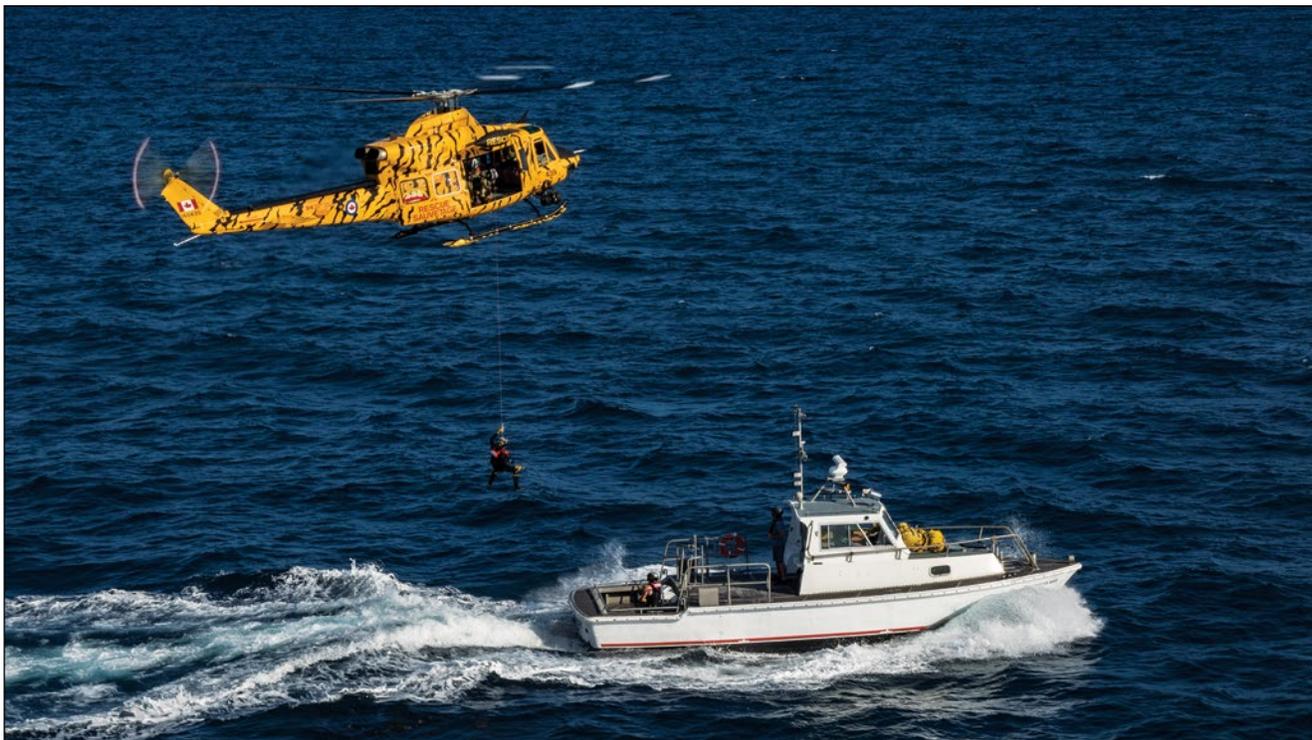


DND photo CK04-2017-0082-014 by Corporal Bryan Carter



A Search and Rescue technician is lowered from a CH-146 *Griffon* helicopter onto a simulated vessel in distress off the coast of Miami, Florida, during Exercise *Southern Breeze*, 8 February 2017.

In Need of Rescue: Canadian Search and Rescue Policy

by James Pierotti

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Introduction

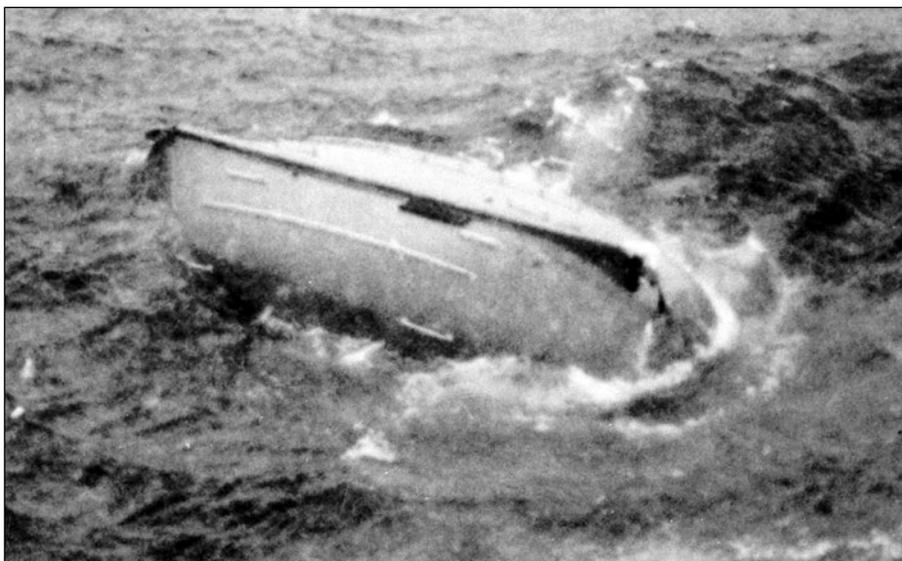
On 14 February 1982, a brutal winter storm bore down on a region of the North Atlantic Ocean near Newfoundland known as the Hibernia Oilfields. The oil rig *Ocean Ranger* was one of several platforms in the area, battered by 160 kph winds and waves nearly four stories tall.¹ By 1:10 am on the 15th, and for reasons beyond the scope of this argument, the *Ocean Ranger* was listing badly and the crew started sending out Mayday calls. A mere 20 minutes later, the radios went silent as the last crew members abandoned to life rafts. Despite a large search and rescue (SAR) response later that day, all 84 lives onboard were tragically lost to the cold and cruel sea.

