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Evaluation of the DND/CAF Contribution to the National Search and Rescue Program

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Acronyms and Abbreviations

AOR	Area of Responsibility
CAD	Canadian Air Division
CAF	Canadian Armed Forces
CASARA	Civil Air Search and Rescue Association
CCG	Canadian Coast Guard
CFM	Cost Factors Manual
CJOC	Canadian Joint Operations Command
CORA	Centre for Operational Research and Analysis
COSPAS-SARSAT	Cosmicheskaya Sistema Poiska Avariynyh Sudov (Космическая Система Поиска Аварийных Судов) Search and Rescue Satellite-Aided Tracking
CRS	Chief Review Services
CSS	Combat Support Squadron
DND	Department of National Defence
DRDC	Defence Research and Development Canada
FE	Force Employment
FG	Force Generation
FTE	Full-time Equivalent
FW	Fixed Wing
FWSAR	Fixed Wing Search and Rescue Aircraft Replacement
FY	Fiscal Year
GC	Government of Canada
ICSAR	Interdepartmental Committee on Search and Rescue
JRCC	Joint Rescue Coordination Centre
LMSAR	Lead Minister for Search and Rescue
MHz	Megahertz
MOU	Memorandum of Understanding
NSP	National Search and Rescue Program
NSS	National Search and Rescue Secretariat
OAG	Office of the Auditor General

OCI	Office of Collateral Interest
OGC	Operational Governance Committee
OPI	Office of Primary Interest
PAA	Program Alignment Architecture
RCAF	Royal Canadian Air Force
RCMP	Royal Canadian Mounted Police
RW	Rotary Wing
SAR	Search and Rescue
SAR Tech	Search and Rescue Technician
Sqn	Squadron
SRR	Search and Rescue Region
US	United States
YFR	Yearly Flying Rate

Executive Summary

This report presents the findings and recommendations of the evaluation of the Department of National Defence (DND)/Canadian Armed Forces (CAF) contribution to the National Search and Rescue (SAR) Program (NSP) over the period of 2008 to 2013. The evaluation was conducted by Chief Review Services (CRS) in compliance with the Treasury Board Policy on Evaluation (2009).

The evaluation assesses the relevance and effectiveness of the DND/CAF contribution towards its SAR portion of the NSP. The DND/CAF contributions to SAR were previously evaluated in January 2008. There have also been numerous external reviews and audits performed on this program area in recent years. This evaluation sought to build upon those reports by validating and assessing the impact of the findings on overall performance, determining root causes of issues, and examining financial aspects of the program.

Overall Assessment

The overall DND/CAF contribution to SAR has been effective. However, some areas for improvement exist, as follows:

- Stronger governance and strategic direction for departmental SAR roles, responsibilities, training, and activities are required in order to contain significant increases in overall program cost.
- Greater collaboration with SAR partners, including increased use of CASARA, is required to improve efficiency.
- Clear performance metrics and targets for the DND/CAF's SAR activities are required to measure effectiveness and monitor the changing nature of SAR taskings.

Program Description

The NSP is delivered by multiple federal, provincial, and territorial departments. The DND/CAF's contribution to the NSP is to provide coordination of aeronautic and maritime SAR operations throughout the Canadian Area of Responsibility (AOR) and to collaborate with the Canadian Coast Guard (CCG), which is accomplished through three Joint Rescue Coordination Centres (JRCC) that are located in Halifax, Trenton, and Victoria. Additionally, the DND/CAF is responsible for providing aviation assets to conduct aeronautical SAR within the Canadian AOR and assist the CCG in the resolution of maritime SAR cases.

To meet the aeronautic SAR requirements, the Royal Canadian Air Force (RCAF) operates dedicated aviation assets (fixed wing (FW) aircraft[1] and rotary wing (RW) helicopters[2]) from five locations across Canada. These aviation assets have crews of specially trained SAR personnel. Four FW aircraft and four RW helicopters are on stand-by for SAR response on a daily basis. In addition, the DND/CAF contributes to space-based SAR sensors and funds and supports training for members of the Civil Air SAR Association (CASARA). This evaluation will focus solely on the primary aviation assets and the overall coordination of SAR provided by the DND/CAF in support of its mandate.

[1] DND/CAF SAR FW aircraft: CC130H Hercules and CC115 Buffalo aircraft.
[2] DND/CAF SAR RW aircraft: CH149 Cormorant and CH146 Griffon helicopters.

Relevance

There is an ongoing and demonstrated need for the DND/CAF's contribution to SAR in Canada based on the stable number of aviation and maritime incidents that occur in Canada's AOR annually. Canada is also the signatory of several memoranda of understanding (MOU) and international agreements on aeronautical and maritime SAR. The safety and security of Canadians remains a high priority for the Department and the Government of Canada (GC).

Performance

The evaluation found that, although a number of areas of improvement exist, the overall DND/CAF contribution to SAR, given current aircraft, has been effective and well positioned, and it has met all objectives. While there have been concerns raised about the age and capability of RCAF aircraft fleets and infrastructure, the evaluation found that the location of bases, number of crews, and number of aircraft, is currently sufficient to meet the vast majority of response times. When targets were not met, the extent to which the response times were exceeded was not significant given the overall time required to complete a mission, which is largely dictated by Canada's vast size.

The key area for improvement is the need for stronger governance and strategic direction for the roles, responsibilities, training, and activities of the DND/CAF contribution to the NSP (Key Findings 12 to 14 and Recommendation 7) to be provided by the National SAR Secretariat (NSS) and the CAF's strategic headquarters. This stems from the need to control the program costs, which have increased by over 33 percent over the past five years, by determining inefficiencies and eliminating potential interdepartmental overlaps.

Key Findings and Recommendations

Key Finding 1: Continued need is demonstrated through a steady number of SAR incidents per year.

Key Finding 2: SAR remains a high priority for the DND/CAF and the GC.

Key Finding 3: The federal government is responsible for coordinated aeronautical and maritime SAR operations as required through signatory status on multiple conventions and agreements.

Key Finding 4: The availability of RCAF aircraft for operational SAR taskings is sufficient. However, the availability of aircraft for training is not consistent.

Key Finding 5: While lacking modern integrated sensors, the overall range and capability of SAR aircraft to perform operational taskings are acceptable.

Key Finding 6: Although the CH146 Griffon is not as capable as the CH149 Cormorant, its use has proven to be an adequate interim SAR platform in Trenton.

Key Finding 7: Over the past five years, the DND/CAF has met the response posture 92 percent of the time on a national basis. On average, RCAF SAR crews are actually airborne much sooner than the response posture. When not met, the median delay was 15 minutes.

Key Finding 8: The mandated airborne response posture times represent only a portion of the overall SAR mission timeline and may not adequately represent the best performance metric for the Canadian AOR.

Key Finding 9: In most cases, the SAR manning levels match the desired level of 6.5 crews per FW and 5.5 for RW squadrons. However, the evaluation was unable to identify a documented requirement for these targets.

Key Finding 10: The range and extent of SAR technician (SAR tech) training increased over the period reviewed by the evaluation. The amount and types of SAR tech training required for the DND/CAF's contribution to SAR response would benefit from stronger strategic oversight.

Key Finding 11: While the DND/CAF has recently implemented steps to improve issues of SAR-specific equipment, a standard or baseline for validating SAR equipment requirements relative to mandated responsibilities does not currently exist.

Key Finding 12: The DND/CAF lacks a dedicated and proportionally resourced SAR governance structure that can provide strategic direction on requirements, standards, and operational boundaries. Without this staff, the DND/CAF risks being unable to resolve ongoing issues and continued potential mission creep.

Key Finding 13: With the inactivity of the Interdepartmental Committee on SAR (ICSAR) and the resulting loss of effective coordination, the CAF and CCG have had to establish a separate operational governance committee (OGC), thus creating potential duplication while lacking the benefit of overall ICSAR direction.

Key Finding 14: The lack of a strategic policy framework and overarching direction for the NSP poses potential risks to the role of DND/CAF capabilities within a coordinated NSP, particularly in regard to equipment, training, and interoperability with partners.

Key Finding 15: The overall cost of the DND/CAF contribution to the NSP has increased significantly during the past five years due primarily to increases in operating costs per hour.

Key Finding 16: CASARA is an effective and cost efficient asset when tasked appropriately.

Key Finding 17: The DND/CAF has increasingly supported non-core humanitarian and medical evacuation missions that are external to its mandate and have not been cost recovered.

Key Finding 18: Although Combat Support Squadrons (CSS)[3] have SAR techs as resources, they have been minimally employed in SAR missions. Given the significant training investment required for SAR tech personnel, the low utilization may be an inefficient use of this highly specialized resource.

Key Finding 19: The RCAF contribution to SAR is cost effective when compared to the overall budget of the DND and the level of service to Canadians and SAR partners.

Recommendations

CRS Recommendation 1: Investigate options for SAR training activities to make more effective use of limited air resources.

CRS Recommendation 2: Investigate options for optimizing the range, payloads, and operational capabilities of the CH146 in the SAR role.

CRS Recommendation 3: To gain insight into the overall SAR requirement, track the number of incidents where commercial RW assets are contracted to conduct the rescue and/or recovery portion of a SAR tasking.

CRS Recommendation 4: Develop a performance metric for the Canadian AOR that considers factors such as transit time, which are often a greater determinant in the overall response time than solely the mandated response time.

CRS Recommendation 5: Determine if the desired manning levels for SAR units are still applicable given current SAR and non-SAR-related tasking levels and training requirements.

[3] DND/CAF CSSs: 417 Squadron Cold Lake, 439 Squadron Bagotville, and 444 Squadron Goose Bay.

CRS Recommendation 6: Given financial, training, and equipment constraints, determine the level and extent of SAR tech capabilities required to meet the DND/CAF contribution to the NSP. Further refine these capabilities into specific skill sets for which specialized equipment and training can be acquired and/or assigned.

CRS Recommendation 7: Augment or restructure SAR command and control in order to provide strategic and operational level oversight and direction for DND/CAF SAR in Canada.

CRS Recommendation 8: Investigate the increased use of CASARA for searching, especially on low probability events such as un-correlated 121.5 MHz beacons.

CRS Recommendation 9: Investigate potential cost recovery for non-core SAR taskings.

CRS Recommendation 10: Investigate inefficiencies in SAR tech resource utilization at CSSs.

1.0 Introduction

1.1 Profile of the DND/CAF Contribution to the NSP and Related Contribution Programs

1.1.1 Background

The following report presents the findings and recommendations of the evaluation of the DND/CAF contribution to the NSP. The evaluation was completed by CRS in accordance with GC policies[4] and approval authority[5] between September 2013 and June 2014. The evaluation assesses the relevance and effectiveness (performance towards expected outcomes) of the NSP based on data from 2008 to 2013. The DND/CAF contribution to the NSP was previously evaluated in January 2008.

Recently, there have been numerous studies of this program area, including those conducted by the Office of the Auditor General (OAG),[6] the NSS,[7] as well as CAF-sponsored assessments of SAR equipment, response times, and base locations. This evaluation sought to build on those reports by validating and assessing the impact of the findings on overall performance, determining the root causes of issues, and examining the financial aspects of the program.

1.1.2 Program Description

The NSP is delivered by multiple federal departments, including the CCG under the Department of Fisheries and Oceans; the Royal Canadian Mounted Police (RCMP) under Public Safety Canada; the Meteorological Service of Canada under Environment Canada; Transport Canada (Aviation); Parks Canada, and the DND/CAF. The efforts of these departments are integrated and coordinated through the ICSAR. The Minister of National Defence is appointed the federal lead minister for SAR (LMSAR) and heads the ICSAR.

The NSS is administered and funded by the DND/CAF. The executive director of the NSS acts as the delegated chair of ICSAR meetings on behalf of the LMSAR and is responsible for the provision of policy advice and program coordination related to the prevention and response initiatives within the NSP. The NSS is also responsible for the delivery of the SAR New Initiatives Fund contribution program and for leading Canada's engagement in COSPAS-SARSAT, the international satellite system for SAR.[8]

As a SAR service provider, the DND/CAF is responsible for providing coordination of maritime (in collaboration with the CCG) and aeronautical SAR operations, anywhere within Canada's designated AOR. SAR coordination is provided by three JRCCs, located in each of the three

[4] Treasury Board of Canada Secretariat. Policy on Evaluation, 2009. http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=15024&section=text.
Policy on Transfer Payments, 2012. http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=13525&section=text.
[5] CRS. DND/CAF Five-Year Plan for Evaluation 2013/14 to 2017/18, February 2013.
[6] Report of the Auditor General of Canada—Spring 2013, Chapter 7: Federal Search and Rescue Activities.
[7] NSS. SAR Quadrennial Review, December 2013.
[8] Defence Research and Development Canada (DRDC) Centre for Operational Research and Analysis (CORA). Canadian National Search and Rescue Literature Review, September 2012, Chapter 5, p. 22.

