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## The Impact of Climate Change on Search and Rescue in the Arctic

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**Solo Flight**

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**THE IMPACT OF CLIMATE CHANGE ON SEARCH AND RESCUE IN THE ARCTIC**

By Lieutenant-Colonel Scott Frost

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## THE IMPACT OF CLIMATE CHANGE ON SEARCH AND RESCUE IN THE ARCTIC

“Annual and seasonal mean temperatures across Canada have increased, with the greatest warming occurring in winter. Between 1948 and 2016, the best estimate of mean annual temperature increase is 1.7°C for Canada as a whole and 2.3°C for northern Canada.”<sup>1</sup> “Annual and seasonal mean temperature is projected to increase everywhere, with much larger changes in northern Canada in winter.”<sup>2</sup> This warming is resulting in increased activity and opportunities across the arctic to include tourism, shipping and natural resource exploitation.

This paper will focus on the impact of rising temperatures and decreased ice coverage in the arctic region as a result of climate change and demonstrate how these changes will impact the demand for search and rescue in the north. More specifically, this paper will determine whether the impacts of climate change in the Canada will be sufficient to require a change to the Canadian Search and Rescue strategy. Although the arctic is generally defined as latitudes north of 60 degrees, for the purpose of this paper it will encompass everything north of 55 degrees of latitude, to coincide with reporting of SAR incidents in the Federal Search and Rescue Operations Governance Committee Annual Reports.<sup>3</sup>

### Search and Rescue Mandate in Canada

The government of Canada, as participants “in international organizations such as International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO)”<sup>4</sup> has agreed to provide search and rescue services to the international community across

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<sup>1</sup> Bush, E. and Lemmen, D.S., editors (2019): *Canada's Changing Climate Report* (Government of Canada, Ottawa, ON, 2019), 116.

<sup>2</sup> Ibid.

<sup>3</sup> Canada, *Federal Search and Rescue Operations Governance Committee Annual Report 2015*, (Canadian Coast Guard and Canadian Armed Forces, November 2016), 3.

<sup>4</sup> B-GA-209-001/FP-001 (DFO 5449), *Canadian Aeronautical and Maritime Search and Rescue Manual (CAM SAR)*, (Ch3, 31 July 2018), section I-1.3(E),1.

the expansive land and water masses that make up Canada and our maritime approaches. The following conventions are the guiding direction for the Canadian Search and Rescue Program.

- a. Convention on International Civil Aviation;
- b. The International Convention for the Safety of Life at Sea (SOLAS), 1974;
- c. International Convention on Maritime Search and Rescue, 1979; and
- d. The Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic, 2011.<sup>5</sup>

The Canadian Armed Forces' mandate to conduct search and rescue activities in Canada can be linked to the 1986 federal government establishment of the National Search and Rescue (SAR) Program.<sup>6</sup> Within the National SAR Program, the responsibility for aeronautical and maritime SAR is a federal responsibility, while ground SAR is considered a provincial/territorial responsibility.<sup>7</sup> In conjunction with the Canadian Coast Guard, the Canadian Armed Forces jointly execute the mandate to provide aeronautical and maritime search and rescue services on behalf of the Government of Canada.

The latest Defence Strategy “Strong, Secure, Engaged” provides further guidance by stating “The Canadian Armed Forces will conduct aeronautical search and rescue in support of people in distress within its area of responsibility, as well as help coordinate maritime search and rescue alongside the Canadian Coast Guard.”<sup>8</sup> As explained in *Strong, Secure, Engaged*, this area

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<sup>5</sup> Ibid, section I-1.02(E), 1.

<sup>6</sup> Ibid.

<sup>7</sup> The Federal mandate for maritime search and rescue only applies to federal waters. The responsibility for maritime search and rescue in provincial or territorial waters is the responsibility of the respective provinces or territories.

<sup>8</sup> Canada, Department of National Defence, *Strong Secure Engaged: Canada's Defence Policy*. (Minister of National Defence, 2017), 87.

of responsibility encompasses “18 million square kilometres of land and water, more than 243,800 kilometres of coastline, three oceans, three million lakes, as well as the St. Lawrence River system.”<sup>9</sup> A significant portion of this area lies within and around the arctic and is subject to the significant changes occurring due to climate change.