The disaster shocked the nation, and the government of Pierre Elliot Trudeau immediately responded with a royal commission that, among many recommendations, identified necessary changes to the SAR system in Canada. The most important of the changes to the SAR system was the 1986 National SAR Program (NSP).² The NSP established a national coordinating authority for SAR policy in Canada called the National SAR Secretariat (NSS), which aimed to ensure that Canada would be better prepared for future SAR incidents of the magnitude of the *Ocean Ranger*. The NSS was to assist the lead minister for SAR, the Minister of National Defence, with formulating future policy for aeronautical and maritime emergencies. The NSP and associated changes promised a robust framework for the development of effective federal SAR policy in Canada.³

Over the three decades since, however, the promise of effective policy was not delivered. The well-regarded operational capabilities of the Canadian Coast Guard and the Royal Canadian Air Force (RCAF) masked the NSP's lack of effectiveness. A brief analysis of the NSP will be presented that finds a SAR policy gap and shows recent efforts to fix the framework that may resolve the systemic weaknesses. However, even as the gap is closed, hidden problems fester in the current delivery of the operational SAR service by the RCAF's joint rescue coordination centres (JRCCs) and aircrew.



The *Ocean Ranger* semi-submersible drilling platform, 16 February 1982.



An overturned lifeboat from the *Ocean Ranger* on high seas off the coast of Newfoundland, after the rig sank in a storm, killing 84.

Specific examples will highlight the types of operational concerns that were hidden in the policy gap until recently, and it will be clarified how policy can resolve each concern. Throughout, it will be argued that the NSP policy gap has allowed serious problems to develop specifically within the RCAF's operational delivery of SAR services, and solutions will be suggested to assist in the ongoing effort to rescue the Canadian SAR framework.

Finding the Policy Gap

The policy framework and the amount of resources assigned to the delivery of federal aeronautical and maritime SAR services in Canada have remained surprisingly static since the development of the NSP in 1986.⁴ Operationally, the number of SAR missions managed per year has not increased, and the assigned geographical area of Canadian coverage has not changed markedly in decades, so there has been no real impetus for close scrutiny of a system that has largely proved successful.⁵ Arguably, the few steps forward after the *Ocean Ranger* tragedy were hastily assembled, and the NSP process has failed to work effectively for recent governments.

The NSP's intended scope of the federal portion of the Canadian SAR system was to impose the pillars of *prevention* and *response* upon distress incidents of maritime vessels in Canada's oceans and Great Lakes, and upon aeronautical incidents anywhere within Canada's area of responsibility.⁶ The magnitude of the area is depicted in Figure 1, and it can be put into perspective by knowing that a SAR CC130 Hercules flight from Trenton, Ontario, to the Northern tip of Ellesmere island takes over eight hours of flight time before the Hercules can even commence search efforts.⁷ It can take a helicopter over a day to reach some of the farthest points North for rescue efforts, and SAR helicopters cannot reach all parts of Canada's oceanic areas. SAR response can take a very long time when someone is in distress, and policy determines how an incident is investigated and searched, which is why the effectiveness of the NSP is so fundamental to the SAR service provided for the Canadian public.

