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LESSONS FORGOTTEN? A HISTORICAL EXAMINATION OF THE RCAF SEARCH AND RESCUE ORGANIZATION

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JCSP 40

Master of Defence Studies

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PCEMI 40

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CANADIAN FORCES COLLEGE / COLLÈGE DES FORCES CANADIENNES
JCSP 40 / PCEMI 40
2013 - 2014

MASTER OF DEFENCE STUDIES

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22 Jun 2014

Word Count: 25, 294

Compte de mots: 25, 294

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LIST OF ABBREVIATIONS

AEA ..... Aerial Experiment Association

AB ..... Alberta

AOC ..... Air Officer Commanding

AOR ..... Area of Responsibility

ASR ..... Air-Sea Rescue

BC ..... British Columbia

BCATP ..... British Commonwealth Air Training Plan

CAF ..... Canadian Air Force

CAF ..... Canadian Armed Forces

CAP ..... Civil Air Patrol

CAS ..... Chief of Air Staff

CASARA ..... Civil Air Search and Rescue Association

CCG ..... Canadian Coast Guard

CF ..... Canadian Forces

CFB ..... Canadian Forces Base

CFS ..... Canadian Forces Station

CMCC ..... Canadian Mission Control Centre

COPA ..... Canadian Owners and Pilots Association

CORA ..... Centre of Operational Research and Analysis

CPI ..... Crash Position Indicator

CRC ..... Communication Research Centre

CSAD ..... Canadian Search Area Definition

CSS ..... Combat Support Squadron

CU ..... Communication Unit

DFC ..... Distinguished Flying Cross

DHH ..... Directorate of History and Heritage

DND ..... Department of National Defence

DOT ..... Department of Transport

EAC ..... Eastern Air Command

EEZ ..... Exclusive Economic Zone

ELT ..... Emergency Locator Transmitter

EPIRB ..... Emergency Position-Indicating Radio Beacon

FG ..... Force Generate

FW ..... Fixed Wing

FWSAR ..... Fixed Wing Search and Rescue

IAP ..... Interim Avionics Program (Labrador)

ICAO ..... International Civil Aviation Organization

ICMSAR ..... International Convention on Maritime Search and Rescue

ICSAR ..... Interdepartmental Committee on Search and Rescue

IFR ..... Instrument Flight Rules

IMO ..... International Maritime Organization

JRCC ..... Joint Rescue Coordination Centre

KU ..... Composite Unit

LEO ..... Low Earth Orbit

LKP ..... Last Known Position

LMSAR ..... Lead Minister Search and Rescue

LOS ..... Line of Sight

LOT ..... Line of Tasking

LUT ..... Local User Terminal

MAJAID ..... Major Air Disaster

MAJMAR ..... Major Marine Disaster

MARLANT ..... Commander Maritime Forces Atlantic

MARPAC ..... Commander Maritime Forces Pacific

MCC ..... Mission Control Centre

MEDEVAC ..... Medical Evacuation

MOTV ..... Modified Offset Track Variable

MN ..... Manitoba

MRSC ..... Marine Rescue Sub-Centre

MSC ..... Maritime Safety Committee

MVFR ..... Mountain Visual Flight Rules

NL ..... Newfoundland and Labrador

NM ..... Nautical Miles

NRC ..... National Research Council

NS ..... Nova Scotia

NSM ..... National SAR Manual

NSP ..... National Search and Rescue Program

NSS ..... National Search and Rescue Secretariat

NTSP ..... National Transportation Safety Board

NWAC ..... North West Air Command

NWT ..... Northwest Territories

NVG ..... Night Vision Goggles

OIC ..... Officer in Charge

ON ..... Ontario

OTU ..... Operational Training Unit

OTV ..... Offset Track Variable

para ..... common term for parachute or related to parachuting

PICAO ..... Provisional International Civil Aviation Organization

POD ..... Probability of Detection

PLB ..... Personal Locator Beacon

QC ..... Quebec

RCAF ..... Royal Canadian Air Force

RCC ..... Rescue Coordination Centre

RCMP ..... Royal Canadian Mounted Police

RCN ..... Royal Canadian Navy

RFC ..... Royal Flying Corps

RFP ..... Request For Proposal

RNAS ..... Royal Naval Air Service

RW ..... Rotary Wing

RU ..... Rescue Unit

SAR ..... Search and Rescue

SARAH ..... Search and Rescue Automatic Homing

SARCUP ..... SAR Capability Upgrade Program (Labrador)

SARSAT ..... Search and Rescue Satellite

SAR Tech ..... Search and Rescue Technician

SAS ..... Stabilization Augmentation System

SM ..... Search Master

SMC ..... Search Master Course

SOLAS ..... International Convention for Safety of Life at Sea

SOS ..... Save Our Souls

SRR ..... Search and Rescue Region

T&R SQN ..... Transport and Rescue Squadron

UN ..... United Nations

UNCLOS ..... United Nations Conference on the Law of the Sea

UK ..... United Kingdom

US ..... United States

USCG ..... United States Coast Guard

VFR ..... Visual Flight Rules

VHF ..... Very High Frequency

WAC ..... Western Air Command

YK ..... Yukon

ABSTRACT

There exists a constant struggle between providing the most effective Royal Canadian Air Force (RCAF) Search and Rescue (SAR) capability and balancing the limited resources available. In order to maximize the benefit of these resources it is imperative that smart decision-making guides change within the organization. These smart decisions must start by considering the path that has led to the current RCAF SAR organization as it exists today.

This study examines the many changes that have occurred over the decades as the RCAF SAR organization has adapted to a changing environment of requirements, resources and technologies. The account will examine the impacts of: Second World War Air-Sea Rescue developments; initial inception and expansion to cover maritime SAR; the era of Hellyer's unification; the creation of Canada's exclusive economic zone (EEZ); new technologies; and the force reduction plan of the 1990s.

Finally, five current SAR issues are examined to show that the RCAF SAR system is currently evolving without due consideration of lessons learned from the past. These issues are: the procurement of a new FW SAR platform; evolution of search procedures; 406 MHz Emergency Locator Transmitters; SAR response postures; and finally consideration of whether the RCAF should still maintain the domestic SAR role.

Will these lessons remain forgotten?

ACKNOWLEDGEMENTS

This Masters of Defence Studies directed research paper would not have been possible without the endless patience and support of my wife Michelle and my three children, Preston, Asia and Parker.

I'd also like to thank my equally patient academic advisor, Dr. Richard Goette, for his expert guidance and keen enthusiasm. Without his dedication and flexibility this paper may very well have never been completed.

I could not have filled in all the information gaps without the friendly and sage advice of Cathy Murphy from the Canadian Forces College Information Resource Centre. Equally key was the professional and enthusiastic assistance Maj Mathias Joost provided from the Directorate of History and Heritage in Ottawa. I would also like to thank Dr. Mathew Trudgen for securing copies of files from the Library and Archives of Canada in Ottawa.

Finally, I would like to acknowledge the dedicated RCAF SAR personnel (past and present) who have courageously put the needs of others ahead of themselves countless times "so that others may live."

RESCUE!

> *From what has been said, little though it is, it will be seen that search and rescue is a big job, calling for great courage and devotion on the part of the men engaged in it. The lives saved by the SAR organization are already many, and they are increasing almost daily in number. The value of the work cannot be calculated in dollars and cents, but the cost of it is more than repaid by the gratitude of those whom it has helped in time of their most desperate need.*
>
> - Squadron Leader (S/L) S. R. Miller, *Search and Rescue in the RCAF*[1]

INTRODUCTION

The 20th century philosopher George Santayana once wrote: "those who cannot remember the past are condemned to repeat it."[2] This frequently used quote is extracted from one of Santayana's literary works concerning change and the human condition. He proposes that positive change must not be absolute but rather must be guided based on retention of the past state. This thought is easy to grasp in theory but many institutions struggle with implementation — the Royal Canadian Air Force (RCAF) Search and Rescue (SAR) system is certainly no exception.

With the invention of flight, humankind had devised a powerful technology that quickly revolutionized the speed and distance one could commute. Simultaneously, the occurrence of quickly becoming stranded and in need of rescue became increasingly commonplace, both over land and at sea. Early aircraft were particularly prone to malfunction due to inherent unreliability or mishandling by the pilots. These issues, coupled with poor weather and getting lost led to many stranded or missing pilots (and their passengers) in the twentieth century. With time, states began accepting the

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[1] S/L S. R. Miller was in charge of the RCAF's first Rescue Coordination Centre (RCC) at Eastern Air Command Headquarters (HQ) from its formation in January 1947 to March 1949. S.R. Miller, "Search and Rescue in the RCAF," *The Roundel* 3, no. 2 (January 1951): 22.

[2] George Santayana, *The Life of Reason or the Phases of Human Progress* (New York: Charles Scribner's Sons, 1920), 284.

responsibility for assisting in these situations and eventually took on the role of full coordination.

This study is a historical examination of the evolution of Canada's responsibility to coordinate and prosecute search and rescue activities through the RCAF/Canadian Forces (CF). As described in the National SAR Manual, search and rescue in Canada is carried out by a wide array of federal, provincial and municipal organizations that make up the National SAR Program (NSP).[3] The RCAF SAR organization plays a key role in this program as the overall coordinator of federal responses along with providing aviation assets to support both air and marine distress cases. This study will focus on the RCAF portion of Canada's SAR program; although due to the integration of the overall program some minor deviations into the wider NSP cannot be avoided.

The life-saving achievements and apparent failures of the RCAF SAR system are a frequently discussed topic of both the government and public. Whether the interest is fuelled by human compassion or by the direct link from a tactical effect to the Federal government, the topic is almost always emotional in nature. Behind the scene, there is a constant struggle to provide the most effective RCAF SAR organization while balancing the limited resources available. In order to maximize the benefit of these resources and to ensure efficiencies it is imperative that smart organizational decision-making guides all significant changes within the organization.[4]

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[3] The National SAR Manual is the process of being renamed to the IAMSAR Volume 4 in accordance with ICAO agreements. Department of National Defence/Canadian Coast Guard, B-GA-005-000/FP-004 – DFO 2204-23-4, *International Aeronautical and Maritime Search and Rescue Manual (IAMSAR) Volume IV - Canadian Supplement* (Ottawa: DND Canada, 2007), chapter 1, 3.

[4] Martin Shadwick, "Search and Rescue Redux," *Canadian Military Journal* 9, no. 1 (Spring 2008): 102-104, http://www.journal.forces.gc.ca/vo9/no1/doc/15-shadwick-eng.pdf.

This study examines the many changes that have occurred over the decades as the RCAF SAR organization has adapted to a changing environment of requirements, resources and technologies. It demonstrates that the RCAF SAR system is currently evolving without due consideration of lessons learned from the past. This predicament condemns the organization to repeating previously made mistakes — a situation that is entirely avoidable.

This study is broken down into five chapters — four examining the evolution of RCAF SAR to date, and one applying historic lessons to current changes in the organization. Chapter one begins with a brief account of ad hoc SAR activities as they occurred in Canada prior to the Second World War. This is followed by an account of air-sea rescue throughout the Second World War and the lessons that were gained. Next, an account is presented of the internal and external conditions that led to the creation of a formal RCAF SAR organization in 1947.

Chapter two begins with an account of how and why the RCAF SAR role was expanded to include assistance to maritime SAR in Canada. The theme of developing SAR expertise is followed through the 1950s as SAR procedures are refined and new technologies are incorporated in to the RCAF SAR organization. Chapter three discusses the impact that unification brought to the RCAF system, including base closures and down-sizing. Another major influence discussed from this epoch was the retirement and replacement of many SAR aircraft bringing changing capabilities to aviation SAR in Canada. Chapter four begins with the strengthening of Maritime SAR in Canada due to the creation of Canada's exclusive economic zone (EEZ) in the mid-1970s. It then moves on to a discussion of: emergency locator beacon (ELT) regulation; the development of

satellite tracking of ELTs; the creation of a civil SAR organization; SAR helicopter changes; and ends with an examination of the resource impacts caused by the end of the cold war, resulting in the current organizational state of RCAF SAR in Canada. With a thorough account complete on how the RCAF SAR organization evolved over its 67 years of existence, chapter five presents a historically informed analysis on current dilemmas in the organization. It shows that many decisions and concepts from the past have been forgotten by the organization, and decision makers are currently promoting change without "retention of the past state." Five current SAR issues will be discussed: the procurement of a new FW SAR platform; evolution of search procedures; 406 MHz Emergency Locator Transmitters; SAR response postures; and finally consideration of whether the RCAF should still maintain the domestic SAR role.

The first logical step in this historical examination is to begin reviewing the available literature on the history and evolution of SAR in the RCAF. There is a rather large information gap on the subject — a testament to the fact that no one could easily refer to the past state of the organization. This is not to say that there were no historical accounts of the RCAF SAR organization; it simply means that none exist in a readily available, comprehensive, and coherent form. As a result, the history of RCAF SAR in this study has, by necessity, been patched together from a relatively small number of secondary sources and a multitude of primary sources.

Secondary sources, though few in number, provided some important context to help guide the historical account of RCAF SAR in this study. *That Others May Live: 50 Years of Para Rescue in Canada* is written as an historical account from the perspective of the Para Rescue trade, and contains many cues to changes in the larger RCAF SAR

system. The squadron history books for 442, 440, 435, 424, 413 and 103 RCAF Squadrons also provided significant information on changes from the perspective of their locations across Canada. *Sixty Years: The RCAF and the CF Air Command 1924-1984* by famous Canadian aviation author Larry Milberry provided an invaluable perspective on the overall evolution of the RCAF, in particular with respect to the many aircraft flown over the years.

Most academic writing on the subject of SAR focuses either on Combat SAR or Urban SAR.[5] Reference to a number of Department of National Defence (DND) operational research reports helped fill this academic void. Due to the absence of any detailed published literature on RCAF SAR from the mid-1940s-mid-50s, the author turned to the Department of National Defence's (DND) Directorate of History and Heritage (DHH) for primary sources. Finally, contemporary articles in various military aviation magazines such as *The Roundel* and *Airforce* filled many of the remaining gaps.

What originally began as quick examination of the history of SAR grew into a much longer description of the evolution of the RCAF SAR system. Based on the research mentioned above, this study is the most thorough single source account of RCAF SAR history produced to date.

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[5] Combat SAR refers to SAR operations conducted during war or conflict to recover downed aircrew or special operation personnel that are isolated behind enemy lines. https://www.fas.org/man/dod-101/sys/ac/csar htm. Urban search-and-rescue (US&R) involves the location, rescue (extrication), and initial medical stabilization of victims trapped in confined spaces in an urban environment after disasters such as earthquakes, hurricanes, tornadoes or other man-made disasters. http://www fema.gov/urban-search-rescue

CHAPTER 1: AD HOC TO ORGANIZED

Introduction

After his famous first powered flight in Canada on February 23, 1909, John McCurdy went on to became the first Canadian to become a licenced aviator. He sought interest from the Canadian Militia, but the soldiers spurned him as they considered the contraption to be dangerous and of little military value at the time. Undeterred, McCurdy decided to perform air displays across North America. One of his most famous aerial displays involved an attempt to cross the 96 miles of water between Key West, Florida and Havana, Cuba, on January 10, 1911. Due to an engine failure, he was forced to ditch about a mile short of Havana. He was recovered in what was likely the first air-sea rescue of a Canadian in a downed aircraft. This rescue, and many that followed in the years leading up to the Second World War; were conducted by any willing party in attempts to preserve human life. This chapter will examine the impetus and influences that led from these ad hoc procedures to the eventual organization of an intentional RCAF SAR system in 1947.[6]

A commitment to the International Convention for Air Navigation in 1919 began Canada's official commitment to international aviation cooperation and safety; while courage, ingenuity and good intensions from both RCAF and civilian aviators fulfilled the requirement for rescues and mercy flights. During the Second World War, both procedure and equipment advances in air-sea rescue were made to recover downed aircrew— a valuable resource required to facilitate the war effort. Following the war, Canada had a surplus of aviation resources that were soon organized to meet international commitments

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[6] Larry Milberry, *Air Transport in Canada: Volume 1* (Toronto: CANAV Books, 1997), 18.

Canada had made through the International Civil Aviation Organization. Armed with sufficient resources, newly developed helicopters and a solid intent, the RCAF led SAR from ad hoc to organized in five years.

Ad Hoc Rescue

When Britain signed the Peace Convention in Paris, in 1919, Canada became committed to the International Convention for Air Navigation. The convention addressed many topics, including: licensing standards, aircraft markings, aerodrome procedures, weather reporting procedures, communication protocols, etc. Besides the brief mention of SOS (Save Our Ship) signals to indicate distress, it is notable that there was nothing further on the subject of providing assistance to aircraft in distress.[7]

An offer of surplus aircraft from Britain soon gave a newly formed Canadian Air Board valuable resources that would be used primarily for forestry reconnaissance, fire protection and photographic operations. This injection of air resources was a key step towards securing a strong future for aviation in Canada. It was not until 1920 that the Air Board agreed to use some of the donated resources to establish a military flying program and the Royal Canadian Air Force (RCAF) would not be formed until April 1st, 1924. The initial cadre of 68 officers and 307 airmen were located at six air stations across

[7] Paris Peace Conference, *International Air Navigation: Convention Relating to Regulation of International Air Navigation Agreed to by the Allied And Associated Powers* (Washington: Govt. print. off., 1919), 51.

Canada where their primary flying activities involved supporting other government departments.[8]

Despite having no official mandate to manage or facilitate rescue operations, the RCAF assisted internal or external rescue requirements in an ad hoc manner. This assistance was also extended to isolated communities in the form of "mercy flights," primarily due to medical emergency scenarios. The RCAF responded to its first mercy flight on October 20th, 1924 when a diphtheria epidemic threatened the community of Norway House, Manitoba. All the usual aviation resources were withdrawn to the South due to the end of the normal flying season so the RCAF detachment in Victoria Beach was requested to assist. After quickly assembling crews and preparing aircraft, vaccines were in Norway House six hours later.[9] This was the first of many mercy flights that the RCAF would fly over the years. The RCAF continues to respond to these types of flights to this day. They are now known as humanitarian operations.

During the same period civilian bush pilots were making names for themselves conducting heroic rescue flights throughout the remote regions of Canada. An unfortunate but historic incident occurred in November 1929 off the West coast of Alaska. An Alaskan bush pilot by the name of Ben Eilson crashed his aircraft in fog while trying to transport furs from a schooner that was stuck in the ice between Alaska and the Soviet Union. News of the event spread rapidly around the world and before long volunteer Alaskan, Soviet, and Canadian aviators where headed to the region to help. The crashed Hamilton aircraft was located but unfortunately Eilson and his mechanic had perished in

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[8] Royal Canadian Air Force, *Silver Jubilee of Royal Canadian Air Force: 1924 - 1949* (Ottawa: King's Printer, 1949), 19.

[9] Ibid., 20.

the crash.[10] Although this rescue effort was ad hoc in nature, it is none-the-less the earliest documented example of an aviation rescue operation conducted with cooperation between American, Canadian and Soviet parties — a concept that would be formalized and practiced in the future via Arctic SAR Exercises.

The exploits of bush pilot W.R. "Wop" May are particularly worthy of mention. After receiving the Distinguished Flying Cross (DFC) for his efforts during the First World War as a pilot in the Royal Flying Corps (RFC), May returned to his home in Edmonton. He was instrumental in the formation and management of a number of civilian aviation organizations and by 1930 he had become a legend due to his courage and compassion for helping those in distress. His exploits of more than 24 mercy flights over the period of 1932 and 1934 included flying vaccines into remote locations, helping the RCMP track criminals and evacuating the sick and wounded to medical facilities.[11] May's ingenuity as a bush pilot and his compassion for helping others would eventually lead to the inception of para-rescue a decade later.

The next major change for the RCAF resulted from the creation of the Department of Transport (DOT) on November 2, 1936. All matters related to civil aviation were transferred to DOT from the RCAF. This left the RCAF only responsible for some aerial photography and transportation work, allowing it to focus more effort on military matters.[12] Increasing air mail and transport activity, continuing aerial photography and developing aviation routes to The North and to Britain were all clear indicators of the

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[10] Time-Life Books, *Bush Pilots* (Morristown: Time-Life Books, 1983), 42-48.
[11] Milberry, *Air Transport in Canada: Volume 1...*, 83-84.
[12] Royal Canadian Air Force, *Silver Jubilee of Royal Canadian Air Force...*, 49.

rapidly developing aviation situation in Canada. SAR responsibilities were still done on a best effort basis with no government or private organization taking official lead.

Air-Sea Rescue of The Second World War

Increasing aerial activity in Canada as a result of its entry into the Second World War meant that there was a corresponding growth in the requirement to recover downed aircrew all across the nation and off its shores.[13] The solution was the creation of Air-Sea Rescue systems comprised initially of resources on hand with the addition of some specialized equipment. The RCAF drew many lessons from their British counterparts.

Britain learned many hard lessons concerning aircrew recovery during the Battle of Britain in 1940. One thing was for certain: experienced aircrew were in high demand and the war depended heavily on them being safely recovered if possible. In January 1941, Britain approved the formation of a Directorate of Air-Sea Rescue (ASR) Services. The service's responsibilities were to: coordinate all sea rescue operations, provide air droppable survival equipment to aid downed aircrew, and provide adequate marine craft for rescues. After dividing their area of responsibility up into smaller rescue areas and assigning liaison officers to the associated Command groups, the Directorate began tackling five major problems: how to make aircraft designs more survivable, how to teach aircrew best practices on ditching and egressing, how to extend the life of the aircrew

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[13] This increased aerial activity was a result of a number of aviation activities including; the creation of the British Commonwealth Air Training Plan (BCATP); Eastern and Western Air Command war related activities; and the ferrying of aircraft to Russia via the Northwest Staging Route and Europe via an Atlantic route. Milberry, *Air Transport in Canada: Volume 1*..., 161.

once they had safely exited, how to find the aircrew once they were waiting rescue, and finally, how to retrieve them as quickly and safely as possible.[14] These fundamental concerns associated with rescue operations are still in existence today.

Directorate of ASR consultation with the British Ministry of Aircraft Production soon resulted in safety design improvements on new aircraft including better exit options and improved access to survival equipment. A campaign of education and training was also conducted to ensure aircrew had the knowledge and skills required to better egress their aircraft and then use their survival equipment effectively. By 1943 all RAF and RCAF squadrons were issued with Air-Sea Rescue Standing Orders containing guidance on emergency and distress procedures, sighting reports, search procedures and required post action reports.[15]

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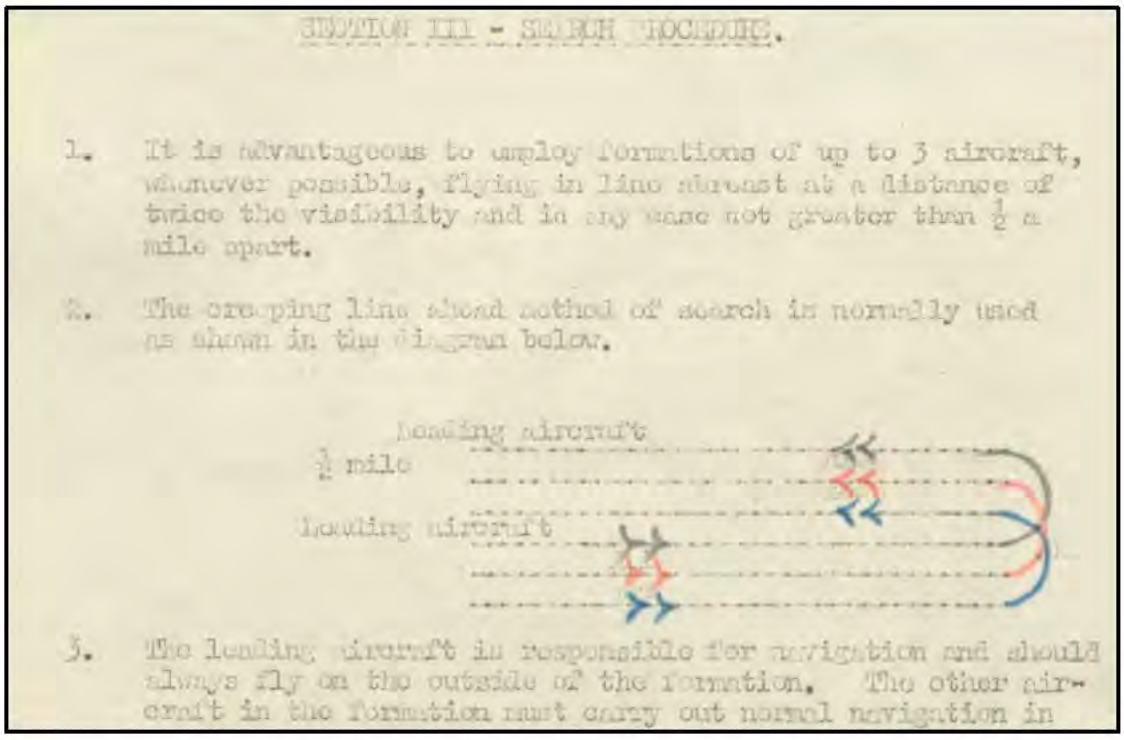
[14] Jonathon Sutherland and Diane Canwell, *The RAF Air Sea Rescue Service 1918-1986* (Barnsley: Pen and Sword Aviation, 2005), 34-37.

[15] RCAF, *Air/Sea Rescue Standing Orders*,1943, (DHH).



SECTION III - SEARCH PROCEDURE.

1. It is advantageous to employ formations of up to 3 aircraft, whenever possible, flying in line abreast at a distance of twice the visibility and in any case not greater than ½ a mile apart.

