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## Evaluation of Maritime Air Capabilities

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Canada 

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## Acronyms and Abbreviations

1 CAD	Canadian Air Division Headquarters
ACCE	Air Component Command Element
ADM(Mat)	Assistant Deputy Minister (Materiel)
AIMP	Aurora Incremental Modernization Project
AIS	Automatic Identification System
AOR	Area of responsibility
ASLEP	Aurora Structural Life Extension Project
ASW	Anti-Submarine Warfare
C2	Command and Control
CAF	Canadian Armed Forces
CANSOFCOM	Canadian Special Operations Command
CAS	Chief of the Air Staff
CDS	Chief of the Defence Staff
CEFCOM	Canadian Expeditionary Force Command
CF-188	Canadian Forces Hornet (Fighter Aircraft)
CFAWC	Canadian Forces Aerospace Warfare Centre
CFDS	<i>Canada First</i> Defence Strategy
CH-124	Sea King Maritime Helicopter
CH-148	Cyclone Maritime Helicopter
CJOC	Canadian Joint Operations Command
CMAAG	Commanders Maritime Air Advisory Group
CMS	Chief of Maritime Staff
CONOPs	Concept of Operations
CONPLAN	Contingency Plan
CP-140	Aurora: Intelligence, Surveillance and Reconnaissance Aircraft
CRS	Chief Review Services
CSNI	Consolidated Secret Network Infrastructure
DGAEPM	Director General Aerospace Equipment Program Management
DND	Department of National Defence
ELE	Estimated Life Expectancy
FE	Force Employment
FG	Force Generation
FY	Fiscal Year
GC	Government of Canada
HELAIRDET	Helicopter Air Detachment
HCM	Halifax Class Modernization



IMP	Incremental Modernization Project
ISR	Intelligence Surveillance and Reconnaissance
LRP	Long-Range Patrol Squadron
LRPA	Long-Range Patrol Aircraft
MAR AIR	Maritime Air Capability
MCDV	Maritime Coastal Defence Vessel
MDA	Maritime Domain Awareness
MH	Maritime Helicopter
MHP	Maritime Helicopter Replacement Project
MND	Minister National Defence
NAFIWG	Navy-Air Force Interoperability Working Group
NASP	National Air Surveillance Program
NATO	North Atlantic Treaty Organization
NORAD	North American Aerospace Defense Command
OAT	Other Aerospace Tasks
OCI	Office of Collateral Interest
OPI	Office of Primary Interest
OGD	Other Government Departments
OIWG	Operational Implementation Working Group (CH-148)
PAL	Provincial Airways Limited
PER	Periodic Maintenance
RADARSAT	Radar Satellite
RCAF	Royal Canadian Air Force
RCN	Royal Canadian Navy
RDIMS	Records, Documents and Information Management Systems
RFE	Request for Effects
RIMPAC	United States Navy-led Biennial <i>Rim of the Pacific</i> Exercise
RJTF	Regional Joint Task Force
SAR	Search and Rescue
SJS	Strategic Joint Staff
Sqn	Squadron
SUAV	Small Uninhabited Air Vehicle
TARM	Total Air Resource Management
TBS	Treasury Board Secretariat
TC	Transport Canada
UAV	Uninhabited Air Vehicle
VCDS	Vice Chief of the Defence Staff
YFR	Yearly Flying Rate



## Executive Summary

This report presents the findings and recommendations of the evaluation of the Maritime Air Capability (MAR AIR) program activities within the Department of National Defence (DND). The evaluation was conducted by Chief Review Services (CRS) between November of 2012 and October of 2013, as a component of the DND/Canadian Armed Forces (CAF) Five-Year Evaluation Plan (2012-17), and in compliance with the Treasury Board Secretariat (TBS) Policy on Evaluation (2009). As per the TBS policy, the evaluation examined the relevance and the performance of the Program over a five-year period (2008-2013).

### Program Description

The MAR AIR is defined as those elements of the CAF, including supporting and related components, which are responsible for establishing and maintaining maritime domain awareness (MDA) and control in domestic and international operations. This capability is carried out principally through the conduct of autonomous fixed and rotary wing maritime air patrols, organic and remote maritime air support to deployed Royal Canadian Navy (RCN) vessels, and through the use of satellite technology.

The Program is administered principally by the Royal Canadian Air Force (RCAF), the RCN, and the Canadian Joint Operations Command (CJOC). In addition, both the Vice-Chief of the Defence Staff (VCDS)/Director General Space and Assistant Deputy Minister (Materiel) (ADM(Mat)) provide support services. This program falls primarily under sections 2.1, 2.3, and 3.2 of DND's 2009 Program Alignment Architecture and involves annual expenditures in excess of \$991 million.<sup>1</sup>

<sup>1</sup> This amount includes \$480 million for maintenance and betterments—areas of the Program that were not included in the scope of the evaluation.

### Overall Assessment

- There is an ongoing and demonstrable need for a MAR AIR program within DND. This capability is clearly aligned with DND's roles, responsibilities and priorities.
- Although the Program consistently met Government of Canada (GC) and DND expectations and demands for the conduct of operations, over the past ten years these expectations have been reduced. The overall capability is |||||  
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- Despite the increased age of its primary assets, the overall program costs have not increased and remained relatively constant.



## Relevance and Performance

The evaluation determined that the need for DND to conduct both the generation and employment of a MAR AIR is of continuing relevance and is aligned with federal Government and departmental roles, responsibilities and priorities. While the expenditures for MAR AIR represent three percent of DND's annual spending, the impact of its contribution to overall DND strategic objectives and priorities has been significant. The MAR AIR can directly impact and improve the safety and security of Canadians, and provide public confidence in the Government's ability to defend Canada and protect Canadian citizens at home and abroad. The MAR AIR also works closely with other government departments to deal with a wide range of security threats, including terrorism, illegal resource exploitation, pollution violations, narcotics trafficking and illegal migration.

With respect to performance, during the period of the evaluation, the Program was seen to consistently meet the expectations of force employers, including the contribution to awareness and control in the maritime domain, and support to other aerospace tasks (OAT)—such as search and rescue and humanitarian relief. However, |||||

Further, there is some evidence that the expectations of force employers have been lowered in light of program pressures. |||||

||||| Delays in capital projects have put further pressure on operational capacity by extending the use of already aging aircraft fleets. In addition, resource issues have contributed to |||||

With respect to efficiency and economy, the Program was seen to have demonstrated sound value. The average annual budget for the MAR AIR has remained constant over the five-year evaluation period despite increasing personnel costs. In comparison, inflation in the Canadian economy was 16 percent over the same period. The cost of Long Range Patrol Aircraft (LRPA) CP-140 Aurora has remained largely stable over the evaluation period, while the cost of shipborne helicopters, such as the Sea King Maritime Helicopter (CH-124) has seen a moderate increase. This, however, was largely achieved by |||||

Other significant improvements to efficiency were noted, including the increased use of contracted air services, other government department (OGD) air services, and Radar Satellite (RADARSAT), to deliver more comprehensive surveillance results at reduced cost.

In summary, the MAR AIR program has demonstrated, despite challenges, sound, real-world results. During the evaluation period, the Program faced pressures due to fleet modernization requirements, age of equipment, evolving mission types, |||||

|||||, and increased operational tempo. Looking ahead, while the program has taken steps to be more efficient in the delivery of capability, |||||

|||||, will remain a principal concern and, as such, will need continued attention.

Here are the findings and recommendations of the Evaluation.