### **Climate Change and the Arctic**

It has been widely reported that climate change is causing significant temperature rise around the world. Nowhere is it more evident than in the arctic. As reported by the National Snow and Ice Data Centre, “over the past 30 years, the Arctic has warmed at roughly twice the rate as the entire globe.”<sup>10</sup> This warming is causing significant changes to the ice coverage as well as changes to the permafrost layers across the arctic. “It is very likely that increased temperatures under all emissions scenarios will result in continued reduction in sea ice area across the Canadian Arctic in summer and the east coast in winter. Most Canadian Arctic marine regions will be sea ice-free for part of the summer by 2050.”<sup>11</sup> The reduction in sea ice is impacting native hunting patterns and increasing the risk associated with these activities, but at the same time it is opening up opportunities across the arctic that have been precluded in the past due to the extensive ice coverage. Although the expectation exists that most waterways in the arctic will be ice free for parts of the summer months by 2050, the authors state that ice flows coming from the regions north of the arctic archipelago will continue to pose risks to marine traffic.<sup>12</sup> The significant reduction in sea ice will create great opportunity in the north. The opening of the northwest passage for longer durations each summer, access to areas historically

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<sup>9</sup> Ibid.

<sup>10</sup> National Snow and Ice Data Centre, *All About Arctic Climatology and Meteorology*, Last accessed 18 May 21, [https://nsidc.org/cryosphere/arctic-meteorology/climate\\_change.html](https://nsidc.org/cryosphere/arctic-meteorology/climate_change.html)

<sup>11</sup> Bush and Lemmen, *Canada’s Changing Climate Report*, 198.

<sup>12</sup> Ibid.

covered in ice year round and more hospitable temperatures for longer durations each year will result in increased tourism, exploration and maritime and air travel. Will this result in a need to change the national SAR strategy?

### **Current Canadian Armed Forces Search and Rescue Structure**

The CAF SAR system is comprised of five Primary SAR units, three Rescue Coordination Centres, a Canadian Mission Control Centre and various commanders responsible for the command and control of the SAR enterprise. The SAR squadrons and their respective aeronautical resources are spread across the lower latitudes of the nation, to include locations in Gander, Newfoundland; Greenwood, Nova Scotia; Trenton, Ontario; Winnipeg, Manitoba and Comox, British Columbia. The three Rescue Coordination Centres are located in Halifax, Nova Scotia; Trenton, Ontario and Victoria, British Columbia.<sup>13</sup> It is from these three Rescue Coordination Centres that “alongside the Canadian Coast Guard, the Canadian Armed Forces responds to more than 9,000 search and rescue calls annually, approximately 1,000 of which result in the launching of search and rescue air assets”<sup>14</sup> from the five SAR squadron locations across the nation. More specifically, in 2019 the Rescue Coordination Centres dealt with 8581 cases<sup>15</sup>, of which the CAF responded with air assets 852 times.<sup>16</sup> In comparison, the five year average from 2015-2019 shows the Rescue Coordination Centres responding to an average of 9339 cases, of which the CAF launched air assets on average 948 times. Within these numbers,

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<sup>13</sup> Canada, *Federal Search and Rescue Operations Governance Committee Annual Report 2015*, (Canadian Coast Guard and Canadian Armed Forces, November 2016), 3.

<sup>14</sup> SSE, 87.

<sup>15</sup> Canada, *Federal Search and Rescue Operations Governance Committee Annual Report 2019*, (Canadian Coast Guard and Canadian Armed Forces, June 2020), table 4, pg 9.

<sup>16</sup> Ibid, table 3, pg 8.

the CAF responded to SAR missions north of 55 degrees of latitude 56 times in 2019, and on average 58 times from 2015-2019.<sup>17</sup>

### **Climate Change and Increased Maritime Traffic**

As previously stated, of the more than 9000 SAR cases per year, less than 1% of these cases occurred north of 55 degrees of latitude and required a CAF air asset response.<sup>18</sup> Numerous sources have stated that the demand for search and rescue in the arctic will increase due to climate change, however it is critical to determine whether the increased demand requires a change to the overall strategy. In *Strong, Secure, Engaged*, the Minister of National Defence states “[c]limate change, combined with advancements in technology, is leading to an increasingly accessible Arctic.” It also states that “[t]oday, state and commercial actors from around the world seek to share in the longer term benefits of an accessible arctic. Over time, this interest is expected to generate a corresponding rise in commercial interest, research and tourism in and around Canada’s northern territory.”<sup>19</sup> Further, SSE states “climate change is transforming the Northern landscape, bringing an evolving set of safety and security challenges, from greater demand for search and rescue to increased international attention and military activity.”<sup>20</sup>

In his article *Arctic SAR is Improving*, retired Colonel Pierre LeBlanc states “open waters have made entrance to the Arctic Archipelago more accessible...the new access has attracted many adventurers and cruise ships in search of new exotic and exciting destinations.”<sup>21</sup> Events of the past five years, as reported by the CAF and the Canadian Coast Guard in their annual report,

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<sup>17</sup> Ibid, table 8, pg 12.