2. The creeping line ahead method of search is normally used as shown in the diagram below.

leading aircraft
½ mile
leading aircraft

3. The leading aircraft is responsible for navigation and should always fly on the outside of the formation. The other aircraft in the formation must carry out normal navigation in

Figure 1 - First Recorded Search Procedure (This document contains what appears to be the earliest Canadian record of a formalized search pattern)
Source: Canada. RCAF Air/Sea Rescue Standing Orders, 7, (DHH).

A number of creative solutions were devised to help aircrew survive their "cold swim" including: inflatable dinghies, Thornaby bags, Bircham barrels, air-droppable Lindholme dinghies, rescue floats (which were a copy from the Germans and in the end of little value), and eventually an air-droppable powered survival boat.[16]

The fifth issue ASR directorate had to solve was slowly overcome as recovery resources were wrestled from other services. Most notable were the high-speed rescue launches operated along the coast, seaplanes such as the Walrus that could land near downed aircrew, and a number of miscellaneous aircraft used for searching. The last issue

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[16] George Galdorisi and Thomas Philips, *Leave No Man Behind: The Saga of Combat Search and Rescue* (Minneapolis: Zenith Press, 2008), 41.

of reducing the time required to locate aircrew was a major challenge. Improved radios allowed crews to advise of their predicament more reliably, but unfortunately crews did not always know exactly where they were. Optimized search patterns were devised to maximize the coverage of aircraft while searching. In 1942 radios were being introduced into the dinghies so that aircrew could communicate with searching aircraft but they had limitations due to their bulkiness.[17]

Later during the war, a compact VHF transmitter, referred to by the British as 'Walter' came into wide use.[18] This type of beacon could be homed by air-sea rescue (ASR) aircraft at night and in poor weather. This was a significant improvement to the survivability of ditched aircrew and would prove to be an effective way for SAR crews to find those in distress for decades to come.

Back in Canada, the lessons on air-sea rescue were not lost on Western Air Command (WAC). Larry Milberry described SAR in WAC as follows:

> A vital aspect of WAC operations was search and rescue. Throughout the war hundreds of aircraft went down off the West Coast; to give crews a chance of survival a search and rescue plan was established that placed a dedicated number of SAR aircraft on duty and kept others on standby at bases along the coast and on the islands off BC.[19]

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[17] Hugh A. Halliday, "Plucked From The Sea: Air Force, Part 45," *Legion Online Magazine*, last modified 25 June 2011, http://legionmagazine.com/en/2011/06/plucked-from-the-sea-air-force-part-45/

[18] Louis Meulstee, "Wireless for the Warrior," last accessed 14 Mar 2014. http://www.wftw.nl/asr2.html

[19] Larry Milberry, *Sixty Years: The RCAF and the CF Air Command 1924-1984* (Toronto: CANAV Books, 1984), 115.

Similarly, Eastern Air Command implemented air-sea rescue plans as early as October 1943, which included procedures using current resources that would also be on air-sea rescue standby.[20]

Air-sea rescue planning was primarily being driven by a necessity to recover experienced military aircrew while they were flying over large bodies of water. In 1943 however, one individual was contemplating a better way to help people in distress over wide expanses of wilderness: Wop May — the First World War fighter pilot and post-war bush pilot and aviation entrepreneur who had gained renown for his courage and compassion in the aid of others. In early 1943, while employed as a civilian manager of the British Commonwealth Air Training Plan's 2 Air Observer School in Edmonton, May had an idea that would increase the aid provided to isolated people in distress.[21] Although parachutes (para) had been used in the RCAF from as early as 1925 for bailing out of a disabled aircraft, no one had considered using them to parachute assistance into remote locations. Wop May had two of his civilian aviation mechanics attend a US forestry smoke jumper course in Missoula, Montana. After completing the six-week course the two men returned to Edmonton with borrowed parachute equipment in tow and what followed was a year of hap-hazard para jumps that frequently led to incidents or injuries. The obvious risk and a lack of para related resources led May to approach Air Force Headquarters in 1944 to gain support for the program. Air Vice-Marshal T.A. Lawrence,

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[20] C.F.W. Burns, *Standby Aircraft for Air Sea Rescue*. RCAF, EAC, AOC: file S.325-28 (SFCO), 01 October 1943. The document further discusses the types of rescue stores that were to be kept on hand, including smoke floats, Bircham barrels and Lindholme rescue gear.

[21] The Chronicles of W.R. (Wop) May, "RCAF Rescue Services," last accessed 01 Apr 2014, http://www.wopmay.com/adventures/rcafRescue.htm

the Air Officer Commanding (AOC) of the newly created North West Air Command, took a keen interest in this new para rescue capability.[22]

The initial cadre of para jumpers was selected from Air Frame and Engine Mechanics so that they could also assess the salvageability of the wreckages.[23] Beyond the obvious requirement for para training, it was agreed the para jumpers would also be taught survival techniques, medical procedures and how to maintain all of their specialized equipment. After being selected from 20,000 applications, twelve keen candidates began the first RCAF para-rescue course on February 12, 1945. At the end of the Second World War, the RCAF disbanded its infant para-rescue organization but as the overall plan to implement organized SAR in Canada developed the para-rescue capability was back up and running two years later.[24] To this day, the RCAF still selects only the best candidates annually to complete this training, although this trade is now called SAR Technician (SAR Tech).[25]

ICAO, Canada and SAR

To this point, the primary drivers of change in SAR were the initiatives of individuals and wartime necessity. There was still a need for formal federal policy on SAR in Canada, and this was born from Canada's participation in the Chicago Convention

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[22] Para Rescue Association of Canada, *That Others May Live, 50 Years of Para Rescue in Canada, 1944-1994* (Astra: The Para Rescue Association of Canada, 1994), 15.

[23] Ibid., 16.

[24] Buzz Bourdon, "Search and Rescue in Canada: 50 Years of Excellence," *Airforce* 21, no. 3 (Fall 97): 33.

[25] Para Rescue Association of Canada, *That Others May Live...*, 14-22.

on International Civil Aviation of 1944. As the development of aviation exploded worldwide during the Second World War, so too did the related complications of inter-state frictions and policy. Canada readily adopted a position of international cooperation and began lobbying for peaceful solutions that would see mutually beneficial agreements in the international aviation environment.[26] A majority of the convention pertained to the fair and amicable travel of commercial air carriers between and over states.

The importance of assisting those in distress was not lost during the discussions, and as a result Article 25 was introduced. Albeit very basic in direction, this article (which is still in effect today) established the responsibility of a state to provide aid to those in need of assistance within their territory:

> Article 25: Aircraft in Distress
> Each contracting State undertakes to provide such measures of assistance to aircraft in distress in its territory as it may find practicable, and to permit, subject to control by its own authorities, the owners of the aircraft or authorities of the State in which the aircraft is registered to provide such measures of assistance as may be necessitated by the circumstances. Each contracting State, when undertaking search for missing aircraft, will collaborate in coordinated measures which may be recommended from time to time pursuant to this Convention.[27]

Concurrent to the primary convention discussions, a number of subcommittees addressed more specialized topics including Subcommittee 9, which was concerned with accident investigation, search and salvage issues.[28] Canada was a significant contributor to these discussions, and particular Canadian proposals related to SAR included:

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[26] Statistics Canada, *Aviation in Canada* (Ottawa: Minister of Supply and Services Canada, 1986), 184.

[27] International Civil Aviation Organization (ICAO), "Convention on International Civil Aviation - Doc 7300," last accessed 24 March 2014, http://www.icao.int/publications/Documents/7300_orig.pdf

[28] International Civil Aviation Organization (ICAO), "Proceedings of the International Civil Aviation Conference," last accessed 24 March 2014, http://www.icao.int/ChicagoConference/Pages/proceed.aspx

establishing search operations as soon as possible after an aircraft has gone missing; conducting searches within an organized system; deciding on a mechanism for discontinuing unsuccessful searches; and the potential cost recovery for search costs. The Subcommittee chairman reported on November 16, 1944 that all members have come to "complete agreement on the principles outlined herein."[29] Clearly, Canada was not a follower in the pursuit of improving SAR; rather, Canada helped lead the way.

After many weeks of significant political discussions, 52 countries signed the Convention on International Civil Aviation on December 7, 1944. This resulted in the birth of the Provisional International Civil Aviation Organization (PICAO). [30] An RCAF representative was part of a Canadian team that attended the first regional PICAO meeting in Dublin, Ireland in March 1946.[31] This meeting and another held in Seattle, Washington helped lay the groundwork for inter-state SAR relationships and the assignment of regional responsibilities. Canada's international commitment to provide SAR services covered the country's domestic air space and significant expanses of Pacific, Atlantic and Arctic oceans on the approaches to Canada. Two years after the initial meeting in Chicago, the Convention on International Civil Aviation was fully ratified on April 4, 1947,[32] thereby solidifying Canada's commitment to a safe and efficient international aviation community.

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[29] International Civil Aviation Organization (ICAO), "Subcommittee 9: Accident Investigation, Including Search and Salvage Memorandum," last modified 16 November 1944, http://www.icao.int/ChicagoConference/Pages/proceed.aspx

[30] W.P. Pleasance, "I.C.A.O.," *The Roundel* 3, no. 10 (Oct 1951): 2. It was only provisional due to the fact that 26 states required more time to ratify their positions.

[31] Department of National Defence, *Search and Rescue Information: RCAF Eastern Area Search and Rescue Co-Ordination Centre* (Ottawa: DND Canada, 1955), 1.

[32] W.P. Pleasance, "I.C.A.O.," *The Roundel...*, 2.

After ratification the organization was renamed to the International Civil Aviation Organization (ICAO), a name still in use today. Canada played a key role as a mediator throughout the 1947 conference, in particular between the US and UK.[33] As a result, it was decided that Montreal would be an ideal neutral location for the new organization's headquarters. Established later that year, the ICAO headquarters remains in Montreal to this day, and is an important symbol of Canada's contribution to aviation worldwide.[34] Nevertheless, the international recognition Canada had earned in the field of aviation came with great responsibility, in particular concerning the provision of SAR capabilities off the East and West coasts of Canada.

The Development of a Formal Canadian Aviation SAR System

Having vested much effort in the principles of ICAO, Canada immediately began studying the regulatory and organizational commitments it had agreed upon. Most civil SAR responses to date had been coordinated locally by multiple agencies including the RCMP. This led to a decision by Cabinet to create an interdepartmental committee, chaired by the RCMP, to study the SAR issue and propose a rescue organization plan.[35] This committee was comprised of representatives from the RCMP, RCAF, RCN, Canadian Army, Department of Transport and the Department of Fisheries. On December 29, 1945, Cabinet reviewed the committee's report and came to the following

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[33] David MacKenzie, *Canada and International Civil Aviation 1932-1948* (Toronto: University of Toronto Press, 1989), 199.

[34] International Civil Aviation Organization (ICAO), "ICAP in Brief," last accessed 27 March 2014, http://www.icao.int/about-icao/pages/foundation-of-icao.aspx.

[35] G.Y. Smith, *Seek and Save: The History of 103 Rescue Unit* (Erin: The Boston Mills Press, 1990), 11.

conclusions: a SAR service was needed, the organization must make maximum use of existing government resources, and the Department of National Defence should take over coordination. Cabinet then tasked the Cabinet Defence Committee to investigate the SAR plan further with the mission of ensuring a comprehensive SAR plan that maximized inter-departmental coordination.[36]

Given the size of the RCAF by the end of the Second World War, there was a surplus of equipment and personnel resources available for such a task. By March 1947, the Defence Committee reported to Cabinet that, "An adequate Rescue Organization for aircraft in distress could be provided by existing services in cooperation, and that the Department of National Defence for Air should undertake responsibility for the necessary coordination to this end." Cabinet was pleased with this low cost solution and on January 16, 1946, appointed the RCAF to assume formal chairmanship of the interdepartmental committee. [37]

After some delays caused by pending post-war reorganizations, the committee formulated a plan that maximized existing equipment and facilities but still required some additional resources. A total of $1.7 million was needed for recurring costs and the addition of 142 RCAF and 10 RCN personnel.[38] The final plan was submitted to Cabinet in May 1947 and it was approved on June 18, 1947, along with the required funding and

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[36] Department of National Defence, *Aide Memoire on SAR* submitted with Memorandum for Cabinet Defence Committee: *Procurement of SA16B Aircraft,* from Minister of National Defence, 26 Jan 1959, (DHH), 1.

[37] Ibid., Appendix A.

[38] Department of National Defence, Inter-Departmental Committee on Search and Rescue, *Report of the Inter-Departmental Committee On Search and Rescue to Cabinet*, May 1947, (DHH 2002/03 Series 1 File 12a), Appendix E & H.

manpower allocations that were outlined in it.[39] This date is significant: it is considered the official birthdate of the RCAF SAR system, and marks the commencement of official RCAF obligation to provide resources and an overall organization of aviation rescue operations in Canada.[40] Although all government organizations must consider financial impacts of their decisions, it is interesting to note that the decision to task the RCAF with the responsibility of SAR in Canada was born from an environment of budgetary constraint.

Rescue Helicopters

As the RCAF and the government of Canada were developing policy and plans for conducting SAR operations in Canada, aviation trailblazer Igor Sikorsky was working out the technical details of an invention that would revolutionize rescue operations for the foreseeable future — the helicopter. Sikorsky's early production model helicopters had already been in use by the US Army and the US Coast Guard (USCG) during the latter part of the Second World War to conduct rescue missions. They included flights to deliver medical supplies, landing and evacuating stranded personnel, and even combat rescue evacuation of personnel after an aircraft crash in Burma.[41] The utility of

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[39] Department of National Defence, *Aide Memoire on SAR...*, 2.

[40] Mike Mroz, "CF Search and Rescue turns 50," *Roundel* 4, no. 11 (Sep 1997): 10.

[41] C.V. Glines, "The Skyhook," *Air Force Magazine*, July 1988. http://www.airforcemag.com/MagazineArchive/Documents/1988/July 1988/0788skyhook.pdf
Robert F. Dorr, DefenseMediaNetwork. "The First Helicopter Rescue: Where the special operations combat rescue mission began," last updated 30 April 2010, http://www.defensemedianetwork.com/stories/burma-where-special-ops'-combat-rescue-mission-began/

helicopters for rescue was already obvious but the introduction of a hoist brought the utility of helicopters to a whole new level in SAR operations.[42]

Due to the close relationship between Canada and the US, the RCAF was quickly exposed to the value of helicopters in SAR. The first recorded use of a helicopter to conduct a rescue mission in Canada occurred in Labrador in May 1945.[43] A Canadian PBY-5A/Canso aircraft had conducted a forced landing 180 miles to the South of Goose Bay.[44] Once the aircraft was located a number of rescue attempts were made using RCAF aircraft on skis but due to the snow conditions only the worst casualties were lifted out before weather and ice conditions prevented any further help. A US Coast Guard HNS-1 helicopter located at Air Station Brooklyn, New York was disassembled and flown to Goose Bay in a transport aircraft. After being reassembled, the helicopter conducted nine ferry trips between a base camp and the stranded airmen due to only being able to carry one person at a time.[45]

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[42] Off the coast of Fairfield, Connecticut on November 29, 1945 an oil barge was grounded by a violent storm and the two men stranded onboard were in peril of being washed overboard. Police called the nearby Sikorsky plant to request help after local efforts to reach the men by boats had failed. The Sikorsky company chief pilot, with the assistance of a US Army captain, was soon on scene surveying the situation from their Sikorsky R-5 helicopter. However with no way to land the helicopter they could do nothing to assist the two men. They returned to the Sikorsky flight facilities and flew back with another R-5 helicopter that had been previously configured with an experimental hoist. The R-5 crew were then able to successfully remove the two men from the disintegrating barge in what has been documented as the first successful helicopter hoist rescue. Sikorsky Archives, "Civilian Rescue," last accessed 30 Mar 2014, http://www.sikorskyarchives.com/Civilian_Rescue.php.

[43] Renald Fortier, "Igor Sikorsky: One Man, Three Careers. National Aviation Museum," last accessed 30 Mar 2014, http://casmuseum.techno-science.ca/doc/research/casm/e_sikorsky.pdf.

[44] Larry Milberry, *Air Transport in Canada: Volume ...*, 345.

[45] US Coast Guard Aviation History, "Coast Guard Station Brooklyn... Then and Now," last accessed 30 March 2014, http://uscgaviationhistory.aoptero.org/CGAS_Brooklyn/AIR_STATION_HISTORY/50TH_BOOK/CH2.HTM. Another similar situation occurred in Gander, Newfoundland in September 1946, when a Belgian Sabena Airlines DC-4 carrying 44 passengers to New York crashed in the rugged Newfoundland terrain 35 km southwest of Gander airport. Once again, USCG helicopters were flown to Gander in the back of a transport aircraft to assist. This time, one helicopter each was sent from USCG Air Station Brooklyn and USCG Air Station Elizabeth City. Once the two helicopters were reassembled in Gander they were flown to

By this time the helicopter had clearly proven its value in the prosecution of rescue missions over the remote and rough terrain of Canada. The first Canadian pilots to fly helicopters were in the Royal Canadian Navy when they worked with both the Royal Navy and the USCG.[46] In 1947, the RCAF took its first seven helicopters on strength. The Sikorsky H-5 was selected due to its proven ability to transport enough payload to be useful in rescue operations.[47] The first H-5 was stationed in Trenton, Ontario and the second H-5 to be received was stationed at 103 Rescue Unit on the East coast of Canada. A mere five days after arrival at 103, the H-5 was tasked on its first mission to investigate the crash of a Navy Seafire fighter aircraft near Dartmouth, Nova Scotia. The helicopter landed near the crash site one hour later but unfortunately the Seafire pilot had succumbed to his wounds.[48] This was the first rescue mission flown by an RCAF pilot in an RCAF helicopter; it would definitely not be the last.

Organizing the RCAF SAR System

The RCAF now had at its disposal helicopters, para-rescue specialists, and an excess of post war aircraft and airmen. These resources, coupled with an inherent

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the crash site to begin ferrying the 18 survivors, one at a time, to a nearby base camp. At this transfer point the survivors were moved from the helicopters via dinghies to awaiting PBY-5A/Canso amphibious aircraft for the final transfer to the Gander airport. Due to its obvious utility, the USCG decided to leave one of the helicopters at the US Navy base located at Argentia, Newfoundland when the rescue operation was complete. US Coast Guard Articles, "Tragedy and Rescue: Oscar Oscar-Charlie Baker George Sabena Airlines DC-4 Crash Near Gander Lake, Newfoundland September 1946," last accessed 30 March 2014, http://www.zianet.com/tmorris/GanderRescue.html.

[46] Larry Milberry, *Air Transport in Canada: Volume 1...*, 338.

[47] "The Sikorsky S-51 design followed the now classic helicopter configuration with a single main rotor and an anti-torque tail rotor. It first flew in February 1946 and was the first Sikorsky helicopter to receive approval for civil use. Most S-51 helicopters however went into military service where they were often known under the designation H-5." Canadian Wings-The History & Heritage of the Royal Canadian Airforce, "Sikorsky H-5," last accessed 30 Mar 2014, http://www.canadianwings.com/Aircraft/aircraftDetail.php?H-5-178.

[48] Smith, *Seek and Save: The History of 103 Rescue Unit...*, 21.

domestic will of compassion and new international obligations, set the necessary conditions for a successful start to the Canadian aviation SAR system. In anticipation of the Cabinet direction to assume responsibility for the organization of SAR, the RCAF incorporated ICAO advice on SAR best practices and the interdepartmental committee organizational advice into what was referred to as Organization Order 855 with restructure plan "E."[49] This plan established new Rescue Units (RUs) and Rescue Coordination Centres (RCCs) under each of the existing RCAF Commands in accordance with the size of their Area Of Responsibility (AOR), the type of terrain, and the flying activity. Each Command corresponded to each of the five Search and Rescue Regions (SRRs) that were created to divide up Canada and its approaches into manageable areas.[50] Figure 2 depicts the five SRRs as they were initially defined and the location of key SAR organizations or resources.

The Group or Command headquarters assigned to manage each of the SRRs was as follows: Atlantic SRR-Maritime Group HQ in Halifax, Eastern SRR-Training Command HQ in Trenton, Central SRR-Tactical Group HQ in Winnipeg, Western SRR-North West Air Command in Edmonton and Pacific SRR-No 12 Group HQ, Vancouver.[51] In accordance with ICAO regulations, and good practice, each SRR was to have a corresponding RCC established to manage its SAR missions. These RCCs had to be manned 24 hours a day by trained personnel who were proficient in radio communications. Each RCC also required extensive communication equipment to allow

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[49] Ibid., 12.
[50] S.R. Miller, "Search and Rescue in the RCAF," *The Roundel* 3, no. 2 (Jan 1951): 14-22.
[51] Ibid., 14-22.

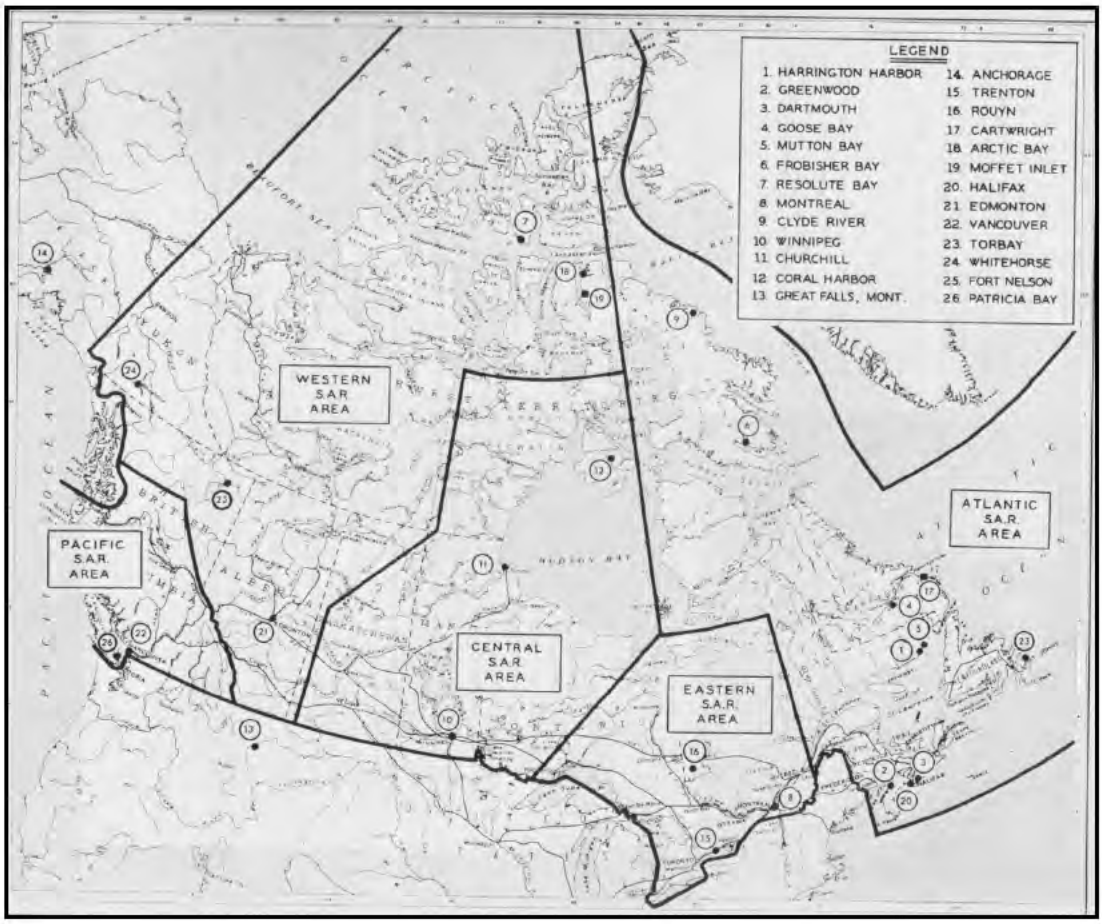

Figure 2: Initial Search and Rescue Regions
Source: Miller, "Search and Rescue in the RCAF," 16.

contact with air traffic services, higher Command HQ, SAR units, meteorological stations and adjacent SRR RCCs as a minimum.[52] The first dedicated RCC was established in Halifax in November 1946, while the remaining Commands used their existing Canada

[52] International Civil Aviation Organization (ICAO), *Convention on International Civil Aviation: Annex 12 Search and Rescue* (Montreal: ICAO, 2004), 2.1-2.2.

Flying Control Operations Rooms as interim RCCs.[53] The RCC for Training Command was initially located in Rockcliffe, ON but would be replaced by one located in Trenton in 1950.[54]

Taking ICAO advice to keep an eye on the advancement of helicopter technology, the RCAF purchased seven Sikorsky H-5 helicopters and assigned a few to SAR duties. Dakotas and Norseman on floats, not unfamiliar with the SAR role, were transferred from their more traditional transport duties. Canso flying boats were converted from their wartime anti-submarine role due to their ability to land at a variety of locations and good endurance. Given the immense search areas and recommendations from ICAO, a number of Lancasters were pulled out of storage and converted from their bomber configurations to the SAR role. This would allow for the long endurance required to conduct searches far offshore of the East and West coasts of Canada.[55] The initial plan was to allocate 34 aircraft to the primary SAR role, spread out across the country at ten locations. The initial SAR fleet consisted of seven Canso flying boats, four Lancaster bombers, five Dakotas, eleven Norseman on floats and five helicopters.[56] In addition to these aircraft, any RCAF aircraft could be temporarily assigned to SAR duties if available, a practice still used to

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[53] Department of National Defence, *Report of the DND for the Fiscal Year Ending March 31, 1947* (Ottawa: King's Printer, 1947), 46.