SAR regions: JRCC Victoria, JRCC Trenton, and JRCC Halifax. The JRCCs coordinate and direct SAR missions for the commander of the Canadian Joint Operations Command (CJOC)[9] through their respective Search and Rescue Region (SRR) commanders.

To meet the aeronautical SAR requirements, RCAF specially trained SAR personnel operate dedicated aviation assets (FW aircraft and RW helicopters) from five locations across Canada. Four FW aircraft and four RW helicopters are on stand-by in Canada for dedicated SAR response at all times. In addition, the DND/CAF provides secondary air, maritime, and land-based assets, as required, and contributes to space-based SAR sensors. The DND/CAF also draws upon members of CASARA.

The search component of the DND/CAF SAR is generally carried out with space-based sensors and FW aircraft, operated by either the CAF or CASARA. When unable to utilize surface units for extraction, the rescue component is generally carried out with RW aircraft operated by the CAF, or it is contracted out.

1.1.3 Program Objectives

As stated in the National SAR Manual, the objective of the NSP is "to prevent loss of life and injury through search and rescue alerting, responding, and aiding activities using public and private resources."[10]

To accomplish its portion of this objective, the DND/CAF must be ready and able to effectively conduct tasked SAR operations and perform effective coordination of aeronautical and maritime SAR. The specific activities, outputs, and outcomes of the DND/CAF contribution to the NSP are illustrated in the Logic Model at Annex C.

[9] CJOC. Search and Rescue Posture Review 2013, p. 2-3.
[10] National Search and Rescue Manual, May 2000, Chapter 1, p. 3.

1.1.4 Program Stakeholders

As a multi-tiered initiative in Canada, the NSP includes stakeholders from three levels of government and multiple SAR volunteer associations. Table 1 provides a list of key NSP stakeholders. The target population for the NSP is the Canadian public and, to a lesser extent, the international community with respect to demonstrating Canada's compliance with its international treaties, conventions, and agreements.

List of Key NSP Stakeholders	
DND/CAF	**External Stakeholders**
• CJOC • RCAF • Royal Canadian Navy • Canadian Army • Assistant Deputy Minister (Materiel) • Assistant Deputy Minister (Policy) • Chief Military Personnel	• CCG (Fisheries and Oceans Canada) • RCMP (Public Safety Canada) • Transport Canada • Meteorological Service of Canada (Environment Canada) • Parks Canada Agency • CCG Auxiliary • SAR Volunteers Association • CASARA • Multiple provincial and territorial SAR associations

Table 1. List of Key NSP Stakeholders. This table summarizes the key NSP stakeholders within and external to the DND/CAF.

1.2 Evaluation Scope

1.2.1 Coverage and Responsibilities

The DND/CAF component of the NSP is included in the Department's Program Alignment Architecture (PAA) under the program area of Defence Services and Contributions to Government as sub-sub programs 2.2.3 – National Search and Rescue Program and 2.2.4 – Search and Rescue Operations.[11]

The evaluation scope included all activities, outputs, and results related to the DND/CAF's dedicated aeronautical SAR response and coordination of air and maritime SAR operations between 2008 and 2013. Although it is recognized that the DND/CAF aeronautical response for SAR can include any secondary CAF air, marine, and land asset, the evaluation focused only on those resources dedicated exclusively to SAR. Further, the evaluation did not examine the activities associated with the procurement, maintenance, or infrastructure support of SAR

[11] DND. PAA, July 2013.

resources or the initial occupation training of SAR personnel as these areas are included in other broader program areas.

The role of the NSS was included in the scope of the evaluation as it relates to the DND/CAF sphere of responsibility within the NSP as a direct DND-funded agency.

1.2.2 Resources

The DND/CAF contribution to the NSP includes three JRCCs, five bases (aircraft squadrons and bases), 37 dedicated aircraft,[12] and over 800 personnel.

Based on the PAA, the annual spending directly attributed to the DND/CAF component of the NSP and related contribution programs averaged $227.6 million over the period of fiscal year (FY) 2008/09 to FY 2012/13.[13] This, however, did not include all costs associated with the operation and conduct of the program, including such items as amortization of capital costs and some aspects of base and infrastructure support that are generally shared with non-SAR units. Based on the DND Cost Factors Manual (CFM), which does include these expenditures, the average annual cost of the program during this same period was $321.5 million.

1.2.3 Issues and Questions

In accordance with the Treasury Board Policy and Directive on Evaluation, the evaluation addresses five core issues related to relevance and performance. The methodology used to gather evidence in support of the evaluation questions is provided at Annex B.

The issues and questions addressed in the evaluation are as follows:

Relevance

Continued Need

Does the DND/CAF mandated SAR program address an actual and ongoing need?

Alignment with Federal Roles and Responsibilities

Are the priorities of SAR consistent with DND/CAF strategic outcomes and federal government priorities?

Alignment with Government Priorities

Is the delivery of SAR consistent with the roles and responsibilities of the federal government and the DND/CAF?

[12] Only four FW and four RW aircraft are on standby of the total 37.
[13] DND. PAA, July 2013.

Performance (Effectiveness)

Is the DND/CAF SAR program prepared to respond?
Is there effective direction or coordination of partners in SAR?

Performance (Efficiency and Economy)

Are the most efficient means of achieving objectives for SAR being employed?
What are the economic costs and benefits of the SAR program?

2.0 Findings and Recommendations

2.1 Continued Need

Evaluation Question: Does the DND/CAF mandated SAR program address an actual and ongoing need?

Key Finding 1: Continued need is demonstrated through a stable number of SAR incidents per year.

The Canadian SAR AOR is immense, stretching across 18 million square kilometres. It covers three oceans, stretching from 1,500 kilometres west of Vancouver Island to the North Pole to half way across the Atlantic Ocean. However, Canada has a relatively small population of approximately 34 million people,[14] who largely reside in the southern part of the AOR. Tourism and economic development activities in the northern regions are increasing,[15] which may lead to changes in future SAR requirements.

The ongoing need for DND/CAF aviation SAR assets is demonstrated by the stable number of incidents that occur. Annually, the JRCCs track an average of 9,419 SAR incidents, including ground, marine, and air incidents. Of these, the RCAF was requested to respond to more than 1,000 incidents.

Annual Total SAR Incidents by SRR						
SRR	**2009**	**2010**	**2011**	**2012**	**2013**	**Five-year Average**
Halifax	2,665	2,868	2,651	2,682	2,515	2,676
Trenton	3,527	3,710	3,664	4,110	3,632	3,729
Victoria	3,166	2,894	2,868	3,244	2,898	3,014
Total	**9,358**	**9,472**	**9,183**	**10,036**	**9,045**	**9,419**

Table 2. Five-year Total and Average SAR Response by SRR[16]. This table shows the annual total SAR incidents by SRR between 2009 and 2013, as well as the five-year average.

[14] DND. Quadrennial SAR Review, December 2013, p. 5.
[15] Ibid., p. 14.
[16] Figures listed in Table 2 represent total incidents that could have formed a SAR case coordinated by the JRCCs (and the Maritime Rescue Sub-centre in Quebec, which is represented under the Trenton and Halifax SRR data). Source: DND CJOC. Federal SAR OGC Annual Report 2013, p. 13.

Annual Total SAR Taskings by Responder						
Responder	**2009**	**2010**	**2011**	**2012**	**2013**	**Five-year Average**
RCAF	1131	1005	957	1011	1071	1035
CASARA	225	248	162	129	148	182
CCG	4875	4463	4336	4577	4050	4460
CCG Auxiliary	1884	2059	1941	1962	1732	1916

Table 3. Five-year Total and Average SAR Response by Responder[17]. This table shows the annual total SAR taskings by responder between 2009 and 2013, as well as the five-year average.

2.2 Alignment with Government Priorities

Evaluation Question: Are the priorities of SAR consistent with DND strategic outcomes and federal government priorities?

Key Finding 2: SAR remains a high priority for the DND/CAF and the GC.

SAR is a major priority of the DND and is included in the six core missions of the *Canada First* Defence Strategy under the section entitled Defending Canada – Delivering Excellence at Home.[18]

SAR is also identified as a high priority in the DND Report on Plans and Priorities under the priority "ensuring sustainable operational excellence both at home and abroad" and under Defence priority Readiness to Respond.[19] SAR-related items were also included in recent federal budgets (2012-2014).[20] Lastly, the GC has recently committed to SAR-related procurements, including the new SAR FW aircraft, observation satellites, and other equipment upgrades and modernization.

[17] Figures listed in Table 3 represent total incidents that could have formed a SAR case coordinated by the JRCCs (and the Maritime Rescue Sub-centre in Quebec, which is represented under the Trenton and Halifax SRR data). Source: CJOC. Federal SAR OGC Annual Report, 2013, p. 13.
[18] DND. *Canada First* Defence Strategy, p. 7.
[19] DND. Report on Plans and Priorities 2013-14. "To provide security to Canadians, Defence will continue to provide prescribed levels of SAR response capability in collaboration with SAR mission partners within the Canadian Search and Rescue Region."
[20] Federal budget items include a SAR maritime virtual trainer for the CCG (Federal Budget 2012 and 2013) and tax benefits for SAR volunteers (Federal Budget 2014).

2.3 Alignment with Federal Roles and Responsibilities

Evaluation Question: Is the delivery of SAR consistent with the roles and responsibilities of the federal government and the DND/CAF?

Key Finding 3: The federal government is responsible for coordinated aeronautical and maritime SAR operations as required through signatory status on multiple conventions and agreements.

The GC has federal responsibilities pertaining to SAR operations, through its participation in international organizations and as required by the following signatory treaties, conventions, and agreements:

- Convention on International Civil Aviation (1944);
- International Convention on the Safety of Life at Sea (1974);
- International Convention on Maritime SAR (1979); and
- MOUs:
  - Maritime Forces Pacific (CAF) and the United States (US) Coast Guard for mutual assistance;
  - CAF, CCG, US Coast Guard and United Kingdom federal departments (Coast Guard, Defence, Civil Aviation division of Environment, Transport, and Regions) defining operational and administrative responsibilities and coordination;
  - Maritime Force Atlantic (CAF) and US Coast Guard for off-shore petroleum exploration; and
  - DND/CAF and Transport Canada for SAR training and CASARA employment.

2.4 Performance

The performance of the DND/CAF contribution to the NSP was assessed against its ability to deliver on target outcomes and objectives, which ultimately leads to the prevention of loss of life and injury.

To achieve its objectives, the DND/CAF procures and maintains SAR aircraft and equipment; trains SAR aircrew, technicians, and rescue specialists (SAR techs); conducts exercises; provides governance and direction for SAR activities; and sustains the alerting and coordination systems for overall SAR response to aeronautical and maritime incidents within Canada's AOR.

Based on these activities, the evaluation examined the following key performance areas:

1. Availability of air assets vs. stated needs;
2. Capability of air assets;
3. Location of air assets vs. incident location;
4. Response times vs. stated targets;
5. Quality of training and availability of crews vs. stated needs;
6. Quality and type of SAR tech equipment; and
7. Effectiveness of governance and coordination with other partners and stakeholders.

2.4.1 Availability of Air Assets

Key Finding 4: The availability of RCAF aircraft for operational SAR taskings is sufficient. However, the availability of aircraft for training is not consistent.

Recent reviews, including the 2013 OAG Report[21] have cited concerns with the availability and reliability of SAR aircraft. This was also found in key informant interviews and document reviews. Primarily, the problems stem from the age of the FW fleets, which creates frequent maintenance challenges. These are compounded by the difficulty in obtaining parts and having service issues with the CH149 Cormorant helicopter.

In response to these concerns, during the evaluation period the RCAF increased the overall number of RW aircraft available for primary response by adding five CH146 Griffin helicopters in Trenton. Although a less capable aircraft than the CH149 Cormorant, this addition has ensured an increase in the overall availability of RW SAR assets. Furthermore, in 2011, the RCAF obtained a large pool of spare parts, assembled spares, and ground support equipment from the US Navy's cancelled Presidential VH-71 program (an upgraded but similar CH149 aircraft) in an effort to increase the serviceability of the CH149 fleet. Combined, these initiatives have resulted in a steady increase in the daily availability of the SAR RW fleet. In fact, since FY 2010/11, the amount of hours that RW aircraft were utilized on SAR mission increased from 1,327 hours to 2,000 hours.[22]

As the oldest CC130H Hercules aircraft have been retired from service, the RCAF has continued to invest in major component retrofits.[23] This fleet has been consolidated and standardized into an almost exclusive SAR role.[24] These 13 remaining FW aircraft, along with the six CC115 Buffalo, which have also undergone upgrades[25] and spares augmentation,[26] have supported a steady daily availability for the SAR FW fleet. The distribution and type of aircraft are shown in Table 4, including the number of aircraft required to be available to respond at all times.