## Findings and Recommendations

### Findings—Relevance

1. MAR AIR addresses an actual and ongoing need to conduct surveillance patrols along Canada's littoral and maritime borders to detect any threats before they reach our shores, and, when necessary, to respond to these threats and maintain control of the maritime domain.
2. MAR AIR capabilities are employed in accordance with the *National Defence Act* (NDA) mandate.
3. MAR AIR's contribution to maritime surveillance and defence aligns with GC priorities for security (domestic/continental and expeditionary) and sovereignty, including the Arctic.

### Findings—Performance (Effectiveness)

4. Throughout the past five years, MAR AIR was ready and able to conduct operations, albeit at reduced capacity.
5. ||||| of maritime aircraft presents significant risks to ||||| required.
6. RADARSAT 2/Space-based Automatic Identification System (AIS) and contracted air services have increasingly compensated for the reduced CP-140 availability in the aspect of surface MDA.
7. Protracted implementation schedules of major capital projects for Maritime Helicopter (MH) and LRPA have exacerbated program challenges—including |||||.
8. ||||| may present growing risks.
9. The strategic governance of MAR AIR is lacking mechanisms to foster a collaborative delivery of Joint Maritime Effects.
10. MAR AIR has conducted surveillance activities that have contributed to building and maintaining a growing confidence in the effectiveness of MDA.





11. MAR AIR operations have contributed to control activities in the maritime domain in past and current operations. However, the planned reduction of the CP-140 fleet, combined with its |||||, may present |||||
12. |||||
13. Senior leaders indicated satisfaction with support provided by MAR AIR assets to OAT; however, the expanded non-maritime employment may present ||||| of core MAR AIR competencies.
14. The MAR AIR contribution was instrumental to the success of the missions examined.
15. Exercises are conducted mainly at the Tactical level, while the Operational and Strategic levels are infrequently exercised.

#### **Findings—Performance (Efficiency and Economy)**

16. The costs for the CP-140 LRPA have remained stable over the five-year evaluation period in spite of being an ageing weapons system.
17. Given its impending replacement, CH-124 maintenance costs remained at or slightly below the inflation rate by selective adjustments of the maintenance practices.
18. The addition of satellite technology (e.g., RADARSAT-2 and space-based AIS) and partnership in using contracted air services (e.g., Provincial Airways Limited (PAL) and Transport Canada (TC)/National Air Surveillance Program (NASP)) have proven to be very efficient for conducting maritime domain awareness.
19. The expanded use of the CP-140 simulators to conduct force generation (FG) has been cost-effective.
20. The total expenditures directed at Canada's MAR AIR<sup>2</sup> have remained virtually flat over a five-year period, even though salary, wages, and inflation<sup>3</sup> costs have increased during the same period.

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<sup>2</sup> Financial data was compiled by request from 12, 14, and 19 Wing, 1 CAD, ADM(Mat), CJOC, and Chief Defence Intelligence.  
<sup>3</sup> Inflation rates used in this report were calculated by DND for operating expenditures and found in the DND Economic Model Historical Rates—2012 Edition Document.



## Recommendations

- 1) Given the force-multiplier value of organic shipborne helicopters, completion of the Maritime Helicopter Replacement Project (MHP) should remain a top priority for the Department.  
**OPI:** RCAF
  
- 2) Give increased priority to operational training events that maximize the preservation and development of perishable core skills sets, such as |||||  
|||||  
**OPI:** RCAF, **OCI:** RCN
  
- 3) To further enhance the comprehensive partnership in the development and delivery of Joint Maritime Effects, improve the governance forums and mechanisms, such as by re-instating the Navy-Air Force Interoperability Working Group (NAFIWG), to establish clear strategic priorities; to address interoperability issues; and to provide for a comprehensive performance monitoring strategy.<sup>4</sup>  
**OPI:** RCAF, **OCI:** RCN
  
- 4) Given the expanded capabilities of new sensors being introduced in CP-140 Block III and MHP, develop a comprehensive concept of operations for processing the significant increase in information volume and complexity.  
**OPI:** RCAF, **OCI:** CJOC
  
- 5) Support the timely implementation of RADARSAT Constellation Mission.  
**OPI:** VCDS, **OCI:** CJOC
  
- 6) Given serviceability and availability trends, validate the surge readiness requirements of the CP-140. If unchanged, expand the fleet beyond the ten original Block III/Aurora Structural Life Extension Project (ASLEP) modified aircraft, while allocating a sufficient number of additional crews.<sup>5</sup>  
**OPI:** SJS/CJOC, **OCI:** RCAF
  
- 7) |||||  
|||||<sup>6</sup>  
**OPI:** RCAF

<sup>4</sup> Recommendation No. 3: The first session of the re-established NAFIWG was held on May 13, 2014, with senior RCN and RCAF membership.

<sup>5</sup> Recommendation No. 6: During the drafting of this evaluation report, the Minister National Defence (MND) announced that four additional CP-140 aircraft (for a total of 14) would undergo the ASLEP. In addition to three new capability enhancements, the additional aircraft will allow the LRPA the capability to be effectively extended to 2030.

<sup>6</sup> Recommendation No. 7: During the drafting of this evaluation report, the MND announced the addition of a Self-Defence Suite that will allow the current LRPA the capability to be operationally effective to 2030.



- 8) Continue the expansion of Contingency Plan (CONPLAN) exercises, especially those requiring the participation of higher headquarters.

**OPI:** CJOC, **OCI:** RCAF

- 9) Adopt a policy of maintaining parity between simulation devices and the operational fleets.

**OPI:** RCAF, **OCI:** ADM(Mat)

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**Note:** Please refer to [Annex A—Management Action Plan](#) for the management responses.

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## 1.0 Introduction

### 1.1 Profile of Maritime Air Capability

#### 1.1.1 Background

This report presents the findings and recommendations of the evaluation of MAR AIR,<sup>7</sup> covering the period of January 2007 to December 2012. This evaluation was completed by CRS in accordance with the TBS Policy on Evaluation<sup>8</sup> and approval authority,<sup>9</sup> towards meeting the evaluation coverage requirements established by the TBS. The Evaluation was conducted between October 2012 and November 2013.

#### 1.1.2 Program Description

MAR AIR provides air and space-based surveillance and defence support to operations in the maritime domain, which includes the littoral<sup>10</sup> region. The capability supports the CAF capacity to survey and patrol the maritime domain due to the long range and sophisticated sensory equipment of the Aurora aircraft and RADARSAT. Domestically, MAR AIR is integral to persistent surveillance of Canada's extensive military area of responsibility (AOR) and extreme boundaries (e.g., Arctic) which are ||| In fact, the aircraft traditionally associated with MAR AIR (i.e., CH-124 Sea King MH and CP-140 Aurora LRPA) are also ||| air assets in the CAF that can provide ||| Furthermore, when working in coordination with the RCN as part of a naval task force, MAR AIR greatly increases a ship's line of sight, which allows the ship to detect (and engage) threats from a much further distance than if it was operating alone. In addition to supporting military efforts, MAR AIR is also employed for constabulary support to counter-narcotics, counter-migrant and anti-pollution efforts by other government partners and agencies. As such, MAR AIR requires a collaborative partnership principally between the RCAF and RCN, as the two environments often work jointly in maritime operations.