[54] Mroz, "CF Search and Rescue turns 50," *Roundel*..., 11.

[55] Department of National Defence. *Aide Memoire on SAR*..., 1-3.

[56] Miller, "Search and Rescue in the RCAF," *The Roundel*..., 15. In addition to the aircraft inventory, the RCAF also had high-speed launches (boats) at its disposal. These launches were used to ferry crews, fuel and supplies back and forth between the shore and RCAF flying boats unless required to respond to near-shore rescue missions. The launches had a standard crew of three and were capable of speeds over forty knots. At times of high flying activity the launches would be pre-positioned along specific routes to maintain radio watch for aircraft in distress. Hugh Halliday, "The Role of the Boats: Air Force, Part 46," *Legion Magazine*, last accessed 01 April 2014, http://legionmagazine.com/en/2011/08/the-role-of-the-boats-air-force-part-46/ .Two such craft, *Huron* and *Montagnais*, were on duty in the Pacific SRR in the 1940s and 50s. There were two similar craft used to assist with searches on the East coast stationed in Dartmouth and Sydney, NS. P.R. Gilliam, "Rescue Co-ordination Centre, Vancouver," *The Roundel* 3 no. 8 (Jul-Aug 1951), 18-23.

this day. Particular units were also assigned teams of two or four Para Rescue technicians and accompanying air-droppable SAR equipment.[57]

RCAF aviation resources assigned to prosecute SAR missions were not part of full squadrons but rather were located at newly created small units across the country. These locations were chosen based on: the international commitments Canada now had for the approaches to Canada, historical patterns of rescue assistance, and where they could be co-located with existing facilities. The units were initially designated as follows: 103 Rescue Flight in Greenwood, NS which also had detachments in Torbay[58] and Goose Bay, NF; Training Command Communication Flight in Trenton, ON; 111 Communication Flight in Winnipeg, MB; North West Air Command Communication Flight, Edmonton, AB; Station Whitehorse, YT; Station Fort Nelson, BC; and 123 SAR Flight, Sea Island, Vancouver, BC.[59] Overall, the RCAF managed to create an extensive and well-coordinated SAR organization in Canada using existing resources, and therefore with minimal expense to the government.

By 1950, the RCAF had established fully functional, full-time RCCs at five locations across the country plus an additional sub-centre in Torbay, NL. The aircraft and crews dedicated to SAR were also well established in a routine of saving the lives of those stricken by misfortune. One noteworthy mission handled by the Vancouver RCC in February 1950 involved a missing US B-36 strategic bomber that was carrying a nuclear weapon. Named "Operation Brix," this SAR mission was a major bilateral Canada-US

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[57] Miller, "Search and Rescue in the RCAF," *The Roundel...*, 15.

[58] The 103 Rescue Flight detachment was sent to Torbay after Newfoundland joined confederation on 01 April 1949. It was important to show Federal support for the newest province of Canada. Smith, *Seek and Save: The History of 103 Rescue Unit...*, 25.

[59] Mroz, "CF Search and Rescue turns 50," *Roundel...*, 11.

effort. Within 12 hours there were 17 surface vessels and 34 aircraft from both nations searching in an attempt to locate the missing B-36 and its crew of 17 before they perished from exposure or hypothermia. Two days after the aircraft had gone missing eleven of the crew were located on Princess Royal Island by the crew of a civilian fishing vessel that had been assisting in the search. These members of the crew were soon evacuated to safety but the rest of the B-36 crew was never found.[60] The intra-state coordination between Canada and the US had gone flawlessly thereby validating the preparation both countries had put into meeting ICAO recommendations. To this day, Canada and the US continue to conduct bilateral SAR missions and training exercises to the benefit of those in need.[61]

A *Report of the Department of National Defence* for the fiscal year ending March 31, 1949 noted that "One hundred and sixteen missions were undertaken during the year, of which forty-two were searches for missing aircraft, thirty-five for missing vessels, twenty-eight for the evacuation of sick or injured persons and eleven for the provision of medical assistance."[62] These missions would require almost 2,600 hours of flying time to prosecute. By 1950, twenty Para Rescue technicians were operational at five of the SAR units while another ten more were being trained. SAR units participated in over 200 incidents, which was almost double the amount from the previous year.[63]

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[60] Dirk Septer, *Lost Nuke: The Last Flight of Bomber 075* (Toronto: Heritage House Publishing Company, 2012), 43-51.

[61] CAF and USCG operations regularly interact in three prime areas: search and rescue, illicit drug surveillance and interdiction, and illegal migrant interdiction. http://www.forces.gc.ca/en/news/article.page?doc=the-canada-u-s-defence-relationship/hob7hd8s

[62] Department of National Defence, *Report of the DND for the Fiscal Year Ending March 31, 1949* (Ottawa: King's Printer, 1949), 15.

[63] Department of National Defence, *Report of the DND for the Fiscal Year Ending March 31, 1950* (Ottawa: King's Printer, 1950), 15.

Conclusion

The five years following the Second World War were key in the development of the RCAF SAR organization. The war had created the initial demand for Air-Sea Rescue services while driving international aviation forward. As the war came to a close, it also provided required equipment and manpower resources as other aspects of the RCAF were de-mobilizing. The creation of the Canadian SAR system had been driven by lessons from the Second World War and international obligations to ensure the safety of all aviators in distress. Although the RCAF SAR organization would never reach a completely steady state, it had materialized as a highly organized and capable system for saving lives.

CHAPTER 2: DEVELOPING SAR EXPERTISE

Introduction

Now that the RCAF had a well-planned aviation SAR organization it was not long before the government sought to expand this role to include maritime SAR — again initiated by obligations to an international organization. The remainder of the 1950s was characterized by the development of expertise in many SAR fields including: search planning and execution, incorporation of homing and radar technologies and exploring the use of helicopters for SAR operations. This period of development would help secure Canada's place internationally as experts in Search and Rescue procedures.

Marine SAR

With the creation of ICAO, the international aviation community had the beginnings of a cooperative organization that would facilitate global coordination, efficiency and safety for years to come. Although there were a number of small intra-state maritime organizations in existence, it was not until the formation of the United Nations (UN) in 1945 that the mechanics were in place for a meaningful global maritime agreement.[64] Canada was one of 36 countries to attend the UN Maritime Conference of 1948 in Geneva.[65] The conference solidified the mechanisms required to establish the International Maritime Organization (IMO) as the Specialized Agency in the field of

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[64] The first Convention on Safety of Life at Sea (SOLAS) was signed by only five states in 1914, but led to extensive application regulations in Britain, France, the United States and Scandinavia. International Maritime Organization (IMO), "The History of Safety at Sea," last accessed 02 Apr 2014, http://www.imo.org/KnowledgeCentre/ReferencesAndArchives/Documents/P. Boisson History of safet at sea extract.htm - _Toc516043736.

[65] International Maritime Organization (IMO), "The Origins of the International Maritime Organization," last accessed 02 Apr 2014, http://www.imo.org/KnowledgeCentre/ReferencesAndArchives/Pages/TheOriginsOfIMO.aspx - 6

shipping and included the formation of a Maritime Safety Committee (MSC). As described in Article 29 of the IMO agreement, this committee was given the duty of considering a number of safety matters including the consideration of salvage and rescue.[66] Canada was also a partner in the International Convention for Safety of Life at Sea (SOLAS) of 1948, and by February 1st, 1951 had approved the convention. This led to the international SAR obligations described in Regulation 15 of this agreement, which follows:

> Regulation 15
> *Search and Rescue*
> (a) Each Contracting Government undertakes to ensure that any necessary arrangements are made for coast watching and for the rescue of persons in distress at sea round its coasts. These arrangements should include the establishment, operation and maintenance of such maritime safety facilities as are deemed practicable and necessary having regard to the density of the seagoing traffic and the navigational dangers and should, so far as possible, afford adequate means of locating and rescuing such persons.
> (b) Each Contracting Government undertakes to make available information concerning its existing rescue facilities and the plans for changes therein, if any.[67]

Although Canada was a willing party to this maritime convention, once again, a commitment to an international body drove change in the Canadian SAR system. The government of Canada quickly turned to the existing RCAF aviation SAR system for both the experienced and economical solution. It was already common practice for RCAF resources to informally assist in marine search incidents alongside RCN vessels. This is

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[66] International Maritime Organization (IMO), "Convention on the Intergovernmental Maritime Consultative Organization," last modified 06 March 1948, http://www.imo.org/KnowledgeCentre/ReferencesAndArchives/Documents/E CONF.4 61.pdf.

[67] SOLAS, International Convention for the Safety of Life at Sea, last modified 10 June 1948. http://www.imo.org/KnowledgeCentre/ReferencesAndArchives/HistoryofSOLAS/Documents/SOLAS 1948 UK Treaty Series.pdf.

not surprising since RCN vessels frequently assisted in aviation searches, which helped build a good relationship between aviation and maritime units.[68] The established RCCs across the country had both the required expertise and the capacity to take on more SAR coordination.

On July 12, 1951 Cabinet directed the RCAF to take lead on coordination of maritime SAR incidents in Canada. Cabinet Directive Circular No.22 on Search and Rescue Services detailed the regulations for all government departments in support of establishing this formal maritime SAR organization. The RCAF was designated as lead agency for overall coordination through the RCCs established in Halifax, Vancouver and Trenton; moreover, all departments were to report position and status of vessels to the RCAF RCCs; and all departments were to ensure a good system of communication with RCAF RCCs so that there was minimum delay on distress and update notification.[69]

The Interdepartmental Committee of Search and Rescue primarily handled the creation and implementation of these new terms. Initially the RCAF adopted this additional maritime role without any additional manning, facilities or equipment. In 1954 however, it was decided that each of the three RCCs concerned with maritime SAR (Halifax, Trenton and Vancouver) would be manned with one Marine Coordinator from the Marine Operations Branch of the Department of Transport.[70] These Marine Coordinators provided advice on marine SAR matters to the RCAF staff.[71] Unfortunately,

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[68] Miller, "Search and Rescue in the RCAF," *The Roundel...*, 17.

[69] House of Commons, *Cabinet Directive Circular No. 22: Search and Rescue Services* 12 July 1951, Annex "C" to *Aide-Memoire on SAR*, (DHH).

[70] Mroz, "CF Search and Rescue turns 50," *The Roundel...*, 11.

[71] Department of Transport, Marine Operations Branch, *Marine Search and Rescue in Atlantic Area* (Ottawa: Queen's Printer, 1961), (DHH), 4.

with only one Marine Coordinator per RCC they were only reliably available during the day shift and on call after hours. Due to basic landline communications of the era the coordinator was often unreachable, causing delays in some marine SAR missions. After the formation of the Canadian Coast Guard (CCG) organization in 1962, each RCC was allocated five CCG Officers by 1966, which then allowed for a 24-hour marine watch.[72] This cooperative manning between the RCAF and the CCG endures at the three current JRCCs to this day.

Prior to the new marine rescue responsibility, SAR areas on the east and west coasts were already favourably resourced due to the offshore ICAO commitments. This meant that only minor changes were required to meet the new marine assistance mandate. By the end of 1951, RCAF SAR resources were positioned across Canada as shown in table 1.

In total, five RCCs, 32 RCAF aircraft, 32 Para Rescue personnel and six High Speed Rescue Launches were then dedicated to primary SAR duties. In addition to these resources there were eleven trained ground search teams spread across the country at RCAF bases. Stocks of para-rescue equipment, air droppable stores, fuel caches and ground equipment were also stored and maintained.[73] This picture of SAR was vastly improved over the ad hoc system from only five years prior.

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[72] JRCC Halifax Website, "History," last accessed 02 April 2014, http://www.jrcchalifax forces.gc.ca/JRCC_home_E htm.

[73] Ibid.

Table 1 —SAR Resource Allocation by 1951

SRRs and RCCs	Rescue Units and Resources
Pacific SAR Area RCC-Vancouver	123 Rescue Flt at Sea Island (2 x Cansos, 2 x Lancasters, 2 x Norseman, 1 x H-5 Helicopter, 4 x Para Rescue) [74]
	Patricia Bay, BC (2 x High Speed Launches).[75]
Western SAR Area RCC-Edmonton	6 Comm Flt in Edmonton, AB (1 x Canso, 1 x Dakota, 1 x Norseman, 2 x Para Rescue, 1 Para Rescue trained Medical Officer)
	Station Whitehorse, YK (1 x Dakota, 1 x Norseman, 4 x Para Rescue)
	Station Fort Nelson, AB (1 x Dakota, 1 x Norseman, station closed in 1951)
Central SAR Area RCC-Winnipeg	111 Comm Flt in Winnipeg, MB (1 x Canso, 1 x Dakota, 1 x Norseman, 2 x Para Rescue)
	Joint Service Experimental School in Churchill, MB (1 x Norseman, 2 x Para Rescue)
Eastern SAR Area RCC-Trenton	102 Comm Flt in Trenton, ON (1 x Canso, 1 x Dakota, 1 x Norseman, 6 x Para Rescue, 1 x High Speed Launch)
Atlantic SAR Area RCC-Halifax	103 RU in Greenwood, NS (2 x Cansos, 2 x Lancasters, 1 x Dakota, 1 x Norseman, 1 x H-5 Helicopter and 4 x Para Rescue)
	103 Det in Torbay, NL (1 x Canso, 1 x Norseman, 2 x Para Rescue)[76]
	103 Det in Goose Bay, NL (1 x Dakota, 1 x Norseman, 2 x Para Rescue, 1 x High Speed Launch)
	Dartmouth, NS (2 x High Speed Launches)

Developing Search Expertise

Due to the volume of air traffic and the wide expanses of Canada, the RCAF SAR system became particularly experienced in the practice of aerial search. In fact, if any

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[74] P.R. Gilliam, "Rescue Co-ordination Centre Vancouver," *The Roundel* 3, no. 8 (Jul-Aug 1951): 18.

[75] Para Rescue Association of Canada. *That Others May Live...*, 45.

[76] The void of helicopters in Newfoundland was filled by USCG helicopters based in Goose Bay and Argentia.

single characteristic of SAR in the 1950s was singled out, it would be the incredible amount of search operations that took place. In January 1950, a USAF C-54 went missing on a flight between Elmendorf, Alaska and Great Falls, Montana. Although nothing was ever found, this search spanned almost an entire month and consumed approximately 2000 hours of RCAF and US Air Reserve flying time. That same year, an RCAF Expeditor went missing between Presque, Maine and Chatham, NB. Once again, despite 1300 hours of searching, the aircraft and crew were never found.[77]

On August 25th, 1953, a float equipped Norseman aircraft was doing contract work for a group of geologists in the Quebec and Labrador North when the aircraft, with 7 people on board, disappeared between Fort Chimo and Nitchequon. When the aircraft was reported as overdue to the authorities four days later, SAR Chimo began. The search area was huge at 198,770 square nautical miles. Thirty-nine RCAF and civilian aircraft searched off and on into October until the Norseman was finally spotted on a lake 100 miles off track. The pilot had become lost and ran out of fuel so was forced to land on a lake. Fortunately all seven of the people on board survived the ordeal.[78] These major searches and many other similar ones were relentlessly sapping RCAF Rescue Units. Only a few years earlier in 1949 the total hours spent on rescue operations was approximately 2600 hours.[79] By 1952 RCAF aircraft flew an incredible 9100 hours with

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[77] DND, *Report of the DND for the Fiscal Year Ending March 31, 1950...*, 15.
[78] Smith, *Seek and Save: The History of 103...*, 45.
[79] DND. *Report of the DND for the Fiscal Year Ending March 31, 1949...*, 15.

1953 and 1954 following suit with 8100 hours and 8737 hours respectively.[80] This trend could not continue — something had to be done.

There were two logical approaches to influencing this problem of increasing number and intensity of RCAF search operations. The first was to improve search effectiveness, and the second was to reduce the requirement to do a search in the first place. An example of addressing the first problem can be found in the development of SAR best practice manuals. Although central direction and authority to conduct SAR operations was retained at Air Force HQ, the supervision of actual day-to-day operations were decentralized down to the Regional Command or Group level.[81] As a result, each of the RCC centres, on behalf of their Commands, produced SAR manuals specifically designed to capture best practices for their regions. Examples of these manuals include: *Training Command's Search and Rescue Information- RCAF Eastern Area SAR RCC* Manual(1955)[82] and Maritime Air Command's *Search and Rescue Atlantic Area Directive*(1955).[83] These manuals included basic SAR procedures that were common across Canada but they also included more specific regional nuances and valuable local communication information for the RCC controllers. Specific sections of these manuals included: a brief history of the RCAF SAR system, facilities for SAR from all parties (RCAF, Army, RCN, RCMP, DOT, commercial and private operators), duties for RCC

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[80] Department of National Defence, *Report of the DND for the Fiscal Year Ending March 31, 1952* (Ottawa: King's Printer, 1952), 20 and Department of National Defence, *Report of the DND for the Fiscal Year Ending March 31, 1953* (Ottawa: King's Printer, 1953), 20 and Department of National Defence. *Report of the DND for the Fiscal Year Ending March 31, 1954* (Ottawa: King's Printer, 1954), 56.

[81] Smith, *Seek and Save: The History of 103...*, 12.

[82] Department of National Defence, Training Command, *Search and Rescue Information: RCAF Eastern Area Search and Rescue Co-Ordination Centre* (Ottawa: DND Canada, 1955), (DHH 325.009(D646)).

[83] Department of National Defence, Maritime Air Command, *Search and Rescue Atlantic Area* (Ottawa: DND Canada, 1955).

staff, customs considerations, cooperation with US organizations, communications, search planning, briefing and de-briefing, and information on specialized SAR equipment.[84] These same topics make up the bulk of the current National SAR Manual for Canada.[85]

Search Masters

RCC staff routinely handled the coordination of emergency related communications and the initial response to aircraft or vessels in distress. If the response was reasonably quick (i.e., the position of the distress was known) the RCC would handle the complete coordination of the event. However, if it appeared that a prolonged search was about to start, a major search was declared and a Search Master (SM) was appointed. Whenever a major search began, a local search HQ was stood up near the search area for two reasons: the first was to facilitate better control of the search resources by allowing face-to-face briefs and debriefs of the SAR crews; while the second was because the workload of such a large search would detract considerably from normal RCC day-to-day coordination duties. An experienced SAR operator was designated as the Search Master and was put in charge of coordinating the search effort until the aircraft was found or the search was reduced.[86]

By 1959, the RCAF stood up a specialized SAR training school at RCAF Station Trenton to help provide more standardization across the organization. An important

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[84] Ibid.

[85] Department of National Defence/Canadian Coast Guard, B-GA-005-000/FP-004 – DFO 2204-23-4, *IAMSAR Volume IV...*, Chapter 4, 4.

[86] R.J. Mokler, *Aircraft Down* (New York: Exposition Press, 1968), 48.

component of this new school included the first serial of a Search Master Course (SMC), which taught standardized methods on how to conduct and direct a search operation.[87] This course, along with a more specific RCC Controller Course, is still run by the SAR community today. Every year, on three different occasions, SAR experts from across the RCAF and CCG are brought together at the CCG College in Sydney, NS to conduct one serial of the Search Master Course and two serials of the RCC Controllers course. The current syllabus includes: SAR System Overview, RCC Organization and Responsibilities, Search and Rescue Satellites, Dealing with Next-of-Kin, Legal Aspects of SAR, Selection of Search HQ, Search Planning, Search Master Duties, Reports, SAR Tech Capabilities, Civil Air Search and Rescue Association (CASARA) and Public Affairs/Media.[88]

The current Search Master Course finishes with a three-day exercise that simulates a major search for a missing aircraft. By the end of the exercise, students will have hands on practice at Search Master daily tasks including search planning, briefing/debriefing crews on their search assignments, dealing with media and next-of-kin situations. At the end of the course attendees are only considered qualified to act as Assistant Search Masters on a real search. Once they have completed ASM duties, and with CO approval, they will be awarded full Search Master status. [89] The handling of major searches by Search Masters was critical to RCC workload management over most

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[87] D.A. McIsaac, "Search and Rescue's new Look," *The Roundel* 13, no. 9 (Nov 1961): 6-9.

[88] Due to the joint nature of the course and the fact that CCG currently hosts the SM course, information on the course can by found on the CCG SAR training website. Department of Fisheries and Oceans, Canadian Coast Guard, "Search Master Course," last accessed 07 Apr 2014, http://www.ccg-gcc.gc.ca/eng/College/search_Master_Course.

[89] The author of this study not only attended the SMC in 2006, he was also the course director for the SMC from 2008 to 2011 as part of his duties while working at A3 SAR at 1 Cdn Air Div in Winnipeg.

of the history of SAR in Canada. However, this has been changing over the last decade due to less frequent and shorter duration major searches. This both reduces the requirement for and challenges the development of experienced Search Masters.

Evolution of SAR Procedures

The RCAF now had manuals standardizing SAR procedures, and courses to ensure corporate knowledge was passed on through more consistent training, but what of the actual procedures? After the previously mentioned search pattern drawn from Air-Sea Rescue in 1943, the next record concerning the conduct of search patterns appears in the *Training Command's Search and Rescue Information- RCAF Eastern Area SAR RCC* Manual from 1955.[90] The procedure describes plotting the most probable track following by the missing aircraft, from last known position to its destination. Using other indicators that may have denoted areas of higher probability, search areas were to be assigned along the track. If no areas of high probability where known, multiple aircraft would be assigned to complete a "Parallel Tracks" search pattern which essentially followed the same assumed path of the missing airplane. Aircraft would be spaced twice the spotter visibility apart to ensure they did not overlap. If few aircraft were available, this pattern was modified into a zigzag pattern back and forth across the track — a search pattern that is now referred to as a Creeping Line Ahead (CLA). If a Search Master had information leading him to a very high area of probability then he would employ an "Expanding Square" search pattern that commenced at the most likely location of the missing aircraft. All three of these patterns are shown in Figure 3. Similar variations of these search

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[90] Department of National Defence, Training Command, *Search and Rescue Information: RCAF Eastern Area Search and Rescue Co-Ordination Centre*..., Part 6, 1.

patterns are still in use by current RCAF SAR crews, as described in the National SAR Manual.[91]

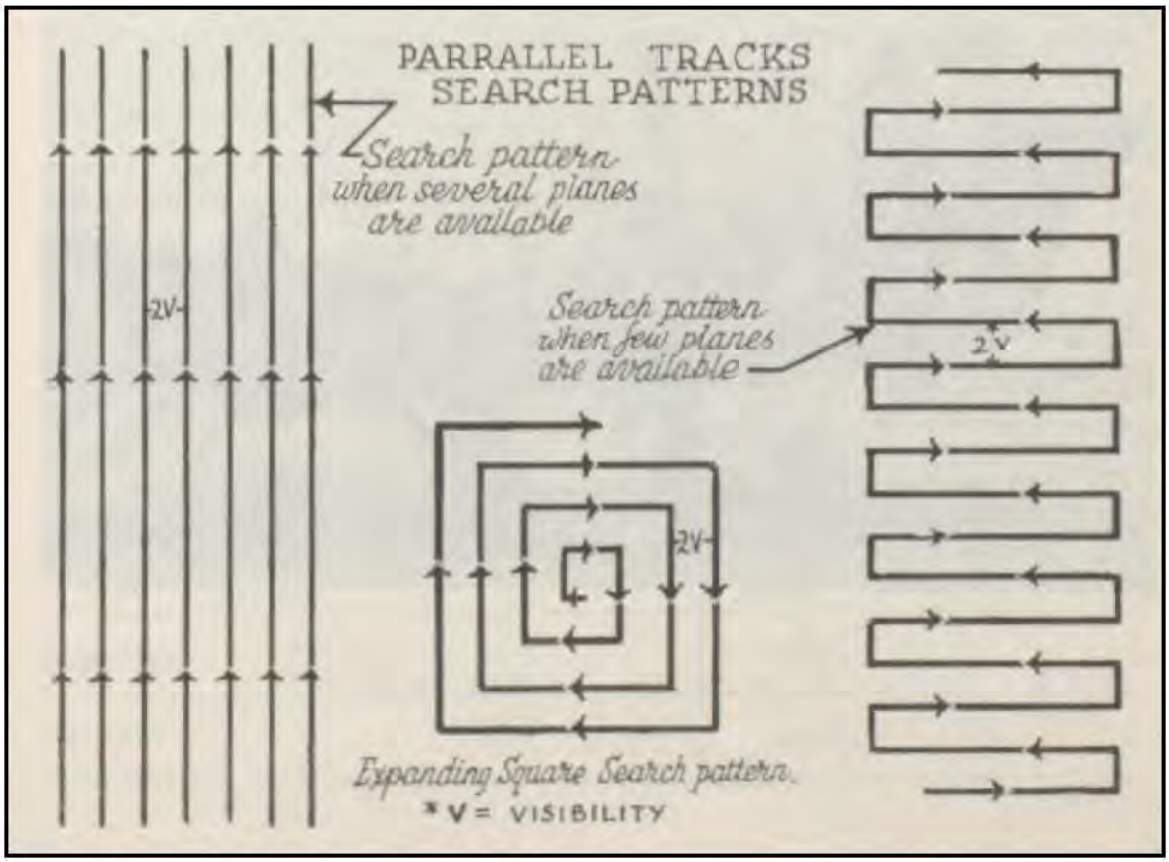

Figure 3: Search Patterns in 1955
Source: Canada. Training Command, *Search and Rescue Information: RCAF Eastern Area Search and Rescue Co-Ordination Centre* (1955), DHH 325.009 (D646), 6-1

To improve search operations, the RCAF also began implementing the results of an operational research report that was conducted in 1949.[92] The report attempted to quantify the effectiveness of searches to help Search Masters determine to what extent

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[91] Department of National Defence/Canadian Coast Guard. B-GA-005-000/FP-004 – DFO 2204-23-4, IAMSAR Volume IV..., Chapter 5, Annex 5A.