The evaluation reviewed RCAF data regarding its availability to respond. It found that the SAR response posture was met the vast majority of the time, with only a small percentage of incidents not having aircraft available on time. For example, in 2013, aircraft were unavailable in 33 out of 878 incidents requiring a SAR aircraft response or four percent of the time (see Table 5). Of these 33 occurrences, 23 had aircraft available, but they were being refueled, having just returned from a prior mission or training, meaning that they were only temporarily delayed. In only 10 cases, or 1.2 percent of incidents, were aircraft unavailable due to service issues. In such situations, aircraft from other regions or secondary SAR assets, such as non-SAR CC130J Hercules transport aircraft or CP140 Aurora patrol aircraft would typically have been tasked.

[21] OAG. Report of the Auditor General of Canada 2013: Federal Search and Rescue Activities.
[22] Calculated using RCAF total air resource management data.
[23] CC130H Sustainment Project, 2009-2018.
[24] 435 Transport and Rescue Squadron continues to have an air-to-air refueling role and YFR allocation.
[25] CC115 Buffalo Avionics Life Extension Project, 2011.
[26] CC115 Sustainment/Performance on Maintenance Project, 2012.

Primary SAR Assets		
Location	**Air Assets**[27]	**Aircraft Mandated to be Available**
103 SAR Sqn, Gander, Newfoundland	3 CH149 Cormorant Helicopters	1 CH149 RW SAR
413 Transport and Rescue Sqn, Greenwood, Nova Scotia	4 CH149 Cormorant Helicopters 3 CC130H Hercules Aircraft	1 CH149 RW SAR 1 CC130H FW SAR
435 Transport and Rescue Sqn, Winnipeg, Manitoba	4 CC130H Hercules Aircraft	1 CC130H FW SAR
424 Transport and Rescue Sqn, Trenton, Ontario	5 CH146 Griffon Helicopters 4 CC130H Hercules Aircraft	1 CH146 RW SAR 1 CC130H FW SAR
442 Transport and Rescue Sqn, Comox, British Columbia	5 CH149 Cormorant Helicopter 4 CC115 Buffalo Aircraft	1 CH149 RW SAR 1 CC115 FW SAR
Depot Level Maintenance, Contractor facilities	2 CC130H Hercules Aircraft 2 CH149 Cormorant Helicopter 2 CC115 Buffalo Aircraft	

Table 4. Location of Primary Air Assets and Availability Requirements.[28] This table demonstrates the primary SAR assets, specifying their location, number of air assets, and number of aircraft mandated to be available.

Note that in 2013 there were 38 other incidents where the SAR response posture was not met. These were due to various reasons, such as weather or crew-related issues, and generally resulted in short delays to the response as opposed to an inability to respond. This is discussed further in Section 2.4.4.

Response Time Delays in 2013						
Reason	**103 Sqn**	**413 Sqn**	**424 Sqn**	**435 Sqn**	**442 Sqn**	**Grand Total**
Refueling Delay	2	3	10	8		**23**
Aircraft Unserviceable		2	4	1	3	**10**
Total	**2**	**5**	**14**	**9**	**3**	**33**

Table 5. Reasons for Not Meeting the Response Posture in 2013.[29] This table demonstrates the number of aircraft-related delays that resulted in not meeting the response posture in 2013.

A number of issues were raised in reports and key informant interviews concerning the availability of aircraft for crew training. While on average there should be aircraft available for

[27] It is accepted that these numbers will fluctuate depending on need and fleet serviceability.
[28] CJOC. Federal SAR OGC Annual Report 2013, p. 12.
[29] Source: 1 CAD data.

both training and operational SAR responses at each location, the availability of training aircraft was not consistent. This means that, although overall fleet availability was met, at times individual squadrons may have had too few serviceable aircraft available to conduct training.

This situation is compounded by the organizational structure and nature of the fleet. Presently, the RCAF operates four separate fleets of aircraft, both FW and RW, from five different locations separated by significant geographic distances. Essentially, each squadron operates two independent units in a stand-alone function and is responsible for a dual SAR response, training, and minor maintenance. Under this model, there are very few opportunities to leverage resources across the program. This means that when one squadron is short an aircraft type, it cannot utilize an available one from another squadron.

Another principle concern is the future availability of SAR aircraft based on the estimated life expectancy of the existing FW fleets, which at present is 2015 for the CC115 and 2017 for the CC130H. The Fixed Wing SAR Aircraft Replacement (FWSAR) project [redacted] The evaluation was advised that the RCAF is investigating how to extend the fleet life at least until 2020. Once in place, the FWSAR project may also resolve the concern of having multiple fleets[30] and enhance the level of reliability.

Concerns have also been raised with respect to RW availability. However, this has been recently offset by improvements to the serviceability of the CH149. In 2012 and 2013, the serviceability of the CH149 significantly improved as more spares were readily available and by resolving several long-standing technical issues. Figure 1 illustrates the increased availability of the CH149 from FY 2010/11 to 2012/13.

[30] The FWSAR project does not constrain the number of potential FW fleets delivered.

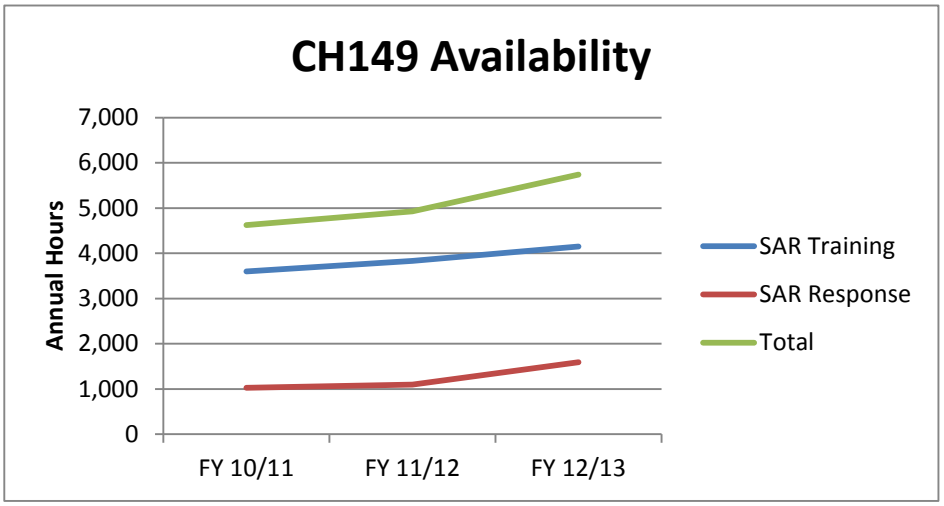

Figure 1. Availability of the CH149 from FY 2010/11 to FY 2012/13. The data is summarized in Table 6.

Availability of the CH149 from FY 2010/11 to FY 2012/13 Yearly Flying Rate (YFR)			
Type of Flight	**FY 2010/11 YFR**	**FY 2011/12 YFR**	**FY 12/13 YFR**
SAR Training (Force Generation (FG))	3,599	3,831	4,148
SAR Response (Force Employment (FE))	1,024	1,099	1,594
Total	**4,623**	**4,930**	**5,742**

Table 6. Availability of the CH149 from FY 2010/11 to FY 2012/13 YFR.[31] This table shows the availability of the CH149 from FY 2010/2011 to FY 2012/2013 for training and response activities.

Consideration may be given to returning to a single RW fleet due to the enhanced reliability, particularly once a midlife upgrade of the CH149 is complete. For example, in 2013, the CH149 fleet provided approximately the same number of hours in service as did the CH149 and the CH146 combined in 2011.

Another potential opportunity may be to centralize training into one or two locations or to reorganize into fewer squadrons with detachments. This may allow resources to be more readily shared across the program and allow any temporary needs to be filled.

[31] Source: Annex F. Note that table data is from 1 CAD YFR.

CRS Recommendation

1. Investigate options for SAR training activities to make more effective use of limited air resources.
OPI: RCAF

Finally, it is necessary to examine exactly what training is taking place in order to address any shortfall concerns. As per figure 2, the amount of training time for the fleet overall has significantly increased from 5,824 hours flown in 2011 to 8,524 hours in 2013, notwithstanding the CC130 Hercules YFR. This is discussed in later sections of this report.

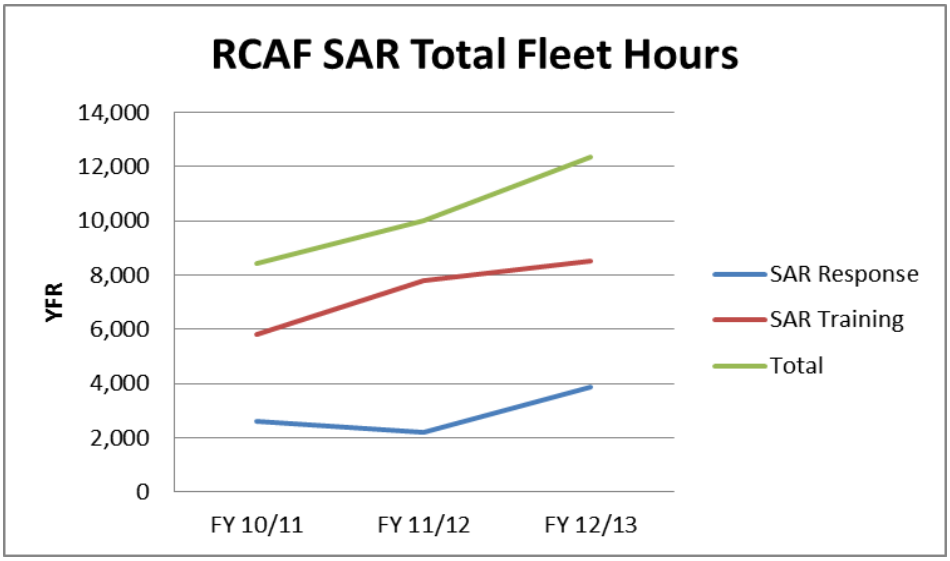

Figure 2. Increase in RCAF SAR Hours Flown from FY 2010/11 to FY 2012/13. The data is summarized in Table 7.

RCAF SAR Hours Flown from FY 2010/11 to FY 2012/13 YFR			
Type of Flight	**FY 2010/11 YFR**	**FY 2011/12 YFR**	**FY 2012/13 YFR**
SAR FG (Training)	5,824	7,796	8,524
SAR FE (Response)	2,604	2,211	3,855
Total	**8,428**	**10,007**	**12,379**

Table 7. RCAF SAR Hours Flown from FY 2010/11 to FY 2012/13 YFR.[32] This table shows the total RCAF SAR hours flown from FY 2010/2011 to FY 2012/2013 for training and response purposes.

[32] Source: Annex F. Note that the table data is from 1 CAD YFR.

2.4.2 Capability of Air Assets

Key Finding 5: While lacking modern integrated sensors, the overall range and capability of SAR aircraft to perform operational taskings are acceptable.

Aside from reliability issues, concerns have been raised over the capability of existing SAR air assets. For example, the OAG noted that the 45-year-old CC115 Buffalo and the 20-year-old CC130H Hercules FW aircraft are not equipped with sensors and data management systems found on modern SAR airplanes.[33] However, FW and RW SAR assets perform different aspects of the SAR mission. In general, the FW SAR assets are used for the rapid search, location, and airborne deployment of personnel (SAR techs) and equipment, while the RW assets are generally used for the recovery (rescue) portion and specific search scenarios. Different requirements drive different capabilities. Combined with the changing nature of airborne SAR, the increasing availability of wireless communications, global positioning systems, and emergency location beacons onboard civilian aircraft may lead to reduced search time.

While modern systems would undoubtedly improve the capability of these aircraft, it should be noted that, with their speed, range, and cargo capacity, these legacy aircraft have performed effectively in their SAR role. Accordingly, the FW CC115 and the CC130H have performed SAR in a reasonable manner.

With regard to RW assets, the evaluation noted few concerns with the capability of the CH149, aside from the aforementioned reliability. With the exception of the CH146 overwater operational risk assessment,[34] the evaluation did not find evidence of equipment capability deficiencies preventing the CH146 or the CH149 from performing adequately in their assigned role.

Key Finding 6: Although the CH146 Griffon is not as capable as the CH149 Cormorant, its use has proven to be an adequate interim SAR platform in Trenton.

A primary concern raised by the OAG and in interviews with SAR crews was the use of the CH146 Griffon helicopter. Issues raised included its capacity limits, range, and all-weather and over-water operations. The size of the aircraft limits the amount of SAR tech equipment able to be transported, as well as the number of SAR techs who can train simultaneously on this aircraft. With respect to passengers/survivors who can be transported, the CH146 is limited to one stretcher and one seat as compared to the CH149, which can accommodate 12 stretchers. The range of the CH146 is also shorter than that of the CH149. Its range and capacity are approximately 200 nautical miles at a speed of 100 knots versus 250 nautical miles at 130 knots for the CH149. An RCAF risk assessment determined a current rating of medium for the CH146's over-water night operations capability.

[33] For more information on capabilities and limitations of CH146 and CH149 see the OAG Report: Federal Search and Rescue Activities 2013, p. 14-18.
[34] CH146 over-water Record of Airworthiness Risk Management.