Associated Press/Image ID 8202161189

Associated Press/CP Images 04712650

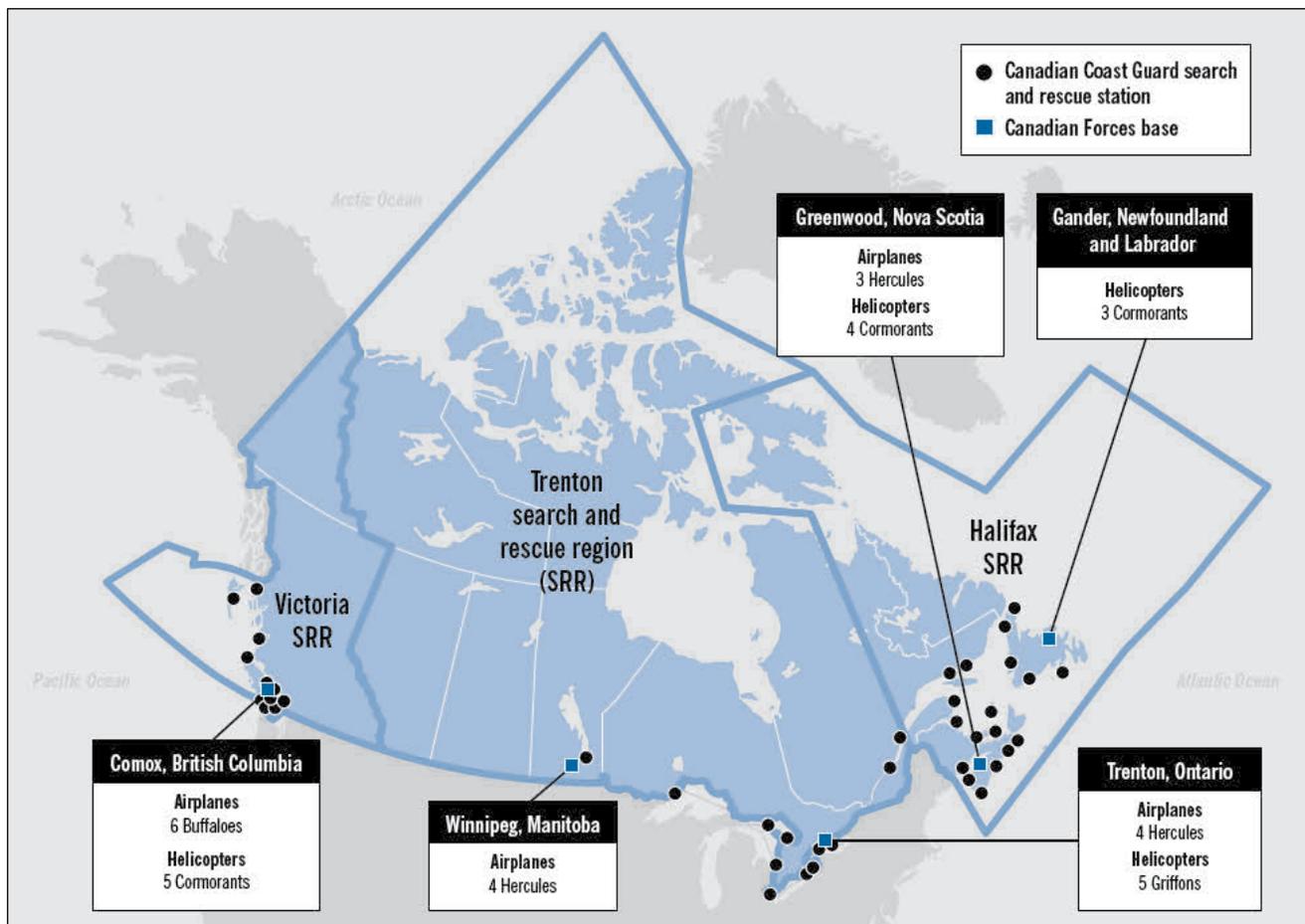


Figure 1: Locations of Canada's search and rescue stations and bases.⁸

The objective of the NSP was “to prevent loss of life and injury through search and rescue alerting, responding and aiding activities ...” and at the time it was believed that provincial and federal areas of SAR responsibility were generally well-defined.⁹ It is important to note that provinces and territories are still responsible for ground SAR and maritime rescue in provincial lakes, which have limited the amount of rescue activity required from RCAF and Canadian Coast Guard federal resources. However, the limits are not as separate as one might imagine, and provincial and territorial partners are largely left out in the cold for most deliberations of federal SAR policy.¹⁰ Even with the limits, there are still numerous Government of Canada departments that must remain aligned for federal SAR services. Leading this alignment, the Department of National Defence (DND) was responsible for the effective operations of the coordinated aeronautical and maritime SAR system in Canada.¹¹

In order to ensure effective alignment between federal departments, the NSP reconfirmed the lead Minister for SAR, the Minister of National Defence, as the “single spokesperson for the government on overall SAR matters.”¹² An Interdepartmental Committee on Search and Rescue (ICSAR) and the NSS supports the lead minister. ICSAR is formed of senior personnel from the Canadian Armed Forces (CAF), Fisheries and Oceans, Parks Canada, Public Safety Canada, the Privy Council Office, and many others in the federal government. The role of ICSAR

is “to provide interdepartmental coordination and advice to the ministers in the areas of SAR policy, planning, resources, and effectiveness.” Complementing ICSAR, the NSS was created to play “a central managerial support role” in defining national SAR objectives and to advise the lead minister for SAR on policy, planning, resources and effectiveness. Together, ICSAR was to identify problems, the minister was to provide government direction for federal SAR policy changes, and the NSS was to write the policies and coordinate the procedures between the applicable departments to enable the solutions.