[92] John Stanley, "RCAF Operational Research Report No 4: An Analysis of the Efficiency of SAR Procedure," (Ottawa: CORA, 09 Sep 1949).

specific areas had been effectively covered. The researcher used scientific and statistical methods to determine coverage factors based on a number of variables. These included: height, speed, visibility, turbulence, health of spotters, incidence of airsickness, size of lost aircraft, condition of crash, type of terrain, number of spotters, position of spotters and duration of search, including any transit times.[93] Although the author admitted that "the analysis [had] been carried through by as rigorous an application of the Theory of Probability as the formidable difficulties of the problem will allow," the final report did conclude with a step-by-step process to help determine search effectiveness. Search Masters considered each of the aforementioned variables and would consult various charts to determine numerical factors of efficiency.[94]

Although simpler in format, the basic theories of this 1949 study are evident in the *RCAF Eastern Area Search and Rescue Co-Ordination Centre Manual* (1955)[95], and endure to this day in the current National SAR Manual. [96] These theories continue to help both Search Masters and aircraft commanders in determining their search effectiveness. Area coverage is now determined by considering four mathematical expressions related to how the search is conducted. These expressions are: track spacing, probability of detection (POD), sweep width, and coverage factor. POD is influenced by a number of

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[93] Ibid., 3.

[94] Ibid., 1.

[95] Department of National Defence. Training Command. *Search and Rescue Information: RCAF Eastern Area Search and Rescue...*, Chapter 6, Sect 3, 1.

[96] Department of National Defence/Canadian Coast Guard. B-GA-005-000/FP-004 – DFO 2204-23-4, IAMSAR Volume IV..., Chapter 5, 14.

factors including: search object characteristics, terrain conditions, search craft speed, position of the sun and spotter effectiveness.[97]

After a number of scientific studies over the decades, the RCAF continued to improve search procedures until the 1990s. An inability to change these procedures has recently developed however and is discussed further in chapter 5. Following the task of improving search procedures, the second method of reducing the search workload was not to search at all — this was made feasible through new technologies.

New Technologies

RCAF aircraft continued to carry the primitive beacons from the Second World War in their emergency kits or dinghies in the post-war period until a better system became available in the early 1950s. The British developed and introduced a system referred to as SARAH (Search and Rescue And Homing), which consisted of two parts.[98] The first part was a transmitter that was normally kept in the onboard survival kit or in a vest worn by aircrew. The unit could either be used to transmit a continuous series of pulses on a frequency of 243 MHz or it could be used in a voice mode to allow two-way communication with a search aircraft. The battery life was good for approximately 20 hours of continuous use in pulse mode, less with extensive use of voice. The second part of SARAH was a receiver unit that was normally installed in search aircraft. Two antennas, one mounted on each side of the aircraft fuselage, would receive the analog signal from emergency beacons and feed the information back to the SARAH receiver.

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[97] Ibid., Chapter 6,18.

[98] Meulstee, Wireless for the Warrior, last accessed 07 April 2014, http://www.wftw nl/asr3.html.

Crews would "line up" the signal with a reference line, which meant they were either heading directly towards or away from the beacon.[99] If the signal strengthened they were going in the right direction and once the signal stopped — due to a signal void directly over the transmitter — it meant they were close. The beacon radiation pattern formed a cone approximately 140 miles wide at a height of 10,000 ft.[100] Crews would then simply follow this procedure at gradually lower altitudes until they had a small area to continue to search visually. Current SAR aircraft are equipped with integrated homing systems that provide pilots with bearing indications on navigation instruments in the cockpit. As a backup to equipment malfunction, crews are also taught how to use an "aural null" homing procedure, which essentially follows the SARAH procedure. Crews tune the analog distress frequency to a radio set and fly bearings mapping out when signals become stronger and weaker to triangulate the beacon location.[101]

Concurrent to the RCAF implementation of SARAH, a researcher at the National Research Council (NRC) was developing another type of emergency beacon. The device was a Crash Position Indicator (CPI), which was essentially a rescue beacon that could be manually or automatically deployed from the outside of an aircraft. If the aircraft sank or burned in a post-crash fire the emergency beacon would still function. The first model was available in 1959 and although it has gone through many variations and upgrades over the years, CPIs are now standard on almost all aircraft that fly over water including

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[99] Para Rescue Association of Canada, *That Others May Live...*, 65.

[100] D.F. Metcalfe, "Search and Rescue Training," *The Roundel* 15, no. 9 (Nov 1963): 2-6.

[101] Department of National Defence, CFP 209, *Search and Rescue Orders and Procedures* (Ottawa: DND, 11 Feb 1976), (Comox Military Museum), Annex E, E-50.

SAR helicopters and commercial carriers.[102] In spite of RCAF officials strongly recommending emergency beacons at the time, most civil operators did not carry them or have them installed in their aircraft. Despite the increasing availability of commercial beacons and the obvious lives saved, ELT carriage on aircraft would not be mandated in Canada until 1974.[103]

Another element of developing technology that also helped locate missing aircraft, or that helped avoid incidents altogether, was radar. By 1959, radar units of Air Defence Command were able to provide assistance to lost aircraft by tracking aircraft positions and providing vectors to lost pilots. The *RCAF Eastern Area Search and Rescue Co-Ordination Centre Manual* includes procedures for pilots to indicate they were in distress, including making a radio call over 121.5 MHz or flying triangular patterns to attract attention.[104] Even after an incident had occurred, Air Defence Command could help isolate the last known position of aircraft within their radar coverage areas (a practice still commonly used during major searches today with current RCAF radar resources).

An initiative conducted by the RCAF in an attempt to reduce the steadily increasing burden of SAR activities included education campaigns that targeted high potential "customers."[105] These campaigns pressed the importance of filing a flight plan,

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[102] National Research Council Canada, "Saving Survivors by Finding Fallen Aircrafts," last accessed 07 April 2014, https://www nrc-cnrc.gc.ca/eng/education/innovations/discoveries/fallen_aircraft html.

[103] Para Rescue Association of Canada, *That Others May Live...*, 129. (This topic will be revisited in chapter 4).

[104] Department of National Defence, Training Command, *Search and Rescue Information: RCAF Eastern Area Search and Rescue....*, Appendix F.

[105] McIsaac, "Search and Rescue's new Look," *The Roundel...*, 9.

reinforced the benefits of carrying survival equipment and ELTs, and provided general information on the SAR system overall.

Further Organizational Developments

Along with the training and procedural improvements of the 1950s, a number of organizational changes were also made to the RCAF SAR system. A detachment of 103 Rescue Unit (RU) had been stationed in Torbay since Newfoundland joined Canada in November 1949.[106] This unit was kept busy supporting Newfoundland and the Eastern oceanic approaches to Canada. In 1954, the decision was made to make the detachment a full unit, and so 103 RU Det was disbanded and in its place 107 Rescue Unit was stood up on April 1st, 1954.[107] The action was merely administrative in nature since the same crews and aircraft kept flying in the same role.

Coordination of SAR activities was also not without change in the late 1950s. In *Aircraft Down*, Flying Officer R. J. Mokler describes the closure of RCC Edmonton: "During the late spring of 1959 information was received from Air Force Headquarters that the Edmonton Centre would soon be combined with the Winnipeg Centre."[108] Shortly thereafter, the majority of the Edmonton RCC staff moved and combined with the Winnipeg RCC leaving behind an Air Observer manned sub-centre to help manage what was about to become a very large Search and Rescue Region. The Edmonton based Rescue Flight was also disbanded, leading to its aircrew and aircraft, along with Station

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[106] Smith, *Seek and Save: The History of 103...*, 25.

[107] Department of National Defence, "RCAF Organization Order 9/54. 107 Rescue Unit, RCAF, Torbay, Nfld," 895-63/107 (DOE), 05 Feb 1954, (DHH).

[108] Mokler, *Aircraft Down...*, 33.

Whitehorse and Station Fort Nelson resources, being reallocated to 111 Composite Unit in Winnipeg.[109]

With the removal of Edmonton SAR resources, the RCAF also reassessed the national SRRs and re-divided Canada's SAR area of responsibility into four regions, one less than previous. The Pacific SRR remained essentially unchanged; the Western RCC absorbed the Central SRR; the Eastern SRR absorbed some of Atlantic and Central SRRs original responsibility; and the Atlantic SRR had less inland area to cover. Figure 4 depicts the revised SRR regions as they were in 1961. These new boundaries would remain unchanged for just over three decades. One last change on the east coast saw the

[109] Department of National Defence, *Report to the Chiefs of Staff Committee by the Joint Planning Committee on Search and Rescue*, CSC 1195-1, 16 Mar 1961, (DHH), 4.

creation of a sub-centre in Torbay, NL to support the increasingly busy Atlantic SRR.[110]

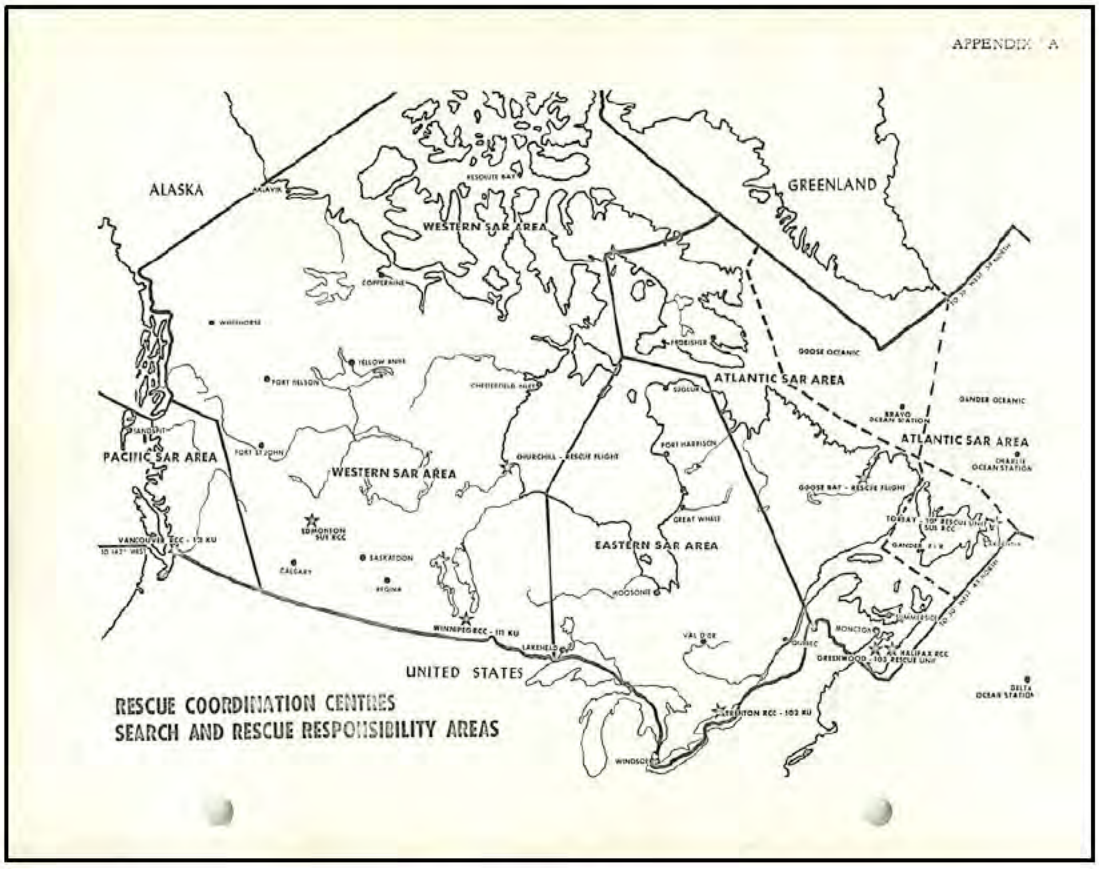

Figure 4: Redefined SRR Boundaries (1961)
Source: Canada, Search Masters Handbook (circa 1961), Chapter 1 Appendix A.

Proof that the RCAF SAR organization had developed into one of the most credible SAR organizations of its kind globally can be found in accounts of RCAF members being requested to give their expert opinions at ICAO meetings. On one occasion, a member of the Brazilian delegation was so impressed by the SAR manuals produced by the RCAF that they "patterned their SAR program on the Canadian system."[111] RCAF officers went on to provide continuing expertise to ICAO in many

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[110] Ibid.

[111] "ICAO and the RCAF," *The Roundel* 8, no. 9 (Nov 1956): 27.

aviation fields including SAR. In fact, RCAF officers contributed to the production of a SAR manual "for the use of all ICAO member nations."[112] The RCAF SAR organization progressed significantly during this era of procedural development but many changes were yet to come.

Conclusion

The 1950s saw the RCAF SAR organization successfully expand its role to provide coordination and response in the maritime realm. This was accomplished while continuing to develop improved search procedures through scientific analysis — a practise that should continue to this day. A number of new technologies were successfully integrated into search operations including: SARAH electronic beacon systems, radar assistance and helicopters. The extent of this developmental success is evidenced by other nations imitating the RCAF organization through ICAO information sharing meetings. The RCAF enjoyed a decade of capability refinement and expansion — this would not be the case in the 1960s.

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[112] Ibid., 28.

CHAPTER 3: AIRCRAFT CHANGES AND UNIFICATION

Introduction

During the 1940s and 50s there were very few SAR platform changes, but this would change significantly in the following decade. All organizations that utilize aircraft will go through cycles of procuring new platforms based on the sustainability of current fleets, requirements to fill new roles, and the appeal of technological advancements. The most significant aircraft change was the introduction of the Labrador helicopter, which brought key improvements to SAR helicopter capabilities. A second major influence on the RCAF SAR system was the streamlining effects of Minister of National Defence Paul Hellyer's unification plan. Along with the rest of the RCAF, SAR operations were significantly impacted by base closures and downsizing — with the most significant being the removal of all SAR resources from Newfoundland.

de Havilland DHC-3 Otter

The first aircraft to be replaced from the initial cadre of aircraft was the Noorduyn Norseman. Through many SAR missions in and over the remote areas of Canada, the Norseman had proven the value of a small, rugged and reliable aircraft with floats or skis. Starting in 1953, the RCAF began replacing the Norseman throughout the RCAF with the de Havilland Canada DHC-3 Otter. The new aircraft was employed at transport and SAR units across the country and even saw duty out of country on United Nations (UN) missions in the Sinai and New Guinea.[113] The RCAF purchased 69 Otters of which 14

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[113] Milberry, *Sixty Years: The RCAF...*, 310, 328.

were used in the SAR role at 103 RU, 102 KU, 111 KU and 121 KU.[114] The well designed, Canadian built, Otter performed well enough but its speed and range only provided a marginal improvement over the Norseman it had replaced. This may explain why it only lasted a decade in the SAR role before being removed in 1963.[115] The value floatplanes like the Norseman and the Otter had brought to SAR in the early years would eventually be overshadowed by the improving capabilities of helicopters.

Sikorsky H-5 Helicopter

The Sikorsky H-5 helicopter that was introduced in 1947 brought an invaluable capability to SAR, allowing rescues to be prosecuted over almost any terrain. Equipped with a rescue hoist, seating for one pilot and three passengers, and with a useful payload of 1450 lbs, it was a practical but limited option for many rescue missions. There were only seven in the RCAF inventory, spread out across Canada in a training, utility or SAR role. It did not help that limited aircrew experience and low mechanical reliability led to a number of mishaps, further reducing availability.[116] Combine these low numbers with a 65 mph cruise speed, a 260 mile range, and day-VFR (visual flight rules) only operations, and it was a challenge to have one in the right place at the right time. These helicopters were however, invaluable at proving the concept of use for SAR operations, which led the

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[114] Department of National Defence, *1960-65 Program Summary, Search and Rescue* (Ottawa: DND, 1960), (DHH), 21.0.3-21.0.4.

[115] Para Rescue Association of Canada, *That Others May Live...*, 86.

[116] Milberry, *Air Transport in Canada: Volume 1...*, 346.

RCAF to purchasing a more capable replacement helicopter eight years after the H-5 had been introduced into service.[117]

Piasecki/Vertol H-21A Helicopters

The replacement for the H-5s began arriving in 1954 in the form of a "Flying Banana."[118] The RCAF made an initial purchased of six Piasecki/Vertol H-21A tandem rotor helicopters that went towards training aircrew and preparing for the construction of the Mid Canada Line.[119] Nine more H-21s were delivered in 1955 and 1956 of which most made it to SAR units across Canada. Two were stationed with 103 RU in Greenwood, one with 102KU in Trenton, two with 111KU in Winnipeg and two with 121 KU at Sea Island.[120] The H-21 was more stable to fly, had a more capable hoist and the large interior cabin space facilitated much improved patient care with transiting."[121] Along with these improvements over the H-5, the H-21 also boasted an improved cruise speed of 90 mph and a range of 400 miles.[122] The enhanced capabilities the H-21 brought to rescue operations across Canada were significant and before long rescues were routinely being conducted from the sides of mountains and from ships at sea.[123] The H-21 proved an invaluable workhorse and would serve in a variety of transport and utility roles

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[117] Sikorsky Archives, "S-51/HO3S/H-5F, G, H Helicopter," last accessed 08 April 2014, http://www.sikorskyarchives.com/S-51.php.

[118] Crews referred to the Piasecki H21 as a "flying banana" due to the banana shaped fuselage.

[119] Milberry, *Sixty Years: The RCAF...*, 294-295. The Mid-Canada Line was a chain of radars located along the 55th parallel during the 1950s tasked to detect incoming enemy aircraft.

[120] Department of National Defence, *1960-65 Program Summary...*, 21.0.3-21.0.4.

[121] Grant MacDonald and Terry Strocel, *442 Squadron History* (Comox: 442 Sqn, 1987), 107.

[122] Boeing, History: CH-21 Shawnee/Vertol 44 Helicopter, last accessed 19 April 2014, http://www.boeing.com/boeing/history/boeing/ch21.page.

[123] MacDonald, *442 Squadron History...*, 117.

until 1971, but would be replaced in the SAR role by the Vertol/Boeing Model 107 helicopter starting in 1963.[124]

Vertol/Boeing CH-113A Labrador Helicopters

The RCAF intended to purchase the Vertol model 107 helicopters for both utility and SAR roles by as early as 1960, but the priority was to have the high performance Vertol 107s assigned directly to "the more exacting task of Search and Rescue."[125] The first six SAR Vertol helicopters were located at three units: two with 121 KU at Sea Island, two with 102 KU in Trenton and the final two with 103 RU in Greenwood.[126] By 1964 the RCAF would purchase six more of the SAR Vertol 107 variants, referred to as CH-113A Labradors and six of the utility Vertol 107 variants, referred to as CH-113 Voyageurs. The CH-113 helicopter had major improvements over previous helicopters used by the RCAF, including: twin turbine engines, electrical de-icing on the rotor system (which was later deactivated on the Canadian variants),[127] a rear-loading ramp and a stability augmentation system (SAS).[128] The twin turbines not only provided major horsepower improvements (2500 hp for both engines vice 1425 hp from the H-21), but in the event of an engine failure the aircraft could potentially return to base, depending on

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[124] A.G. Trimble, "Introducing the CH-113 Helicopter," *The Roundel* 15, no. 4 (May 1963): 14.

[125] Department of National Defence, *1960-65 Program Summary, Helicopters* (Ottawa: DND, 1960), (DHH), 13.8.2.

[126] E.D. Bryson and N.D. Bray, "An Evaluation of the future RCAF Search and Rescue Requirement," (Ottawa: DND, February 1964), Appendix "A" Table 1.

[127] Peter Pigott, *On Canadian Wings: A Century of Flight* (Toronto: Dundurn Press, 2005), 160.

[128] Trimble, "Introducing the CH-113 Helicopter," *The Roundel*..., 14.

the flight conditions when the failure occurred.[129] The rear ramp brought obvious advantages for on and off loading equipment and personnel, especially stretchers. The SAS, combined with avionics improvements, meant that the CH-113 helicopter could fly in Instrument Flight Rule (IFR) weather conditions, which significantly expanded the response capabilities of the helicopter for SAR operations.

The Labrador and Voyageur variants had a number of minor variations but the major differences were that the Labrador came with auxiliary fuel tanks in the sponsons and IFR instrumentation.[130] In 1974 Force Mobile Command received eight new and very capable CH-147 Chinook helicopters for troop transport and utility duties.[131] Now surplus, the Voyageur helicopters were redistributed for SAR duties where they performed adequately considering they were missing a number of the original SAR configurations. These extra helicopters came at an opportune time due to the creation of an additional Rescue Unit to support SAR operations in Newfoundland in 1976.[132] In order to bring the Voyageur to the same standard as the Labradors and to also include advances in aviation technology, a two phased upgrade program was initiated in 1978.[133] The first phase of the program, termed Interim Avionics Program (IAP), consisted of improvements to navigation and communication systems along with the installation of a high-powered searchlight. The second upgrade phase was termed SAR Capability Upgrade Program (SARCUP) and incorporated an improved hoist, addition of a weather

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[129] Boeing, History: CH-21 Shawnee/Vertol 44 Helicopter, last accessed 19 April 2014, http://www.boeing.com/boeing/history/boeing/ch21.page.

[130] Pigott, *On Canadian Wings: A Century of Flight...*, 159.

[131] Milberry, *Sixty Years: The RCAF...*, 373.

[132] Smith, *Seek and Save: The History of 103...*, 105. (This topic is discussed further in Chapter 4)

[133] "Chopper Modifications," *The Airforce* 4, no. 1 (Mar 1980): 15.

radar and further cockpit instrumentation improvements. Along with these upgrades the Voyageur helicopters were also brought up to the Labrador SAR configuration standard, including the addition of auxiliary fuel tanks in the sponsons. Five years later, fourteen upgraded Labradors were in service across Canada.[134]

As well suited as the Labrador was for SAR operations, it was not without its faults. Despite attractive fuel capacities and cargo weight specifications, the reality was that one cancelled out the other. If a crew wanted to take maximum fuel for an extended mission they had to offload equipment and fly at reduced airspeeds for the initial part of their flight. A second weakness concerned the inability of the helicopter to remain in the hover if an engine failed. Over a third of the CH113 fleet would be lost in its service life and most of these losses were due to engine failures.[135] This issue was recognized in a Flight Safety report written in response to a Labrador crash in 1992: "The poor single engine performance of the CH-133A Labrador is well understood. The nature of the SAR role demands that the aircraft be flown in the flight regimes that precludes options if a single engine flames-out."[136] In spite of its engine issues, the Labrador helicopter excelled at SAR duties and became a major SAR icon in Canadian aviation history for four decades. In 2004, the last Labrador helicopter was retired at 424 Squadron in Trenton when it was replaced by the CH-149 Cormorant helicopter.[137]

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[134] Smith, *Seek and Save: The History of 103...*, 113-114.

[135] Pigott, *On Canadian Wings: A Century of Flight...*, 161.

[136] Larry Milberry, *Air Transport in Canada: Volume 2* (Toronto: CANAV Books, 1997), 926.

[137] "Last Cormorant Arrives," *Airforce* 27, no. 4 (Winter 03/04): 5-6. The entrance of the Cormorant into Canadian SAR service will be covered in chapter 4.

Grumman (SA16B) Albatross

The venerable Canso had been in service with the RCAF since 1941 serving primarily on the East and West coasts in the anti-submarine role.[138] After the Second World War, the RCAF began assessing the Canso for other roles including transport and SAR. The aircraft was assessed as "excellent" for straight search operations due to its long endurance times and good spotter visibility by a large crew complement. It was also noted that parachute jumping and supply dropping from the rear blisters was possible, although some modifications to the blister area would be prudent. It was noted that the aircraft lacked manoeuvrability for low altitude searching in rugged terrain and cold weather operations were less than ideal due to difficulty in reaching the engines for warming procedures.[139] Regardless of its strengths and weaknesses the Canso was used successfully at many SAR units across Canada from 1945 until replaced in the early 1960s.[140]

By 1959 it was apparent that the Canso was becoming difficult to maintain and that it would only have a useful life until 1961. A suitable replacement — in fact the only available amphibious aircraft still being manufactured at the time — was identified as the Grumman SA16B (Albatross). This aircraft had a proven track record and was already in service with the USAF, the US Navy, USCG, the German Air Force and the Japanese Air

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[138] Milberry, *Sixty Years: The RCAF...*, 120-124.

[139] Department of National Defence, "Air Search and Rescue - Canso Aircraft," Letter from Air Officer Commanding NWAC to Department of National Defence for Air, 4-17-1 (C. Staff O), 26 Sep 1945, (DHH).

[140] Department of National Defence, 1960-65 Program Summary, Search and Rescue..., 21.0.4.

Force.[141] After what was a lightning speed procurement by today's standards, the Department of National Defence purchased and delivered ten Albatross aircraft by 1961. The aircraft were stationed as follows: three at 102 KU in Trenton, three at 121 KU at Sea Island, two at 103 RU in Greenwood and two at 111 KU in Winnipeg.[142] It is interesting to note that the Albatross was the first aircraft that the RCAF procured specifically for the role of SAR. Besides the improved maintainability of a new aircraft, the Albatross also brought performance improvements over the Canso. The Albatross had a cruise speed of 170 mph, compared to the Canso at 115 mph. The Albatross also had a maximum range 600 miles further than the Canso, giving it the ability to fly up to 3150 miles with auxiliary fuel tanks — which came in very handy on long searches.[143]

The Albatross was a well-designed amphibious aircraft but unfortunately the requirement to use this type of platform for SAR operations was quickly waning and the Albatross was retired from service a decade later when the CC-115 Buffalo aircraft arrived. The dwindling requirement for an amphibious aircraft can be linked to two primary factors. The first was due to the increasing capability of helicopters that began dominating the "rescue" portion of SAR operations in the mid-1960s with the introduction of the Labrador. The second factor was related to the requirement for reasonably calm waters to allow the Albatross to conduct a water-landing rescue. A

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[141] Department of National Defence, "Procurement of SA16B Aircraft," Memorandum for Cabinet Defence Committee from Minister of National Defence," 26 January 1959, (DHH), 1.