<sup>18</sup> Ibid.

<sup>19</sup> SSE, 51.

<sup>20</sup> SSE, 52.

<sup>21</sup> Pierre LeBlanc, *Arctic SAR is improving!*, March 4, 2021. Last accessed 4 Apr 21, <https://vanguardcanada.com/arctic-sar-is-improving/>

shows an increase in cruise ship activity in the north. In 2016, “the Crystal Serenity cruise ship successfully transited through the Northwest Passage with more than 1,600 people on board.”<sup>22</sup> Since then the presence of cruise ships in the area has increased with 14 cruise ships in 2017, 12 in 2018 and 15 in 2019, as reported in the Governance Committee annual reports.<sup>23</sup> The number of vessels for 2020 will be released in summer of 2021, however due to the impacts of Covid-19 it is expected to falsely represent the reality of what would have occurred without the presence of Covid-19. It can be safely assumed that once the impacts of Covid-19 are over, cruise ships and their passengers wanting to experience the beauty of the arctic will resume in full force.

A more detailed report of the marine traffic in the northwest passage authored by R.K. Headland, demonstrates not only the increase in volume of traffic in the Northwest Passage, but also the change in vessel type. In his paper he provides vessel name, type and route sailed by all 313 vessels which have transited the Northwest Passage from the first ship to do so in 1903 to the last ship to complete the voyage in the 2019 sailing season.<sup>24</sup> Vessels prior to the year 2000 were mostly icebreakers or ice strengthened ships, with only a handful of vessels completing the transit each year. As climate change has continued to reduce the ice, open up the waters and extend the sailing season, the past two decades has seen a significant increase in number of vessels per year as well as a trend towards non-fortified pleasure crafts. In the year 2000, four icebreakers, one catamaran and one yacht made the transit through the passage. In 2010 these numbers increased to 12 vessels, of which eight yachts, one ice breaker, two ice-strengthened ships and one sloop made the transit. In 2019, 24 vessels made the voyage, of which only five

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<sup>22</sup> Canada, *Federal Search and Rescue Operations Governance Committee Annual Report 2016*, (Canadian Coast Guard and Canadian Armed Forces, April 2017), 38.

<sup>23</sup> Canada, *Federal Search and Rescue Operations Governance Committee Annual Report 2019*, (Canadian Coast Guard and Canadian Armed Forces, April 2020), 37.

<sup>24</sup> R.K. Headland, *Transits of the Northwest Passage to End of the 2019 Navigation Season*, 17 March 2020. Last accessed 1 May 21, <https://www.spri.cam.ac.uk/resources/infosheets/northwestpassage.pdf>



were ice-strengthened ships. The 2019 vessels comprised cruise ships, yachts, cargo ships, sloops and cutters.<sup>25</sup> With very simple analysis it becomes obvious that the Northwest Passage is becoming accessible to everyone, not just large commercial operations with heavily fortified or icebreaker type vessels. With increased accessibility will come increased usage, and inevitably increased safety incidents.

Although climate change is resulting in decreased ice coverage and opening up the potential for increased transit through the Northwest Passage, the debate over whether or not it will become a major shipping route in the next couple decades seems to be widely disputed. As stated by Thomas Herrmann, “[w]hen the NWP becomes accessible, it will decrease transit distance for most voyages by at least 7,000 km, compared to going through the Panama Canal or around the tip of South America.”<sup>26</sup> A significant time and cost savings for sure, however the increased risks associated with shallow and uncharted waters, lack of navigational aids and uncertain weather conditions are all factors that are likely to reduce the appeal for large companies to use the Northwest Passage.<sup>27</sup>

Along with the increase in shipping, tourism and exploration, the increased water temperatures will also bring about an increase in fish species and commercial fishing. The Arctic’s offshore Shrimp, Arctic Char and Turbot industries will become more accessible and will consequently create an increase in fishing vessel traffic. As can be seen in the Annual Governance Committee Reports from 2015-2019, a significant portion of the SAR missions in

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<sup>25</sup> Ibid, 12.

<sup>26</sup> Thomas Herrmann, *Shipping Through the Northwest Passage: A Policy Brief*, 27 June 2019. Last accessed 26 May 21, [https://jsis.washington.edu/news/shipping-through-the-northwest-passage-a-policy-brief/#:~:text=The%20Northwest%20Passage%20\(NWP\)%20is,from%20Asia%20to%20North%20America](https://jsis.washington.edu/news/shipping-through-the-northwest-passage-a-policy-brief/#:~:text=The%20Northwest%20Passage%20(NWP)%20is,from%20Asia%20to%20North%20America).