If one accepts that provincial and territorial partners are not required for developing federal SAR policy, the system described above should work well. In effect, it appears that all the right federal organizations have a say in SAR policy development; there is a clear process for advising the government and for receiving a clear answer from one individual in Cabinet, and the NSS is assigned to follow up with policy and coordination. The NSP should have been successful.

However, there were signs pointing to a lack of effective coordination, which will be described momentarily. It is likely that the root of the coordination problems lies in the failure of the NSS to develop “an overall federal policy, planning framework, clear statement of expectations for federal SAR services, or ability to measure overall federal SAR effectiveness.”¹³ In the absence of a

formal policy provided by the NSS, CAF and the Canadian Coast Guard refined their existing *National SAR Manual* to capture the international direction governing SAR requirements in Canada and to present common procedures, techniques, and terminology for maritime and aeronautical SAR operations.¹⁴ The manual did not provide policy principles, common priorities, service requirements, or standards because NSS was responsible for a national performance measurement framework that was never delivered, and therein lies the beginning of the gap.¹⁵

To be fair, the NSS was not in an ideal position to create the necessary policy. The NSS was an entity within DND, and it reported directly to the Minister of National Defence.¹⁶ It made efforts to build relationships with other federal organizations and non-federal agencies, but DND narrowed its focus to delivering aeronautical SAR services and to assisting the Canadian Coast Guard in maritime SAR cases rather than the previous assumption of DND responsibility for all federal operational SAR matters.¹⁷ The NSP had envisaged a SAR policy framework existing within the leadership of DND, but that framework no longer appeared to be necessary, wanted, or functional.

An obvious example of the gap was the lack of updates to the policy contained in the *National SAR Manual*. It was last updated in 2000, and it was replaced in 2014 with the remarkably similar *Canadian Aeronautical and Maritime Search and Rescue Manual (CAMSAR)*.¹⁸ In the new CAMSAR, investigative procedures for JRCCs remained nearly identical, and only minor changes were made to search policies for RCAF aircraft. At the risk of oversimplification, it took 14 years to change the manual's format and to make minor changes to Canada's only SAR policy document. There was negligible policy progress during this time.

The lead minister for SAR and the ICSAR meetings are two other areas where reality was not living up to the promise of the NSP. Even though it is not clear when the lead minister for SAR function in government ceased, it has not been a function used by government for some time, and departments have been left to coordinate policy with other organizations on their own.¹⁹ In fact, a 1999 NSS report stated that there was no evidence of issues or advice ever passed from ICSAR to the lead minister for SAR.²⁰ Perhaps the lack of ministerial direction explains why ICSAR only met once in the three years before 2015, as direction from Cabinet was no longer provided by one minister and the NSS was not able to provide the necessary policy follow-through required as a result of any agreement reached by ICSAR and federal department's leadership.²¹ What is clear is that the NSP was coming undone and a new process was required to prevent a policy gap big enough for another disaster.

Fixing the Framework

Change came in the form of the spring 2013 Report of the Auditor General of Canada. This scathing report outlined detailed coordination problems among the federal organizations responsible for SAR, and the criticisms were subsequently confirmed by a DND report on its role in national SAR.²² By the summer of 2015, the Canadian government had acted upon the criticism and the NSS, along with the NSP, was transferred to Public Safety Canada.²³

Public Safety Canada may prove to be an ideal department for the overall coordination of SAR policy in Canada because it has expertise in coordinating among various government organizations as well as a history of coordination between federal, provincial, and territorial partners.²⁴ Arguably, that coordination was sadly lacking in recent years and could well have been responsible for the gradual decline of ICSAR's effectiveness prior to 2015. Since the transfer, however, ICSAR has met at least six times to identify problems, to resolve them, and to develop a new SAR framework.²⁵

ICSAR now reports to Public Safety Canada.²⁶ Although there is no formal direction appointing a new lead minister for SAR, that role now belongs—for all intents and purposes—to the Minister of Public Safety and Emergency Preparedness.²⁷ There is, once again, a 'belly button' in Cabinet, so to speak, for all matters relating to the overall delivery of federal SAR

services. Another promising sign is the acknowledgement that the existing pillars of *prevention* and *response* overlooked the importance of *preparedness*, which had placed a disproportionate SAR policy emphasis on the operational response from CAF and the Canadian Coast Guard.²⁸ The coordinated preparation for the future needs of SAR is the missing piece that may connect the government's policy on federal SAR activities with the operational delivery of the SAR service, including provincial and territorial authorities. The value of preparation will be highlighted in the upcoming discussion on problems remaining in the policy gap.

