Management Consulting Company. *Defence Air Mobility Requirements, Utility Transport Aircraft Replacement Study*. Prepared for Innovation, Science and Economic Development Canada. March 2020.

Babcock, Sandy. *Operation Canon: A case Study of Early RCAF Arctic Search and Rescue Capabilities*. In Sic Itur Ad Astra: Canadian Aerospace Power Studies, Volume 4: De-Icing Required! The Historical Dimension of the Canadian Air Force's Experience in the Arctic. eds P. Whitney Lackenbauer and W.A. March. Ottawa: Her Majesty the Queen as represented by the Minister of National Defence. 2012.

Canada. Government of Canada. Public Safety Canada. *Quadrennial Search and Rescue Review*: Public Safety ADM(PA). Ottawa: 2013.

Canada. Office of the Auditor General. *Report of the Auditor General of Canada to the House of Commons, Chapter 7: Federal Search and Rescue Activities*. Ottawa: Office of the 100 Auditor General of Canada Distribution Centre. 2013.

Canada. Government of Canada. Royal Canadian Air Force. *Search and Rescue*: http://www.rcaf-arc.forces.gc.ca/en/search-rescue.page.

Canada. Department of National Defence. *Canadian Forces Search and Rescue: 50 Years of Service to Canadians*: Ottawa: Art Direction CAFSU(O) Creative Services. 1997.

Canada. Department of National Defence. Department of Fisheries and Oceans Canada. B-GA-209-001/FP-001, DFO 5449. *Canadian Aeronautical and Maritime Search and Rescue Manual*: 2018.

Canada. Government of Canada. Prime Minister of Canada Justin Trudeau. *Mandate Letters 16 Dec 2021*: 2021. https://pm.gc.ca/en/mandate-letters.

Canada. Dept. of National Defence. B-GA-400-000/FP-001. *Royal Canadian Air Force Doctrine*. Ottawa, Ont: Joint Doctrine Branch. 2016.

Canada. Government of Canada. Public Safety Canada. *National Search and Rescue Program*. https://www.publicsafety.gc.ca/cnt/mrgnc-mngmnt/rspndng-mrgnc-vnts/nss/prgrm-en.

Canada. Department of National Defence. Canadian Armed Forces. Canadian Joint Operations Command. *Canadian Joint Operations Command Search and Rescue Directive 2020*. Ottawa, Ont: 2020.

Canada. Government of Canada. *Search and Rescue in Central Canada, JRCC Trenton*. https://www.canada.ca/en/department-national-defence/services/operations/military-operations/types/search-rescue/central-canada.

Canada. Office of the Auditor General. *Report of the Auditor General of Canada to the House of Commons, Chapter 7: Federal Search and Rescue Activities*. Ottawa. Office of the 100 Auditor General of Canada Distribution Centre: 2013.

Canada. Government of Canada. RCAF. *CC295 Kingfisher*. http://www.rcaf-arc.forces.gc.ca/en/aircraft-current/cc-295.page.

Canada. Department of National Defence. *Statement of Operational Requirement for the Fixed-Wing Search and Rescue Aircraft*. Final Report 12 Mar 2010. https://www.canada.ca/en/department-national-defence/corporate/reports-

publications/equipment/review-of-the-statement-of-operational-requirement-for-the-fixed-wing-search-and-rescue-aircraft.html.

Canada. Department of National Defence. Canadian Armed Forces. *Canadian Search and Rescue Helicopter Statement of Operational Requirement*: 1999.

Canada. Canadian Coast Guard. *Search and Rescue Operations Governance Committee Annual Report 2020*. CAF and CCG. CCG GCDocs 21527742. Ottawa: Jan 2021.

Canada. Government of Canada. Department of National Defence. *March 2020 Search and Rescue*. CAF Operations and Activities – Transition Binder 2020. Ottawa: 2020. https://www.canada.ca/en/department-national-defence/corporate/reports-publications/transition-materials/caf-operations-activities/2020/03/caf-ops-activities/search-rescue.html.