[142] Department of National Defence, 1960-65 Program Summary, Search and Rescue..., 21.0.4.

[143] Canadian Wings-The History & Heritage of the Royal Canadian Air Force, "Consolidated Canso," last accessed 20 Apr 2014, http://www.canadianwings.com/Aircraft/aircraftDetail.php?CANSO-146.
Canadian Wings-The History & Heritage of the Royal Canadian Air Force, "Grumman CSR-110 Albatross," last accessed 20 Apr 2014, http://www.canadianwings.com/Aircraft/aircraftDetail.php?ALBATROSS-154.

Centre for Operational Research and Analysis (CORA)[144] report conducted in 1964 pointed out that the Albatross had only prosecuted one operational landing on water during the year of 1962, and that is was superfluous in nature.[145] The report went on to recommend eliminating the Albatross from SAR services — by the early 1970s this recommendation was actioned.

Douglas Dakotas

Like the Canso, the Lancaster was re-roled after the Second World War to fulfil a number of duties, one of which was the long-range search requirements of the RCAF SAR program. ICAO standards at the time required an aircraft that could "conduct a two hour search at a radius of at least 750 nautical miles."[146] The Lancaster was very well suited for this role with an impressive range of 2530 miles at a cruise speed of 210 mph, and was strategically stationed on both the West and East coasts of Canada.[147] With four engines the crews had a good safety margin in the event of an engine failure while operating far out to sea, a feature that neither the Canso nor the Albatross possessed. However, the Lancaster was another aircraft predicted to reach the end of its useful life in the early 1960s. Rather that procure specific aircraft for this role, Dakota aircraft already in wide use for transport duties in the RCAF were reallocated to the long-range SAR role. The first Dakotas were officially used for SAR as early as 1960, and by 1963 Dakotas

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[144] CORA type organizations had varying names over the decades. For clarity, the term CORA will be used throughout this paper when referring to all Operational Research and Analysis sources.

[145] Bryson, "An Evaluation of the future RCAF Search and Rescue..., 6.

[146] Ibid., 6.

[147] Canadian Wings-The History & Heritage of the Royal Canadian Air Force, "Avro Lancaster," last accessed 20 Apr 2014, http://www.canadianwings.com/Aircraft/aircraftDetail.php?LANCASTER-MP-164.

were allocated to SAR operations as follows: two Dakotas at 111 KU in Winnipeg, one Dakota at 102 KU in Trenton, one Dakota at 103 RU in Greenwood and finally one Dakota was stationed in Goose Bay.[148] The Dakotas served in the RCAF/CF until the late 1980s but were removed from the SAR role by the early 1970s.[149] Worthy of note is the fact that two North Star aircraft were transferred in 1963 to 107 RU in Torbay to replace the Lancasters. This situation was short lived however, since 107 RU was closed by 1964.[150]

The 1950s and 60s saw many changes in the aircraft used to conduct SAR operations, and although most were re-roled from other RCAF jobs they all performed well in the hands of dedicated SAR crews. Initially, amphibious aircraft and aircraft on floats were necessary to conduct the rescue portion of the SAR equation but with time this role became dominated by the helicopter. As a result, water-landing aircraft were becoming less and less desirable. Separating the roles of "search" and "rescue" helped clear the way for almost any aircraft with a reasonable endurance to perform search duties. Once the people in distress were located either a helicopter or a surface vessel would be vectored in for the pick-up.

By 1964 the RCAF SAR organization reached an all-time low of primary resources. Although any RCAF resource could be tasked to help with searches as a secondary resource there were only twenty RCAF primary SAR resources in Canada: ten

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[148] Bryson, "An Evaluation of the future RCAF Search and Rescue..., Appendix A.

[149] Para Rescue Association of Canada, *That Others May Live...*, 116.

[150] Department of National Defence, *1963-68 Program Summary, Search and Rescue* (Ottawa: DND, 1963), (DHH), 22.1.4.

Albatross, six H-21 helicopters and four Dakotas.[151] This was a sign of the reductions coming for the entire Air Force as the new Defence Minister, Paul Hellyer, rolled out his plan to streamline Canada's military force through unification.

Hellyer's Unification

When the Liberal party returned to power in the federal election of 1963, Paul Hellyer was appointed the Minister of National Defence (MND) under Prime Minister Lester B. Pearson. Hellyer diligently continued efforts that had already begun to "rein in" the RCAF, RCN and Canadian Army through a number of significant policy changes.[152] The 1964 White Paper on Defence described a ten-year strategic defence plan for Canada that included the integration of the three services into a single Canadian Armed Forces — known as unification. The basic tenets were to reduce the overhead that three separate services carried at the national headquarter level while also improving the civil-military relations through the creation of a more integrated force structure with improved civil control. The savings realized in the headquarter reductions were required for capital equipment purchases in the years ahead. A portion of the capital procurement funding would go towards air transport aircraft in an effort to meet the 1964 White Paper's plan to "substantially augment our existing air transport capability" to meet an overall goal of greatly increasing force mobility. Given the essential role that transport aircraft played as either primary or secondary resources in search operations this boded well for SAR. Although SAR only had a fleeting mention in the White Paper, as an additional "quasi-

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[151] Department of National Defence. *1964-69 Program Summary, Search and Rescue* (Ottawa: DND, 1964), (DHH), 19.1.3.

[152] Daniel Gosselin and Craig Stone, "From Minister Hellyer to General Hillier: Understanding the Fundamental Differences between the Unification of the CF and its Present Transformation," *Canadian Military Journal* 6, no. 4 (Winter 05/06): 6.

military" task under the heading of Defence of Canada, the changes to come in the SAR organization would be substantial. [153] Many of these changes would follow the recommendations of a Department of National Defence CORA study.

In February 1964, CORA published a report evaluating future RCAF SAR requirements. The purpose of the study was to "investigate the requirement for SAR facilities and to examine the methods which the RCAF could adopt to discharge its SAR obligations."[154] After consideration of the organizational structure and through scientific analysis of SAR statistics from the period of 1958 to 1963, significant recommendations were made on how to improve, or more specifically, how to economize the provision of SAR in Canada.

The first point the report discussed was the number and locations of RCCs and their sub-centres. It was pointed out that "coordination of SAR activities through the RCC's was direct, efficient and economical" but to have a sub-centre manned 24 hours a day in the same SRR was redundant and a waste. The locations of SAR activities were also plotted and used to validate that the RCC locations aligned well with the majority of SAR cases. Based on the statistics of case prosecution and SAR activity it was recommended that Edmonton was a better location than Winnipeg for the Western Region RCC.[155] The influence of this report is clearly evident in that both the Edmonton RSC and the Torbay RSC were closed before the end of 1964.[156] The recommendation to move the

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[153] Department of National Defence, *1964 White Paper on Defence* (Ottawa: Queen's Printers, 1964).

[154] Bryson, "An Evaluation of the future RCAF Search and Rescue..., 1.

[155] Ibid., 3.

[156] The Torbay and Edmonton RSCs disappeared when a comparison between the 63-68 and 64-69 Program summaries is made. Department of National Defence, *1964-69 Program Summary. Search and*

Western Area primary RCC from Winnipeg to Edmonton would not be followed until 1971.

Next, the CORA study examined the role and location of SAR units used to prosecute SAR cases. It noted that "the organization met the basic requirements for an effective primary SAR organization" but aircraft utilization on SAR operations was very low at times. The nature of SAR operations was a "feast or famine" arrangement that saw crews with little to do in the off seasons while they were exhausted during periods of high activity. This situation led to two recommendations: the first was to pursue the possibility of utilizing civilian aircraft to assist in searches during the busy periods. This situation was already being exploited in both the US and Australia at the time of the report. The RCAF would pursue this recommendation but it would be two decades before a formal organization was in place — it would be formed as the Civilian Aviation Search and Rescue Association (CASARA) in the mid-1980s, which will be discussed in more detail in chapter 4. The second recommendation was that dedicated SAR squadrons were not required by ICAO and that due to the low flying rates at times the job would be better handled as a secondary tasking for other RCAF units. Although SAR would not be made a secondary duty, by the late 1960s all but one of the SAR units was re-designated as dual role — Transport and Rescue Squadrons. This allowed the Squadrons to maintain specialized SAR equipment and trained personnel but also allowed for these resources to contribute to a second role, which was a more efficient arrangement.[157] This compromise did however require a larger crew complement than a single role unit, since at least two

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Rescue..., 19.1.3. and Department of National Defence, *1963-68 Program Summary. Search and Rescue*..., 22.1.4.

[157] Bryson, "An Evaluation of the future RCAF Search and Rescue..., 4-5.

lines of tasking (LOT) had to be maintained including the no-fail LOT for an immediate SAR response.

Finally, the report states "*search* and *rescue* are essentially separate functions."[158] Fixed wing resources primarily carried out the *search* function and helicopters primarily prosecuted the *rescue* function. The use of the Albatross aircraft was an attempt to bridge these two roles together but it had not done so effectively so amphibious aircraft were declared "not required."[159] The content of this report had a lasting impact on the RCAF SAR organization as many of the recommendations were implemented and are still in effect to this day.

Base Closures and Unit Moves

The RCAF deeply felt the impact of Hellyer's master plan, which included the movement and closure of various units across Canada in an effort to reduce redundancy and unnecessary defence spending. Rescue units in particular were significantly rearranged in the mid to late 1960s. Starting on the West coast and working eastward across the country, Sea Island was closed in 1964 causing 121 KU to look for a new home. A logical new location lay just across the Strait of Georgia at RCAF Station Comox, which is where 121 KU officially moved as of July 1st, 1964.[160] The move occurred seamlessly as the unit continued to operate Albatross and H-21 helicopters for SAR operations. Four years later, on July 8th 1968 the unit was re-designated as 442 Communications and Rescue Squadron but this re-naming was modified four months

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[158] Ibid., 6.
[159] Ibid. As mentioned earlier, the Albatross was removed from service in 1971.
[160] Department of National Defence, *1964-69 Program Summary. Search and Rescue...*, 19.1.3.

later to 442 Transport and Rescue Squadron.[161] As recommended in the 1964 CORA report, 442 Squadron now had two roles. To this day 442 T&R Squadron is still located in Comox, BC and retains the dual role designation.

Another major change in the Pacific SRR was RCC Vancouver moving to Victoria circa 1970.[162] At some point between 1964 and 1973 the Victoria SRR boundaries were expanded to include all of BC, the Yukon Territory and a portion of NWT located West of the Mackenzie River. This was likely an attempt to balance the workload between the Victoria and Edmonton SRRs after closing the RSC in Edmonton in 1964. The change would remain in place for twenty years. Another rebalancing would occur in 1984 when the Victoria SRR would be truncated back to the land territory of BC and its offshore area of responsibility.[163]

Moving westward, 111 KU based in Winnipeg would be re-designated as 440 Communications and Rescue Squadron on July 8th, 1968. In keeping with the multi-role trend, this new squadron would be renamed a month later as 440 Transport and Rescue Squadron. The squadron operated Dakotas and H-21 helicopters from Winnipeg during many SAR operations for the following three years. In 1971, 440 Sqn ceased operating helicopters and took over a detachment of four de Havilland Buffalos that were located in Edmonton. The Buffalos were primarily used in the Transport role but this was short lived as the flight was disbanded by 1974. Also in 1971, 440 Sqn aircrew began training on the de Havilland Twin Otter out of Edmonton. When the Twin Otter training was completed near the end of 1971, 440 Squadron moved to Edmonton where it remained

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[161] MacDonald, *442 Squadron History...*, 126.
[162] Para Rescue Association of Canada, *That Others May Live...*, 109.
[163] MacDonald, *442 Squadron History...*, 137.

flying only Twin Otters in the SAR role until the 1990s. Circa 1972, a detachment of one Twin Otter was established in Yellowknife — a situation that would endure over the years until 440 was permanently moved to Yellowknife in the 1990s. [164] A final Western Area change occurred in 1971 with the move of the Western Area RCC from Winnipeg to Edmonton — another example of changes in line with recommendations of the CORA report of 1964.

Meanwhile, in the Eastern SRR there were only minor adjustments made to the RCAF SAR organization in the Trenton area. 102 KU was continuing to provide light transport and SAR services for the Eastern region since it was stood up. Like its fellow rescue units across the country, 102 KU was redesignated to a full squadron on July 8th, 1968. Initially 102 KU became 424 Communication and Rescue Squadron but shortly afterwards the name was adjusted to 424 Transport and Rescue Squadron.[165] The unit would remain in Trenton along with the Eastern SRR RCC. Both are still located in Trenton today.

Continuing to the last region, the Atlantic SRR experienced the most significant changes of the 1960s reorganization. Forgetting the previously pledged support to the newest province to join confederation, 107 Rescue Unit in Torbay, Newfoundland was closed in 1964 with no replacement. Additionally, the drawdown of US aircraft from the American bases at Stephenville and Argentia meant that all SAR operations had to be supported by 103 RU or other secondary RCAF resources. This situation in

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[164] Carl Vincent and Terry Strocel, *440 Squadron History* (Stittsville: Canada's Wings Inc, 1983), 73.

[165] E.A. Johnson and Spence Gludish, *Trenton: 50 Years of Air Force* (Trenton: CFB Trenton 50th Anniversary Committee, 1981), 138.

Newfoundland persisted until public pressure and increased offshore activity led to SAR resources being reintroduced in the late 1970s.[166] A second controversial change in the Atlantic SAR system involved the movement of 103 Rescue Unit from Greenwood to Summerside, PEI. The decision was purely to placate political pressures by redistributing the military footprint after Neptune maritime patrol aircraft had been phased out. Although the move had no tangible operational impact, it is disconcerting that operational implications were "never at the forefront of the debate."[167] 103 Rescue Unit would be renamed to 413 Rescue Squadron on July 8th, 1968, while still in the process of moving to Summerside, PEI. Before long the unit was rebranded 413 Transport and Rescue Squadron, a name it would keep throughout its stay in Summerside into the 1990s. The RCC for the Atlantic SRR remained in Halifax, and has stayed there ever since.

CC-115/DHC-5 Buffalos

Throughout the organizational changes brought about by unification, there were also a number of platform changes, in particular within the fixed-wing fleets. The Canadian Armed Forces (CAF) purchased a total of fifteen CC-115/DHC-5 Buffalos from DeHavilland Canada (DHC) in 1967 as a show of support for the Canadian aircraft manufacturer in the wake of a US order cancellation. The Buffalos were mainly assigned to 429 Squadron in the transport role but by 1970 a number of them were assigned to SAR squadrons to replace the Albatross and the Dakota airframes.[168] Six Buffalos were

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[166] Smith, *Seek and Save: The History of 103...*, 105.

[167] Ibid., 101.

[168] Milberry, *Sixty Years: The RCAF...*, 355. As previously mentioned, the Albatross, which had been specifically bought for SAR duties, only lasted a decade in the role.

sent to 424 Sqn in Trenton where the Otters and H21 helicopters were immediately phased out. Dakotas were kept on strength until the end of the year when Twin Otters came on strength and were operationally ready for SAR duties.[169] In 1971, four Buffalos that were previously a detachment of 429 Sqn were assigned to the transport role at 440 Sqn. These Buffalos would be re-assigned in 1974 to 424 Sqn in Trenton due to the high transport operation tempo: in particular support to UN operations around the world and a northern airfield construction program. On the West coast, three Buffalo replaced the Albatross and the Dakota in 1970, which meant three aircraft would be doing the job previously done by nine.[170] Finally, on the East coast, 413 Squadron in Summerside was also putting newly acquired Buffalo aircraft through their paces.

It is interesting to note the differences between the Buffalo and the two aircraft it replaced, the Albatross and the Dakota. The Buffalo is a twin turbo prop aircraft with a cruise speed of 208 mph and a range of 2171 miles. Both the Albatross and the Dakota were twin piston engine aircraft with ranges of 3150 miles and 1600 miles respectively. The Buffalo therefore provided a middle range capability during SAR operations that would have had an impact on long searches and long-range offshore missions. It was recognized that a longer-range aircraft was required to conduct these types of operations — explaining a growing reliance on the RCAFs C-130 Hercules aircraft. The Buffalo was however an ideal medium range SAR aircraft for a number of reasons: it was very maneuverable at low levels over rugged terrain, it had a ramp for deploying SAR Techs and para equipment, and it had a very good Short Take-Off/Landing (STOL) capability

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[169] Nora Bottomley, *424 Squadron History* (Belleville: The Hangar Bookshelf, 1985), 103-106.
[170] MacDonald, *442 Squadron History...*, 128.

which allowed it to operate from small aerodromes. The Buffalo would do well enough at SAR in the mountains that it has served with 442 Squadron from 1970 to present — 44 years and counting.[171]

DeHavilland Canada Twin Otter

Another workhorse introduced in 1971 was the de Havilland Twin Otter. The Canadian Forces ordered eight of the aircraft for use at 440 T&R Squadron in Edmonton and Yellowknife (two each), and four for use at 424 Sqn in Trenton. The first two to arrive at 424 Sqn were immediately sent overseas to support UN missions in India, while the second two were kept in Trenton to take over SAR duties from the Dakota. This passing of the torch was delayed however due to the Twin Otter not initially being cleared for para operations. The Twin Otter did not have near the range or endurance of the Dakota but it was much more maneuverable and could be equipped with wheels, skis or floats. Despite good performance and being kept busy, the Twin Otter did not remain long with 424 Sqn. Four years after their arrival, the Twin Otters were sent to 440 Sqn in Edmonton in October 1975 where they would remain employed in the Transport and Rescue role until the early 1990s.[172]

Lockheed CC-130 Hercules

The retirement of the Dakotas and Albatross aircraft created a significant long-range search capability gap. Although not yet a primary SAR resource, the Lockheed CC-

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[171] RCAF, "CC-115 Buffalo: Transport/SAR Aircraft", last accessed 21 May 2014, http://www.rcaf-arc forces.gc.ca/en/aircraft-current/cc-115.page.

[172] Bottomley, *424 Squadron History*..., 113.

130 Hercules transport aircraft that entered service in 1965 very quickly became a secondary SAR resource of choice — this is no surprise with a range of over 5000 miles with a minimal payload on board. 435 Squadron Hercules flew 800 hours in support of SAR operations in 1972, a trend that was to continue.[173] By the mid-1970s a 436 Sqn Hercules in Trenton was maintaining a two-hour standby in support of SAR operations.[174]

SAR helicopters also saw changes during the mid-1960s to mid-70s. The six Labrador helicopters were performing very well at 442, 424 and 413 Squadrons. The performance improvements over the H-21 had allowed crews to push themselves to new limits in reaching aircraft and ships in distress. The H-21 had remained in service at 440 Sqn until the Twin Otters arrived — these would be the last helicopters to operate from that squadron. In Trenton, H-21s and Labradors were removed when the Buffalos arrived in 1970, leaving 424 Sqn without helicopters like 440 Sqn — this was however short lived. In 1975, at the same time as Twin Otters left, ex-Army Voyageur helicopters arrived at 424 Sqn. These Voyageurs were given temporary SAR paint jobs and employed as less capable Labrador helicopters. The Voyageurs were not left in Trenton long though, as significant events were on the horizon for east coast SAR that would draw them away.[175]

By 1976 the Canadian Armed Forces SAR system SRRs were as depicted in Figure 5 below and the organization had evolved as shown in Table 2.

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[173] Milberry, *Sixty Years: The RCAF...*, 387.
[174] Bottomley, *424 Squadron History...*, 116.
[175] Smith, *Seek and Save: The History of 103...*, 105.

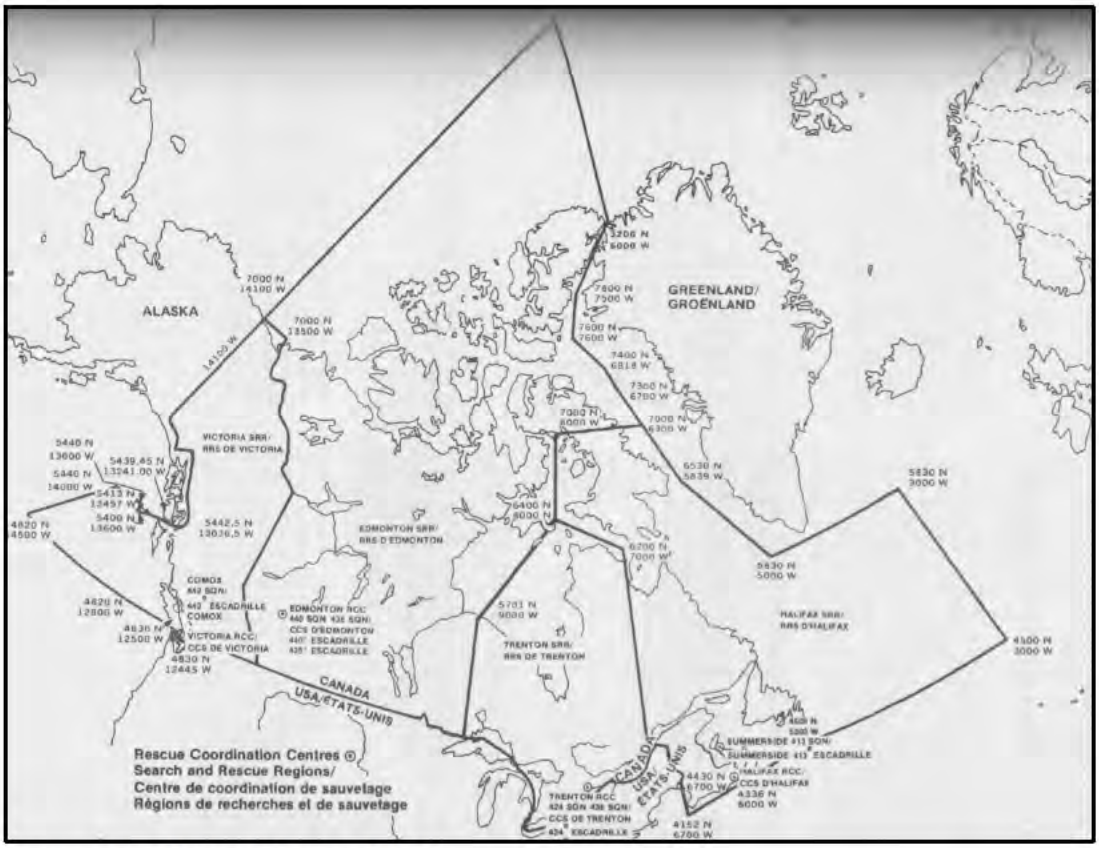

Figure 5: SRR Boundaries (1976)
Source: Canada, CFP 209-Search and Rescue Orders and Procedures, Annex H.

Table 2 —SAR Resource Allocation by 1976[176]

SRRs and RCCs	Rescue Units and Resources
Victoria SRR RCC-Victoria	442 T&R Sqn in Comox, BC (3 x Labradors, 3 x Buffalos)
Edmonton SRR RCC-Edmonton	440 T&R Sqn and 435 Transport Sqn in Edmonton, AB(6 x Twin Otters, and 1 x Hercules)
	440 Det in Yellowknife (2 x Twin Otter)
Trenton SRR RCC-Trenton	424 T&R Sqn and 436 Transport Sqn in Trenton, ON (3 x Voyageurs, Buffalos, 1 x Hercules)
Halifax SRR RCC-Halifax	413 T&R Sqn in Summerside, PEI (3 x Labradors, 3 x Buffalos).

[176] Department of National Defence, CFP 209, *Search and Rescue Orders...,* 1.01 - 1.02.

Conclusion

The original benefits of creating a SAR system using post Second World War surplus equipment started to wane in the mid-to-late1950s as aircraft reached the end of their useable lives. This period was characterized by major aircraft changes in both the rotary-wing and fixed-wing fleets. SAR helicopters transitioned from the initial Sikorsky H-5 to the H-21 and eventually to the much more capable Labrador. Numerous fixed-wing aircraft saw use in the SAR role including the Otter, Albatross, Dakotas, Twin Otter, Buffalo and Hercules — the Buffalo and Hercules are still employed in the SAR role to this day. The reality of resource constraints came to a head with the unification of the Canadian Armed Forces, which led to reductions in the Canadian Armed Forces SAR organization. Fortunately, other influences would result in a strengthening of the CAF SAR system in the 1970s.

CHAPTER 4: ELTs TO PEACE DIVIDENDS

Introduction

After a decade of downsizing brought on by unification and defence spending reductions, the CF SAR system received a resource injection in the 1970s as a result of offshore resource developments. Most notably, a rescue unit was re-established in Newfoundland for the first time since the mid-1960s. By the 1990s however, streamlining would return again to the CAF SAR organization as a result of the post-Cold War "peace dividend." Throughout this period major advances also took place including: the mandatory carriage of ELTs on aircraft, the development of a satellite based ELT detection system, the creation of a volunteer civil aviation SAR organization and the procurement of the very capable SAR helicopter — the Cormorant.