It should now be clear that the NSP's initial focus on the Minister of National Defence leading federal SAR activities was an overly narrow approach that failed to work for the Canadian government at the highest levels. It took the Auditor General to initiate change, but the work completed by Public Safety Canada so far is very promising. A significant reason for optimism is that modernizing the SAR framework is not resulting from a major disaster where solutions were required quickly; it is resulting from internal analysis and current operational effectiveness to provide a well-researched and well-thought-out new framework. As improvements are not being made under public duress, a new policy framework may prove more durable over the years to come.

“Although there is no formal direction appointing a new lead minister for SAR, that role now belongs – for all intents and purposes – to the Minister of Public Safety and Emergency Preparedness.”



DND Photo IS03-2016-0035-004 by Master Corporal Pat Blanchard

A Search and Rescue technician jumps from a CH-149 *Cormorant* helicopter into a lake during the National Search and Rescue Exercise (SAREX 2016) in Yellowknife, Northwest Territories, 21 September 2016.

Problems Hidden in the Policy Gap

Improvements are well underway for SAR policy. However, serious problems developed in the policy gap, and they need to be outlined, reviewed, and repaired before the new framework is fully implemented. Specifically, discussion will clarify that policy has not kept up with telecommunications and search improvements needed for the Canadian public's use of cellular phones and the global positioning system (GPS). The JRCC's investigative searches need to have the ability to locate distressed callers, whether they are phoning from landlines or mobile cellular phones. Additionally, the prolific use of GPS in the maritime and aeronautical environments, and other related technological advances, require significant upgrades to search policies. Improvements in these two areas will close the remaining operational gap and enable the federal SAR partners to maintain success in any new national SAR framework.

One of the most significant problems in the policy gap is the inability of JRCCs to locate people in distress using telecommunications. This inability is important because the three JRCCs in Canada prosecuted 9,172 SAR incidents in 2014, and they require the distress locations quickly.²⁹ Currently, coordinators rely on information obtained from the caller rather than an automatic provision of caller location. The only policy on telecommunications requirements in JRCCs, however, is that all conversations

on operational communications lines shall be recorded, kept, numbered, and dated.³⁰ It has been left to JRCCs to determine if more robust communications requirements are needed and to implement any new requirements without supporting policy.

One of the subtleties of the JRCC's placement on military bases is that the base telephone exchange system does not always synchronize phone number information between military and civilian phone exchanges. Practically, this has serious implications.

Many numbers would not register on call display from outside the military exchange, and even numbers that did, could not be accessed if the call terminated prior to the Coordinator writing down the number. As an example; a boater in the water screaming for help into a cell phone would not receive assistance if location [and] the phone number were not passed [to the coordinator] before the call terminated.³¹

In 2011, JRCC Victoria initiated a telecommunications upgrade from the military phone exchange to a civilian system, which resulted in the ability to automatically acquire the phone number of every caller.³² The following year, JRCC Halifax put in place a more refined version of the new system.³³ However, and for reasons unknown, JRCC Trenton has not yet followed the example of the other JRCCs.³⁴ The practical reality of insufficient policy is that Canadians receive different levels of SAR investigative service across the country.

An interim solution is to upgrade JRCC Trenton to the new Victoria and Halifax JRCC standard, but more work on telecommunications is required. For example, the new CAMSAR does not address a JRCC need to locate cell phones of distressed callers, even though there are now 30,045,817 mobile phone subscribers in a population of 36,155,487 in Canada, meaning 83 percent of all Canadians have a cell phone in their pockets that emergency management agencies can use to locate individuals in distress.³⁵ In fact, a 2009 policy developed by the Canadian Radio-Television and Telecommunications Commission mandated that all Canadian wireless service providers had to implement a method to determine the location of every individual calling 911 from a cell phone, and to ensure that the 911 centre was given a location within 30 seconds.³⁶ Therefore, there are existing ways in which JRCCs can acquire the location of distressed people calling emergency-service phone numbers.³⁷

However, because JRCCs do not receive most calls through 911 centres, it is quite complicated for a JRCC to acquire a cell phone location.³⁸ While it is likely that all three JRCCs have a procedure to acquire mobile caller information from Canadian cellular service providers, only JRCC Victoria currently has a procedure outlined in their standard operating procedures (SOP).³⁹ Arguably, the complicated nature of obtaining location information means that the procedure is not used very often or, put another

way, as often as would be desired by coordination personnel.⁴⁰ There is not enough data available to determine how many times the caller location would assist SAR investigations, but if JRCCs could acquire caller locations quickly and more often, then SAR investigations would be considerably streamlined to provide a better service.