Canada. Department of National Defence. *Arctic Security: Canadian Armed Forces Exercise Alongside U.S. Allies*. News Release: 28 Feb 2022. https://www.canada.ca/en/department-national-defence/news/2022/03/arctic-security-canadian-armed-forces-exercise-alongside-us-allies.html.

Canada. Department of National Defence. *Strong, Secure, Engaged: Canada's Defence Policy*. Ottawa: 2017.

Canada. Department of National Defence. Joint Task Force North. https://www.canada.ca/en/department-national-defence/services/operations/military-operations/conduct/regional-task-force/north.

Canada. Department of National Defence. B-GJ-403-0XX/FP-001. DRAFT *Royal Canadian Air Force SAR Force Employment Concept*. RCAF Aerospace Warfare. Trenton, Ont: 2021.

Canada. Government of Canada. Public Safety Canada. *Search and Rescue Policies and Programs*. Ottawa, Ont: 2020. https://www.publicsafety.gc.ca/cnt/mrgnc-mngmnt/rspndng-mrgnc-vnts/nss/index-en.aspx.

Canada. Department of National Defence. Fixed-Wing Search and Rescue Procurement Project. *CC-295 Kingfisher Aircraft*. https://www.canada.ca/en/department-national-defence/services/procurement/fixed-wing-search-and-rescue-procurement-project.html.

Canada. Transportation Safety Board of Canada. *Marine Transportation Safety Investigation Report M18C0225*. 24 Aug 2018. https://www.tsb.gc.ca/eng/rapports-reports/marine/2018/m18c0225/m18c0225.html.

Canada. Royal Canadian Air Force. *Remembering the Crash of Boxtop Flight 22*. News Article. RCAF PA: Oct 2017). http://www.rcaf-arc.forces.gc.ca/en/article-template-standard.page?doc=remembering-the-crash-of-boxtop-flight-22/ig9v1k0t.

Canada. Department of National Defence. *Search and Rescue Northern Canada*. https://www.canada.ca/en/department-national-defence/services/operations/military-operations/types/search-rescue/northern-canada.html.

Canadian Forces College. LCol Francois Fasquelle. Joint Command and Staff Program 48. *Searching for Effectiveness: A Recommended Improvement to the Search and Rescue Regional and Command Construct*. Service Paper DS 545 Component Capabilities. CFC Toronto: Jan 2022.

Canadian Joint Operation Command. 103 Squadron SAR Mission Reports. RCC Case Number T2018-01907. Unit Mission Number 18-0100A and 18-0100B. *Grounding Akademik Ioffe*. Aug 2018.

Clark, Dylan G., Ford, James D., and Tabish, Taha. *What Role can Unmanned Aerial Vehicles Play in Emergency Response in the Arctic: A Case Study from Canada*. PLoS One 13, no. 12: 2018.

Defence Research and Development Canada. Séguin, René. Prepared for DG Air Force Development. *Search and Rescue Squadron Air Crew Manning Study, Preliminary results 413 Squadron*: DRDC – Centre for Operational Research and Analysis: May 2020.

Defence Research and Development Canada. Arseneau, L. and Serré, L. *Search and Rescue Technician Establishment Study*. Scientific Report. DRDC: 2016.

Defence Research and Development Canada. Shiell, Nicholi. prepared for Canadian Joint Operations Command Search and Rescue. *New Planes on the Block - An Assessment of the Newly Acquired CC295s in CONPLAN SOTERIA*. DRDC – Centre for Operational Research and Analysis: Nov 2021.

Ford, J. and Clark, D. *Preparing for the Impacts of Climate Change Along Canada's Arctic Coast: The Importance of Search and Rescue*. Marine Policy 108: 2019.