<sup>27</sup> Auditor General of Canada, “2014 Fall Report of the Commissioner of the Environment and Sustainable Development: Marine Navigation in the Canadian Arctic”: 2. Last accessed 20 May 21, [https://www.oag-bvg.gc.ca/internet/English/parl\\_cesd\\_201410\\_03\\_e\\_39850.html](https://www.oag-bvg.gc.ca/internet/English/parl_cesd_201410_03_e_39850.html)

Canada involve fishing vessels off the eastern coast of Canada. The impact of climate change will allow these vessels to venture further and further north, therefore increasing the demand for SAR in the arctic waters. Conducting medevacs from commercial fishing vessels is a very challenging task on the best of days, let alone the increased complexity of operating in the arctic with potential total darkness towards the end of the summer fishing season, high winds, and long distances from available infrastructure.

### **Climate Change and the Increased Aviation Traffic**

Linking climate change to aviation incidents requiring a SAR response is much more difficult than linking climate change to the impact on maritime incidents. As tourism and commercial ventures continue to grow across the arctic, the demand for air transport will increase proportionally. This will be seen in both commercial airline travel as well as with private and corporate aviation.

In 2016, Nav Canada, the corporation charged with providing Air Traffic Control services across Canada, published usage data showing “Air traffic operating on polar routes has shown a marked increase over the years, increasing 15-fold between 2003 and 2015. In 2016, over 14,000 flights used the polar routes.”<sup>28</sup> As airlines continue to search for ways to improve efficiencies, meet climate goals and reduce greenhouse gas emissions, the use of polar routes to achieve these objectives will likely continue to increase.

The increased tourism and exploration, which can be linked to the effects of climate change, will cause an increased demand for aviation in the north. Similar to any economic

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<sup>28</sup> Nav Canada, Polar Routes: Past, Present and Future, (27 April 2017). Last accessed 18 May 2021. <https://www.navcanada.ca/en/news/blog/polar-routes--past-present-and-future.aspx>

model, the increased tourism will contribute to increased need for infrastructure and supply chains to support the growing demand. This will cause a proportional increase in air traffic due to the inability to resupply the arctic using traditional land routes. It can be expected that marine re-supply will be used to the max extent possible, however that will only be possible during the summer months with open water access.

### **Search and Rescue: A Numbers Game**

The demand for search and rescue can be directly correlated to population and activity level. With climate change causing a warming of the north, we have seen an increase in transient activity levels but also a gradual increase in the population of the northern territories. According to the 2016 Canadian census “[t]he three northern territories were home to just over 113,600 people in 2016, representing 0.3 per cent of Canada’s more than 35 million inhabitants.”<sup>29</sup> The 2016 census also shows a growth rate in the northern territories of 5.6 per cent, which is slightly higher than the Canadian average of 5 per cent.<sup>30</sup> Although the growth rate is exceeding the national average, natural population growth in the northern territories will not be sufficient enough reason to change the National SAR strategy. With only 1% of the current SAR responses linked to the arctic, a drastic population growth across the arctic would be required in order to justify a change to the SAR strategy based on natural population growth.

As demonstrated in Headlands summary of vessels to conquer the Northwest Passage, the activity level is consistently increasing year over year. Research, natural resource exploration,

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<sup>29</sup> Levon Sevunts, Census 2016: Nunavut leads Canada’s population growth, (Radio Canada International, 8 Feb 2017). Last accessed 16 May 2021. <https://www.rcinet.ca/eye-on-the-arctic/2017/02/08/census-2016-nunavut-leads-canadas-population-growth/#:~:text=Canada's%20Arctic%20territory%20of%20Nunavut,census%20data%20from%20Statistics%20Canada.&text=In%20Yukon%2C%20the%20population%20increased,compared%20to%2033%2C897%20in%202011>

<sup>30</sup> Ibid.

shipping and pleasure crafts will all contribute to an increased activity level in the north, thanks to the impacts of climate change and the opening of the waters. “The surge in human, maritime, and aeronautical traffic alone would be enough to constitute an increase in demand for SAR services, but northern extraction operations further swell the need for this service.”<sup>31</sup> It is however very difficult to determine the how quickly and to what extent the activity level will increase. To further complicate the issue, safety standards and policy will significantly impact the likeliness of vessels or aircraft getting into distress and requiring a search and rescue response.