“JRCC integration into 911 telecommunications would undoubtedly result in a very robust improvement of federal SAR investigations across the country.”

Now that Public Safety Canada is responsible for SAR policy development, consideration should be given to developing a policy that incorporates JRCCs into the next-generation 911 service planned to integrate provincial, territorial, and municipal governments.⁴¹ This incorporation may not be as challenging to implement as may appear; fire halls on military bases are already connected to the 911 service, and it is quite possible that the same service can be extended to the JRCCs.⁴² As 98 percent of Canadians have access to 911, the time may finally be right to integrate federal, provincial, and territorial emergency management frameworks with a coordinated policy.⁴³ JRCC integration into 911 telecommunications would undoubtedly result in a very robust improvement of federal SAR investigations across the country.

The other area where policy has not kept up to technological advances is in search policies for RCAF aircraft, and a recent announcement by the Trudeau Government has made it critical to review those policies now. The Canadian government will purchase



DND photo CX2013-0088-40 by Private Dan Moore

Royal Canadian Navy Search and Rescue Launch 64 cruises past HMCS *Edmonton* during a search and rescue exercise held off the coast of Prince Rupert, BC, 30 April 2013.

16 C295W aircraft from Airbus Defence and Space to replace the current fixed-wing SAR capability provided by the CC130 *Hercules* and the CC115 *Buffalo*.⁴⁴ The C295W is far superior to the *Buffalo* and it is a better aircraft than the *Hercules* in many respects, but it transits slower than the *Hercules* by 45 knots, which means that search efficiency is needed for the new SAR aircraft to arrive at distress locations as quickly as the *Hercules*.⁴⁵

An example of a SAR aircraft search policy that needs updating is the Canadian Search Area Definition for missing aircraft.⁴⁶ Since the definition became policy in the late 1980s, the use of GPS has become widespread, and an operations research scientist conducted a study in 2010 to determine if there was a discernible change in the pattern of crash data obtained over the 2003 to 2010 period.⁴⁷ In order to ease the passage of any potential change in policy, it was decided to use the exact same methodology as the study that created the Canadian Search Area Definition. The conclusion was definitive; “more crashes fall within Area One alone, than were previously covered by Area One and Two combined.” Without going into detail about each search area, the new data made it clear that the overall search area assigned to RCAF aircraft could easily be reduced while achieving a higher rate of confidence that the search object would be within the new assigned area. Despite the clear data and same methodology, the search area policy has not changed.

The importance of updating search policy is to ensure that RCAF aircraft arriving at an incident location are assigned the smallest search area required. By searching a smaller area with the same or higher probability that the search object is in the area, lives may be saved, and that is precisely why the research suggestion should inform operations. In fact, searching a smaller area for ongoing missions falls under the authority of the SAR region commander in charge of a JRCC, and in at least one SAR mission, a smaller search area was assigned because the area would have otherwise taken well over a week in life-threatening mountain weather.⁴⁸ Searching a smaller area in that mission meant a greater possibility that survivors might have been found and it reduced risk to the search crews by limiting their flying time in difficult conditions. Again, the lack of updated SAR policy means that differing standards are emerging across the country.

One last example of search-policy problems is the long-standing RCAF focus on visual search techniques on aircraft. Currently, the aircrew on board a SAR aircraft conducting a search will set up spotter rotations so that there is always someone visually searching both sides of the aircraft from large windows made for that purpose.⁴⁹ If an item of interest is spotted, the aircraft will circle until the spotter can confirm whether or not the item of interest is the search object. This tried-and-true method works very well over land, but it does not always work sufficiently over water, as can be imagined in the following case.

On 2 August 2010, four men onboard the vessel *Qualicum Rivers 9* failed to return from a charter-fishing trip on the west coast of Vancouver Island. In this case, the vessel’s failure to return was reported late in the day, and fog and cloud cover closed in,

thus hampering visual search efforts throughout the six days of searching. The SAR CC115 *Buffalo* resorted to finding contacts on its weather radar, and the CH149 *Cormorant* could only view the area right underneath the aircraft.⁵⁰ The CP140 *Aurora* aircraft was required to use its advanced sensors to locate objects in the water and to determine if any of the objects located might have been part of the missing vessel.

As the search went on, it became clear that electronic searching from aircraft located many items, but it was not always possible to determine if these items were the search object.⁵¹ To make matters worse, the winds and currents expanded the search area so quickly over the first five days that searches had to be conducted in American waters hundreds of miles from the vessel’s last known position. As an insufficient number of search vessels were available to check out each object located by aircraft, or the vessels were not close enough to proceed to the location in a timely manner, some of the unidentified objects were left unresolved. Electronic searches like the one described above are relatively rare, but coordination between RCAF aircraft and vessels searching in bad weather needs policy improvement.