Strengthening Marine SAR in Canada

In the three decades following the Second World War, offshore oil exploration and advances in commercial fishing began to create animosity between states within their surrounding waters. Canada had concerns over pollution in the Arctic and was interested in oil exploration and the ongoing depletion of fish stocks in the Grand Banks. Canada engaged in a number of discussions and UN conferences including the Third United Nations Conference on the Law of the Sea (UNCLOS) that was convened in 1973.[177] Even though the convention would not end with an adopted constitution until 1982, Canada declared fisheries jurisdiction over a 200-nautical mile area in 1977. Canada's

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[177] United Nations, Oceans & Law of the Sea, The United Nations Convention on the Law of the Sea (A Historical Perspective), last accessed 05 May 2014, http://www.un.org/depts/los/convention_agreements/convention_historical_perspective.htm.

exclusive economic zone (EEZ) would not be formally established domestically until twenty years later when the Oceans Act came into force. Other nations still had the right of passage but this establishment of an EEZ gave Canada the exclusive right to develop and manage all resources both above and below the seabed. With these rights came many responsibilities, including: policing of the EEZ to enforce Canada's rights, monitoring the area for polluters and monitoring and conserving the biomass in the area. Much of these duties were passed to the Department of Fisheries and Oceans and the Canadian Armed Forces.[178]

With the increase in government department, fishery and oil exploration activity came an increase in requirement for marine SAR responses, in particular off the East coast of Canada. The following major organizational changes were implemented in 1976: a standing Interdepartmental Committee on Search and Rescue (ICSAR) was created to help facilitate interdepartmental cooperation on SAR matters; the Minister of National Defence was appointed as the lead minister responsible for all aspects of SAR in Canada; Marine Rescue Sub Centres (MRSCs) were stood up in Quebec City, QU and St. John's, NL to better facilitate coordination of regional marine cases; the Canadian Coast Guard purchased more ships for SAR duties; and CF rescue helicopters were stationed in Newfoundland.[179]

Concurrent with the EEZ developments, Newfoundlanders had been lobbying for better SAR coverage off of the east coast of Canada since 107 RU was closed in the mid-

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[178] Department of Fisheries and Oceans, Canada's Ocean Estate: A Description of Canada's Maritime Zones, last accessed 05 May 2014, http://www.dfo-mpo.gc.ca/oceans/canadasoceans-oceansducanada/marinezones-zonesmarines-eng htm - ex.

[179] "SAR Strengthened," *Airforce* 1, no. 1 (January 1977): 28-29.

1960s. It is likely not a coincidence that the timing of the announcement to move SAR resources to Newfoundland was one month after the Dutch freighter *Gabriella* sank off its coast, leading to 13 fatalities. The change would not be simple however, and required the juggling of resources at both 424 and 413 Squadrons. The three Voyageurs stationed at 424 Squadron in Trenton — they had only been there a year — were moved to 413 Squadron in Summerside, and the three (more capable) 413 Squadron Labradors were moved to Torbay airport.[180]

The crews and maintainers in Torbay were primarily made up of a detachment from 424 Squadron, which was eventually permanently moved to Gander, NL on January 15th, 1977. Four months later, on May 1st, 1977 the detachment was officially renamed 103 Rescue Unit.[181] The unit proudly served Canadians as a rescue unit for twenty years at which time it was granted squadron status on 1 March 1997.[182] The decision to reestablish a SAR unit in Newfoundland was timely in hindsight, for on June 2nd, 1977 the Marine Vessel *William Carson* sank off the Southern coast of Labrador with 128 people onboard. A well-coordinated effort from the CCG and 103 RU saw to it that every single person was saved from what could have been a disastrous situation.[183]

Back in Summerside, 413 Sqn helicopter crews quickly converted to the Voyageur, a variant they would fly for a few years prior to a SARCUP program that would bring all of the CH113 variants up to an improved standard of the Labrador. Extra

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[180] Smith, *Seek and Save: The History of 103...*, 105.
[181] Bottomley, *424 Squadron History...*, 113-114.
[182] "103 Sqn Receives Colours," *Airforce* 21, no. 4 (Winter 1998): 36.
[183] Smith, *Seek and Save: The History of 103...*, 105.

converted Voyageur airframes would also eventually lead to an additional allocation of two more helicopters to 442 Sqn in Comox in 1984.[184]

Twin Hueys and Griffons in Trenton

The CH113 helicopter shuffle eastward created a helicopter void in Trenton that had to be filled quickly. The solution was to move three CH-135 Twin Huey helicopters to Trenton from 427 Squadron in Petawawa. By the end of the summer of 1977 the squadron was fully operational with newly painted yellow Twin Hueys. Although the Twin Huey was less capable than the Voyageur, the aircraft and crews performed many challenging SAR missions over the decade that it was temporarily used at 424 Squadron. There was one mission in November 1978 though, where the reduced capabilities of the Twin Huey could easily have cost lives. An unpowered barge was adrift on Lake Ontario in bad weather, resulting in a 424 Sqn SAR tasking. After unloading all unnecessary kit in Oshawa, the crew began a search for the missing barge in low ceiling and reduced visibility conditions. Once located, they hoisted five of the survivors off of the barge before having to depart to offload and refuel, which meant leaving two survivors behind. The remaining two survivors might have perished in the meantime which could have been blamed on the reduced capabilities of the Twin Huey. Luckily, the SAR crew relocated the barge and extracted the final two survivors before anything untoward occurred.[185] The Twin Hueys would remain in Trenton on SAR duty until the upgrade program on the Labrador and Voyageur helicopters was completed in 1986. The three SAR Twin Hueys

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[184] "SAR Strengthened," *Airforce* 1..., 29. and MacDonald, *442 Squadron History*..., 137.
[185] Bottomley, *424 Squadron History*..., 117-118.

were then moved to Goose Bay to form a base rescue flight in support of a NATO low-level tactical flying program.[186]

This temporary use of a lesser helicopter in the SAR role at 424 Sqn would not be a one-time event. The fifteen Cormorants that were originally purchased in the early 2000s to replace the Labrador helicopter were expected to require much lower levels of maintenance that they did in actuality. This higher level of maintenance combined with the standard teething pains that come with a new advanced platform, a major unexpected issue with the tail rotors, and the loss of a Cormorant in a crash all led to the inability to reliably keep Cormorants serviceable at four SAR squadrons. In October 2005, it was announced that the CH146 Griffon helicopter — essentially a modern Twin Huey — would be used "temporarily" in Trenton while the Cormorant helicopter fleet suffered from low availability issues. This plan was implemented under the name Operation Starfish, and saw the Trenton Cormorants redistributed to the East and West coast SAR squadrons. Griffon helicopters were moved from the Combat Support Squadrons (CSS)[187] to give 424 Sqn in Trenton three aircraft initially — a fourth would be eventually transferred from 1 Wing at a later time. The aircraft were initially configured in the CSS configurations but eventually additional safety equipment was added due to the inherent risk of operating over open water with Griffon helicopters which were not properly configured for marine operations. Nine years later, this temporary situation is still in place

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[186] Para Rescue Association of Canada, *That Others May Live...*, 180.

[187] Combat Support Squadrons (CSS) began as Base Rescue Flights (BRF) and were small units normally equipped with three helicopters and four crews including four SAR Technicians. The primary job of these units was to support local fighter operations both in the utility and rescue roles. There are currently three CSS units, 417 CS Sqn in Cold Lake, 439 CS Sqn in Bagotville and 444 CS Sqn in Goose Bay. Although these squadrons are not primary SAR squadrons they are often used as secondary SAR resources, a role they perform very well due to the nature of their primary role and the SAR Techs in their crew complement. The author served as a pilot flying Griffons at 444 CS Sqn from 1997-2000.

with no end in sight, although there have been some discussions about acquiring more Cormorants to create an environment where returning to Trenton would be possible.[188]

ELTS

Despite having been initially developed during the Second World War and being commercially available as early as 1956, emergency locator beacons (ELTs) were not being used by all aircraft operators in Canada. It would take two significant incidents in the US to push the mandatory use of ELTs forward in North America.

The first incident involved a small plane with three people onboard that was transiting from Portland, Oregon to San Francisco, California. The aircraft went missing during the trip after crashing into the snow covered Trinity Mountains. Miraculously all three passengers survived the crash. The pilot and his wife had sustained significant but non-life threatening injuries while their fifteen-year-old daughter, Carla Corbus, received only minor injuries. They watched helplessly for weeks as aircraft flew overhead in poor weather searching. Eventually they starved to death but their story lived on through a journal they had kept of the ordeal. This journal helped fuel the beginning of a public outcry aimed at preventing this type of unnecessary loss of life.[189] Although public and government debate had begun, it would not be until another high profile accident occurred that regulations would be passed to make the carriage of ELTs mandatory for all aircraft in North America.

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[188] The author lived through the transition from the Cormorant to the Griffon as a pilot at 424 Sqn from the summer of 2005 to 2008. He also staffed many of the safety upgrades to the Griffons in Trenton from an A3 SAR Systems position at 1 Cdn Air Division from 2008 to 2011.

[189] Harlod H. Martin, "Please hurry, someone," *Saturday Evening Post*, 1967, http://sierranaturenotes.com/GI$/SARs/Corbus Crash.1967/Corbus Crash.1967.pdf.

A Pan Alaskan Airways Cessna 310C that was carrying two US senators from Anchorage to Juneau, Alaska, went missing on October 16th, 1972. One of the most extensive air, sea and land searches ever conducted ensued, lasting 39 days. Despite efforts of the US Air Force, US Army, US Coast Guard, Civil Air Patrol and other civilian planes and helicopters, no sign of the aircraft or its passengers was ever found. According to the US National Transportation Safety Board (NTSB) investigation the Cessna 310C "was not equipped with an emergency locator transmitter (ELT), nor was one required by Federal Aviation Regulations." [190] Interestingly, Alaska had passed a law effective September 6th, 1972, that made ELTs mandatory within the state. Pan Alaskan Airways complied with the Alaskan law by having their pilots carry handheld ELTs on their person. Unfortunately, the pilot forgot to bring his ELT; but even if he had, if he was incapacitated in the crash the beacon could not have been activated anyways. In the conclusion of the report, it is disappointing to note that the NTSB did not recommend mandatory carriage of ELTs on all aircraft flown within the US.[191]

Following this incident there was enough attention on the issue in both US and Canada to cause federal aviation agencies to finally regulate the carriage of ELTs. In Canada, the Ministry of Transport would pass regulations in 1971 that would require most aircraft to have 121.5/243 MHz ELTs installed by June 1st, 1974.[192] The regulations

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[190] United States, National Transportation Safety Board, NTSB-AAR-73-1, "Aircraft Accident Report: Pan Alaska Airways, Ltd. Cessna 310C, N1812H Missing Between Anchorage and Juneau, Alaska, October 16, 1972," (Washington: NTSB, 1973), 6, http://www.airdisaster.com/reports/ntsb/AAR73-01.pdf

[191] Ibid., 9.

[192] Para Rescue Association of Canada, *That Others May Live...*, 129.

involved both the mandatory installation of ELTs and elevating the functional standards required for commercially manufactured devices.[193]

In reaction to the new mandatory ELTs, in June 1974 the CF began a major program to ensure all SAR aircraft had the latest electronic homing equipment to prosecute the upcoming increase in ELT searches — both real and false.[194] There was however one major weakness of the ELT system left unsolved.

COSPAS-SARSAT

Up to this point an emergency beacon signal had to be received by a nearby ground station or aircraft to elicit a SAR response. This was a particularly significant problem for Canada given its territorial size, the significant unpopulated areas, and many infrequently travelled routes. Discussions began in Canada as early as 1971 on a potential solution to this problem, and by 1972 federal funding was allocated to research the possibility of using low earth orbit (LEO) satellites to receive the ELT signals.[195] The principle science behind the idea rested with the already proven Doppler location

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[193] The ELTs would have to be mounted on part of the airframe that is most likely to survive a crash and would have to have G-switch activation so that they would self-activate during an impact. Unfortunately, manufacturer limitations led to two issues: insufficient supply, which caused some delays in compliance, and poor designs which led to two major operational problems. Although many lives would be saved over the years by these first generation ELTs they would also be plagued by a 60% failure rate when needed and an alarming 97% false alarm rate. The failures were caused primarily by the following issues: insufficient G loading on impact, improper installation, poor batteries and impact or fire damage after a crash. The false alarms were mainly caused by: internal malfunctions, pilot hard landings, technician mishandling and accidental switch activation. Eventually a second generation of 121.5/243 MHz ELT would be regulated and manufactured resulting in improvements but some problems would remain — including the continued use of first generation ELTs. Bernard J. Trudell and Ryland R. Dreibelbis, "Current Emergency Locator Transmitter (EKT) Deficiencies and Potential Improvements Utilizing TSO-C91a ELTs," National Aeronautics and Space Administration Contractor Report 4330 (Landover: NASA, 1990), http://ntrs nasa.gov/archive/nasa/casi.ntrs nasa.gov/19910001651.pdf.

[194] Para Rescue Association of Canada, *That Others May Live...*, 129.

[195] Larry Milberry, *Canada's Air Force Today* (Toronto: CANAV Books, 1987), 28.

technique that had been pioneered by the Communications Research Centre (CRC) of the Department of Communications of Canada in cooperation with NASA and NOAA.[196] It was initially realized that the 406 MHz transmission band was a superior frequency but due to the proliferation of 121.5 MHz ELTs, the program would roll out on the lower frequency with a plan to move forward with the 406 MHz band at a later date. The USSR had been conducting research of its own along a similar line, and despite Cold War tensions an agreement was reached between the East and West to cooperate for the good of the international aviation and maritime communities. The program was formalized by an MOU between France, Canada, USA and USSR on 23 November 1979 and the COSPAS-SARSAT system was born.[197]

On 30 June 1982, COSPAS-1 was launched and became the first operational satellite in the new SARSAT system. At the time there were only experimental Local User Terminals (LUTs) in operation to help prove the concept. As put in a 1995 article on the history of SARSAT: "Selling a space-based system to political leaders, the public and to the search and rescue community would require real world 'saves', not just technical demonstrations."[198] It did not take long for the system to prove itself.

In July of 1982 a massive search was conducted for a missing pilot who disappeared in the mountains of northern British Columbia. Despite many weeks of

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[196] COSPAS/SARSAT, "Cospas-Sarsat 1979-2009: A 30-year Success Story," Cospas-Sarsat Information Bulletin, Issue 22- February 2010, 2, http://www.cospas-sarsat.int/images/stories/SystemDocs/Current/bul22_final_enclosure.pdf.

[197] Ibid. (The Russian part of the project is named COSPAS. SARSAT stands for Search and Rescue Satellite Aided Tracking. The overall program is referred to as COSPAT-SARSAT but it shall be referred to as SARSAT for brevity.)

[198] Richard J. H. Barnes and Jennifer Clapp, "Cospas-Sarsat: A Quiet Success Story," *Space Policy* 11, no. 4 (1995): 261. http://www.cospas-sarsat.int/images/stories/media/Documents/CospasSarsat_quietsuccessstory.pdf

searching (at an estimated $2 million in expenses) the search was called off with nothing found. The pilot's father however, continued searching for his son at his own expense. After twelve days of searching misfortune struck again on September 9th when the father, the pilot he had hired, and a friend also went missing. Initially the Victoria RCC responded with a standard search operation but they followed up with an inquiry to Ottawa on the status of the new SARSAT system. By the next morning data had been received and processed leading to a predicted location of the missing aircraft. Rescue aircraft were dispatched to the potential location and soon received the weak signal of an ELT that led the SAR crew to the crashed aircraft. All three people on board had survived the crash with injuries and were soon evacuated to medical facilities by a Labrador helicopter.[199] The stark contrast between the two searches — one which took much time and treasure to come up empty handed and the second which was quick, efficient and saved three lives — quickly solidified support for the new SARSAT system.

Given its promising start, in February 1983 Canada committed to a fifteen-month trial period to help further demonstrate and evaluate the SARSAT system.[200] It continued to show its worth in both saving lives and reducing the costly business of prolonged searches — although the previously mentioned issues with 121.5 MHz ELTs precluded SARSAT assistance in some cases. The system worked as follows: a distress signal was transmitted by a distress beacon; the signal was received by a satellite passing overhead in a low earth orbit; this information was retransmitted in real time to any Local User Terminals (LUTs) within line of site (LOS) of the satellite; and the LUT processed the

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[199] Ibid., 263.

[200] Paul Manson, "Today and Tomorrow in the Canadian Forces." *Airforce* 6, no. 4 (Dec 1982): 11.

signal and sent this information to a Mission Control Centre (MCC) that interpreted the data and decided which RCC to advise (see Figure 6). A second pass by a different satellite was required to determine a more specific location of the signal. There are a few other technical aspects to the SARSAT system that should be noted: COSPAS and SARSAT "satellites" were (and still are) secondary payloads on polar orbiting satellites with other functions; although the initial effort used the inferior 121.5 MHz band due to the already prolific use of ELTs in this range, the SARSAT system was always capable of working with the superior 406 MHz range; and the system worked not only for ELTs but also for ship borne Emergency Position Indicating Radio Beacons (EPIRBs) and Personal Locator Beacons (PLBs) that are carried by individuals.[201]

[201] COSPAS/SARSAT, “Cospas-Sarsat System Overview,” last accessed 21 May 2014, http://www.cospas-sarsat.int/en/system-overview/cospas-sarsat-system.

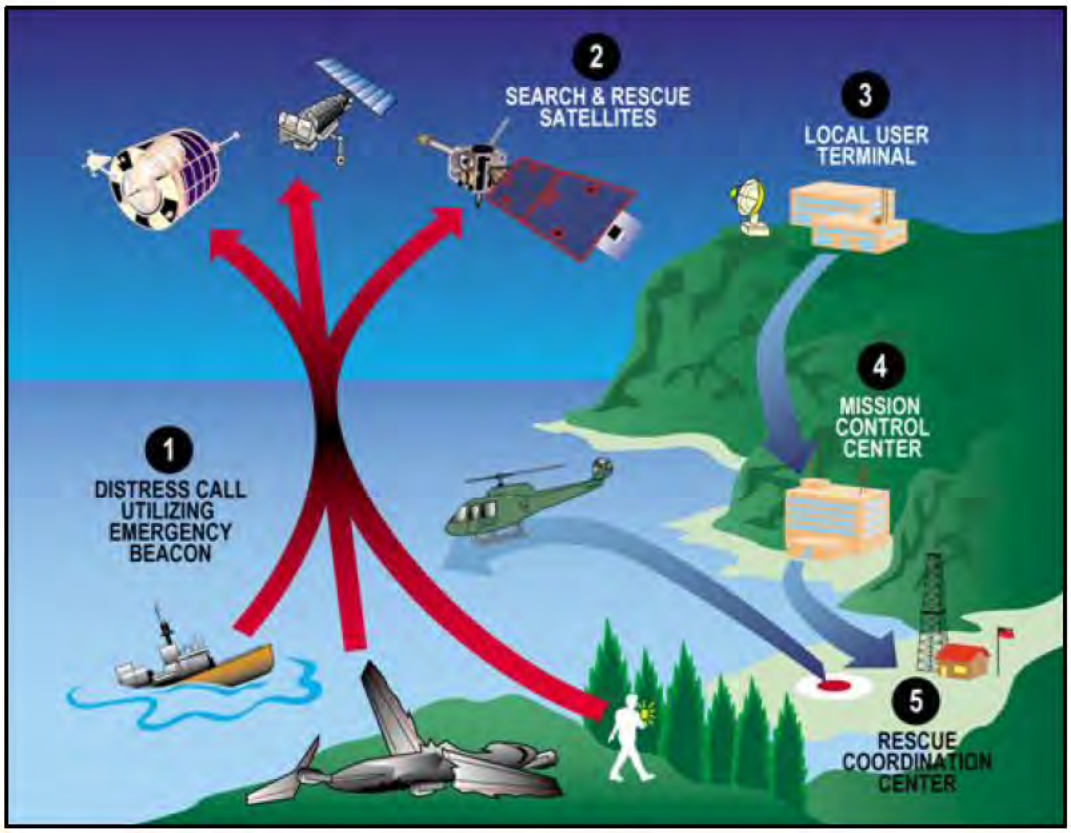

Figure 6: COSPAS-SARSAT System
Source: NOAA Website - Search and Rescue Satellite Aided Tracking - System Overview http://www.sarsat.noaa.gov/sys-diag.html Last accessed 4 May 2014.

By mid-1984 at least 255 people had been rescued globally using this new technology which led to the system being declared operational by July 1985.[202] Canadian involvement and expertise in this field was clearly evident when an Ottawa based company, Canadian Astronautics Limited (CAL), received an initial contract for the manufacture of four LUTs, three for Canada and one for Brazil. The Canadian SARSAT ground support system consisted of three of these LUTs (one in Edmonton, AB, one in Churchill, MB and one in Goose Bay, NL) and a MCC referred to as the Canadian

[202] COSPAS/SARSAT, "Cospas-Sarsat 1979-2009: A 30-year Success Story..., 3.

Mission Control Centre (CMCC) located in Trenton, ON.[203] These ground facilities are still in place today supporting a system that saves hundreds of people worldwide every year. Canada's commitment to the SARSAT program would be further strengthened in 2005 when the COSPAS-SARSAT Program office was established in Montreal.

The system was a great success over the years but it was not without its problems. The initial decision to use 121.5 MHz had its merit in quickly getting the system operational but it came at a price. This particular band of the electromagnetic spectrum was susceptible to interference resulting in numerous false signals from non-ELT sources and it was challenging to determine false activations from real ELTs without sending a SAR asset to investigate. The solution was to push towards an ELT system that worked on the 406 MHz band, a frequency the satellites were already prepared to handle. In 1993 IMO mandated all commercial vessels carry 406 MHz EPIRBs, in 2000 the SARSAT Council decided that in February 2009 the SARSAT system would no longer receive and process 121.5 MHz signals, thus encouraging operators to move forward with the new beacons.[204]

The new 406 MHz ELT, which is currently in use, sends pulses of digitally encoded information rather that give off a constant analog signal. This allows an ID tag to be carried with the signal that can be cross referenced with a user data base to find details on the owner of the ELT — thus allowing RCC staff to determine whether there is a legitimate SAR requirement prior to launching SAR resources. The more advanced models also include GPS position information to further enhance the response. Another

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[203] "SARSAT Search and Rescue," *Airforce* 10, no. 1 (Apr-Jun 1986), 26.
[204] COSPAS/SARSAT, "Cospas-Sarsat 1979-2009: A 30-year Success Story..., 5.

benefit of this system is that due to the pulse versus constant signal, the transmission strength can be stronger. This means that satellites orbiting at higher altitudes — geo-stationary satellites — can be used in the program. By 1998 three such satellites were introduced into the program giving instantaneous coverage of 70% of the globe — due to the position of these satellites over the equator, the polar regions could not be seen. Given their stationary nature relative to the earth these satellites could also not use Doppler techniques to locate a 406 ELT (unless the signal has GPS location encoding) but they provided an instantaneous early warning capability to augment the LEO system.[205] Continuing with improvements, the SARSAT organization is currently implementing a third tranche of satellite capability to further improve the system, this time involving Middle Earth Orbit (MEO) satellites.[206]

Civil Aviation Search and Rescue Association (CASARA)

The last of the recommendations made in the 1964 CORA Report on RCAF SAR was that Canada should make more effective use of civilian resources during search operations. This was not a new concept — the US had been successfully using the Civil Air Patrol (CAP) for a number of roles including SAR since the Second World War. This recommendation had great appeal due to the high expense of RCAF resources during prolonged search operations, and yet it would take over two decades to officially implement a program at the federal level. There were examples of cooperation between SAR units and provincial organizations at the local level. In the mid-1970s, 442 Sqn was

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[205] Ibid.

[206] NOAA, Search and Rescue Satellite Aided Tracking, "SARSAT Future Enhancements," last accessed 05 May 15, http://www.sarsat.noaa.gov/future html.

giving briefings to BC Provincial Emergency Program (PEP) personnel on survival techniques, safe flying practices and search techniques.[207] In Alberta around the same timeframe, 440 Sqn was giving defensive flying lectures in an effort to reduce the numbers of accidents and emergencies. 440 Sqn was also liaising with other provincially organized air associations such as the Saskatchewan Emergency Measures Air Division and the Manitoba Air Patrol groups to assist with search operations.[208] The first evidence of serious consideration from the federal level on the prospect of officially creating a civil SAR organization in Canada can be found in a report on the subject from 1977.[209] The report examined two aspects of a proposed Civil SAR Plan; the first part was aimed at determining whether there was a valid requirement; and the second part assessed the availability of human and hardware resources to support a meaningful program. The report's conclusions very succinctly stated that the program would be of great benefit to all parties and that the civil sector was very willing to participate and contribute meaningful resources to the proposed program.

By 1981, an implementation plan was developed to roll out the Civil Air Search and Rescue Association (CASARA). The plan consisted of the following main points: CASARA would be funded and managed by both the Department of National Defence and the Department of Transport; CASARA should consist of provincial level sub-organizations that are centrally managed by a national CASARA HQ; a compensation plan should be implemented to pay CASARA members for out of pocket expenses; insurance coverage was to be purchased to protect CASARA members during official

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[207] MacDonald, *442 Squadron History...*, 132.
[208] Vincent, *440 Squadron History...*, 79-81.
[209] Department of National Defence, *CASARA Feasibility Study*, March 1977, (DHH), 1.

activities; and finally, DND would establish training standards and administer them through CASARA Liaison Officers who would be experienced aircrew from SAR squadrons.[210] These recommendations were followed up, and after a lengthy rollout CASARA was officially declared operational in 1986. The main recommendations of this initial report were very wise in hindsight and are still in place to this day. CASARA members have made considerable contributions to the aviation SAR system in Canada over the years. Changing trends in aviation have led to fewer requirements for lengthy searches, which has meant decreasing CASARA involvement in SAR operations in recent years. In accordance with the CASARA Contribution Agreement, CASARA still plays an important role improving the Canadian aviation SAR system by facilitating member training, tracking ELT reports, providing spotters and educating the general aviation public on safe practices.[211] The formation of CASARA would be the last major change to the CF SAR system until the early 1990s.