To assess the impact of the reduced capability of the CH146, the evaluation examined two studies prepared for the RCAF by DRDC. A November 2009 and August 2010 review of the RW SAR demand for JRCC Trenton assessed the performance of the CH146 as a SAR platform, particularly with respect to range and capacity. These studies demonstrated that, under ideal operating conditions, approximately 18.7 percent of all air SAR incidents were within the unrefueled operation range (one hop) and passenger capacity of the CH146. A full 52 percent of incidents were within the capacity of the CH146 with one refueling stop (two hops). Utilizing the same criteria, the evaluation compared the results to that of the CH149. The results are shown in Table 8.

Percentage of Incidents by Unrefueled Operation Range of RW Assets at JRCC Trenton		
Aircraft Type	**One Hop**	**Two Hops**
CH146 Griffin	18%	52%
CH149 Cormorant	44%	93%

Table 8. Percentage of Incidents within the Range/Capacity of RW Assets at JRCC Trenton.[35]
This table demonstrates the percentage of incidents within the range/capacity of RW assets at JRCC Trenton.

A 2009 summary analysis of the Trenton RW SAR Evaluation of Options studies conducted by DRDC assessed the impact of the CH146 Griffon's lack of capability compared to the CH149 Cormorant. That study reviewed incidents involving RW assets from Trenton over 11 years (1997 to 2008). The study determined that in only six cases out of a total of 29,711 incidents would the safety of the victims have been impacted by the reduced capability of the CH146.[36]

The evaluation also noted that, in its primary SAR configuration, the CH146 utilizes a crew of five, which includes a flight engineer and two SAR techs. However, the RCAF operates the CH146 in a secondary SAR role, utilizing a crew of four with only a single SAR tech. Further study noted that other countries operating similar SAR platforms (the US H60 and H65, the United Kingdom's AW139, and Ireland's S92 and S61) also utilize a four-person crew while sharing the SAR/medical crewman and hoist man responsibilities. Based on the RW SAR Study for Trenton SRR Past and Present Trends,[37] a third passenger capacity (via a reduced crew size) would increase the number of incidents the CH146 could address in two hops from 52 percent to 65 percent.[38]

[35] Ninety-five percent of incidents in the Trenton SRR occur within 415 nautical miles of Trenton. Source: DRDC CORA. RW SAR Study for Trenton SRR Past and Present Trends, August 2010.
[36] DRDC CORA. Technical Report: RW SAR Trenton Evaluation of Options, August 2009, p. 14.
[37] Collin, I., et al. Rotary Wing Search and Rescue Demand for Joint Rescue Co-ordination Centre Trenton: Historical Trends – Trenton Analysis 1994-2004, November 2010, p. 24.
[38] Ibid.

CRS Recommendation

2. Investigate options for optimizing the range, payloads, and operational capabilities of the CH146 in the SAR role.
OPI: RCAF

The DND CFM indicates that the operating costs (exclusive of personnel cost, long-term acquisition, infrastructure, and overall DND training costs, etc.) for the CH146 Griffon is $1,450 per hour, which is approximately 21 percent of the cost of operating the CH149 Cormorant at $6,650 per hour. Accordingly, while not as capable a SAR helicopter as the CH149, the CH146 has proven to be a reasonable SAR platform with significantly less operating costs. Recently, the RCAF has committed to further upgrades of the CH146. Modifications include door raft systems, bubble window inserts, and an over-water avoidance system. Due to the inability to maintain serviceable CH149 at four locations, the CH146 is a reasonable interim RW SAR asset offset.

In addition to RCAF assets, CASARA is a volunteer organisation that is funded through the DND/CAF and provides light FW aircraft with visual spotters and basic electronic homing capability. These aircraft do not have the ability to drop airborne personnel, but do provide a large, geographically dispersed search and localization function. Additionally, CASARA provides trained visual spotters to DND/CAF aircraft, as required. CASARA aircraft are able to detect aircraft emergency locator transmitter signals, thus greatly reducing search times and diminishing false alarm events. As shown in tables 9 through 14, CASARA members are utilized in more than 15 percent of all air responses tasked by JRCCs.

Number of Taskings of CASARA Relative to CAF in 2009			
SRR	**RCAF Utilized**	**CASARA Utilized**	**% Use of CASARA**
Halifax	407	10	2.46
Trenton	405	122	30.12
Victoria	319	93	29.15
Total	**1131**	**225**	**19.89**[39]

Table 9. Number of Taskings for CASARA Relative to RCAF in 2009. [40] This table shows a comparison of CASARA and RCAF taskings in 2009.

[39] Please note that in tables 9 through 14, the total percentage cell represents the average percentage use of CASARA for the three SRRs.
[40] Data is based on JRCC reported taskings. Note that data may include duplications between CAF and CASARA utilizations.

Number of Taskings of CASARA Relative to CAF in 2010			
SRR	**RCAF Utilized**	**CASARA Utilized**	**% Use of CASARA**
Halifax	370	30	8.11
Trenton	396	139	35.10
Victoria	239	79	33.05
Total	**1005**	**248**	**24.68**

Table 10. Number of Taskings of CASARA Relative to RCAF in 2010.[41] This table shows a comparison of CASARA and RCAF taskings in 2010.

Number of Taskings of CASARA Relative to CAF in 2011			
SRR	**RCAF Utilized**	**CASARA Utilized**	**% Use of CASARA**
Halifax	326	15	4.60
Trenton	381	93	24.41
Victoria	250	54	21.60
Total	**957**	**162**	**16.93**

Table 11. Number of Taskings of CASARA Relative to RCAF in 2011.[42] This table shows a comparison of CASARA and RCAF taskings in 2011.

Number of Taskings of CASARA Relative to CAF in 2012			
SRR	**RCAF Utilized**	**CASARA Utilized**	**% Use of CASARA**
Halifax	364	7	1.92
Trenton	377	91	24.14
Victoria	270	31	11.48
Total	**1,011**	**129**	**12.76**

Table 12. Number of Taskings of CASARA Relative to RCAF in 2012.[43] This table shows a comparison of CASARA and RCAF taskings in 2012.

[41] Ibid.
[42] Ibid.
[43] Ibid.

Number of Taskings of CASARA Relative to CAF in 2013			
SRR	**RCAF Utilized**	**CASARA Utilized**	**% Use of CASARA**
Halifax	363	12	3.31
Trenton	423	83	19.62
Victoria	285	53	18.60
Total	**1,071**	**148**	**13.82**

Table 13. Number of Taskings of CASARA Relative to RCAF in 2013.[44] This table shows a comparison of CASARA and RCAF taskings in 2013.

Total Number of Taskings of CASARA Relative to CAF from 2009 to 2013			
Year	**RCAF Utilized**	**CASARA Utilized**	**% Use of CASARA**
2009	1,131	225	19.89
2010	1,005	248	24.68
2011	957	162	16.93
2012	1,011	129	12.76
2013	1,071	148	13.82
Total	**5,175**	**912**	**17.62**

Table 14. Total Number of Taskings of CASARA Relative to RCAF from 2009 to 2013. This table summarizes the total number of CASARA taskings relative to RCAF from 2009 to 2013.

While the amount of taskings for CASARA has remained stable over the past five years, the amount of hours flown has declined by 35 percent. Data was unavailable to distinguish between CASARA taskings for aircraft, spotters, or emergency locator transmitter ground search teams. CASARA remains a viable and effective resource.

2.4.3 Location of Bases

The geographic size and uneven population distribution of Canada, as well as environmental conditions pose significant challenges for SAR. Accordingly, ensuring that aircraft are staged in the best locations to respond to incidents is a key measure of effectiveness.

Numerous studies (in 2005, 2011, and 2013) have been completed by the CORA at DRDC to assess the appropriateness of current base locations. According to those results, and given our current aircraft, the present location of the five bases achieves 98.0 percent of the optimized solution,[45] with current FW bases achieving 99.6 percent, and RW bases achieving 96.3 percent

[44] Ibid.
[45] Based on a mathematically computed statistical analysis.

of the statistical ideal.[46] It is understood that, should numbers and capabilities of aircraft change, the location of bases may have to be altered accordingly to achieve similar results.

In examining these and other DRDC CORA studies,[47] the evaluation noted that 90 percent of all incidents are within the operating range of RW assets based at the four locations. This study did not include secondary RW SAR assets that are located at Cold Lake, Bagotville, and Goose Bay. It should be noted that 90 percent of all SAR incidents are concentrated in 11 percent of the Canadian SAR AOR. The remaining 10 percent of incidents are scattered among the remaining 89 percent of the AOR. Accordingly, while on average each existing base provides effective RW coverage of approximately 18 percent of all incidents, any additional RW bases would at best only provide coverage for one to two percent of incidents. Furthermore, the location of any potential bases would also likely be in areas where weather or the operating environment (i.e., the Arctic) would pose considerable challenges. Figure 3 highlights the theoretical operating range of RW assets at each location and the corresponding incident occurrences from 2008 to 2012. It also shows the secondary SAR resources, consisting of CH146 and SAR tech crews located at the CSSs at Canadian Forces bases Cold Lake, Bagotville, and Goose Bay. Note that Canadian Forces Base Winnipeg only has FW SAR.

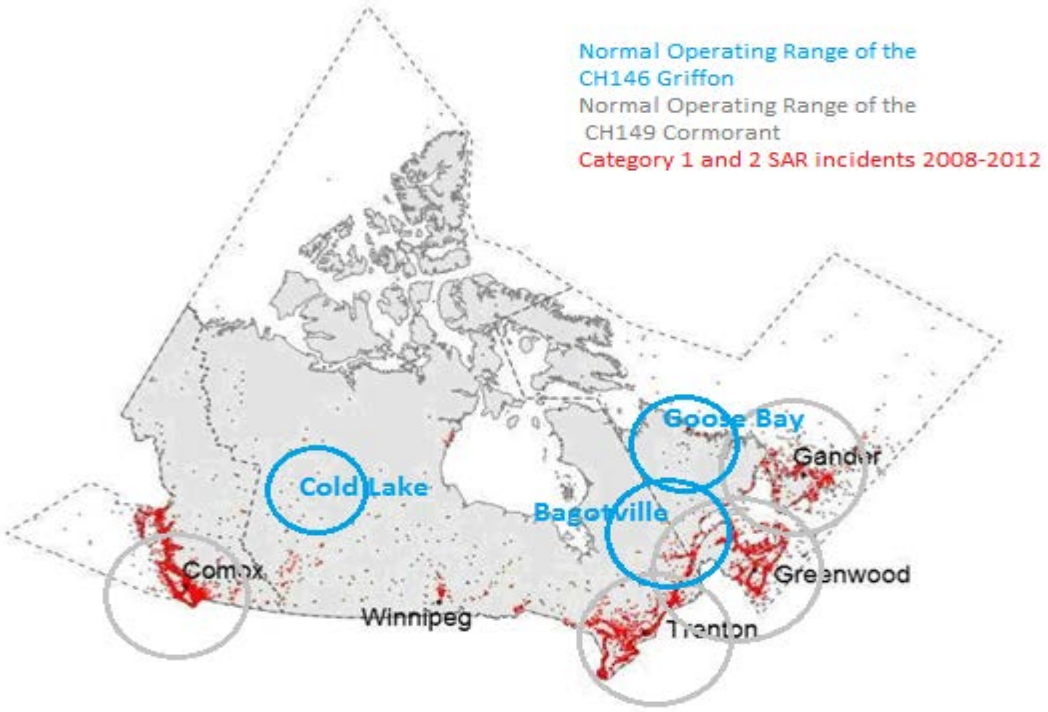

Figure 3. Operating Range of RW Assets at Each Location and the Corresponding Incidents from 2008 to 2012. This figure is a map of Canada that shows operating range of RW assets at each location and the corresponding incidents from 2008 to 2012.

[46] CJOC. Search and Rescue Posture Review, 2013, p. 4-5.
[47] DRDC CORA. Preliminary Spatial Analysis of Historical Search and Rescue Incidents, April, 2012.

Canadian demographics and off-shore activities have historically driven the incident rate for SAR activities and, combined with our current aircraft capabilities, the location of primary SAR bases. The northern portions of our AOR represent a huge geographic area with an increase in both industrial and recreational/tourism activity. At this time, the incident rate in the northern areas (north of 60 degrees north latitude) has remained steady at very low levels. As compared to the southern regions of Canada, only about 5 percent of all air SAR incidents occur in the North.[48]

However, the northern areas do present risk. The significant transit distances required to reach the edges of our AOR,[49] as well as the limited number of communities and refueling opportunities, effectively make RW response (whether CH146 or CH149) impractical. The distances and the lack of roads limit ground response as well. Weather and climate also impact local SAR operations.

Due to the distances involved and the nature of the SAR region, commercial RW assets are routinely contracted to complete the rescue or recovery portion of a SAR incident when dedicated FW SAR assets initiate a response. Reliable performance data and metrics for the use of contracted air support in northern incidents were unavailable for this evaluation.