The two LRPA (CP-140 Aurora aircraft) squadrons (Sqns) that contribute to MAR AIR are located at 14 Wing Greenwood, Nova Scotia (405 Sqn) and 19 Wing Comox, British Columbia (407 Sqn). Two MH (CH-124 Sea King helicopter) Sqns dedicated to MAR AIR are located at Shearwater, Nova Scotia (423 Sqn) and Pat Bay, British Columbia (443 Sqn). Additionally further MAR AIR is supplied by contracted air surveillance services in collaboration with OGDs, co-operation with allied forces, Uninhabited Aerospace Vehicles (UAVs), and satellite (RADARSAT and Space-based AIS) and radar equipment.

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<sup>7</sup> DND, CRS Memorandum 1258-204 (Director General Evaluation), October 29, 2012.

<sup>8</sup> Treasury Board of Canada Secretariat, "Policy on Evaluation," 2009, retrieved from <http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=15024&section=text>.

<sup>9</sup> DND/CAF Five-Year Evaluation Plan: 2013/14 to 2017/18. Retrieved February 2013 from <http://uav-local.mil.ca/dl-tc/eval/epln-2013-eng.pdf>.

<sup>10</sup> Defence Terminology Bank, Reference 33690 (English). Retrieved from <http://terminology.mil.ca/term-eng.asp>.

### 1.1.3 Program Objectives

The major activities associated with MAR AIR are related to building and maintaining readiness within the defence pillars of personnel, equipment and infrastructure to ensure that the CAF has all necessary components available to conduct maritime air operations.

There are three intermediate outcomes for the MAR AIR capability.

- **Building and maintaining maritime domain awareness:** includes awareness of all activities (e.g., surveillance and vessel detection) taking place in the maritime regions, whether within the Canadian territory or in support of deployed operations. MDA also includes matching demonstrated behaviour of vessels with their declared intentions (i.e., intelligence) to ensure there is a clear, complete understanding of the maritime picture.
- **Control of the maritime domain:** includes the ability to exert control within the maritime region, domestically or during expeditions abroad. This encompasses *presence* (being seen), *deterrence* by influencing behaviour as a result of direct (e.g., radio contact) or indirect (e.g., inference of electronic signals) interactions, and *prosecution* through use of active force (e.g., firing of weapons).
- **Other aerospace tasks (OAT) are supported:** includes back-filling of Search and Rescue (SAR) activities when required, providing ship-ship or ship-shore air lift of equipment or personnel and surveillance support for overland activities, usually in support of the Canadian Army.

The logic model diagram in [Annex C](#) shows the relation of the foregoing activities and outcomes for MAR AIR that were considered.

### 1.1.4 Stakeholders

The primary stakeholders in delivering a MAR AIR capability are the RCAF, particularly the LRPA and MH sqns, and the RCN's naval task forces. The RCN's ships provide the support crew and ship decks from which a helicopter detachment (HELAIRDET) flies during maritime operations and the LRPA detachments interface with the ship's company to provide surveillance information and air weapons, as the situation requires.

DND/CAF also engages PAL to provide some contracted surveillance for MAR AIR, and other private sector firms are engaged to deliver contracted training (e.g., air target services), equipment maintenance and supply support related to the generation and sustainment of a MAR AIR capability. The RCAF collaborates with and supports law enforcement agencies, such as Canada Border Services Agency, Canadian Coast Guard, Fisheries and Oceans Canada, Royal Canadian Mounted Police, and TC in the sharing of general domestic surveillance information and during constabulary activities in Canada.



## 1.2 Evaluation Scope

The evaluation of MAR AIR includes all relevant data, primarily (but not exclusively) from fiscal year (FY) 2008/09 through FY 2012/13. The scope of the evaluation includes an assessment of relevant outcomes related to the capabilities of maritime air forces, including specific aspects of force development (training), generation, employment and sustainment.<sup>11</sup>

The evaluation did not examine in detail maintenance expenditures, as this was included in the Evaluation of RCAF Aerospace Equipment Maintenance (2012). The evaluation scope also did not include activities related to Initial Individual Occupational Training, equipment or real property acquisition and disposal, Search and Rescue, nor activities conducted exclusively overland (i.e., in support of the Canadian Army). These topics will be assessed as part of other evaluations.

### 1.2.1 Coverage and Responsibilities

As MAR AIR does not represent a formal program in DND, the scope of this evaluation crosses a number of elements of DND's Program Alignment Architecture. Therefore, this evaluation covered components of the following strategic activities program areas, as they related to maritime air activities or assets:

- 2.1 Maritime Readiness, specifically:
  - 2.1.1 Contingency Task Group HELAIRDETs; and
  - 2.1.2 National Task Group HELAIRDETs.
- 2.3 Aerospace Readiness (excluding 2.3.1 Aerospace Force Application, 2.3.2 Air Mobility), specifically:
  - 2.3.3.0.3 Tactical Helicopter—Maritime Helicopter Operations;
  - 2.3.4.0.5 Aerospace Intelligence, Surveillance and Reconnaissance;
  - 2.3.6.2 .0.6 Aerospace Infrastructure Maintenance and Wing Support—12 Wing Shearwater (partial);
  - 2.3.6.2.0.7 Aerospace Infrastructure Maintenance and Wing Support—14 Wing Greenwood (partial);
  - 2.3.6.2.0.10 Aerospace Infrastructure Maintenance and Wing Support—19 Wing Comox (partial);

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<sup>11</sup> Some elements or activities of MAR AIR may be covered in other evaluations included in the CRS five-year Evaluation Plan: "DND/CAF Five-Year Evaluation Plan: 2013/14 to 2017/18", February 2013, retrieved from <http://uav-local.mil.ca/dl-tc/eval/epln-2013-eng.pdf>.



- 2.3.6.3.0.6.1 Aerospace Equipment Maintenance 12 AMS; and
- 2.3.6.3.0.7.1 Aerospace Equipment Maintenance 14 AMS.
- 3.2 .1 Canadian Sovereignty Operations (3.2.1.0.0.3.2 Maritime Air Patrols); and
- 3.2.3 Canadian Peace and Stability Operations (Assistance to Law Enforcement Agencies—Department of Fisheries and Oceans patrols, counter drug activities, Canadian Special Security Events).

## 1.2.2 Resources

Annual spending directly attributed to MAR AIR is approximately \$517.5 million, based on an assessment of the FY 2011/12 departmental Strategic Cost Model and the Program Alignment Architecture. This includes spending attributed to the operation of maritime helicopters and maritime patrol aircraft, excluding maintenance (RCAF Wing, associated civilian and military salaries, readiness training, contracted services, etc.).

## 1.2.3 Issues and Questions

### Relevance

The evaluation questions used to assess the issues of relevance and performance against outcomes for MAR AIR are listed in Table 1.

Evaluation Issue	Evaluation Question
<b>Relevance</b>	Does MAR AIR address an actual and ongoing need?
	Is MAR AIR consistent with Government of Canada, DND/CAF objectives and priorities?
	Is it the role or responsibility of the federal government (and DND specifically) to deliver MAR AIR?
<b>Performance—Achievement of Expected Outcomes (Effectiveness)</b>	Is the DND/CAF able to conduct MAR AIR operations?
	To what extent has MAR AIR contributed to building and maintaining MDA?
	To what extent has MAR AIR contributed to maritime domain control?
	Through its MAR AIR capability, is the DND/CAF meeting expectations to provide support to OAT?
<b>Performance—Achievement of Expected Outcomes (Efficiency &amp; Economy)</b>	Were resources utilized efficiently/economically to produce the outputs and outcomes of MAR AIR?

**Table 1. Evaluation Issues and Questions for MAR AIR.** This table lists the evaluation issues of relevance and performance, and the corresponding questions for assessment.