As mentioned earlier in this paper, the Canadian Armed Forces, in conjunction with the Canadian Coast Guard, are responsible to coordinate and execute the response for all aviation and marine incidents within the Canadian Area of Responsibility. As the northern waters of Canada continue to become more and more accessible and areas further north start to open up, the response to incidents becomes more difficult. Fixed wing aircraft are able to conduct searches and deploy Search and Rescue Technicians to provide immediate casualty first aid, however the recovery and rescue of the technicians and the victims becomes more and more difficult the further north it is. A variety of means are used to conduct rescues, but in general it is either a vessel or helicopter that completes the rescue mission. Although vessels can reach great distances self-sustained, their speed is slow, which often impacts survivability of severely injured patients. They do however provide the capability of launch and recovery of helicopters from their deck, which has been used many times in the past to complete the rescue portion of mission. With strategically positioned fuel caches, helicopters can reach great distances. This

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<sup>31</sup> Brynn Goegebeur, “Canadian Arctic Search and Rescue: An Assessment”, (Major Research Paper, University of Ottawa, 2014), 19 November 2014. Last accessed 26 May 21  
<https://ruor.uottawa.ca/bitstream/10393/31976/1/GOEGEBEUR,%20Brynn%2020149.pdf>

approach has good potential, however it is only feasible for the portion of the AOR that is covered in land, and not the vast expanse of water that is opening up north of the Northwest Passage.

## **Recommendations**

With limited resources to conduct search and rescue in Canada, the decision on whether or not to alter the national search and rescue strategy will need to be based on factual evidence of an increased requirement. The statistical analysis reported in the Federal Search and Rescue Operations Governance Committee Annual Reports from 2015-2019 do not indicate a trend of increased demand for SAR in the near term, however this should be closely monitored in order to identify positive trends in the future. Based on Canada's Changing Climate Report and the prediction that by 2050 the waters surrounding the Northwest Passage will be fully open for extended periods in the summer, the need for increased search and rescue capacity in the north will occur, however the exact timeline of the increased demand will be influenced by multiple factors and not just climate change.

In the short term it is recommended that the Government of Canada implement specific policies to help minimize the potential for mass casualties associated with cruise ship travel in the arctic. Policies such as buddy tourism requiring two cruise ships to travel together in order to provide self-rescue capabilities could significantly reduce the burden on the CAF and should be considered as a safety policy. This same policy could be implemented for shipping vessels in order to provide a self-rescue capability.

Specific opening and closing dates for transit through the Northwest Passage would also allow the CAF and the Coast Guard to manage the search and rescue requirements through

strategically scheduled training and support missions. Scheduled training events in the arctic during the open transit dates would allow for an improved response without the requirement for permanent change to the search and rescue strategy. A strategically placed Coast Guard vessel and helicopter within the passage and a fixed wing Canadian Armed Forces SAR aircraft in a location such as Resolute Bay during the open transit season would allow for a significantly improved response time, while concurrently providing training opportunities and exposure for the search and rescue crews.

The Royal Canadian Navy and their new Arctic Offshore Patrol Ships (AOPS) should also be integrated into the National Search and Rescue Strategy. With the ability to carry either a CH-148 Cyclone, or the standard CH-149 Cormorant Search and Rescue helicopter, the AOPS could be an excellent operating base from which to launch search and rescue missions deep into the arctic waters where limited infrastructure will hamper normal operations. The multi-role rescue boat which is integral to the AOPS design will also provide quick response capability to reach stranded victims in smaller or shallower bays along the miles of coast line throughout the arctic.<sup>32</sup>

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<sup>32</sup> Canada, RCN\_AOPS\_FactSheet – 8X11, Last accessed 26 May 21, [http://www.navy-marine.forces.gc.ca/assets/NAVY\\_Internet/docs/en/rcn\\_aops\\_factsheet-8x11\\_web.pdf](http://www.navy-marine.forces.gc.ca/assets/NAVY_Internet/docs/en/rcn_aops_factsheet-8x11_web.pdf)

## **Conclusion**

Climate change and its' impact on the arctic is becoming more and more evident as highlighted in Canada's Changing Climate Report. Over time these changes will allow for increased activity in the north, and consequently result in an increased demand for search and rescue services. The change in demand will be proportional to the increased number of days in which the waters surrounding the Northwest Passage are ice free each year as well as the increased activity level, both maritime and aviation related. The timeline for this increased demand is still unknown, however based on the predictions of Canada's Climate Report, it could be expected that significant increased demand will start to occur between 2035 and 2050. Changes to the SAR strategy are not currently required, however as time evolves and the impacts of climate change on the arctic become more pronounced, a shift to the strategy in the 2035-2050 will be required.

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