To conclude our sad story of the missing vessel, it was located on the fifth day, and the sixth day was devoted to searching shorelines in the area for possible survivors. Tragically, the vessel was found overturned with men’s pants tied around the leg of the outboard motor as a makeshift flag to help spotters. The sad reality was that the cold water temperatures reduced the survival time of the four men to no more than 13 hours, meaning that the men had already succumbed by the first full day of search efforts.⁵² They were not found.

“The technology to conduct searches for cell phones is not new; it is in current use by law enforcement authorities in the United States.”

Better use of electronic searching would not have changed the outcome of this particular case, but better use of electronic searching to supplement visual searches may save lives in the future. The new C295W will include electro-optic and infrared sensors, and the improved poor-weather search ability means that electronic searches are going to be conducted by SAR aircraft more often.⁵³ Another interesting line of investigation from the tragedy outlined above was that all four men had carried cellular phones, and efforts were made to determine if a location was available from the cellular service provider.⁵⁴ Even though the service providers had been unable to assist in this case, if phones in future cases remain functional after a distress incident, the missing object and people might be found if search aircraft have a means to locate the cell phone. Consideration needs to be given to electronic-search policies that can enable search aircraft to locate cellular phones carried by missing people.

Surprisingly, there has been very little research conducted on the use of electronic searching for cell phones during SAR missions.⁵⁵ As discussed earlier, cell phones are now carried by the majority of people in Canada, and search policy and RCAF aircraft search equipment should make use of the signals emitted by cellular phones. The technology to conduct searches for cell phones is not new; it is in current use by law enforcement authorities in the United States.⁵⁶ Indeed, the technique is fairly simple. A device in a search aircraft emits a cell phone tower

signal that activates a dormant cell phone and causes it to contact the search device, after which time the device can determine the cell phone's location.⁵⁷ New policy to incorporate cellular phone searches could prove highly beneficial for the C295W aircraft and would help take the search out of search and rescue.

In summary, there are telecommunications problems in the JRCCs and there are better ways to do business for RCAF SAR aircraft. Resolving these problems, which do not appear to be difficult, would eliminate the policy gap brought on by an ineffective NSP. As the RCAF begins to bring on a new SAR aircraft that will take a little longer to reach a search area, now is a good time to close the policy gap.

Conclusion

The NSP and the NSS were long overdue when the Canadian SAR framework was formalized in 1986. Unfortunately, the duress created by the *Ocean Ranger* disaster meant that the government enabled the NSP and NSS without first determining if the needs of the provinces and territories fit within the federal SAR construct. As the operational SAR lines became blurred between federal and other levels of policy, the NSS lost effectiveness, the role of minister for SAR dissolved, and ICSAR stopped meeting regularly. Aided by DND limiting its involvement to aeronautical SAR responsibilities, the NSP drifted into irrelevance and policy became badly outdated.

Fortunately, the recent transfer of SAR to Public Safety Canada is likely to provide a long-term solution for the SAR

policy framework in Canada. The now-regular ICSAR meetings are an important first step in closing the policy gap and developing a framework that should ensure long-term effectiveness of the Canadian SAR service. However, there are still problems evident in JRCC telecommunications and in specific search techniques that keep the policy gap wide enough for another disaster.

The *good* news is that the solutions are largely straightforward. Public Safety Canada needs to look at the possibility of a next-generation 911 policy that can incorporate the JRCCs' telecommunications needs. ICSAR needs to look at search policies for aircraft to ensure that the search area definitions are supported by recent research. Finally, the RCAF needs to conceptualize the requirement for electronic cell phone searching from RCAF SAR aircraft to inform new policy solutions. These efforts are owed to the Canadian public.

In closing, effective policy is crucial to the operational SAR service. However, ineffective and outdated policy has left the JRCCs with inadequate tools for the technological characteristics of Canadians in distress. It cannot be said that people have died because of the problems, but the frightening reality is that it is impossible to know if or how many people have lost their lives because of inadequate telecommunications and search policies. Despite the promise of a new national framework, Canadian SAR policy is still in need of rescue.



DND photo BN07-2017-0500-006 by Corporal Gary Calvé

A Search and Rescue technician is raised from the water to a CH-146 *Griffon* helicopter during a simulated evacuation off the coast of Miami, Florida, during Exercise *Southern Breeze*, 14 February 2017.