## 2.0 Findings and Recommendations

Evaluation findings and recommendations are outlined in Sections 2.1 through 2.5.

### 2.1 Continued Need

#### **Evaluation Question: Does MAR AIR address an actual and ongoing need?**

The evaluation utilized the following indicators to make this determination:

- previous MAR AIR employments (frequency, type, intensity; use of MAR AIR by/in allied forces, including those of the North Atlantic Treaty Organization (NATO));
- likelihood of future need for MAR AIR (threats); and
- uniqueness of MAR AIR to CAF (i.e., CAF without MAR AIR).

**Key Finding 1:** MAR AIR addresses an actual and ongoing need to conduct surveillance patrols along Canada's littoral and maritime borders to detect any threats before they reach our shores and, when necessary, to respond to these threats and maintain control of the maritime domain.

Interviews with senior CAF leadership confirmed the future need for MAR AIR in dealing with ongoing and potential future threats. Persistent threats from subsurface and surface vessels were particularly noted as requiring MAR AIR, specifically to conduct ASW and surface warfare and, thus, to protect Canadian sovereignty. They explained that the rise in the number of acts of terrorism and of piracy,<sup>12</sup> and a resurgence of submarine activities, are considered significant threats to global peace and stability.<sup>13</sup> Senior CAF leadership also noted the opening of the arctic passage to maritime traffic as presenting a range of potential threats to Canadian sovereignty, prosperity and security.<sup>14</sup>

Over the last five years, MAR AIR aerospace assets, including space-based radar technology and rotary and fixed-wing aircraft, have been deployed on behalf of the GC to provide MDA and, when necessary, exert control of the maritime domain on a large number of CAF/RCN operations, as illustrated in Table 2. As 65 percent of the value of world trade is conducted via maritime means, and as 80 percent of the world urban centers are located in littorals, the likelihood of future maritime operations is also forecast in DND force development documents.<sup>15</sup>

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<sup>12</sup> DND, VCDS, *The Future Security Environment 2013-2040* (Draft version 8), June 26, 2013, page 81.

<sup>13</sup> *Ibid.*, page 90.

<sup>14</sup> *Ibid.*, page 23.

<sup>15</sup> Also represents 90 percent of trade by volume (*Ibid.*, page 89).





MAR AIR aerospace assets, including the Sea King helicopter, the Aurora maritime patrol aircraft, satellite and radar technology, and, to a limited extent, the Canadian Forces Hornet (Fighter Aircraft) (CF-188),<sup>16</sup> were utilized to conduct maritime surveillance on domestic operations such as Operation PODIUM during the 2010 Vancouver Olympics. On continental operations with the United States, such as Operation CARIBBE, conducted to interdict drug smuggling in the western Caribbean and eastern Pacific, and on international operations with NATO allies, such as Operation MOBILE during the 2011 Libyan campaign, CAF maritime air assets predominantly conducted surveillance and control operations in the maritime domain, including the littoral area.

Number <sup>17</sup> of CFDS operations that utilized MAR AIR			
FY	Domestic	Continental	International
2008/09	3	1	2
2009/10	4	1	2
2010/11	6	2	2
2011/12	3	1	4
2012/13	4	1	2

**Table 2. Number of Canada First Defence Strategy (CFDS) Missions/Operations that Utilized MAR AIR.** Grouped according to CFDS priorities, this table depicts the number of operations where elements of MAR AIR were utilized during the evaluation period.

“Canada is a maritime nation”<sup>18</sup> with the longest coastline among nations of the world, and is surrounded by three oceans. The CAF conducts regular and comprehensive surveillance of Canada’s littoral and maritime borders using satellite and radar technology, and short and long-range patrol aircraft. The CAF has three defined coastal surveillance zones encompassing Canada’s maritime domain. Domain awareness is managed within each zone under the umbrella of Operation LIMPID by a regional plan referred to as Operation LEVIATHAN on the Atlantic coast, Operation SEA LION on the Pacific coast, and Operation QIMMIQ in the Arctic.

Canada’s maritime security is conducted using a whole-of-government framework<sup>19</sup> whereby a partnership among OGDs was formed under a mandate to achieve comprehensive maritime security. Data from OGD partners is shared and fused in joint regional Marine Security Operations Centres to provide a detailed picture of vessels approaching Canada. Satellite assets currently track and detect several hundred maritime vessels daily in or approaching Canada’s AOR.<sup>20</sup> Further intelligence gathering and

<sup>16</sup> Recently, UAV trials and operations have also been conducted by the RCN in the maritime domain with the Scan Eagle UAV. Source: RCN, “Navy News—HMCS Regina returns from overseas mission.” Retrieved August 28, 2013 from <http://www.navy-marine.forces.gc.ca/en/news-operations/news-view.page?doc=hmcs-regina-returns-from-overseas-mission/hio8snha>.

<sup>17</sup> These numbers reflect the combined use of both the Sea King helicopter and Aurora fixed wing aircraft, and include DND-contracted air services.

<sup>18</sup> Stephen Harper, Prime Minister of Canada, “Statement by the Prime Minister of Canada on the occasion of the unveiling of The Royal Canadian Navy Monument,” May 3, 2012, Ottawa, Ontario. Retrieved August 16, 2013 from <http://pm.gc.ca/eng/media.asp?id=4782>.

<sup>19</sup> TBS, “Whole-of-government framework.” Retrieved August 28, 2013, from <http://www.tbs-sct.gc.ca/ppg-cpr/frame-cadre-eng.aspx>.

<sup>20</sup> Regional Joint Operations Center program and document data retrieved from the Consolidated Secret Network Infrastructure (CSNI), DND, and CJOC Annual Surveillance Reports.

identification of vessels is conducted when they are determined to be suspicious or in need of further inspection to ascertain their purpose and destination.

The Aurora Long-Range Patrol Aircraft and contracted services are used to conduct surveillance of Canadian littoral borders, including in the Arctic, to both validate the information obtained from satellite and radar detection, and to further identify approaching vessels when necessary.

Post Operation Reports, interviews and case study data show that routine and comprehensive surveillance of Canada's littoral and maritime borders by MAR AIR has enabled the detection and identification of approaching migrant vessels. For example, in August 2010, a migrant smuggling vessel was tracked and intercepted through satellite and airborne surveillance<sup>21</sup> in the Pacific Ocean headed for the Vancouver coast, and was boarded in Victoria by DND, Royal Canadian Mounted Police and Canada Border Services Agency officers. According to intelligence data, known terrorists were on board.<sup>22</sup> This is an example of the evidence CRS found to suggest that MAR AIR<sup>23</sup> is a principal component of the CAF's ability to conduct and maintain MDA.

## **2.2 Alignment with Federal Roles and Responsibilities**

**Evaluation Question: Is it the role or responsibility of the federal government (and DND specifically) to deliver MAR AIR?**

The evaluation utilized the following indicators to make this determination:

- alignment with or inclusion of MAR AIR in relevant acts, legislation and government directives;
- congruence in roles/responsibilities of OGD and DND/CAF to deliver MAR AIR (i.e., duplications, gaps); and
- assessment of whether private industry or other levels of government. complement, augment or duplicate MAR AIR.

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<sup>21</sup> DND, Canada Command, Commander Greg Lye, J8, Canada Command (RDIMS 122076), November 30, 2010, slide number 50.