CRS Recommendation

3. To gain insight into the overall SAR requirement, track the number of incidents where commercial RW assets are contracted to conduct the rescue and/or recovery portion of a SAR tasking.
OPI: RCAF

The evaluation noted that during the past five years, the DND/CAF has significantly improved its northern SAR response capabilities, including the following:

- Expanding the use of civilian assets, including private industry and volunteer organizations such as CASARA to deliver small pack aerial kits for survival;
- Increasing the training exercises of secondary SAR assets such as the Twin Otter fleet in Yellowknife, as well as expanding the scale of annual northern exercises; and
- Training based on the major air disaster contingency plan, which is designed to prepare the DND/CAF for a large aircraft disaster in the remote parts of Canada. The major air disaster plan includes air-drops from CC130 aircraft of scalable sustainment kits for large numbers of survivors as well as an all-terrain SAR vehicle that is dedicated for immediate deployment.

Overall, given historical incident rates, combined with the use of CASARA and contracted RW assets, it is assessed that the current fixed number and capabilities of RCAF FW and RW SAR assets are appropriately located. Should numbers and capabilities change, this would require reassessment.

[48] Incident data from RCAF 1 CAD.
[49] For example, Mexico City is closer to Trenton than most of Baffin Island.

2.4.4 Response Posture

Key Finding 7: Over the past five years, the DND/CAF has met the response posture 92 percent of the time on a national basis. On average, RCAF SAR crews are actually airborne much sooner than the response posture. When not met, the median delay was 15 minutes.

SAR response is measured by the DND/CAF as the amount of time required to launch a search aircraft based on the following minimum state of readiness found in the National SAR Manual:

> "The minimum state of readiness for each rescue squadron shall be one SAR aircraft of each type, on 30-minute standby during work hours and on 2-hour standby during quiet hours and statutory holidays."[50]

Based on program data, the evaluation noted that, over the past five years, the DND/CAF has met the response posture 92 percent of the time on a national basis. Often, RCAF SAR crews are actually airborne sooner than the timeline targets. For example, a 2013 Response Posture Review performed by CORA demonstrated that the average response time was 75 minutes.

During the evaluation period, the force employer (CJOC) undertook efforts to improve overall average incident coverage. In accordance with the 2013 OAG Report, an adjustment to posture times[51] at the Trenton JRCC was implemented to provide the 30-minute response time to match peak periods for incidents, reflecting both days of the week and seasons when more potential SAR incidents could occur. A "posture shift" is also being implemented at the Victoria JRCC as maritime SAR incidents related to fishing, resource industries, and recreational activities require their own unique optimal posture adjustment.

Table 15 demonstrates the number of delays in 2013 and the associated reasons across all regions. The table demonstrates that DND/CAF response failed to meet response posture in eight percent of incidents (or 71 times out of 878 missions). Of those delays, the 30-minute response posture was not met 41 times and the two-hour response posture was not met 30 times.

The evaluation also examined the impact of delays. A snapshot of 2013 data indicates that the median delay time was 15 minutes, 80 percent of delays were less than 45 minutes long, and less than 10 percent of incidents exceeded two hours. Another DRDC CORA study of the Response Posture Review (2012) assessed the impact to human life and injury caused by delays and found that a 45-minute delay may have impacted the outcome of only two percent of incidents for which there was a response.[52]

[50] National Search and Rescue Manual, May 2000, Chapter 4, Annex 4A, p. 17.
[51] CJOC. Search and Rescue Posture Review, 2013.
[52] DRDC. Response Posture Review. Steele, J.A. The Impact of Primary Air SAR Response Postures on Incident Outcomes, 2012.

SAR Squadrons Not Meeting Response Posture						
Reason	**103 Sqn**	**413 Sqn**	**424 Sqn**	**435 Sqn**	**442 Sqn**	**Grand Total**
Aircraft Unserviceable		2	4	1	3	10
Aircrew		1		1		2
Base Support		3	1			4
Equipment	1		2	1		4
Flight Plan	1	1	1		3	6
Ground Crew		1			1	2
Location		1			1	2
Range	2	2	1		1	6
Refuel	2	3	10	8		23
Weather	4	1	2			7
Unknown	3				2	5
Total	**13**	**15**	**21**	**11**	**11**	**71**

Table 15. Number of Times and Reasons a SAR Squadron Did Not Meet the Response Posture in 2013.[53] This table shows the number of times and the various reasons a SAR squadron did not meet the response posture in 2013.

Key Finding 8: The mandated airborne response posture times represent only a portion of the overall SAR mission timeline and may not adequately represent the best performance metric for the Canadian AOR.

A major consideration is that the airborne response time only represents a small portion of the overall time involved in a SAR incident. The timeline demonstrates all aspects of a mission.

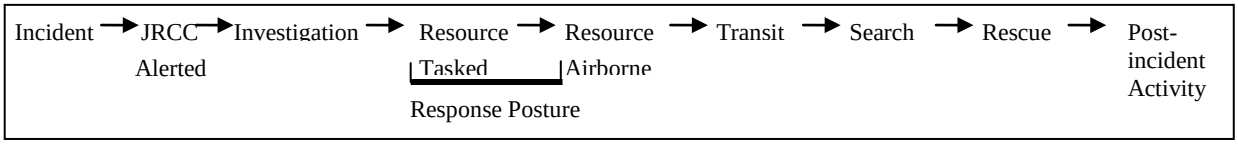

Figure 4. Timeline Demonstrating All Phases of a SAR Mission.[54] This figure represents a timeline of all phases of a SAR mission.

Due to the extensive geographic size of Canada, transit time is a significant portion of the overall time required to arrive at the scene of an incident. Program data shows that the average transit time for air or marine SAR missions is two hours[55] and can be as long as eight hours depending on the location. This, along with the undocumented investigation time and the variable search

[53] Source: RCAF incident data for 2013 from 1 CAD.
[54] Search and Rescue Posture Review 2013, September 2013, Chapter 5.3, p. 6.
[55] DRDC report.

time, means that these combined time spans are a greater factor than response posture time. Although the data system for the JRCC does not readily provide the time for incident investigation and searching, there are indications that the amount of time spent during these portions of a SAR mission may be diminishing. As stated previously, the expanded use of emergency beacons, global positioning systems and other communications technology, as demonstrated by CASARA data, appears to be reducing the amount of time required for searches. If this is indeed the case, it would be logical to assume that this same technology is also impacting the alert timeframe.

CRS Recommendation

4. Develop a performance metric for the Canadian AOR that considers factors such as transit time, which are often a greater determinant in the overall response time than solely the mandated response time.
OPI: Commander CJOC

In summary, it would appear that changes to the response posture and technological improvements are reducing the overall time for SAR missions and are therefore potentially improving on an already very high record of mission success.

2.4.5 Training and Availability of Crews vs. Stated Needs

Availability of Crews

There are over 824[56] personnel that deliver or directly support the DND/CAF's SAR activities. These personnel are primarily located at RCAF SAR squadrons and to a lesser extent at JRCCs and headquarters.[57] Although a significant portion of the personnel are employed in SAR aircraft maintenance, for the purposes of this evaluation, the focus is placed on the SAR aircrew, their availability, and training.

Key Finding 9: In most cases, the SAR manning levels match the desired level of 6.5 crews per FW and 5.5 for RW squadron. However, the evaluation was unable to identify a documented requirement for these targets.

To sustain a 24/7/365 SAR posture, the RCAF aims to maintain 6.5 crews per FW aircraft and 5.5 crews per RW aircraft at each SAR squadron. There are five main squadrons for SAR supporting eight primary SAR aircraft (four FW and four RW), plus the additional SAR aircrew resources at CSS 444, 439, and 417. It should be noted that these squadrons are not a primary SAR resource, nor do they maintain 5.5 crews.

Based on RCAF data for 2013, manning levels for SAR squadrons appear adequate (see Table 16).[58] A larger issue than manning levels is the quality or experience of crews in each squadron.

[56] Total for 2012/13 was approximately 824. For full squadron and JRCC resources/FTEs, see Annex D.
[57] CJOC. Search and Rescue Posture Review 2013, September 2013, Chapter 5.3, paragraph 9.
[58] Some squadrons also have operational training unit members who increase the number beyond the 6.5 required.

Interviews have indicated that some squadrons, while having the right overall numbers of personnel, sometimes have a low number of aircraft commanders who must be present on all flights. This leaves first officers with less flying time for FG and overuses the limited aircraft commanders. This has negatively affected the FG of first officers into aircraft commanders and limits the number of complete crews.

Current Crew Levels per SAR Squadron		
Squadron	**Crew Numbers**[59]	**Crew Required**
103 SAR Sqn, Gander, Newfoundland	33	32.5
435 Transport and Rescue Sqn,[60] Winnipeg, Manitoba	71	45.5
424 Transport and Rescue Sqn, Trenton, Ontario	80	78
413 Transport and Rescue Sqn, Greenwood, Nova Scotia	85	78
442 Transport and Rescue Sqn, Comox, British Columbia	82	71.5

Table 16. Current Crew Levels per SAR Squadron.[61] This table shows the current crew manning levels per SAR squadron.[62]

In addition to the squadrons listed in Table 16, there are SAR crews, specifically SAR techs, employed at the three CSSs that are not accounted for in the table. However, they have many of the same current operational and training requirements as those on primary SAR squadrons.

Based on the document and data review, although the RCAF is meeting the 6.5-crew manning standard, this may not equate to 6.5 crews due to the ratio of aircraft commander to first officer. Even among pilots and SAR techs, the actual numbers seem sufficient to meet the target of 6.5 crews per ready aircraft. For example, each SAR aircraft requires two SAR techs for a total of 16 SAR techs needed to crew the eight aircraft. Accordingly, the 6.5 crew would require 104 SAR techs. Presently, there are 108 SAR techs assigned to primary SAR squadrons.[63]

The document review conducted for this evaluation was unable to determine a clear basis or formal source for the required 6.5 FW or 5.5 RW crew levels. No available official documentation shows this as a requirement, although several interviews suggested 6.5 was insufficient given the current non-flying responsibilities and training needs of RCAF members.

[59] Aircrew numbers for squadrons as of November 2013, as per the report on the management of resources. Note that crew numbers represent number of filled positions.
[60] Crew strength in 435 Squadron is greater than 6.5 due to its air-to-air refuelling mandate and associated manning.
[61] Source: RCAF, 2013.
[62] Both 424 and 442 Squadrons have excess crew numbers due to operational training units.
[63] Based on data from the report on the management of resources for 2013.

CRS Recommendation

5. Determine if the desired manning levels for SAR units are still applicable given current SAR and non-SAR-related tasking levels and training requirements.
OPI: RCAF

Training of SAR Tech Crews

Key Finding 10: The range and extent of SAR tech training increased over the period reviewed by the evaluation. The amount and types of SAR tech training required for the DND/CAF's contribution to SAR response would benefit from stronger strategic oversight.

Based on interviews and on the review of program documents, the amount and type of training activities for SAR techs has increased over the past five years to the point where insufficient time, or number of SAR techs, exists to accomplish all training and operations activities. This training includes, parachuting, diving,[64] extensive paramedic training, survival skills, mountaineering, fast water rescue, and a multitude of other core and administrative skills. While this training may not be required for the majority of SAR missions, the DND/CAF is expending significant effort to provide these capabilities where other SAR partners (CCG, RCMP, provincial authorities) may have primary responsibility and existing capabilities. Additionally, the DND/CAF is funding this training, by and large, to all SAR techs as opposed to small specialized teams. Document reviews indicated a lack of clear direction on the extent of the DND/CAF SAR mandate and related SAR tech training requirements.

2.4.6 Issues with Specialized SAR Equipment

Issues related to the procurement of specific SAR equipment were raised in both interviews and existing program documents. In a recent morale review of the SAR tech community, 72 percent of respondents indicated "a lot or extreme concern" related to inadequate equipment.[65] Interview responses elaborated that delays in equipment procurement, specificity of SAR equipment requirements, and resolution of known equipment issues were of concern to those members of the SAR tech community who participated in the survey.[66] An internal review of the DND/CAF SAR posture also found that "the time required to implement changes to equipment is often lengthy and the process cumbersome," and that the current DND/CAF process to identify and address critical equipment requirements may not respond adequately to the unique needs of SAR.[67]

[64] Compressed air breathing apparatus and confined area diving; however, this has been recently suspended.
[65] DRDC. SAR Technician Unit Morale Profile: Results Summary, November 2013, p 7.
[66] Ibid, p 57.
[67] CJOC. Search and Rescue Posture Review 2013, September 2013, p 9.

In response to concerns related to SAR equipment, the department conducted a comprehensive internal review whereby details of equipment problem identification procedures, lifecycle management, and scale of issues were analyzed. As a result of this internal review of SAR equipment, a list of the top 10 SAR tech equipment requirements is now provided annually to the Commander 1 Canadian Air Division (CAD).[68] Additionally, a SAR tech equipment oversight committee was expected to be set up in late 2014.[69]

Key Finding 11: While the DND/CAF has recently implemented steps to improve issues of SAR-specific equipment, a standard or baseline for validating SAR equipment requirements relative to mandated responsibilities does not currently exist.