Peace Dividends

In the early 1990s, many countries began cashing in their "peace dividends" with the end of the Cold War and Canada was no exception. With a growing deficit and a perceived reduction in security threats, the federal government began implementing aggressive plans to reduce defence costs.[212] The reductions came in two waves; the first

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[210] Department of National Defence/Transport Canada, DND 3385-27/TP 3327E, *Civil Air Search and Rescue Association (CASARA) Implementation Plan* (Ottawa: DND/TC, December 1981).

[211] In accordance with the CASARA Contribution Agreement between MND and CASARA. April 2010.

[212] Michael Rostek, "A Framework for Fundamental Change? The Management Command and Control Re-Engineering Initiative," *Canadian Military Journal* (Winter 2004-2005), 65.

resulted from the 1989 Federal Budget Announcement which stated "...the government will close or reduce in size 14 military bases and stations across the country."[213] It was announced that CFB Summerside would be one of the bases to be closed and it would be completed by 1992.[214] The decision was made to move 413 Transport and Rescue Squadron back to Greenwood, NS — where the squadron had been located 25 years earlier under the name of 103 RU. Before the move was complete CF Air Command announced another cost saving plan. A fleet rationalization program would see the Buffalo fleet replaced by CC130 Hercules aircraft at 413 Sqn initially, followed by 424 Sqn a year later. 442 Sqn would be the only SAR unit to keep the Buffalo due to its performance in the mountainous terrain of the Victoria SRR. A study was conducted in 1992 to assess the ability of the Hercules in the mountains and whether it could replace the Buffalo in the Victoria SRR.[215] It was determined that although the speed and range of the Hercules would be an improvement for many SAR operations, there would still be a significant capability gap for mountainous terrain searches. The Buffalo remains at 442 Sqn to this day despite numerous FW SAR programs aimed at replacing it over the last two decades. The Hercules was no stranger to SAR operations and easily made the transition to full time SAR duties at 424 and 413 Sqns. The platform showed particular strength on long-range missions to the Arctic or offshore and it still fills this SAR role today. A less tangible second order impact on SAR operations was the dwindling number

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[213] Department of Finance, *The Budget Speech: Delivered in the House of Commons by the Honourable Michael H. Wilson* (Ottawa: DoF, 27 April 1989), 6, http://www.budget.gc.ca/pdfarch/1989-sd-eng.pdf.

[214] David Leyton-Brown, *Politics and Public Affairs 1989* (Toronto: University of Toronto Press Inc, 1995), 199.

[215] Michel Vigneault, ATGOR RN 4/92. "Fixed Wing SAR Capability Requirements in the Victoria Search and Rescue Region," (Ottawa: DND, September 1992).

of air force platforms that would be available for secondary SAR duties during major search operations.

The second wave of reductions came in 1994, again as a result of the federal budget announcements, which amounted to $1.9 billion cuts for defence.[216] By the end of 1994, the most significant changes for the SAR community would be related to activities in Edmonton. 440 Sqn was moved to Yellowknife and was no longer a primary SAR squadron, thereby ending the Twin Otter's primary SAR services. 435 Transport and Rescue Sqn was moved to Winnipeg where is would employ the Hercules aircraft in both the transport and SAR roles.[217] The Edmonton RCC was closed leading to a reduction from four to three SRRs in Canada. The Victoria SRR was expanded to include the Yukon Territory and the Trenton SRR expanded to absorb the rest of the region previously covered by the closed Edmonton RCC. Canada is still divided up into these three SRRs today (see Figure 7). One final impact of the government spending reductions included the Liberal campaign promise to cancel the EH101 helicopters that had been contracted to replace the Labrador and Sea King helicopters. Despite approximately over half a billion dollars in contract cancellation penalties, the Liberal government kept this promise.[218]

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[216] Specifically, on February 22, 1994, The Honourable Paul Martin, Minister of Finance announced among other reductions, that "Defence spending will be cut by an additional $1.9 billion over the next three years by cutting overhead expenses, including closing and reducing Canadian Forces bases and units." Department of Finance, *The Budget in Brief: The Honourable Paul Martin, P.C., M.P., Minister of Finance*, (Ottawa: Canada, 22 February 1994), 14, http://www.budget.gc.ca/pdfarch/1994-brf-eng.pdf

[217] "Defence Expenditure Reductions 1994," *The Roundel* 2, no. 1 (Sep 1994), 13.

[218] Micheal Byers, "Canada could have obtained world-class helicopters at bargain prices, but the Conservatives weren't interested," *National Post*, last accessed 21 May 2014, http://fullcomment nationalpost.com/2014/01/08/michael-byers-canada-could-have-obtained-world-class-helicopters-at-bargain-prices-but-the-conservatives-werent-interested/.

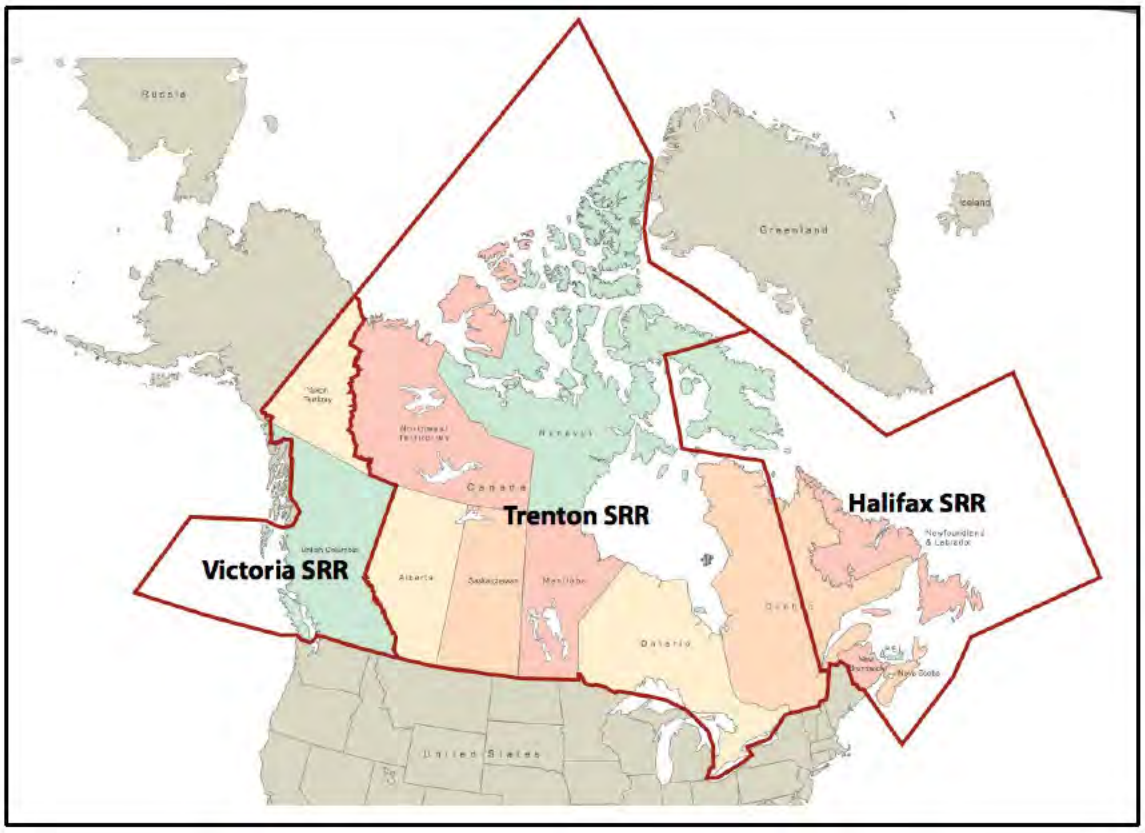

Figure 7: SRRs from 1994 to present
Source: Canada, "CF Aerospace Move Doctrine," 43.

CH149-Cormorant

The original announcement by the Canadian government to procure Agusta/Westland EH-101 helicopters to replace both the Labrador and Sea King was made in 1992.[219] Both helicopters to be replaced had been in service since the early 1960s and were becoming very costly to maintain. The decision to replace both fleets with a common airframe was sound and would have led to significant cost savings and operational benefits derived from shared maintenance, engineering, training and logistical

[219] "$5.4 Billion Chopper Buy," *Airforce* 16, no. 3 (Oct-Dec 1992), 2.

support.[220] The Liberal Party led by Jean Chrétien used the helicopter purchase to leverage their election campaign and promised to cancel the "Cadillac" helicopters if they won the federal election. The project was cancelled as promised but within two years the Liberal government realized the SAR replacement helicopter portion of the procurement would need to be revisited. The MND announced the program would be renewed in November 1995 and following procurement procedures, the first CH149 Cormorant helicopters started arriving at the end of 2001. The initial Cormorants went to 442 Sqn in Comox where the Operational Training Flight (OTF) for the Cormorants was established. By 2003, the fifteenth and final Cormorant arrived at 424 Sqn in Trenton where it began to transition to full operational status by March 2004.[221]

The Cormorant helicopter brought significant capability improvements to SAR over the Labrador. The most significant improvements included: increased range and cruise speed, increased cargo capacity, fully NVG compliant cockpit, flight in moderate icing conditions, improved IFR capabilities and three engines.[222] This last improvement was significant after losing a number of Labradors over the years due to engine failures in challenging regimes of flight. The Cormorant could lose one of its three engines and maintain the hover across a significant portion of its flight envelope, thereby drastically improving the safety of SAR crews. As capable as the Cormorant was, this new platform came with its fair share of teething pains. Before long, a vibration issue led to composite component cracking on the anti-torque tail rotor that seriously impacted fleet serviceability. The significant increase in maintenance requirements that this issue

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[220] Larry A. Ashley, "Cormorant Soars Into 21st Century," *Airforce* 23, no. 2 (Summer 1999), 3-6.
[221] "Last Cormorant Arrives," *Airforce* 27, no. 4 (Winter 03/04), 5-6.
[222] Ashley, "Cormorant Soars Into 21st Century..., 3-6.

brought, along with other less significant teething pains, led to the inability to reliably support Cormorants at four SAR squadrons. Operation Starfish was implemented in the fall of 2005 that saw the 424 Squadron Cormorants distributed to the east and west coast SAR squadrons. As already discussed, CH146-Griffons were transferred from the Combat Support Squadrons and 1 Wing to temporarily fill the gap in Trenton — a gap that still exists at this time nine years later. With the loss of a 413 Sqn Cormorant during a night training mission in 2006, along with ongoing corrosion repairs, it is unlikely the current fleet of fourteen Cormorants will see service with 424 Squadron in the near future.[223]

The addition of Cormorants and temporary use of Griffons in the SAR role completes all changes to date for SAR aircraft in service with the now renamed RCAF. As of 2005, and still valid to date, SAR resources are distributed as shown in Table 3.

Table 3 —SAR Resource Allocation from 2005 to date[224]

SRRs and RCCs	Rescue Units and Resources
Victoria SRR JRCC-Victoria	442 T&R Sqn in Comox, BC (5 x Cormorants, 6 x Buffalos)
Trenton SRR JRCC and CMCC-Trenton	424 T&R Sqn in Trenton, ON (4 x Griffons, Hercules)
	435 T&R Sqn in Winnipeg, MB (Hercules)
Halifax SRR JRCC-Halifax	413 T&R Sqn in Greenwood, NS (4 x Cormorants, Hercules)

[223] As a previous incumbent of the A3 SAR System position and recent CO of 103 Rescue Squadron, the author is intimately aware of the current CH149 fleet limitations. One potential option that could see Cormorants return to Trenton in the future would be the modification of VH71(EH101) helicopters that were purchased for parts from the failed US presidential helicopter program in 2011.

[224] There remains 13 H-Model Hercules dedicated to both the SAR and Air-to-Air Refueling (AAR) roles in the RCAF. The aircraft are moved around as required including through third line maintenance for a number of upgrade programs including an NVG upgrade. There are fourteen total Cormorants in the fleet with twelve distributed to the squadrons as indicated. The remaining two Cormorants rotate through third line corrosion repairs with IMP Aerospace in Halifax, NS. The author worked in the A3 SAR Systems position at 1 Cdn Air Division from 2008-2011. This position included the responsibility to provide operational input on the management of all four SAR fleets.

	103 SAR Squadron, Gander, NL (3 x Cormorants)

Conclusion

Canada's creation of an EEZ led to significant injections in the CF SAR system in the 1970s, including the re-creation of a SAR squadron in Newfoundland. Legislation mandating the carriage of ELTs on aircraft led to an improved ability to locate aircraft in distress, which saved lives while reducing the cost of lengthy searches. The benefit of ELTs was further enhanced by investment in the SARSAT system to detect emergency beacons located anywhere in Canada. These advances combined with the creation of the Civil Aviation Search and Rescue Association (CASARA) led to further efficiencies during SAR operations. The current RCAF SAR organization in Canada is a product of the organizational strengthening in the 1970s followed by the "peace dividend" streamlining of the 1990s. Finally, the addition of the Cormorant helicopter has significantly improved RW SAR capabilities — although there have been many teething pains over the first 13 years of its service.

CHAPTER 5: LESSONS FROM THE PAST

Introduction

Now having discussed how the RCAF Search and Rescue organization began and has evolved to its current state, it is possible to make more educated assessments concerning the present state and future of the organization. This chapter will review five current areas of great concern to the RCAF SAR organization. The first item concerns the strategy for the procurement of a new FW SAR platform and the next one examines how search procedures have evolved — and should continue to evolve in the foreseeable future. The subject of policy regarding 406 MHz Emergency Locator Transmitters is then covered followed by a discussion on the subject of SAR response postures. Finally, a higher-level discussion is conducted on the proposition of whether the RCAF should still be conducting SAR at all.

Fixed Wing SAR Aircraft

When the RCAF was first officially tasked with the aviation SAR role in 1947, all of the required fixed wing resources were already available in the form of post-Second World War surplus equipment such as Lancasters, Cansos and Norseman. The first aircraft purchased specifically for the FW SAR role was the Albatross and it had a short life of only ten years in its dedicated SAR role prior to being retired.[225] By the 1960s, as discussed in the 1964 CORA report, it was already apparent that there was not enough of a constant requirement to keep SAR resources uniquely dedicated to this one role.[226] As

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[225] Smith, *Seek and Save: The History of 103...,* 105.
[226] Bryson, "An Evaluation of the future RCAF Search and Rescue..., 6.

time passed and RW capabilities improved it became clear that the specialized training and employment for RW SAR resources would keep crews busy and challenged while fulfilling both aspects of "search" and "rescue." FW SAR resources on the other hand would be more appropriately employed in more than one role and by 1968 most SAR squadrons were redesignated as Transport and Rescue squadrons. This dual role worked very well for decades as many of the basic skills for FW crews crossed over between both SAR and transport. Some crews held specific SAR qualifications related to para and equipment drops while any crew could be used for search operations, including secondary SAR resources from any government department.

With the passage of time, reductions in overall fleet numbers, and decreasing availability of aircraft due to airframe fatigue and reduced budgets, it became a challenge for many Transport and Rescue squadrons to support both lines of tasking. The problem become such an issue that CFSSAR and the SAR Tech trade in general has been forced in recent years to turn to contracted support for most major para training events. Given the no-fail primacy of SAR operations, SAR duties took precedence over transport duties, leading to the notion of a dual role squadron existing only in name by the turn of the century.[227] The RCAF SAR system would likely have met a breaking point sooner if not for two major factors which helped displace the FW SAR search workload. Firstly, the CASARA organization contributed significant search resources during major searches, especially on the West coast. Secondly, there has been an overall decrease in major search

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[227] Michael Byers and Stewart Webb, "Search and Replace: The Case for a Made-in-Canada Fixed-Wing Search and Rescue Fleet," last modified 07 June 2012, https://www.policyalternatives.ca/sites/default/files/uploads/publications/National Office/2012/06/Search_and_Replace.pdf

events over the last few decades. This decreasing search trend is due to a number of technologies that have become widely available to commercial and general aviation communities in Canada. GPS devices are prolific and reduce the chance of getting lost, cell phones and satellite phones improve communications ensuring flight plans are in place, and tracking devices and 406 beacons are taking the search out of SAR.[228]

In 2002, discussions began exploring the option of procuring a dedicated FW SAR platform to replace both the Buffalo in Comox and the tired H-Model Hercules at the three other squadrons that employed FW SAR platforms. For a variety of reasons — mostly political in nature — procurement plans have yet to come to fruition. Currently the government of Canada is on the cusp of releasing a FW SAR Request for Proposal (RFP) to industry, a process that initially began ten years prior.[229] This plan to procure a dedicated FW SAR platform would certainly ensure a professional and dedicated FW SAR capability to serve Canada but the question remains: is it economically feasible?

A far more sustainable solution to FW SAR is to step back two decades to a time when the Transport fleets were large enough and healthy enough to support both the Transport and SAR roles. The logical solution lies in the form of J-Model Hercules aircraft already in service. Great efficiencies could be realized by expanding the J-Model fleet and re-roling it to Transport and SAR like its predecessor, the H-Model Hercules. The argument has been made that the Hercules aircraft, as capable as it is, is too expensive to warrant its use in the SAR role. In actuality, the benefits of a larger but

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[228] A. Zegers, "Update of the Canadian Search Area Definition (CSAD) With 2003-2010 Data," 3553-1 (DRDC CORA) LR 2010-164 (Ottawa: CORA, August 2010), 2.

[229] Canadian American Strategic Review, “Future New Fixed-Wing Search & Rescue – A Canadian Forces Fixed-Wing Search and Rescue Timeline, November 2012,” last accessed 09 May 2014, http://www.casr.ca/id-fwsar-project-timeline htm.

multi-role fleet, combined with all the benefits of shared training facilities, shared maintenance and shared logistics could very easily overcome the expense factor of a larger than ideal FW SAR platform. The RCAF currently appears to have challenges fully utilizing the current 17 J-Model Hercules due to transport crew force generation and manning issues — if this is so, then the prospect of sharing the fleet for SAR duties has greater appeal.[230]

A recent future concepts initiating document produced by the Canadian Forces Aerospace Warfare Centre (CFAWC) proposes discourse on this multi-role notion:

> Having fleets dedicated to SAR duties may or may not be the optimal construct for the future. How could the RCAF better leverage other fleets (such as the Aurora, Cyclone and Chinook, using current assets as an example) to support the SAR mission? What would be the implications of having multirole fleets supporting the SAR mandate in the future?[231]

The future starts now — the RCAF has the opportunity to learn from the past and re-adopt a philosophy of using multi role aircraft for FW SAR responsibilities.

One point that must also be considered is the uniqueness of the Buffalo currently serving the FW SAR role in the Victoria SRR. The level of effort to maintain the 45 year-old aircraft is at the forefront of the requirements for a replacement FW SAR aircraft. It is no coincidence that Air Command conducted a study in 1992 assessing the FW SAR capability requirements for the Victoria SRR — just prior to the decision to keep Buffalos at 442 Sqn while replacing them at 424 and 413 Sqns.[232] The reason for retaining the Buffalo was due to its valuable flight characteristics conducting search operations in

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[230] Author's opinion based on a number of discussions with senior RCAF officers.

[231] Dany Poitras, *Future Concepts Initiating Document: Development of RCAF Future Search and Rescue Concept*, January 2013. http://www.rcaf-arc forces.gc.ca/assets/AIRFORCE_Internet/docs/en/cf-aerospace-warfare-centre/esi-future-concept-initiating-document-sar-project.pdf

[232] Vigneault, "Fixed Wing SAR Capability Requirements in the Victoria SRR..., 1.

mountainous terrain. Most searches begin with higher altitudes to conduct electronic searches or cooperative survivor searches — a task well suited to the Hercules that would arrive before the Buffalo due to a higher cruise speed.[233] While the Hercules completes the higher altitude search taskings, the Cormorant helicopter would be in transit to arrive in time to carry out the lower level search procedures.

Looking at SAR data from 1987 to 1991, the study concluded that the "CC130 has improved capabilities as a first response aircraft and as a search aircraft for major marine operations" and "for major search operations within the inland plateaus and along the coast."[234] The report also pointed out that a FW aircraft capability gap would be created in the mountains if the Hercules replaced the Buffalo, but the gap could be filled by RW aircraft. At the time of the report the Labrador was in service at 442 Sqn but as of 2002 the Cormorant helicopter has taken its place bringing a higher cruise speed, longer search endurance and all-round increased capabilities. The practicality of back-filling the Buffalo's mountainous search capabilities is further supported by the decreasing occurrences of major search operations.

It would be wise for the RCAF to spend some effort consulting the US Coast Guard concerning their use of Hercules aircraft for SAR operations in Alaska — an endeavour that the US has successfully used in that mountainous region for some time. Interestingly, the USCG has taken the multi role concept to an extreme in Alaska by using

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[233] Department of National Defence/Canadian Coast Guard, B-GA-005-000/FP-004 – DFO 2204-23-4, IAMSAR Volume IV..., Chapter 6, 17.

[234] Vigneault, "Fixed Wing SAR Capability Requirements in the Victoria SRR..., 25.

their Hercules aircraft for SAR, transport, air-to-air refueling and offshore surveillance duties.[235]

The cost of maintaining many small fleets of specialized aircraft is one that the RCAF cannot afford. A FW SAR procurement strategy that replaced the Buffalos and the H-Model Hercules with an expanded fleet of multi role J-Model Hercules aircraft would pay dividends in operational flexibility and cost effectiveness.

Search Procedures

Since the first search procedures were penciled into Air-Sea Rescue squadron standing orders during the Second World War, search techniques have evolved considerably over the decades. Aircraft and usage trends along with SAR resource capabilities and procedures have led to variables that have been periodically assessed for implications on search technique. Initially the procedures and adaptations were based on the experience and common sense of SAR personnel within the RCAF. Over time scientific thought, through statistical analysis of empirical real world data, led to more robust and defendable procedures. The first such scientific report on search procedures, discussed in Chapter 1, dates back to 1949. This study was primarily concerned with assessing the probability of detecting a search object by SAR crews. The study did not

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[235] Defence Media Network, "Coast Guard Aviation Modernizes and Reworks Its Aircraft Fleets," last accessed 09 May 2014, http://www.defensemedianetwork.com/stories/coast-guard-aviation-modernizes-and-networks-its-aircraft-fleets/.

discuss procedures for how to bound a search area or what type of search patterns to use.[236]

Concerning the bounding of areas to be searched, experienced SAR staff would develop plans to concentrate on highest "probability areas." These areas were not actually defined using probability statistics but were in fact common-sense areas to focus attention on using the findings of an investigative process. An initial report in 1974, and a follow-up report in 1977, proposed a new method of bounding search areas using historical search data from previous years. This more scientific approach to the problem used historical data from past cases (1968-73) to determine where crashed aircraft were most likely to be found. The model was referred to as the Offset Track Variable (OTV) method and it helped define areas of 80% probability in relation to the last known position (LKP), the track and the destination of an aircraft.[237] In 1979, CORA published another report on Search and Rescue in Canada, where amongst other subjects, more data was used (1975-76) to re-affirm the validity of the previously devised OTV method of defining search areas. [238]

The OTV method of search area definition received some minor alterations in the early 1980s resulting in the revised procedure known as Modified Offset Track Variable (MOTV). This method worked well for relatively flat terrain where an aircraft was expected to fly straight to a destination, but it did not work as well in much of the

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[236] John Stanley, "RCAF Operational Research Report No 4: An Analysis of the Efficiency of SAR Procedure," (Ottawa: DND, 09 Sep 1949).

[237] K.B. Laver, "Follow-Up Analysis of ORAE Report No 51 (The OTV Search Method)," ATGOR STAFF NOTE 11/77, (Trenton: Operational Research Branch of ATGHQ, July 1977).

[238] R.P. Hypher, "Search and Rescue in Canada," ATGOR STAFF NOTE 5/79, (Trenton: Operational Research Branch ATGHQ, March 1979).

Victoria SRR due to the mountains. This limitation led to an investigation on how to handle search areas in mountainous terrain. CORA published a report in 1985 on this subject, which considered the VFR flight of an aircraft through mountains where direct point-to-point navigation was not possible. Due to the nature of VFR flight in the mountains it was noted that aircraft crashes seemed be near possible tracks through valley routes. This analysis led to the development of the Mountainous Visual Flight Rule (MVFR) search procedure, which optimized search efforts in higher areas of probability while also reducing the overall search area size that would have been used in the OTV search method.[239]

By the late 1980s, with the accumulation of more recent historical search data, further reviews of search procedures were conducted. One such review in 1987 examined 76 cases from 1981-86 and proposed that aircraft crashes were trending closer to their intended track than in the past.[240] The new method proposed was simpler than the MOTV method and produced smaller search areas without reducing the probability of bounding a potential crash location. It considered an initial area that extended 10NM around the expected route and a second area that extended an additional 5 NM beyond the first area. This new search method proposal would form the foundation of the Canadian Search Area Definition (CSAD) method that is currently published in the National SAR Manual (NSM) for search operations.[241]

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[239] Paul H. Saunders, "Search Planning Strategy in the Mountainous Regions of Canada," Report R1/85, (Trenton: Operational Research Advisor ATGHQ, November 1985).

[240] Paul H Saunders, "A New Search Method Based on an Analysis of Air Distress Cases: 1981-86," ATGOR STAFF NOTE 2/87, (Trenton: Operational Research Branch ATGHQ, September 1987).