<sup>22</sup> Royal Canadian Mounted Police, "INTERPOL/CPIC Interface." Retrieved August 28, 2013, from <http://www.rcmp-grc.gc.ca/interpol/cpic-cipc-interpol-eng.htm>; and DND, Canada Command, Commander Greg Lye, J8 Canada Command (RDIMS 122076), November 30, 2010, slide number 50; CBC News, "Tamil migrants to be investigated: Toews," August 13, 2010. Retrieved August 1, 2013, from <http://www.cbc.ca/news/canada/story/2010/08/13/bc-tamil-ship-migrants-esquimalt.html>. The first publication cited refers to the International Criminal Police Organization (INTERPOL) and the Canadian Police Information Centre (CPIC).

<sup>23</sup> DND, Canada Command, Commander Greg Lye, J8 Canada Command (RDIMS 122076), November 30, 2010, slide number 50.



**Key Finding 2:** MAR AIR capabilities are employed in accordance with the NDA mandate.

MAR AIR's role to conduct surveillance and demonstrate presence is aligned with DND's prime responsibility, or *raison d'être*, to defend Canada and Canadians.<sup>24</sup> It is also aligned with the second and third CFDS priorities, to defend North America and contribute to international peace and security.<sup>25</sup> The NDA mandates the Department to defend Canadian sovereignty with the application of lethal force when authorized by the GC.<sup>26</sup> When the use of force becomes necessary in the maritime domain, MAR AIR assets, including the Sea King, the Aurora and the CF-188 and their crews, can be mandated by the GC and the NDA to respond, prosecute and exercise control in the maritime domain.

CONPLANS are established by DND in preparation for possible worst-case scenarios involving operations in areas of conflict or in relation to compromises to Canadian sovereignty and security. A MAR AIR capability is required in seven of the ten CONPLANS to fulfill the Commander's intent to detect and control threats in the maritime domain.<sup>27</sup>

MAR AIR is aligned with two of the GC's stated priorities in the Whole-of-Government-Framework: (1) to ensure a safe and secure Canada; and (2) to ensure a safe and secure world through international engagement.<sup>28</sup> The federal government has initiated a whole-of-government approach to conduct and maintain maritime domain security by devising a framework articulating OGD involvement.<sup>29</sup> Document, interview and site visit data suggest that collaboration occurs among OGD, as interdepartmental coordination is mandated by the GC through Canada's Maritime Security Strategic Framework 2020<sup>30</sup> to achieve comprehensive security in Canada's maritime domain.

Private sector companies have been able to fulfill a supporting role in conducting long-range surveillance of the maritime domain. A contract between the GC and PAL is currently in place to deliver shorter-range surveillance capabilities. However, private sector companies are limited in their role and cannot use force to defend Canada. Only the CAF and DND can be authorized by the GC to come to the defence of Canadians and use force if necessary. This unique capability is particularly important to the GC's stated priority to protect Canadian sovereignty in the Arctic.

<sup>24</sup> DND, Departmental Performance Report 2011/12: Part III—Estimates. Retrieved from [http://www.forces.gc.ca/assets/FORCES\\_Internet/docs/en/DND\\_DPR\\_percent202011-12.pdf](http://www.forces.gc.ca/assets/FORCES_Internet/docs/en/DND_DPR_percent202011-12.pdf), page 5.

<sup>25</sup> Ibid.

<sup>26</sup> *National Defence Act*, Part I (DND), Section 4 (Duties), Revised Statutes of Canada, 1985, c. N-5. Retrieved from <http://laws-lois.justice.gc.ca/eng/acts/n-5/page-2.html#h-5>.

<sup>27</sup> DND, CJOC, Command View, CONPLANS List.

<sup>28</sup> Treasury Board of Canada Secretariat, "Whole-of-government framework." Retrieved August 1, 2013, from <http://www.tbs-sct.gc.ca/ppg-cpr/frame-cadre-eng.aspx>.

<sup>29</sup> OGDs involved in the whole-of-government approach to maritime security include Transport Canada, Department of Fisheries and Oceans, Canada Border Services Agency, Royal Canadian Mounted Police and Immigration Canada.

<sup>30</sup> DND, Canada's Maritime Security Strategic Framework 2020 (RDIMS 6312352), 7 April 2011, page 7.

## 2.3 Alignment with Government Priorities

### **Evaluation Question: Is MAR AIR consistent with GC, DND/CAF objectives and priorities?**

The evaluation team utilized the following indicators to make this determination:

- Alignment with or inclusion of MAR AIR in stated government priorities.
- Alignment with or inclusion of MAR AIR in DND/CAF priorities.

**Key Finding 3:** MAR AIR's contribution to maritime surveillance and defence aligns with GC priorities for security (domestic/continental and expeditionary) and sovereignty, including the Arctic.

MAR AIR is aligned with GC CFDS commitments requiring the CAF to deliver excellence at home by “maintaining the capacity to provide surveillance of Canadian territory, air and maritime approaches, and deter threats to our security before they reach our shores.”<sup>31</sup> The CFDS also directs the CAF to possess the capability to identify and address security threats quickly and effectively.<sup>32</sup>

MAR AIR is also aligned with the GC's commitment in the 2011 Speech from the Throne to ensure that “the CAF play a crucial role in defending our sovereignty and national security,” emphasizing that “the strongest expression of our sovereignty comes through presence and actions, not words.”<sup>33</sup> The Speech also highlights the GC's commitment to “continue to vigorously defend Canada's Arctic sovereignty.” Defending Canada's Arctic sovereignty requires a long-range patrol aircraft<sup>34</sup> that can conduct surveillance and control of the maritime domain.

Both the Prime Minister and the MND have highlighted the contribution that maritime aircraft have made to the defence of Canada, as well as their contribution to operations alongside the US and other allies. The PM has stated that “deployed afloat, Sea Kings will extend the reach of a Canadian Warship, to detect, and just as importantly, to counter a variety of sea-borne threats.”<sup>35</sup>

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<sup>31</sup> DND, *Canada First Defence Strategy*, 2008. Retrieved from [http://www.forces.gc.ca/site/pri/first-premier/June18\\_0910\\_CFDS\\_english\\_low-res.pdf](http://www.forces.gc.ca/site/pri/first-premier/June18_0910_CFDS_english_low-res.pdf), page 7.

<sup>32</sup> Ibid.

<sup>33</sup> Governor General of Canada, Here for all Canadians: Stability, Prosperity, Security, Speech from the Throne, June 3, 2011. Retrieved from [http://www.speech.gc.ca/local\\_grfx/docs/sft-ddt-2011\\_e.pdf](http://www.speech.gc.ca/local_grfx/docs/sft-ddt-2011_e.pdf).

<sup>34</sup> DND, *Canada First Defence Strategy*, 2008. Retrieved from [http://www.forces.gc.ca/site/pri/first-premier/June18\\_0910\\_CFDS\\_english\\_low-res.pdf](http://www.forces.gc.ca/site/pri/first-premier/June18_0910_CFDS_english_low-res.pdf), page 17.

<sup>35</sup> Stephen Harper, Prime Minister of Canada, “PM announces a new Helicopter Hanger for the 443 Maritime Helicopter Squadron,” February 22, 2011, Sidney, British Columbia. Retrieved August 1, 2013, from <http://www.pm.gc.ca/eng/media.asp?id=4021>.