Although improvements have been made in prioritized SAR tech equipment acquisition, the evaluation was unable to determine whether there is a mandated task list against which this acquisition was prioritized. For example, the capabilities of diving and confined area diving as well as mountain and fast water rescue all require specialized equipment and significant training. Beyond the overarching principle of "to prevent loss of life and injury," DND/CAF SAR policy is limited in the specific roles and responsibilities of SAR techs. This evaluation was unable to determine whether the right SAR tech equipment is being procured with the appropriate priority given the lack of a clear directive of what tasks SAR techs are required to perform based on the DND/CAF's responsibilities within the NSP.

The RCAF has recently initiated a review of SAR tech skill sets. It is unclear if this will solely be a "bottom-up" review necessitated by the lack of an overarching policy and strategic direction for future SAR activities.

CRS Recommendation

6. Given financial, training, and equipment constraints, determine the level and extent of SAR tech capabilities required to meet the DND/CAF contribution to the NSP. Further refine these capabilities into specific skill sets for which specialized equipment and training can be acquired and/or assigned.
OPI: Commander RCAF

[68] CJOC. Federal SAR OGC Annual Report 2013, March 2014, p. 5, paragraph 2.3.
[69] Director Air Readiness and Plans. Implementation of SAR Tech Equipment Oversight Committee, May, 2014.

2.4.7 Governance and Coordination of Partners

Internal Governance

Key Finding 12: The DND/CAF lacks a dedicated and proportionally resourced SAR governance structure that can provide strategic direction on requirements, standards, and operational boundaries. Without this staff, the DND/CAF risks being unable to resolve ongoing issues and continued potential mission creep.

The DND/CAF SAR program's 824[70] full-time equivalents (FTE) are almost exclusively employed by the RCAF in SAR squadrons or at the JRCCs. Operationally, these geographically dispersed units report through their separate wing commanders to 1 CAD. Additionally, a Capability Advisory Group, comprised of all SAR commanding officers and chaired by a colonel (currently the 1 CAD A5), meets semi-annually to discuss SAR issues.

Beyond the tactical squadrons and JRCCs, current dedicated SAR management personnel are limited to nine FTEs within three different headquarters. [71] This limited staff is responsible for both FG (training policy) and FE (operational conduct). Essentially, the day-to-day and long-term management of this complicated, resource-intensive system is limited to the rank of lieutenant-colonel as the senior staff officer for SAR at 1 CAD, while other staff work in separate command and control structures. Interviews with SAR operational staff have reinforced the limitations of the under-representation of SAR at the strategic level.

In comparison to the current SAR governance structure, other specialized DND/CAF operations that employ approximately the same number of tactical FTEs as the SAR program have significantly larger national/strategic management structures.[72] Although different organizations have different mandates, they share similarities of employing a small number of specialized individuals with extensive skill sets and training requirements along with larger support structures and highly specialized equipment.

The importance and complexity of DND/CAF SAR activities require an ongoing oversight staff at a strategic level to coordinate and provide direction and policy on capability and resource development. The lack of dedicated personnel may hinder the resolution of many issues raised in recent studies and reviews, including the OAG Audit Report (2013), the Quadrennial SAR Review, the SAR Posture Review, and others.

The evaluation has noted that, within this strategic limitation, the tactical units are increasingly seeking to accomplish all facets of SAR, which may lead to increased resource and training requirements that the Department is neither funded for nor mandated to accomplish. For example, in addition to the specialized types of rescue operations that SAR techs are increasingly

[70] Total for 2012/13 was approximately 824 FTEs. For full table of squadron and JRCC resources, see Annex D.
[71] Five at 1 CAD Senior Staff Officer SAR, one at RCAF headquarters, and three at CJOC.
[72] Operational headquarters, dedicated commands, etc. For example, the Special Operations Forces Command employs approximately 15 percent FTEs in oversight and force development at the national level.

training to perform, there has been an increase in patient medical evacuation (non-military) and SAR aviation assistance to provincial/territorial missing-persons cases, which are resource and training intensive. Additional dedicated national/strategic-level staff would be positioned to properly advise senior departmental leaders of priorities and considerations of extending DND/CAF operations beyond mandated requirements.

CRS Recommendation

7. Augment or restructure SAR command and control in order to provide strategic and operational level oversight and direction for DND/CAF SAR in Canada.
OPI: Commander RCAF

Coordination of Federal SAR Partners (LMSAR and NSS role)

As the NSP spans multiple federal departments and various jurisdictions and has multiple pillars (awareness/prevention, regulations, and operations), the coordination of the federal SAR partners is a critical responsibility. The NSS has traditionally performed this key function, and it provides advice and recommendations directly to the Minister of National Defence as the LMSAR. The key forum for the coordination and resolution of issues used to be the ICSAR, which was led by the NSS. However, this committee has not met in three years.

Key Finding 13: With the inactivity of the ICSAR and the resulting loss of effective coordination, the CAF and CCG have had to establish a separate OGC, thus creating potential duplication while lacking the benefit of overall ICSAR direction.

In part to fill this void, the CAF and CCG have had to establish a separate coordination committee in 2013 to advance coordination and synchronize their operational approaches related to joint responsibilities for aeronautical and maritime SAR.[73] Although effective, it potentially creates duplication and is limited in scope to just CAF and CCG issues, unable to address any larger federal SAR issues. Program documents and interviews demonstrated a significant lack of coordination and support for NSP partners over the evaluation period. Increasingly, the NSS has sought to work through other organizations, such as the Public Safety Emergency Management Committee, that are not focused on SAR but may provide some opportunity of coordination.

The lack of a national strategic SAR policy has been cited as a significant issue for the effective functioning of the NSP.[74] Interviews and program documents indicated that this gap presents risks to SAR interoperability, the delineation of federal responsibilities and operational mandates, and effective program delivery. Within this void, participating departments continue to develop independent policies, and thus risk creating potential interoperability issues and overall NSP gaps or duplications. An example is Transport Canada's 2010 withdrawal of the

[73] Federal SAR OGC Annual Report 2013, March 2014.
[74] OAG. 2013 Spring Report of the Auditor General of Canada, Chapter 7 – Federal Search and Rescue Activities, p. 23.

education/outreach funding of $400,000[75] to CASARA, which was subsequently assumed by DND, even though it was outside its mandate.

Key Finding 14: The lack of a strategic policy framework and overarching direction for the NSP poses potential risks to the role of DND/CAF capabilities within a coordinated NSP, particularly in regard to equipment, training, and interoperability with partners.

The Quadrennial SAR Report noted the great need for compatibility of NSP partners to enhance interoperability, such as "joint training, exercises, and operations… and… standardization (in technology)."[76] As outlined in Section 2.4.6 – Performance Related to SAR Equipment, DND/CAF priorities and equipment selection are hampered by this lack of clear framework, and risks exist in relation to the proper prioritization of activities, capability decisions, and resource allocation within the Department.

2.5 Economy

To assess the economy of the DND/CAF component of the NSP, the evaluation focused on the overall costs associated with the program, particularly the following:

- Costs of dedicated SAR air assets:
  - Costs attributed to SAR FE and FG; and
  - Costs related to SAR incidents.

Costs of Dedicated SAR Air Assets

Key Finding 15: The overall cost of the DND/CAF contribution to the NSP has increased significantly during the past five years due primarily to increases in operating costs per hour.

Although the overall cost of the program is a small percentage of the DND budget, at over $270 million per year,[77] it still represents a significant expenditure. It also appears that the costs of the program are significantly rising, and that the program is consuming a greater proportion of the Defence budget. Based on PAA attributions, the program costs, including personnel and operations, but excluding capital amortization, have risen by 33 percent from 2009 to 2013.

While personnel and infrastructure/capital costs have increased only slightly, the overall increase is driven by large increases (22 to 57 percent, depending on the fleet) in operating costs. These costs, which typically make up 40 percent or more of the full cost of the aircraft, primarily include maintenance, spares, repairs, and fuel.

[75] CASARA-DND Contribution Agreement, April 1, 2010, Chapter 5.1.
[76] NSS. Quadrennial SAR Report, p. 14.
[77] PAA value, not including capital and indirect costs, as per the CFM.

In particular, the majority of the increases occurred between FY 2010/11 and FY 2011/12. During this time, the cost of aviation fuel increased by 31 percent[78] and the Canadian dollar decreased by 5 percent.[79] The decrease in the Canadian dollar greatly impacts maintenance costs as most components are sourced internationally and in-service support costs, such as those paid for the CH149, are paid in US dollars.

The greatest increase throughout the period, however, has been in the costs of replacement components (spares), contracted repairs, and overhaul. These areas represent 70 percent of the overall cost of the fleets and have increased by 50 percent between 2009 and 2012. They reflect increased efforts of maintenance of the CH149 fleet and the increasing costs of operating the older CC130 and CC115 fleets.

The increases in operating costs per hour by aircraft type are shown in Table 17.

Operating Costs per Hour by Aircraft Type					
Aircraft Type	**FY 2008/09**	**FY 2009/10**	**FY 2010/11**	**FY 2011/12**	**% change FY 2009-12**
CC115 – Buffalo	8,098	8,202	9,171	12,689	57%
CC130H – Hercules	8,328	8,285	5,878	10,172	22%
CH146 – Griffon	1,364	1,366	1,408	1,943	42%
CH149 – Cormorant	16,034	16,140	16,840[80]	21,327	33%[81]

Table 17. Operating Costs per Hour by Aircraft Type. This table summarizes the operating costs per hour by aircraft type in dollars per hour.

It is also important to note that for FY 2014/15, costs have remained at FY 2011/12 levels, indicating that while there was a significant increase in 2011, costs have since stabilized.

Costs Related to SAR Incidents

On average, between FY 2008/09 and 2012/13, the DND/CAF has responded to 1,035 SAR incidents annually (see Table 18). In contrast, the costs attributed to each SAR mission conducted by the DND/CAF has increased by approximately 32 percent over the same period, resulting in an overall increase in the average cost of a DND/CAF SAR response. Note that data represents PAA values, which exclude capital costs.

[78] Source: US Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.
[79] http://www.bankofcanada.ca/rates/exchange/monthly-average-lookup. Last accessed on April 13, 2015.
[80] FY 2008-11 in-service support contract cost data from the weapon system managers have been added to CFM figures that were exclusive of the in-service support contract.
[81] This increase is exclusive of Vote 5 (major capital) acquisition costs for the VH71 CH149 Sustainment project.

Overall SAR Costs per Incident					
	FY 2008/09	**FY 2009/10**	**FY 2010/11**	**FY 2011/12**	**FY 2012/13**
Overall SAR Costs per FY	$202,168,388	$202,292,237	$218,987,417	$247,874,522	$266,976,904
Number of DND/CAF SAR Responses	1,131	1,005	957	1,011	1,071
Average Cost per Incident	**$178,751**	**$201,285**	**$228,826**	**$245,177**	**$249,278**

Table 18. Overall SAR Costs per Incident.[82] This table summarizes the overall SAR costs per incident for FY 2008/09 to FY 2012/13.

Going forward, it is important to note that the costs of the program will [redacted] with the addition of the new FWSAR project. According to the CFM for FY 2011/12, the full cost of the CC115 and CC130H fleet is currently $223.9 million per year.[83] [redacted][84] [redacted][85] [redacted]

Furthermore, there will be a limited period of overlap during the transition from the old fleet to the new fleet as training occurs on the new aircraft, and operations continue on the old. It is important to note that this discussion on cost does not factor in the added capabilities brought by the new FWSAR aircraft, nor the investment in a new aircraft.

2.6 Efficiency

As the program is integrated within the DND/CAF, the overall business model is an efficient design. As opposed to a stand-alone organization, the current model for the SAR program can leverage the cost of the internal support services – procurement, finance, human resources, and legal – from the Department as a whole. In addition, it benefits from the sharing of infrastructure with other non-SAR DND assets. Furthermore, the integration of the program within the RCAF allows certain assets, such as the CC130H to have secondary roles, such as transport or air-to-air refuelling operations. While the benefits of such activities are not fed back into the SAR program, they provide valuable support to the CAF and allow the option of dual tasking aircraft. For example, SAR aircrew training and transport activities can be undertaken at the same time.

The evaluation assessed program efficiency by measuring program inputs (budget as per the CFM) against program outputs (the number of incidents and the hours flown in response to

[82] Incident data from CJOC Federal SAR Governance Committee Annual Report, 2013. Financial data from DND PAA.
[83] CFM FY 2011/12 CC130H ($177,737,196) and CC115 ($46,136,790).
[84] Proposed FWSAR costs, exclusive of Project Management costs, as of March 2012 costing information.
[85] FWSAR in-service support contract would include second and third-line maintenance personnel only.

incidents, (i.e., FE flying hours)). As discussed in section 2.5, costs are increasing while the numbers of incidents are remaining fairly stable. Accordingly, the overall cost efficiency of SAR operations has declined.

Through interviews and document review, the evaluation identified areas where efficiencies may be gained for DND/CAF SAR operations. These areas include increased CASARA employment, tracking and validation of non-mandated SAR taskings, and employment of SAR resources within CSS.