[241] Department of National Defence/Canadian Coast Guard. B-GA-005-000/FP-004 – DFO 2204-23-4, IAMSAR Volume IV..., Chapter 6, 10, para 6.19.

None of the search methods discussed will guarantee a search object is found, but rather they provide guidance on how to maximize search efforts in the highest areas of probability. The issue of maximizing the probability of detection (POD) is constant throughout all the search methods and is impacted by spotter skill or fatigue, aircraft characteristics, terrain and weather. A briefing that was given by CORA staff to a Search Master Course in 1994 provides a thorough review of the work that had been done up to that time on search area definition and probability of detection.[242] Advances in navigation techniques and equipment over the last few decades have been exceptional, which should not surprisingly lead to changing trends on crashed aircraft locations.

In August 2010, CORA was once again approached to review current search procedures using current data to determine their validity.[243] Using updated crash data from 2003 to 2010, an analysis was conducted on both the CSAD method and MVFR method of search area definition. The study conclusively determined that the MVFR method of searching was still valid and should continue to be applied to mountainous terrain searches. The review also concluded that the trend of aircraft crashing close to the planned track in non-mountainous terrain was continuing. A full 90% of crashes were now falling within the CSAD1 area and none were falling in the CSAD2 area. [244] The report recommended eliminating CSAD2 and thereby concentrating more effort in the CSAD1 area. This very logical analysis followed the same rigours used previously by the

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[242] Pierre Fournier, Ivan Taylor and Michel Vigneault, "The Application of Search Theory to Search and Rescue," ATGOR Working Paper 3/94, (Trenton: ATGHQ, April 1994).

[243] A. Zegers, "Update of the Canadian Search Area Definition (CSAD) With 2003-2010 Data," 3553-1 (DRDC CORA) LR 2010-164, (Victoria: CORA, August 2010).

[244] Ibid., 7.

same organization to develop current search procedures. [245] Despite this logic and the use of newer data that better reflects current search trends, this recommended change has still not been implemented three and a half years after the report was produced. Senior leadership within the RCAF and the government of Canada should proceed with adopting the recommendation of this report. If risk aversion is preventing senior leadership from authorizing this change then perhaps expanding the analysis to include three more years of data (2010-13) with help quell these worries.

406 Beacons

Genuine attempts to "take the search out of search and rescue" have persisted since the inception of electronic homing beacons used during the Second World War. Despite these early successes and the availability of commercial Emergency Locator Transmitter (ELT) products by the mid-1950s, it would take until the early 1970s for governments to legislate their mandatory carriage onboard aircraft. At the time it took the heart wrenching and highly publicized death of a 16-year-old girl and her parents in California to focus attention on the issue. Even then it was not until two prominent Senators disappeared onboard a small commercial aircraft in Alaska before the US and Canada passed any legislation on the subject. Before long the requirement to provide an "umbrella" to detect ELT signals was recognized and many governments began cooperating on the use of satellites to this end.[246]

Canada has played a key partnership role in the creation of SARSAT from both a participative and commercial expertise point of view. Canada has continued to contribute

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[245] Saunders, "A New Search Method Based on an Analysis of Air Distress..., 1.
[246] COSPAS/SARSAT, "Cospas-Sarsat 1979-2009: A 30-year Success Story..., 1.

to this system financially over the years and even lobbied for the current SARSAT headquarters to be established in Montreal. The system has evolved considerably through a number of initiatives and will soon include additional satellites in a mid-earth orbit (MEO).[247] There is no doubt Canada has invested heavily in the SARSAT system. Why has Canada been so engaged at the highest levels of this program while failing to address a serious domestic weakness as the grass roots level?

From the beginning, the weaknesses of 121.5 MHz ELTs were recognized with a future plan to shift to the much more efficient 406 MHz beacons. Canada was "sitting at the table" in October 2000 when the decision was made for SARSAT to stop listening to the older 121.5 MHz signal. This change essentially put all users of 121.5 MHz beacons back to the pre SARSAT scenario of the 1970s where reliance was on local air traffic of airports to report any distress signals. The low internal level of attention given to this change is evident by the fact that not all RCAF aircraft were modified with the new 406 beacons by the February 2009 deadline and many modifications were temporary solutions. This did not setting a very good example.[248]

Since the 2009 deadline for SARSAT tracking of 121.5 MHz beacons, many operators have yet to switch to the new 406 MHz technology. The Canadian Owners and Pilots Association (COPA) has canvassed on behalf of their membership that the new system would not be enough of an improvement over the old system to warrant the

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[247] NOAA, Search and Rescue Satellite Aided Tracking, SARSAT Future Enhancements, last accessed 05 May 15, http://www.sarsat.noaa.gov/future html.

[248] The author was in the A3 SAR System position at 1 Cdn Air Div HQ during the period of transition and staffed some of the 406 modification files for the SAR fleets while providing advice to other RCAF fleets.

expense.[249] Whether it was due to this advocacy or indifference, Transport Canada failed to put any legislation in place prior to the 2009 121.5 MHz deadline. By 2012, COPA's stance of opposition softened somewhat to supporting the benefits of 406 MHz ELTs but still opposes a mandatory change to the new beacons.[250] To date, Transport Canada still has not legislated the mandatory carriage of 406 MHz ELTs in Canada, which exposed aviators to an increased risk of not being found, or found in time, in the event of a crash.[251] It is unfortunate but it will likely take the death of another "Carla Corbus" to press policy makers into action. It is understandable that opposition from organizations like COPA should bring a pause to consider all the factors at play with regards to policy making, but it should not derail safety initiatives for the sake of saving what is really a small amount of money in the big picture of aviation. Worst case the government could consider a partnership with COPA, Transport Canada, SAR providers and industry to develop a coherent way forward.

A secondary effect of the recent ELT change is the cost to the RCAF. One of the drivers of switching from 121.5 to the newer technology was to avoid the high cost of false alarms eliciting unnecessary responses. With operators continuing to use 121.5 MHz ELTs a new problem is created — or rather an old problem has returned — due to not having the benefit of SARSAT to pin-point the ELT position. Crews must search larger

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[249] Canadian Owners and Pilots Association, "Bring common sense to 406 ELT issue," last accessed 10 May 2014, http://www.copanational.org/September2008.cfm.

[250] Canadian Owners and Pilots Association, "ELT Update - Dec 2012," last accessed 10 May 2014, http://www.copanational.org/ELTUpdateDecember2012.cfm.

[251] Department of Justice, Canadian Aviation Regulations, "605.38 ELT," last accessed 10 May 2014, http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-433/page-214.html - h-938.

areas to find the source of the beacon — which is still often a false indication.[252] The crux of the problem may rest in the fact that whereas Transport Canada has the responsibility to update the legislation, it is a different department, the Department of National Defence, which bears the cost of this policy oversight. Considerable effort has been directed at the upper level of emergency beacon homing —SARSAT — but a grass roots 406 ELT problem has yet to be solved. Until it is solved, aviators will continue to be at unnecessary risk while flying in Canada and DND will continue to assume unnecessary cost.

Response Posture

Given the recent and re-emergent discussions on the response posture of the RCAF SAR system an attempt was made to uncover the origins of the current response posture.[253] The original Cabinet direction, via the ICSAR report, directed that "aircraft included within the primary facilities will be maintained on an immediate readiness for Search/Rescue Operations."[254] A quick analysis of the allocated aircrew, aircraft numbers and basing, leads to a logical conclusion that 24/7 immediate response from the hangar line was not possible by today's crew rest standards.[255] However, an article on the subject of 107 Rescue Unit in the *Air Power* Journal from 1957 confirms otherwise. It was stated,

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[252] CBC News, "Search and Rescue for False alarms Costs Millions," last accessed 10 May 2014, http://www.cbc.ca/news/politics/search-and-rescue-for-false-alarms-costs-millions-1.2594306.

[253] CBC News, "DND Mulls 30-minute Emergency Response Time," last accessed 10 May 2014, http://www.cbc.ca/news/canada/nova-scotia/dnd-mulls-30-minute-emergency-response-time-1.2623551u.

[254] Department of National Defence, "Report of the Inter-Departmental Committee On Search and Rescue..., 4.

[255] Department of National Defence, *1 Canadian Air Division (1 CAD) Orders: Volume 2, Flying Orders*, (Winnipeg: 1 Cdn Air Div, 30 November 1999).

"At any hour of the day or night, a call for help may filter into the Rescue Co-ordination Centre... instantly, the Rescue Centre alerts 107's standby crew and they will have one of their Lancasters airborne within 30 minutes, providing, of course, that weather conditions allow."[256] Although no definitive proof was found, it is a possibility that as crew rest rules were implemented in the RCAF it was apparent that a constant 30 minute posture could not be maintained within the resources allocated to SAR and a compromise had to be made.

The publication *50 Years of Para Rescue in Canada* refers to the ICAO commitments in 1949 driving RCC manning on the East and West coasts of Canada: "the RCC units on the two coasts were more elaborate than those inland; but the major differences were that the inland units were not required to be manned 24 hours a day."[257] A second reference to this point was made in a *Roundel* article on SAR in 1951, which states that "The only two centres with international commitments are those at Vancouver and Halifax. These are the largest and most active of the five centres and are fully manned 24 hours daily."[258] Although these references do not directly address the origin of response postures at primary SAR units, it might be a clue that the answer to the 30-minute/two-hour origin question may lie with historic ICAO direction.

The first evidence found describing actual times to be airborne versus just stating immediate response, was in the 1964 CORA report on SAR. In a summary of the SAR organization at the time it reports that "Each SAR unit is staffed with sufficient air crews to maintain an operational readiness of 30 minutes during normal hours and two hours at

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[256] "RCAF Rescue Unit." *Air Power* 4, no. 2 (Jan 1957), 129.
[257] Para Rescue Association of Canada. *That Others May Live...*, 40.
[258] Miller, "Search and Rescue in the RCAF..., 15.

other times.[259] From this point on, literature on the subject of RCAF SAR begins to make more and more mention of this 30-minute/2-hour standby as an accepted norm with very few exceptions. Another operational research report conducted in 1972 reaffirms the posture stated in the 1964 report: "The state of readiness for the 4 rescue squadrons is 30 minutes during normal working hours and 2 hours at other times."[260]

One minor variation was noted in the *424 Squadron History* book circa 1968 where crews were described as being on a 30-minute posture from 0800 to 1630 hrs, Monday to Friday. They were then on a one-hour posture from 1630 hrs to sunset and then two-hour standby after sunset and on weekends. This was the only occurrence of an additional one-hour liability period and no indication is given of when this procedure began or ended.[261]

A *Canadian Forces Search and Rescue Orders and Procedures* manual from 1976 breaks down the response posture by aircraft type. At the time Buffalos, Voyageurs, Labradors, Twin Hueys and Twin Otters at the primary SAR squadrons were all on a 30min/2 hour state of readiness. In addition to the primary squadron's aircraft, one Hercules at each 436 and 435 Sqns were also on a two-hour posture 24/7.[262]

The DND Operational Research Division published a report analyzing the alert postures of SAR squadrons in November 1987.[263] The report was aimed at examining the optimization of when the 30-minute response posture should be held in order to maximize

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[259] Bryson, "An Evaluation of the future RCAF Search and Rescue..., 2-3.

[260] E.J. Emond, "Canadian Search and Rescue Experience: 1966-1971 (U)," Staff Note 72/7, (Ottawa: DND Operational Research Division (Air), August 1972), 3.

[261] Bottomley, *424 Squadron History*..., 97.

[262] Department of National Defence, CFP 209, *Search and Rescue Orders*..., 5-4.

[263] A.M. Shurson and F.H. Fitch, "An Analysis of the Alert Posture of the SAR Squadrons," DOAR STAFF NOTE 87/17, (Ottawa: DND Operational Research Division, November 1987), 8.

overall effectiveness of the CF SAR system. The report examined data from 1983-1986 and during the analysis pointed out that during 30-minute standby crews were airborne in approximately 18 minutes on average and during 2-hour standby crews were airborne in about an hour (this data is the same as the current 103 Rescue squadron data from 2010-12).[264] The report also concluded that in general the period between 1000 to 1400 hrs was a slightly better time to begin an eight-hour shift for all RCCs and that the Trenton SRR was the only region that showed any appreciable increase in incidents on Saturday and Sunday. It was also evident that the further an incident was from a SAR resource the longer the transit time was and therefor the less impact the response time to get airborne had on the overall mission. [265]

To this day, the National SAR Manual (NSM) grants an SRR Commander the ability to shift the 40 hours per week of 30-minute response as they see fit to maximize SAR response.[266] The norm over the recent past has been to maintain the 30-minute response during the 0800 to 1600 timeframe from Monday to Friday with some small exceptions being made during peak risk periods, such as the opening of lobster season on the East coast. Recent public attention on SAR has led to discussions on how to improve RCAF SAR response within current resources. This has led to an initiative to once again manoeuvre the 30-minute posture in an attempt to capture the most likely periods of

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[264] Department of National Defence, Presentation by CO 103 Rescue Sqn (Major Clint Mowbray), *103 Squadron Response 2010-2012*, April 2012.

[265] Shurson, "An Analysis of the Alert Posture..., 35.

[266] Department of National Defence/Canadian Coast Guard. B-GA-005-000/FP-004 – DFO 2204-23-4, IAMSAR Volume IV..., Chapter 4, 4, para 4.8.

higher demand based on past statistics.[267] This is a logical and zero cost attempt to make a minor improvement to SAR responses but unfortunately weak trending statistics from the past may not necessarily reflect the future.

The exact moment the 30-minute/2-hour posture was instituted continues to be a mystery, but one fact is certain — SAR crews have always reacted immediately to the call for help. The state of readiness was likely created at some point prior to 1964 to mediate the conflict between an immediate response and the limited resources allocated to SAR.[268] Presently it is used as a performance metric or "back stop" to help bring attention to issues which may be hindering SAR crews from expected responses. Looking at both historic and recent data, the reality is crews are airborne on average in 20 minutes during the 30-minute posture window and in approximately an hour during the 2-hour posture window. These statistics are very good considering the resources saved by not having to maintain a 30-minute posture 24/7.[269]

One final thought concerns the trend of less military personnel staying on base in private married quarters (PMQ). When the RCAF SAR system was first created, military personnel stayed in on-base housing more as the norm than the exception. This means that when the concept of a response from home was conceived the travel time for aircrew would have been minimal. Currently, with a majority of SAR crews living off base travel times can be as high as 45 minutes at some locations due to fairly large geographic limits

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[267] A recent Op Order was issued by Comd 1 Cdn Air Div directing 424, 435 and 442 T & R Sqns to modify their 30-minute response postures for the summer. Department of National Defence, "JFACC OP ORDER 13207/14 REVISED SAR POSTURE 2014," 3385-1 (SAR POSTURE), 01 May 2014.

[268] This analysis is based on the necessary transition that occurred prior to 1964, to line up historic crewing levels and an immediate launch posture with current crewing that has to be in line with crew rest orders.

[269] Shurson, "An Analysis of the Alert Posture..., 8, and Department of National Defence. Presentation by CO 103 Rescue Sqn, *103 Squadron Response 2010-2012*. April 2012.

as per Canadian Forces Administrative Order (CFAO 209.28). Surely this was not envisioned when the 2-hour posture from home was originally created. This situation could be mitigated through two initiatives: first, modify orders to restrict SAR standby crews to a smaller geographic limit; and second, develop desirable PMQs near SAR squadrons while giving habitation priority to SAR personnel. Reducing the transit time of crews from their homes during the 2-hour standby period would help close the gap between the 30-minute and 2-hour SAR response times — likely a more significant change than juggling the 30-minute response posture timings during the day.

Is it Still Appropriate for the RCAF to be Responsible for SAR?

When the RCAF was originally tasked in 1947 with the responsibility for coordinating and facilitating SAR responses in support of aircraft in distress it was for two main reasons: cost savings and experience. Because the RCAF already had operation centres, aircraft and crews to quickly and economically organize an effective system the choice was very logical. The RCAF also had both the expertise developed from the experience of the Second World War and a requirement to maintain this type of service for its own purposes. Much of the historic documentation up until more recent decades included plans for both peacetime and wartime SAR operations. With time these original drivers for choosing the RCAF for the SAR role have changed.

The initial benefit of economy using surplus resources expired decades ago and with dwindling RCAF fleet numbers the ability to multi-role aircraft is becoming a challenge. Currently the RCAF SAR organization keeps eight aircraft on a 24/7 high alert posture along with three JRCCs and a CMCC to support SAR in Canada. This effort is

significant and as a "no fail" mission it does receive operational priority within the RCAF when it comes to manning and funding.[270] Despite minimal fleet sizes, skeleton crewing and negligible staff positions, SAR operations come with an expensive price tag. A large portion of the expense comes from the constant Force Generation (FG) efforts that are required to develop experienced crews on the current four fleets. Due to the constant circulation of military personnel through central RCAF training positions, staff positions, deployments and other training, the requirement to constantly make Aircraft Commanders, SAR Flight Engineers and SAR Tech Team Leads is never ending.[271] This FG cost to the government could be significantly reduced if the RCAF SAR organization was part of a Canadian Coast Guard human resource management type system where members could remain in positions of choice for many years if not their whole career.

Experience and internal requirements for SAR too has changed but to a lesser extent than the previously discussed point of economy. Given that RCAF personnel have conducted SAR with dedication and professionalism for over 67 years, the expertise undoubtedly still rests within the institution. This SAR expertise is no longer gained from providing a service to the RCAF itself; but rather it is an expertise developed serving the aviation, maritime and humanitarian needs of Canadians. In fact, when the RCAF needs dedicated SAR capabilities for itself, it turns to Combat Support Squadrons domestically. When CF personnel are engaged in operations abroad it is always as a coalition where

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[270] Manning and funding falls within prescribed levels. This does not mean, however, that the prescribed levels are correct, as pointed out in the 2013 Auditor General report. Office of the Auditor General, *Chapter 7: Federal Search and Rescue Activities* (Ottawa: Office of the Auditor General of Canada Distribution Centre, 2013).

[271] Office of the Auditor General of Canada, Report of the Auditor General of Canada, *Chapter 7: Federal Search and Rescue Activities*, Spring 2013, 11-12.

Personnel Recovery services are frequently provided by Canada's allies.[272] It is clear that the current RCAF SAR service has very little of the original self-serving requirement left.

This is not the first time mention has been made of considering the validity of the RCAF continuing to provide Search and Rescue services in Canada. The CORA report from 1964 makes the first mention of the notion: "Although it is not within the terms of reference of this study to investigate the transfer of SAR responsibility from the RCAF, a valid argument exists for SAR coordination by the Department of Transport."[273] A more recent example of a proposal to change the existing RCAF managed aeronautical SAR system in Canada is one that a previous CO of 103 SAR Sqn made in 2011. In the paper, Major (now retired) Steve Reid proposes the concept of forming a partnership between industry, federal and provincial governments to tackle the issue of maintaining a robust but cost effective SAR system in Canada. [274] The proposal has similarities with some Medical Evacuation (MEDEVAC) programs that already exist at the provincial level between not-for-profit companies and provincial governments. Canada would not be the first country to seek alternate methods of delivering SAR — the United Kingdom recently began implementation of a contracted SAR helicopter program.[275]

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[272] Department of National Defence, B-GA-404-000/FP-001, *CF Aerospace Move Doctrine* (Winnipeg: DND, 2011), 51. http://airforceapp.forces.gc.ca/cfawc/CDD/Doctrine/Pubs/Operational/404_Series/B-GA-404-000-FP-001.pdf.

[273] Bryson, "An Evaluation of the future RCAF Search and Rescue..., 3.

[274] Steve Reid, "Improving SAR Response-A Discussion Paper," 29 Oct 2011, http://www.google.ca/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CDEQFjAB&url=http%3A%2F%2Fcolinkenny.ca%2Fen%2Fresources%2Fmedia%2FImproving SAR response - A discussion paper.doc&ei=KIJsU6z1CseGyAT1-YK4DQ&usg=AFQjCNEmc44TPfwJPYo.

[275] Defence Industry Daily, “Britain’s Next Search-and-Rescue Helicopters: Civilian Contractors,” last accessed 8 May 2014, http://www.defenseindustrydaily.com/british-searchandrescue-a-billion-pound-partnership-02271/#more-2271.

The US Military is not fully engaged in domestic SAR service delivery like the CF, although it has maintained a coordination element via Air Force Rescue Coordination Centers. The Civil Air Patrol conducts 85% of all federal inland SAR operations in the US and the US Coast Guard coordinates and handles SAR incidents along all major US waterways.[276] US military capabilities are directed primarily at the role of Combat SAR/Personnel Recovery, although domestically they can be requested to assist as secondary resources.

The point of this discussion is not to say that SAR responsibilities should be removed from the RCAF in Canada, but rather to point out that the original reasons for assigning the role to the RCAF are no longer valid. Although it is highly doubtful that any organization could exceed the dedication and quality of SAR service provided by the men and women of the RCAF, there may very well be much more cost effective ways of doing business. The real question will be whether this can be done without a reduction in the quality of service currently being provided.

Conclusion

Five very current RCAF search and rescue issues have been discussed in this chapter, while considering the circumstances that has led to their current existence. Each of the issues examined is unique in nature and yet all five similarly contain elements of history that have been forgotten. The key lessons from this examination are: maintaining a dedicated FW SAR capability is not smart use of resources; search patterns have

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[276] Civil Air Patrol, History of Civil Air Patrol, Emergency Services, last accessed 08 May 2014, http://www.gocivilairpatrol.com/about/civil_air_patrols_three_primary_missions/emergency-services/.

constantly evolved and should continue to do so; ELTs save lives and the latest version should be mandatory for general aviation; the SAR response posture is a balance of capability and economy; and finally the original reasons for assigning SAR to the RCAF are no longer valid. The solutions to these five SAR issues are very attainable if senior members of the RCAF and the government of Canada are willing to step forward and take them.

CONCLUSION

This account of the evolution of the Royal Canadian Air Force Search and Rescue organization demonstrates that Canada's air force has indeed forgotten lessons from the past. In the early years of aviation in Canada, aviation SAR transitioned from ad hoc to a more organized air-sea rescue effort during the Second World War. Canada, along with its allies, made significant advances in air-sea rescue procedures and equipment, which built the foundation for post-war search and rescue programs. Joining ICAO committed Canada internationally to build an effective system for assisting aviators in distress.

Four years after the Canadian government officially assigned the RCAF to carry out SAR in Canada, its responsibilities were expanded to cover marine distress in 1951 — once again as a result of an international agreement (to IMO). What followed for the air force was a decade of developing expertise in search procedures and the incorporation of new technologies including the helicopter. By the 1960s, resource constraints and a 1964 CORA report on SAR led to a streamlining of the SAR system. The era of unification saw significant changes to SAR aircraft, including the demise of the flying boat platform and the assignment of dual roles to SAR squadrons.

In the 1970s, as a result of Canada gaining its exclusive economic zone, the marine SAR system was significantly boosted, resulting in an additional SAR squadron in Newfoundland and the establishment of two additional RCC sub-centres. Regulation of ELT carriage on aircraft and the formation of the Search and Rescue Satellite system provided significant improvements to SAR in the 1970s and 80s. The formation of volunteer civilian SAR organization — CASARA — provided considerable efficiency during major search operations starting in the mid-1980s. Finally, the "peace dividend" of

the early 1990s led to streamlining of the SAR organization once again, and created the organization that remains to this day.

The principle forces that led to these changes over the decades included: external obligations (ICAO and IMO); new technologies (new platforms, ELTs, Satellites, etc.); resource constraints (initial RCAF tasking, unification and peace dividends); and meeting unavoidable capability gaps (Newfoundland SAR in 1970s and EEZ). One thing remained constant throughout these changes, though: the men and women of the RCAF resourcefully and courageously sought new procedures and equipment so "that others may live."

Armed with an accurate account of the evolution of SAR, five key and current issues have been examined to determine if historical lessons have been retained. The perspective on these issues is quite different when illuminated by a historically educated mind, vice considering them in the isolation of the present. The first issue concerns the current intent to procure new fixed-wing aircraft for the sole purpose of SAR duties. Based on the history of FW SAR aircraft in the RCAF and a decreasing major search trend, FW SAR resources should not be solely dedicated to the SAR role — they should be multi-role. Secondly, search procedures have evolved considerably since the late 1940s, factoring in lost aircraft trends, and should continue to evolve with scientific consideration of the most resent search data. The third issue is the mandatory use of ELTs in Canadian airspace. Modern ELTs save lives and should be thoroughly regulated, including legislation of their mandatory carriage on aircraft.

SAR response posture was the fourth issue discussed. Although the original source of the 30-min/2-hour posture is unclear, what is clear is that a balance of

effectiveness and economy must be struck. Current initiatives to manoeuvre the 30-minute posture using historic data may improve SAR response but does not guarantee it. The final discussion point considers the original reasons for assigning SAR to the RCAF. The initial economies of assigning SAR to the RCAF and the requirement to provide an internal SAR requirement have diminished over the years. These original reasons are no longer valid; therefore serious consideration should be given to re-examining the appropriate place for this important task in Canada. This may either validate the continuation of RCAF SAR or may lead to new efficiencies in this service delivery to Canadians.

The examination of these five current issues affecting the RCAF SAR organization proves that consideration of previously learned lessons have indeed been forgotten. The vast expanses, harsh climates and sparsely populated areas of Canada create an undeniable requirement for an effective SAR system, but equally important is the requirement to balance this with the limited resources available. This environment requires that decisions and changes to the RCAF system are made in a thoughtful manner which includes understanding the past to comprehend what has led to the current state. One question remains — will these lessons remain forgotten?

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