The MND highlighted the value of CAF patrol aircraft in maritime operations when he stated that, during Operation CARIBBE, the combined deployment of an RCN Vessel and RCAF maritime patrol aircraft demonstrated “Canada’s ability to provide crucial support to interdict drug trafficking alongside our US and multinational allies.”<sup>36</sup> He further highlighted the unique capabilities of the Aurora when he stated that “as a maritime nation, we rely on the Aurora’s capabilities—with its extensive range and endurance—to scan Canada’s coastline and vast swaths of ocean on their missions.”<sup>37</sup>

## **2.4 Achievement of Expected Outcomes (Effectiveness)**

This section deals with the assessment of the overall effectiveness of MAR AIR. To determine the effectiveness of the program, the evaluation team worked with stakeholders to identify program activities and associated outputs/outcomes. Performance measures were then applied to those outcomes to determine to what extent the program has been able to achieve them.

The MAR AIR program is expected to deliver these five principal outcomes:

1. To have capacity (meet expectations) for the conduct of operations—i.e., sufficient numbers of capable systems, aircraft and personnel are available to meet the needs of the program’s users.
2. To contribute to the establishment of MDA—i.e., the ability to detect, identify, monitor and track all activity within the identified area, both on and below the surface.
3. To contribute to Maritime Domain Control—i.e., the ability to project force within the identified area, both above, on and below the surface.
4. To meet DND/CAF expectations to provide support to OAT, such as search and rescue, reconnaissance, or overland sensing.
5. To contribute to the operational missions of the DND/CAF.

Information utilized in the assessments below is based upon the review of program documentation and interviews with senior leaders at the command and staff levels.

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<sup>36</sup> DND, Departmental Performance Report 2011/12: Part III – Estimates. Retrieved August 28, 2013, from [http://www.forces.gc.ca/assets/FORCES\\_Internet/docs/en/DND\\_DPR\\_percent202011-12.pdf](http://www.forces.gc.ca/assets/FORCES_Internet/docs/en/DND_DPR_percent202011-12.pdf), page 3.

<sup>37</sup> MND, Aurora’s ASLEP Delivery Ceremony, Halifax, Nova Scotia, December 9, 2011. Retrieved August 1, 2013, from [www.forces.gc.ca/site/mobil/news-nouvelles-eng.asp?id=4038](http://www.forces.gc.ca/site/mobil/news-nouvelles-eng.asp?id=4038).



## 2.4.1 Capacity to conduct Maritime Air Operations

The evaluation team utilized the following performance measures to assess this outcome:

- demonstrated ability to meet force employer<sup>38</sup> needs (e.g., sustained, follow-on) for domestic, continental and expeditionary employment;
- fleet availability and reliability;
- personnel availability and quality of experience/training; and
- effectiveness of governance structure and doctrine.

**Key Finding 4:** Throughout the past five years, MAR AIR was ready and able to conduct operations, albeit at reduced capacity.

### 2.4.1.1 Ability to meet Force Employers' needs

Within the CAF, force employers are the command organizations that call upon the RCN, Canadian Army, RCAF or Special Forces to provide equipment and personnel for the conduct of missions. Under the current structure, the force employers are CJOC and the Canadian Special Operations Forces Command (CANSOFCOM).

The principal indicators for the ability to meet force employer needs are the percentage of Requests for Effects (RFEs) that are met and the amount of Yearly Flying Rate (YFR) attributed to the force employers. Submission of an RFE is the method by which demands from the various Commands are recorded and prioritized. CRS noted from interviews and program documents that, over the last five years, most RFEs were fulfilled.<sup>39</sup> Despite Command concerns related to personnel and equipment capacity, it was evident that MAR AIR has been able to conduct operations, albeit at a deliberately reduced capacity from historical levels. Moreover, it was noted that extensive coordination was required and, anecdotally, some of those requests were adjusted to match known capacity.<sup>40</sup>

<sup>38</sup> The flying hours allocated and used are classified as either FG, for the primary purpose to develop and retain the necessary individual and collective skills sets, and Force Employment (FE), for the primary purpose of supporting a Commander in executing their own training or operational tasks. Some level of collateral FG value is gained from FE missions although no actual tracking is conducted.

<sup>39</sup> This is due to shortfalls in personnel, historical equipment serviceability and competing scheduling priorities. (Source: DND, FE Lead Planners Planning Tools; and DND, Air Component Coordination Element (Pacific) Request for Effect Log and e-mails, August & September 2013.)

<sup>40</sup> DND, Force Employment Lead Planners, Planning Tools and Air Component Coordination Element (Pacific) RFE Log and e-mails, August and September 2013.





CP-140 YFR	Allocated	Actual	Ratio (%)
CANADACOM/CJOC Continental			103
CEFCOM/CJOC Expeditionary			107
CANSOFCOM			98
Chief of Maritime Staff (CMS)			97
CLS			117
Chief of the Air Staff (CAS)			116
<b>TOTAL FE</b>			108

**Table 3. FE Yearly Flying Rate by Commands—CP-140.** This table depicts the five-year aggregate level of completeness between the initial CP-140 YFR allocations and the actual usage by the respective Commands, and the ratio between those figures.

Using another metric, CRS noted deliberate efforts and consistent successes in providing Commanders with the available YFR resources allocated in the original plans (see Table 3). Qualitatively however, in interviews with supported Commanders and staff, some acknowledged that the limited FE flying hours were not always available at the required time to achieve the best effect due to conflicting priorities or assets not being serviceable. Again, due to known ||||| aircraft constraints, the FE capacity was deliberately constrained at the planning stage, imposing careful selection of missions and continuous coordination.<sup>41</sup>

**Key Finding 5:** Reduced ||||| availability of maritime aircraft presents significant risks to equipment readiness, ||||| was required.

#### 2.4.1.2 Fleet Availability

The required readiness levels are issued in the annual Chief of Defence Staff (CDS) Readiness Posture Directives; resources are assigned in the Total Air Resource Management (TARM); and standards are promulgated by the chain of command in various publications. Based upon this information, the evaluation assessed the capacity of the program to meet fleet requirements for the three respective fleets of CF-188, CH-124 and CP-140 aircraft.

**CF-188 Fighter Fleet.** The current task for the RCAF is to maintain a small number of CF-188 aircraft on very short notice, primarily for air defence duties in support of the North American Aerospace Defense Command (NORAD). In addition, it maintains a High-Readiness Sqn-sized deployable element to conduct air-to-air and air-to-surface

<sup>41</sup> DND, Total Air Resource Management (TARM), FY 2008/09 to 2012/13 editions, CP-140 and CH-124, Table 3, Constraints and Notes.





operations in a coalition operations construct. While TARM specifies a small number of hours dedicated to CMS/RCN, CRS found limited evidence of YFR usage for that purpose. Interviews indicated that it has been exercised on occasion, primarily in Defensive and Offensive Counter-Air scenarios. The RCN adversarial offensive air training requirement was met principally by the contracted Canadian Air Training System, which did not form part of this evaluation.

**CH-124 Sea King Fleet.** For the last fifty years, the RCN fleet has been designed to embark robust, all-weather maritime helicopters, which are considered an organic asset. Acting as an extension of the ships' sensors and weapons' delivery, it is capable of autonomous action.

The current FE task for the CH-124 fleet is to provide six HELAIRDETs at various degrees of readiness for employment at home and abroad, as well as for conducting the necessary FG activities to support the overall capability. Of note, all time spent aboard a RCN ship is considered FE.

Although the current number of six HELAIRDETs is lower than either the historical level of fourteen Sea King HELAIRDETs, or the planned steady-state requirements of ||||| new HELAIRDETs,<sup>42,43</sup> the Sea Kings' availability was sufficient to meet the reduced TARM demands during this transition period.