Government of Newfoundland. Igloliorte, James J. Commissioner. *Public Inquiry Respecting Ground Search and Rescue for Lost and Missing Persons*. Final Report. Nov 2021.

Hradecky, Simon. *Crash: First Air B737 near Resolute Bay on Aug 20th 2011, impacted terrain*: The Aviation Herald: 21 Aug 2011. http://avherald.com/h?article=4419c56e&opt=0.

Huddart, David and Stott, Tim. National Public Health Emergency Collection. *Adventure Tourism in the Canadian Arctic*. PMC PubMed Central: Oct 2019. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7123082

Johnsen, Anne. Siri, Stephen J.M. Trond Vigerust, Sollid. Jystad, Morten. Rehn, Marius. *Helicopter Emergency Medical Services in Major Incident Management: A National Norwegian Cross-Sectional Survey*. PloS One: 12, no. 2. 2017.

Leblanc, Pierre. *Strengthening Canada's Arctic Search and Rescue Capabilities*. The Maritime Executive: 4 Mar 2021. https://www.maritime-executive.com/editorials/strengthening-canada-s-arctic-search-and-rescue-capabilities.

Leroux, Jean G.R. *Canadian Search and Rescue Puzzle: The Missing Pieces*. Canadian Military Journal 18, no. 2: 2018.

Marchesseau, Patrick, Captain. *Report of the SAREX Nearby the North Pole with LE COMMANDANT CHARCOT & Russian, Norwegian, Greenlandic/Danish, Canadian, US SAR*. 2021.

Nilsen, Thomas. The Independent Barents Observer. *Norway's New Arctic SAR-Base Will Have Helicopters in Joint Operation With Svalbard, Eye on the Arctic*: posted 12 Feb 2021. https://www.rcinet.ca/eye-on-the-arctic/2021/02/12/norways-new-arctic-sar-base-will-have-helicopters-in-joint-operation-with-svalbard.

Norway. The Royal Ministry of Justice and Police Department of Civil Emergency and Rescue Planning. *The Norwegian Search and Rescue Services*. 2002.

Norway. *The Main Rescue Center – The Norwegian Rescue Service*. Ministry of Justice and Police. https://www.hovedredningssentralen.no.

Poitras, Dany. Search and Rescue in the Arctic: *Canadian Arctic Operations, 1945–2015: Lessons Learned, Lost, and Relearned*. Edited by Whitney Lackenbauer and Adam Lajeunesse. Fredericton: The Gregg Centre for War & Society. 2017.

Raath-Brownie, Lee. *Norway to Increase SAR Capability in the Arctic*. Published on Linkedin: 26 Feb 2021. https://www.linkedin.com/pulse/norway-increased-sar-capability-arctic-lee-raath-brownie.

Regehr, Ernie and Jackett, Michelle. Senior Fellow in Defence Policy and Arctic Security. *Circumpolar Military Facilities of the Arctic Five*. The Simons Foundation: 2017.

Runge, Claire A., Daigle, Remi M. and Vera, Hausner H. *Quantifying Tourism Booms and the Increasing Footprint in the Arctic with Social Media Data*. PloS One 15, no. 1: 2020.

Struzik, Ed. Yale School of the Environment. *How a Russian Vessel's Grounding Highlights Perils of Arctic Shipping*. Yales Environment 360: June 2021. https://e360.yale.edu/features/how-a-russian-vessels-grounding-highlights-perils-of-arctic-shipping.

Thatcher, Chris. *King of the Northern Skies: The CC-295 Kingfisher*. Skies Magazine: 15 Jan 2021.

The Arctic Institute. Center for Circumpolar Security Studies. *Canada Facts and Figures*. June 2020. https://www.thearcticinstitute.org/countries/canada.

US Department of Homeland Security. Fiscal Year 2017 Report to Congress. *Arctic Search and Rescue*. Mar 2018.

William, Timothy and Smith, James. *Search and Rescue in the Arctic, Is the U.S. Prepared?*. RAND: 2017.