NOTES

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5. Mowbray, p. 23; and Canadian Armed Forces and Canadian Coast Guard, *Federal Search and Rescue Operational Governance Committee Annual Report 2014* (Ottawa: Canadian Joint Operations Command, March 2015), p. 1.
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7. This information is based upon the author's experience onboard the SAR CC130.
8. Michael Ferguson, "Report of the Auditor General of Canada – Spring 2013", Chapter 7, Exhibit 7.3.
9. There is an edition of the National SAR manual, circa 1988, that is available on the Internet at <http://www.cap-es.net/zips/cansarman.PDF> (accessed 24 February 2017), p. 1.
10. National Defence, *CAMSAR*, Section I-1.05.
11. *Ibid.*, Section I-1.06.
12. All the information for this paragraph comes from *Ibid.*, Section I-1.05.
13. Ferguson, "Report of the Auditor General," Item 7.94.
14. *Ibid.*, Item 7.95.
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17. Department of National Defence, Chief Review Services, "Evaluation of the DND/CAF Contribution to the National Search and Rescue Program, January 2015," Document 1258-216 (CRS), pp. iv-vii.
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20. Maj Jenn Weissenborn, "Mind the Gap: The Ground Truth Behind an Optimized National Search and Rescue System," Canadian Forces College, 2016, p. 67.
21. Telephone conversation with Lawrence Conway, Manager Search and Rescue Transition Team, at Public Safety Canada, at 1pm 7 February 2017. Note that the implied criticism of the NSS is the opinion of the author and not the opinion of Mr. Conway.
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33. 1 Canadian Air Division, *JRCC Halifax Standing Operating Procedures*, February 2015, pp. 103, 137, 139.
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36. Timothy Denton, Canadian Radio-Television and Telecommunications Commission, *A Report on Matters Relating to Emergency 9-1-1* (Ottawa: 5 July 2013).
37. Legislation in Canada allows the phone number, location, and recent call history to be released to JRCCs, provided the distressed caller uses a JRCC emergency number.
38. The JRCCs advertise unique emergency numbers for each centre, and SOPs suggest there is no data transfer from 911 centres at present.
39. The SOPs of all three JRCCs, provided by 1 Canadian Air Division, were scanned for these procedures.
40. 1 Canadian Air Division, "JRCC Victoria Standard Operating Procedures, July 2012," pp. 43-44.
41. Canadian Radio-Television and Telecommunications Commission, Telecom Regulatory Policy CRTC 2014-342 (Ottawa: 25 June 2014).
42. This statement is based upon the author's eight years of experience at JRCC Victoria. It may be noted that the examples used to support this paper are heavily based on JRCC Victoria, because that is the material the author knows best. However, similar examples across the country are certain to be known by experts at the other JRCCs.
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44. Government of Canada, "Fixed-Wing Search and Rescue Aircraft Replacement Project," *Public Works and Government Services Canada*, 8 December 2016, at <http://www.tpsgc-pwgsc.gc.ca/app-acq/amd-dp/air/arsvf-fwsar/index-eng.html> (accessed 14 December 2016).
45. Airbus Defence & Space, "Canadian SAR: Specifications," at <http://www.c295.ca/c295-canadian-sar/specifications/> (accessed 14 December 2016); the CC130 *Hercules* data comes from personal experience as aircrew conducting the SAR role on that aircraft for over 15 years.
46. Mowbray, "Lessons Forgotten?," p. 100.
47. All information for this paragraph is from 1 Canadian Air Division, Antony Zegers, "Update of the Canadian Search Area Definition (CSAD) with 2003–2010 Data," 3553-1 (DRDC CORA) LR 2010-164 (Victoria: CORA, August 2010). The CSAD update has not yet been acted upon.
48. 1 Canadian Air Division, JRCC Victoria, "Major SAR Report: SAR GJUP, V2011-02660."
49. 1 Canadian Air Division, "Air Mobility Standard Manoeuvre Manual, CC130H Search and Rescue Operations," SMM 60-130-2605, 15 December 2016, 1.1.18.
50. 1 Canadian Air Division, JRCC Victoria, "Search and Rescue Operation Report *Qualicum Rivers 9*," SAR Case V2010-02165, p. 14.
51. *Ibid.*, p. 20.
52. *Ibid.*, p. 13.
53. Airbus, "Canadian SAR: Specifications."
54. JRCC Victoria, "*Qualicum Rivers 9*," p. 21.
55. The following source is a comprehensive literature review of recent SAR research: Arctic Domain Awareness Centre, "Current State of Science for Arctic Maritime Search and Rescue: A Literature Synthesis in Support of Arctic-Related Incidents of National Significance as/of 11 May 2016," University of Alaska.
56. Devlin Barrett, "American's Cellphones Targeted in Secret U.S. Spy Program," in *The Wall Street Journal*, 13 November 2014, at <http://www.wsj.com/articles/americans-cellphones-targeted-in-secret-u-s-spy-program-1415917533> (accessed 25 January 2017).
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