While the Sea King fleet has been able to nominally support the minimal required number of HELAIRDETs, a major concern is that a significant proportion of missions are being aborted for technical reasons (see Figure 1).<sup>44</sup> While the helicopters were eventually able to launch and complete most assigned missions, they often did so in a less than optimum timeframe. Current mission effectiveness aboard ships is thereby significantly limited, and further slippage of the MHP could directly increase risk to program equipment and |||||

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<sup>42</sup> The anticipated ||| Cyclone HELAIRDETs (with ||| helicopters aboard ships) would, in theory, suffice to support the Guided Missile Destroyers, Helicopter Carrying Frigates and replenishment vessels and, eventual Full Operating Capability when the Canadian Surface Combatant and Joint Support Ship fleets are in service. The ||| Cyclone would also provide for FG ashore and Scheduled Maintenance. (Source: DND, MHP Senior Review Board Number 6 Presentation, May 31, 2006, page 6. Retrieved September 5, 2013, from [http://otg-vcd-webs018.ottawa-hull.mil.ca/CID/Project-Home\\_e.asp](http://otg-vcd-webs018.ottawa-hull.mil.ca/CID/Project-Home_e.asp); and DND, 12 Wing OIWG, Records of Discussion, April 20, 2010, paragraph 5.

<sup>43</sup> DND, 12 Wing, OIWG Meeting Record of Discussion, April 20, 2010, paragraph 5.

<sup>44</sup> DND, Director General Aerospace Equipment Program Management (DGAEPM), Serviceability and Availability data for a 28-month period ending February 2013. E-mail queries were made in September and October 2013.



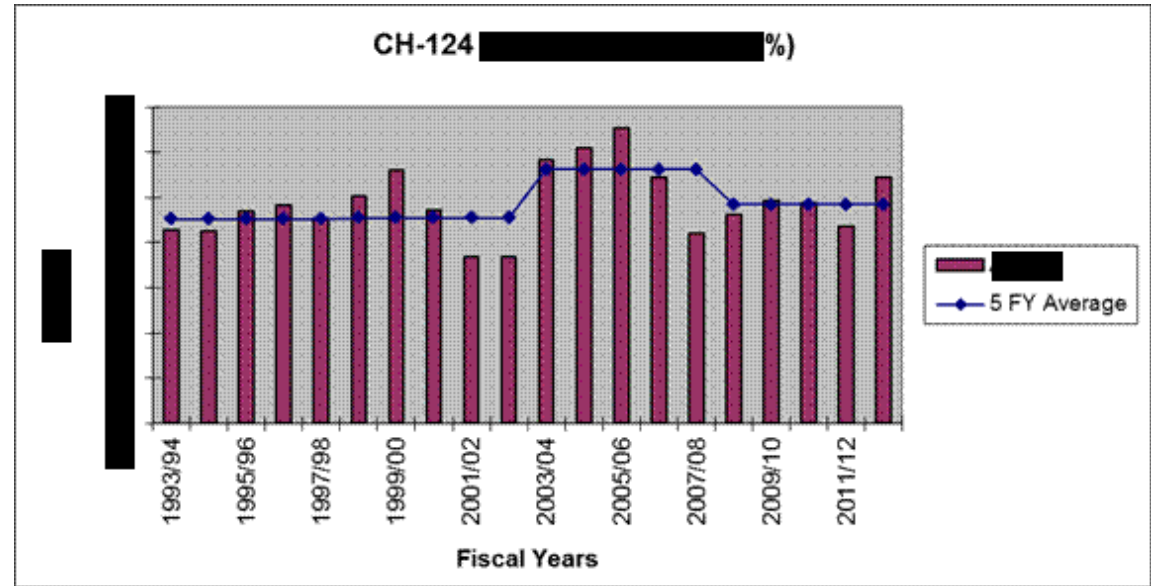


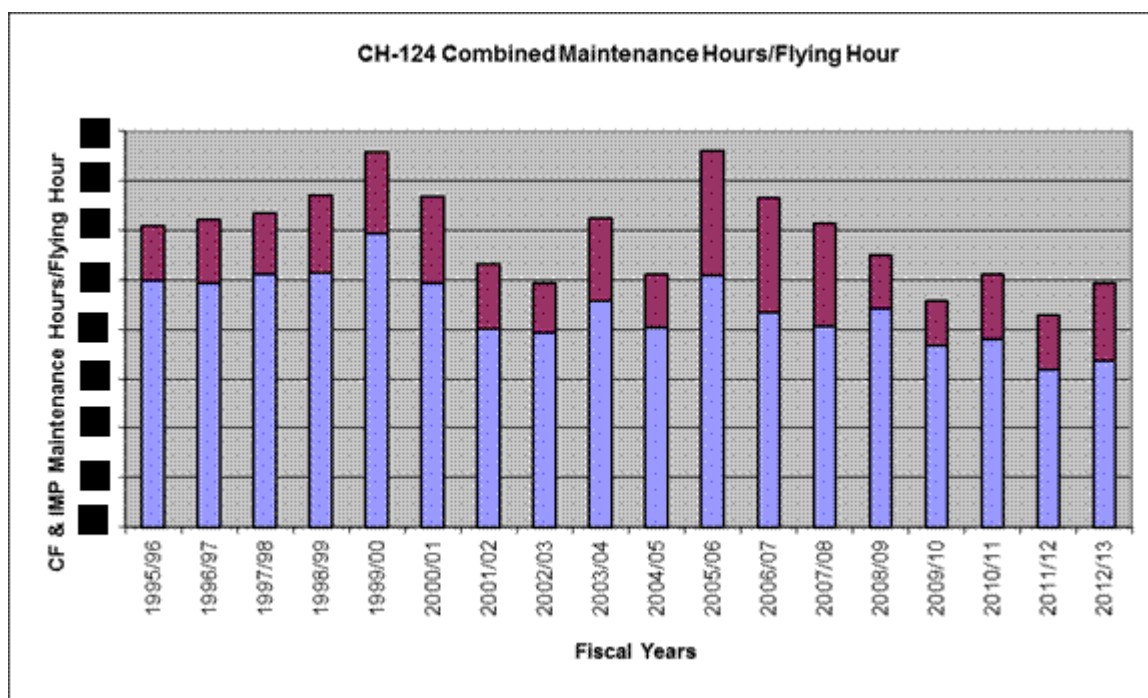
Figure 1. ██████████

FY	██████	5-FY Average
1993/94	████	████
1994/95	████	████
1995/96	████	████
1996/97	████	████
1997/98	████	████
1998/99	████	████
1999/2000	████	████
2000/01	████	████
2001/02	████	████
2002/03	████	████
2003/04	████	████
2004/05	████	████
2005/06	████	████
2006/07	████	████
2007/08	████	████
2008/09	████	████
2009/10	████	████
2010/11	████	████
2011/12	████	████
2012/13	████	████

Table 4. ██████████

In anticipation of the impending CH-124 retirement, changes to the maintenance plan brought a reduction in the workload per flying hour (Figure 2).<sup>45</sup> However, this rationalized maintenance regime was intended as a pre-retirement economy step pending the scheduled arrival of the CH-148. Given recurring MHP project delays since, the Estimated Life Expectancy (ELE) of the CH-124 is being re-assessed, and the potential equipment readiness risks due to sustainability issues will likely be higher.<sup>46</sup>

Another noted issue concerns Helicopter Decks. From interviews and review of program documents, the ongoing Halifax Class Modernization project (HCM) requires the conversion of the flight deck, hangar and other flight department areas to accommodate the Cyclone Maritime Helicopter (CH-148). Such conversion then prevents the embarkation of the Sea King. Given MHP schedule slippage, some frigates have had to be re-modified to accommodate the Sea King in order to allow for upcoming deployments. As a mitigation strategy, a partial fit was introduced for follow-on frigates to allow Sea King sustained operations, pending the arrival of MHP. This schedule issue impacts the ability to generate MH crews,<sup>47</sup> and constrains the RCN ships' HCM project-and-deployment schedule.<sup>48,49</sup>



**Figure 2. Eighteen-Year Trend in Maintenance Hours per Flying Hours' Effort—CH-124 Sea King.** This chart depicts the 18-year trend in maintenance hours for each hour flown for the CH-124, highlighting a reduction over the last five years. The data is summarized in Table 5.