CASARA Employment

Key Finding 16: CASARA is an effective and cost efficient asset when tasked appropriately.

CASARA members are utilized in more than 15 percent of all air responses tasked by JRCCs[86] either in independent searches or as spotting crew on a DND/CAF aircraft. The employment of private CASARA aircraft on search taskings can significantly reduce or eliminate the flying time required by DND/CAF air assets, particularly where CASARA assets are in closer proximity to an incident or when localizing unsubstantiated beacons (e.g., 121.5 MHz signals, which experience a high false-alarm rate). Furthermore, the cost savings of operating a CASARA aircraft is two to eight times greater than any DND/CAF asset.

Costs of SAR Aircraft		
SAR Aircraft	**Operating Costs per Hour**	**Full Costs per Hour**
CC115 – Buffalo	$3,950	$30,500
CC130 – Hercules	$6,500	$43,950
CH146 – Griffon	$1,450	$19,600
CH149 – Cormorant	$6,650	$36,350
CASARA Aircraft	$757	$18,767

Table 19. Operating and Full Costs of SAR Aircraft.[87] This table demonstrates the operating costs per hour and the full costs per hour per SAR aircraft.

The $3.1 million that DND contributes annually to CASARA is independent of the number of hours for which CASARA is employed.[88] In 2008, CASARA was employed for 551 hours by the DND/CAF. In 2012, employment for CASARA declined to 116 hours. Based on interviews, the

[86] See Table 6 in this evaluation report for more information.
[87] Rates are from the Flight Cost Manual (FY 2014/15). Note that operating costs for CASARA include only additional operating reimbursements for mission employment. Full costs include annual averaging of operating reimbursements and grant and contribution funding ($3.1 million annually).
[88] The DND/CAF also provides added reimbursements to CASARA crews for expenses incurred during employment. However, this additional cost has been minimal over the evaluation period (i.e., $757 to $18,767 on average per hour).

decline in employment has been due in part to the higher availability rates of the primary SAR fleet, which allows controllers to send RCAF assets instead of CASARA assets.

Given the cost effectiveness of this investment, the Department should maximize the use of CASARA to the greatest extent possible. For those missions that may require extensive search times with unknown results (e.g., localizing potential false 121.5 MHz signals, early-stage searches, etc.), the cost savings of employing CASARA aircraft over DND/CAF air assets would increase significantly. For example, if it were possible to remove 200 hours of FE from the SAR fleet by transferring it to CASARA, $6 million dollars could be saved.

CRS Recommendation

8. Investigate the increased use of CASARA for searching, especially on low probability events such as un-correlated 121.5 MHz beacons.
OPI: Commander RCAF

SAR Taskings in Support of Other SAR Operations (Non-mandated)

Key Finding 17: The DND/CAF has increasingly supported non-core humanitarian and medical evacuation missions that are external to its mandate and have not been cost recovered.

Over the past several years, the DND/CAF has been requested and has accepted more routine SAR taskings, including humanitarian (lost/missing persons) and medical evacuations missions. A number of these missions could be considered as non-mandated or not "CAF's primary responsibility," as outlined in the most recent National SAR Manual.[89] The recent CJOC Federal SAR Governance Committee Annual Report (2013) noted a high number of SAR incidents to which the DND/CAF responded that are traditionally provincial or other government department responsibilities. These incidents included rescue medical evacuations (48), hospital-to-hospital medical evacuations (17), and air support to ground SAR (55). [90] The report noted that these requests to DND/CAF are due sometimes to the fact that provincial "resources are not suitable or available to carry out these lifesaving missions."[91] Interviews have confirmed that the JRCCs do not initiate cost recovery for these missions.

Table 20 provides the cost of reported humanitarian missions (including civilian medical evacuation and hospital transport flights) by hour and aircraft for the year 2013. It shows a total cost of $9,845,981 in 2013.

[89] CJOC. Federal SAR Governance Committee Annual Report, 2013, p. 16.
[90] Ibid.
[91] Ibid.

Humanitarian Missions			
Aircraft	**Hours**	**Cost per Hour**	**Total Cost**
Buffalo	25.3	$12,878	$325,813
Hercules	192.5	$10,322	$1,986,985
Griffon	162.7	$1,943	$316,126
Cormorant	338.4	$21,327	$7,217,056
Total			**$9,845,981**

Table 20. The Cost of Humanitarian Support for SAR Incidents in 2013. This table summarizes the cost of humanitarian support for SAR incidents in 2013.

CRS Recommendation

9. Investigate potential cost recovery for non-core SAR taskings.
OPI: Commander RCAF

SAR Resources within CSSs

RCAF CSSs are small, non-24/7 RW squadrons that primarily support their host fighter aircraft base. They provide utility transport to their associated fighter weapons ranges and immediate rescue operations to their co-located fighter forces. In this role they employ one SAR tech on the flight crew and thus act as a secondary SAR resource. This is much like all other RCAF and DND assets, but the CSSs are more closely aligned with DND/CAF dedicated SAR assets.

Key Finding 18: Although CSSs have SAR techs as resources, they have been minimally employed in SAR missions. Given the significant training investment required for SAR tech personnel, the low utilization may be an inefficient use of this highly specialized resource.

Of the YFR allocated to the three CSSs, the YFR applicable to SAR operations has been minimal. Table 21 demonstrates that in FY 2011/12, the proportion of the YFR flown by CSS in support of SAR was less than 14 percent, and Table 22 demonstrates that in FY 2012/13, it was less than nine percent. Over these two years, the three CSSs combined have been involved in fewer than 30 SAR missions annually or less than three percent of all SAR missions involving the DND/CAF.

SAR Hours by CSS in FY 2011/12				
CSS Squadron	**YFR Flown**	**YFR SAR**	**SAR % of YFR**	**SAR Missions**
2011/12				
417 Sqn	462.4	61.3	13.2%	9
439 Sqn	530.5	23.5	4.4%	7
444 Sqn	284.5	19.3	6.7%	5

Table 21. Number of Hours Spent on SAR per CSS in FY 2011/12. This table demonstrates the number of hours each CSS has spent on SAR in FY 2011/12.

SAR Hours by CSS in FY 2012/13				
CSS Squadron	**YFR Flown**	**YFR SAR**	**SAR % of YFR**	**SAR Missions**
417 Sqn	633.5	37	5.8%	6
439 Sqn	796.7	65.9	8.3%	19
444 Sqn	495.3	9.4	1.9%	n/a

Table 22. Number of Hours Spent on SAR per CSS in FY 2012/13. This table demonstrates the number of hours each CSS has spent on SAR in FY 2011/12.

As previously discussed, the amount of specialized training undertaken by SAR tech personnel in the DND/CAF is extensive. The minimal employment of SAR tech personnel from CSSs indicates an inefficient use of these highly trained individuals. DND/CAF may be able to reassign the SAR tech personnel of the three CSSs elsewhere within the SAR community to ensure maximal utilization of these resources.

CRS Recommendation

10. Investigate inefficiencies in SAR tech resource utilization at CSSs.
OPI: Commander RCAF

Key Finding 19: The RCAF contribution to SAR is cost effective when compared to the overall budget of DND and the level of service to Canadians and SAR partners.

3.0 Conclusion

The evaluation has determined that the DND/CAF contribution to the NSP is both highly relevant and effective and continues to serve an ongoing demand. The coordination and provision of the current aviation assets to SAR are effectively meeting the desired outcomes, are well positioned, and are delivered in a timely manner.

The evaluation found that, although a number of areas require improvement, the primary requirement is for stronger governance and strategic direction for the specific roles and responsibilities of the Department's significant contribution to the NSP. Clear performance metrics and targets for DND/CAF SAR activities are needed to measure the program's effectiveness and monitor the changing nature of SAR. In addition, greater collaboration with SAR partners, increased use of CASARA, and a rationalization of roles and responsibilities to limit mission creep and contain costs is required.

As the DND/CAF SAR costs increase, and in an era of fiscal constraint, the DND/CAF must ensure it limits the delivery of SAR services to those affordable, mandated responsibilities that will continue to provide ongoing solid performance as outlined in this evaluation.

Annex A—Management Action Plan

CRS Recommendation

1. Investigate options for SAR training activities to make more effective use of limited air resources.

Management Action

The RCAF will investigate options to improve national and regional level efficiencies in SAR training activities and schedules. The aim is to maximize the limited aircraft resources and reduce personnel workloads. The SAR Capability Advisory Group will provide a forum for discussion on national SAR training objectives including the balance between FG and FE issues. On a regional level, SAR squadrons will ensure close collaboration with CCG resources.

OPI: Commander RCAF
Target Completion Date: December 31, 2015.

CRS Recommendation

2. Investigate options for optimizing the range, payloads, and operational capabilities of the CH146 in the SAR role.

Management Action

The RCAF will further investigate options to vary aircraft capabilities to permit an increase in range and payload. However, in order to optimize range and operational payload, the RCAF will reconsider SAR equipment currently carried onboard the aircraft. The expected outcome will be a report outlining the possibility of changing CH146 configuration to optimize SAR range.

OPI: Commander RCAF
Target Completion Date: June 30, 2016.

CRS Recommendation

3. To gain insight into the overall SAR requirement, track the number of incidents where commercial RW assets are contracted to conduct the rescue and/or recovery portion of a SAR tasking.

Management Action

In combination with CJOC J3 SAR, the RCAF 1 CAD Senior Staff Officer SAR will investigate and track the pertinent data through the Canadian Mission Control Centre and the JRCCs. In future, the SAR Mission Management System, SAR mission reports, and SAR Knowledge

Management System will also be employed to capture increased pools of SAR data. JRCCs will monitor commercial RW and FW asset usage and collate data to be reported to 1 CAD Senior Staff Officer SAR and incorporated in the CJOC J3 SAR annual report.

OPI: Commander RCAF
OCI: Commander CJOC
Target Completion Date: June 30, 2016.

CRS Recommendation

4. Develop a performance metric for the Canadian AOR that considers factors such as transit time, which are often a greater determinant in the overall response time than solely the mandated response time.

Management Action

Various SAR reviews have highlighted the need for SAR performance metrics. The OGC acknowledged the need for more in depth SAR performance metrics and directed CJOC J3 SAR to assemble a team to develop performance metrics that will better evaluate the CAF's ability to respond to aeronautical SAR incidents based on current capabilities and assist in identifying areas for improvement. A DND/CAF SAR level of service policy will be formalized with performance measures to analyze our level of service annually. Reporting will be included in the Federal SAR OGC annual report.

OPI: Commander CJOC
Target Completion Date: June 30, 2015.

CRS Recommendation

5. Determine if the desired manning levels for SAR units are still applicable given current SAR and non-SAR-related tasking levels and training requirements.

Management Action

The RCAF, supported by CORA/DRDC, is in the process of conducting a rigorous academic analysis of CAF SAR personnel at selected SAR units. A draft of this extensive study is forecast to be ready by end of March 2015. The study will be used to validate existing SAR unit personnel, training, and mission task requirements. Supported by the CORA/DRDC study, the RCAF will investigate whether the analysis needs to be further expanded to include additional SAR units such as the Canadian Mission Control Centre and the JRCCs.

OPI: Commander RCAF
Target Completion Date: June 30, 2016.

CRS Recommendation

6. Given financial, training, and equipment constraints, determine the level and extent of SAR tech capabilities required to meet the DND/CAF contribution to the NSP. Further refine these capabilities into specific skill sets for which specialized equipment and training can be acquired and/or assigned.

Management Action

The RCAF has completed the SAR tech mission-to-task analysis. It was approved by the Commander RCAF on July 15, 2014. The analysis is fully aligned with the recently reissued National SAR Manual, now termed the Canadian Aeronautical and Maritime SAR Manual.

OPI: Commander RCAF
OCI: Commander CJOC
Target Completion Date: Completed

CRS Recommendation

7. Augment or restructure SAR command and control in order to provide strategic and operational level oversight and direction for DND/CAF SAR in Canada.

Management Action

The RCAF recognizes the need to bolster strategic SAR staffs to provide senior leadership with the support/information to accomplish the many changes and proposals recommended by recent federal audits and internal assessments of the CAF SAR system. The Federal SAR OGC is an asset to operational development; however, horizons II and III demand a uniquely CAF strategic perspective. RCAF, in consultation with CJOC, will investigate options to restructure internal SAR staff with a view to improving the SAR command and control structure. Recommendations will be submitted to the Defence Evaluation Committee as it is anticipated that solutions may involve DND/CAF staff external to the RCAF and CJOC.

OPI: Commander RCAF
OCI: Commander CJOC
Target Completion Date: December 31, 2015.

CRS Recommendation

8. Investigate the increased use of CASARA for searching, especially on low probability events such as un-correlated 121.5 MHz beacons.

Management Action

Through 1 CAD Senior Staff Officer SAR and CASARA National Headquarters, RCAF will reemphasize the value of CASARA resources in cases of low probability alert notifications. The RCAF will ensure that false 121.5 MHz alerts will be closely tracked. JRCCs will continue to utilize CASARA on these and any other missions that will alleviate the need for high-value RCAF assets.

OPI: Commander RCAF
OCI: Commander CJOC
Target Completion Date: December 31, 2015.

CRS Recommendation

9. Investigate potential cost recovery for non-core SAR taskings.

Management Action

The RCAF acknowledges its long-term support to provinces and territories on humanitarian and other missions. However, for example, recent historical averages for non-core SAR taskings for the CH149 Cormorant on the east coast of Canada have shown that approximately 83 hours annually are used to support non-core SAR activities. By RCAF costing, this amounts to an expense of over $3 million for which cost recovery from the requesting provincial authority is normally not practiced. The RCAF/CJOC will continue to track the use of SAR assets in a non-core function and investigate options to address this issue with Assistant Deputy Minister (Policy).

OPI: Commander RCAF
OCI: Commander CJOC
Target Completion Date: December 31, 2015.

CRS Recommendation

10. Investigate inefficiencies in SAR tech resource utilization at CSSs.

Management Action

RCAF will investigate the inefficiencies and options for the employment of SAR techs at dedicated CSSs. The final outcome will be a report/determination of whether SAR tech positions could be transferred within the SAR community.

OPI: Commander RCAF
OCI: Commander CJOC
Target Completion Date: December 31, 2015.

Annex B—Evaluation Questions Matrix

Evaluation Questions Matrix – Relevance					
Evaluation Questions	**Indicators**	**Document Review**	**Interviews**	**Data Analysis**	**Financial Data Analysis**
Continued Need Does the SAR program address an actual and ongoing need?	Number of SAR Incidents Canada's AOR	X		X	
Alignment with Federal Roles and Responsibilities Are the priorities of SAR consistent with DND strategic outcomes and federal government priorities?	Documented sources of commitment and priority for DND and GC	X			X
Alignment with Government Priorities Is the delivery of SAR consistent with the roles and responsibilities of the federal government and the roles and responsibilities of the CAF/DND?	Number and type of domestic and international agreements, MOUs, and treaties	X			

Table B-1. Evaluation Question Matrix – Relevance. This table lists the evaluation questions pertaining to the relevance of the SAR program.

Evaluation Questions Matrix – Performance (Effectiveness)					
Evaluation Questions	**Indicators**	**Document Review**	**Interviews**	**Data Analysis**	**Financial Data Analysis**
Is the SAR program prepared to respond?	Availability of air assets vs. stated needs	X	X	X	
	Capability of air assets	X	X	X	
	Location of air assets vs. incident location	X	X	X	
	Response times vs. stated targets Equipment	X	X	X	
	Quality of training and availability of crews vs. stated needs	X	X	X	
	Quality and type of SAR tech Equipment	X	X	X	
Is there effective governance/ direction and coordination with other SAR partners and stakeholders?		X	X		

Table B-2. Evaluation Question Matrix – Performance (Effectiveness). This table lists the evaluation questions pertaining to the performance (effectiveness) of the SAR program.

Performance (Efficiency and Economy)					
Evaluation Questions	**Indicators**	**Document Review**	**Interviews**	**Data Analysis**	**Financial Data Analysis**
Are the most efficient means of achieving objectives for SAR being employed?	Cost of dedicated SAR air assets	X		X	X
	YFR for SAR FE and FG	X		X	
	Costs related to SAR incidents	X		X	X
	CASARA employment	X	X	X	X
	Tracking and validation of non-mandated SAR taskings	X	X	X	X
	SAR resources within CSS	X	X	X	X
What are the economic costs and benefits of the SAR program?	Costs of SAR program, benefits and value to Canadians	X			X
Are there alternative ways of delivering SAR?	Not assessed for this evaluation	N/A	N/A	N/A	N/A

Table B-3. Evaluation Question Matrix – Performance (Efficiency and Economy). This table lists the evaluation questions pertaining to the performance (efficiency and economy) of the SAR program.

Annex C—SAR Logic Model

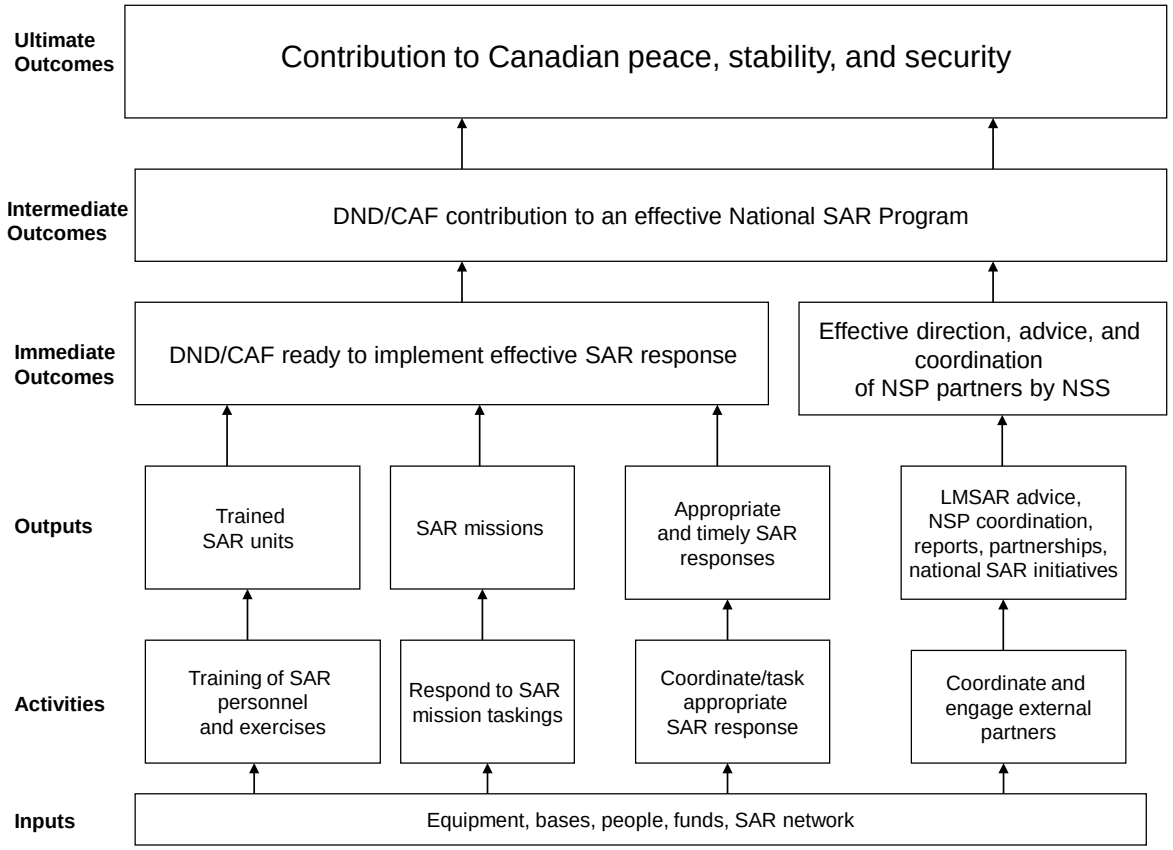

Figure C-1. SAR Logic Model. This logic model demonstrates the flow from inputs to activities, outputs, immediate outcomes, intermediate outcomes and ultimate outcomes of the SAR program.

Annex D—SAR Human Resources

Squadron	FY 2009/10	FY 2010/11	FY 2011/12	FY 2012/13
103 SAR	38	39	41	43
435 Transport and Rescue	199	198	200	211
424 Transport and Rescue	91	95	173	179
413 Transport and Rescue	159	150	160	164
442 Transport and Rescue	166	172	175	159
JRCC Trenton	27	27	25	24
JRCC Victoria	16	11	10	11
JRCC Halifax	16	17	15	14
Canadian Forces School of SAR	35	30	25	19
Total	**747**	**739**	**824**	**824**

Table D-1. SAR Human Resources for FY 2009/10 to 2012/13. This table shows the SAR staffing levels at the different squadrons for FY 2009/10 to 2012/13.

Note: Staffing levels or FTEs are listed per squadron and JRCC (as well as the Canadian Forces School of SAR). These numbers are based on the unit identification code. The table shows an increase in number of FTEs working in SAR in the last two years.

Annex E—SAR Costs Based on YFR and CFM for FY 2011/12

Squadron	Aircraft	FE + FG Costs	Operating Costs/ YFR	Full Costs/ YFR	Total Operating Costs	Total Full Costs
Gander (103 Sqn)	CH149 Cormorant	1,480	21,327	32,325	31,553,297	47,824,838
Winnipeg (435 Sqn)	CC130 Hercules	1,290	10,172	30,792	13,124,932	39,730,918
Comox (442 Sqn)	CC115 Buffalo	1,643	12,689	24,411	20,842,951	40,097,509
Comox (442 Sqn)	CCH149 Cormorant	2,279	21,327	32,325	48,595,702	73,655,745
Greenwood (413 Sqn)	CC130 Hercules	1,053	10,172	30,792	10,712,133	32,427,055
Greenwood (413 Sqn)	CH149 Cormorant	1,171	21,327	32,325	24,973,917	37,852,575
Trenton (424 Sqn)	CC130 Hercules	1,440	10,172	30,792	14,650,732	44,349,718
Trenton (424 Sqn)	CH146 Griffon	1,131	1,943	11,919	2,196,756	13,475,621
Total		**11,486**			**166,650,419**	**329,413,978**

Table E-1. SAR Costs Based on YFR and CFM for FY 2011/12. This table summarizes the costs of the SAR program based on the YFR and the CFM for FY 2011/12.

Annex F—YFR across SAR Squadrons

Squadron	Aircraft	Actual FE SAR	Actual FG SAR	Total
Comox (442 Sqn)	CC115 Buffalo	327	1,149	1,476
Comox (442 Sqn)	CCH149 Cormorant	377	1,706	2,083
Total for Comox		**704**	**2,855**	**3,559**
Greenwood (413 Sqn)	CC130 Hercules	951	788	1,739
Greenwood (413 Sqn)	CH149 Cormorant	310	844	1,154
Total for Greenwood		**1,261**	**1,632**	**2,893**
Gander (103 Sqn)	CH149 Cormorant	337	1,049	1,386
Trenton (424 Sqn)	CC130 Hercules	336	696	1,032
Trenton (424 Sqn)	CH146 Griffon	303	641	943
Total for Trenton		**639**	**1,337**	**1,976**
Winnipeg (435 Sqn)	CC130 Hercules	N/A	N/A	N/A

Table F-1. Distribution of YFR across SAR Squadrons for FY 2010/11.[92] This table summarizes the distribution of the YFR across the SAR squadrons for FY 2010/11.

Squadron	Aircraft	Actual FE SAR	Actual FG SAR	Total
Comox (442 Sqn)	CC115 Buffalo	224	1,419	1,643
Comox (442 Sqn)	CCH149 Cormorant	385	1,894	2,279
Total for Comox		**608**	**3,313**	**3,921**
Greenwood (413 Sqn)	CC130 Hercules	338	715	1,053
Greenwood (413 Sqn)	CH149 Cormorant	247	924	1,171
Total for Greenwood		**585**	**1,639**	**2,224**
Gander (103 Sqn)	CH149 Cormorant	467	1,013	1,480
Trenton (424 Sqn)	CC130 Hercules	433	1,007	1,440
Trenton (424 Sqn)	CH146 Griffon	185	946	1,131
Total for Trenton		**618**	**1,953**	**2,571**
Winnipeg (435 Sqn)	CC130 Hercules	400	891	1,290

Table F-2. Distribution of YFR across SAR Squadrons for FY 2011/12.[93] This table summarizes the distribution of the YFR across the SAR squadrons for FY 2011/12.

[92] Table data is from 1 CAD YFR.
[93] Table data is from 1 CAD YFR.

Squadron	Aircraft	Actual FE SAR	Actual FG SAR	Total
Comox (442 Sqn)	CC115 Buffalo	500	1,346	1,846
Comox (442 Sqn)	CCH149 Cormorant	656	1,984	2,640
Total for Comox		**1,156**	**3,330**	**4,486**
Greenwood (413 Sqn)	CC130 Hercules	587	812	1,399
Greenwood (413 Sqn)	CH149 Cormorant	419	1,024	1,443
Total for Greenwood		**1,006**	**1,836**	**2,842**
Gander (103 Sqn)	CH149 Cormorant	519	1,140	1,659
Trenton (424 Sqn)	CC130 Hercules	615	1,074	1,689
Trenton (424 Sqn)	CH146 Griffon	406	872	1,278
Total for Trenton		**1,021**	**1,946**	**2,967**
Winnipeg (435 Sqn)	CC130 Hercules	672	1,412	2,084

Table F-3. Distribution of YFR across SAR Squadrons for 2012/13.[94] This table summarizes the distribution of the YFR across the SAR squadrons for FY 2012/13.

[94] Table data is from 1 CAD YFR.