<sup>45</sup> DND, Program Data, CH-124 Weapon System Manager Maintenance tables, FY 1995/96 to 2012/13, August 29, 2013.

<sup>46</sup> DND, DGAEPM, October 2013.

<sup>47</sup> Upgrading an MH pilot to aircraft captain status requires compulsory time at sea. (Source: DND, 1 Canadian Air Division, MH Training Directives, page 19, paragraph 2. Retrieved from: [http://winnipeg.mil.ca/cms/Libraries/A3\\_MAR\\_MH\\_1/Maritime\\_Helicopter\\_Combat\\_Training\\_Directive\\_change\\_1-Sep10.sflb.ashx](http://winnipeg.mil.ca/cms/Libraries/A3_MAR_MH_1/Maritime_Helicopter_Combat_Training_Directive_change_1-Sep10.sflb.ashx) Change\_One\_of\_the\_Maritime\_Helicopter\_Combat\_Training\_Directive\_-\_30\_Sept\_2010.sflb.ashx.

<sup>48</sup> DND, 12 Wing, OIWG Records of Discussion, para. 15, April 26, 2012.

<sup>49</sup> DND, 12 Wing, OIWG Records of Discussion, para. 17, September 13, 2012.

FY	CAF Maintenance Hours/YFR	IMP Maintenance Hours/YFR
1995/96		5.51
1996/97		6.39
1997/98		6.18
1998/99		7.84
1999/2000		8.18
2000/01		8.77
2001/02		6.60
2002/03		5.03
2003/04		8.41
2004/05		5.46
2005/06		12.57
2006/07		11.53
2007/08		10.42
2008/09		5.41
2009/10		4.50
2010/11		6.61
2011/12		5.57
2012/13		7.79

**Table 5. Nineteen-Year Trend in Maintenance Hours per Flying Hours’ Effort—CH-124 Sea King.**  
This table depicts the annual maintenance rate, carried out by the Incremental Modernization Project (IMP), resulting from technical issues for the CH-124.

### CRS Recommendation

1. Given the force-multiplier value of organic shipborne helicopters, completion of the MHP should remain a top priority for the Department.

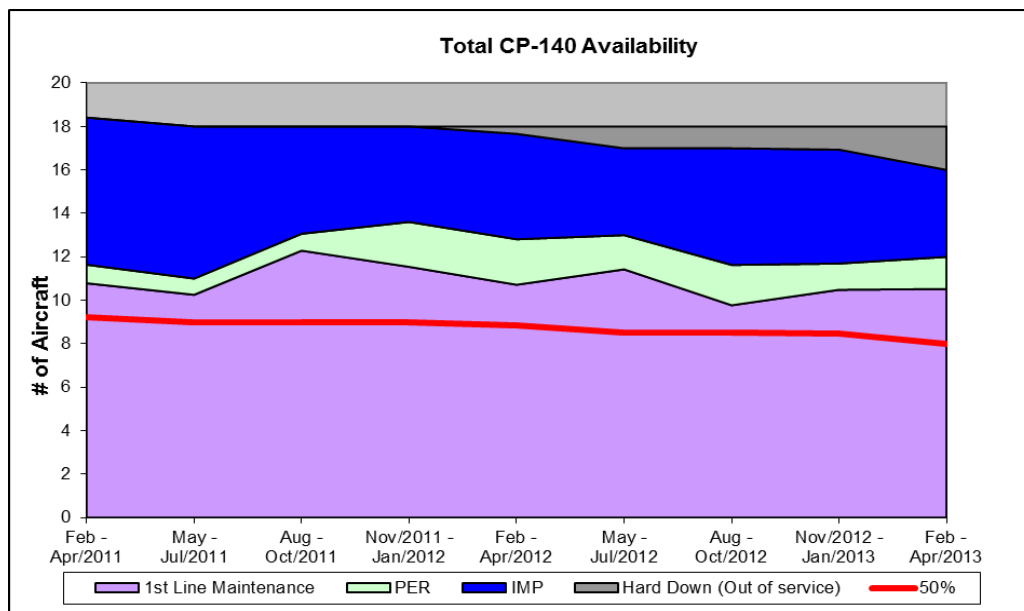
**OPI:** RCAF

**CP-140 Aurora LRPA Fleet.** The current task for the CP-140 fleet is to maintain one aircraft per coast ready on short notice on a 24-hours/7-days-per-week basis. Given a longer notice, an additional number of aircraft are to be ready to deploy overseas (Classified). Finally, the fleet has to be able to conduct the necessary activities to support the overall capability required to support MDA and control needs.<sup>50</sup>

To meet these overall needs, the required standard stated by the RCAF is to have 50 percent of the overall fleet availability to conduct the FG and FE tasks.<sup>51</sup> CRS learned from program documents and interviews with senior leaders and operational personnel that the operational availability of maritime aircraft has remained near or at that threshold (Figure 3) over the evaluation period.

<sup>50</sup> DND, CAS/RCAF, TARM, FY 2008/09 to 2012/13 (respective yearly edition).

<sup>51</sup> DND, 14 Wing, CP-140 Fleet Maintenance Statistics, February 2011 to April 2013.



**Figure 3. Fleet Availability—CP-140.** This chart depicts the average number of CP-140 aircraft available during the February 2011 to April 2013 period. The data is summarized in Table 6.

Dates	1st Line Total	PER Total	IMP	Hard Down	50%
<b>February – April 2011</b>	10.8	0.9	6.8	0.0	9.2
<b>May – July 2011</b>	10.3	0.7	7.0	0.0	9.0
<b>August – October 2011</b>	12.3	0.8	4.9	0.0	9.0
<b>November 2011 – January 2012</b>	11.5	2.1	4.4	0.0	9.0
<b>February – April 2012</b>	10.7	2.1	4.9	0.3	8.8
<b>May – July 2012</b>	11.4	1.6	4.0	1.0	8.5
<b>August – October 2012</b>	9.8	1.9	5.4	1.0	8.5
<b>November 2012 – January 2013</b>	10.5	1.2	5.2	1.1	8.5
<b>February – April 2013</b>	10.5	1.5	4.0	2.0	8.0

**Table 6. Fleet Availability—CP-140.** This table depicts the average number of CP-140 available for the period. It includes those that are in first line maintenance, periodic maintenance (PER), in the IMP, and “hard down” (or out-of-service). The table also depicts the 50 percent standard specified by the RCAF.

A trend of diminishing serviceability has also been observed since 2006.<sup>52</sup> Evidence of a reduced capacity was identified in the RCAF’s TARM across the evaluation period by indicating reduced readiness posture and sustained capacity.<sup>53</sup> In particular, an examination of the fleet assignments shows that on the east-coast this standard is rarely met, while on the west coast it is only met approximately half the time (see figure 4). Mar Air operational serviceability has been negatively impacted by challenges in providing spares (availability and timely access),<sup>54</sup> limited contractor support, finite limit of

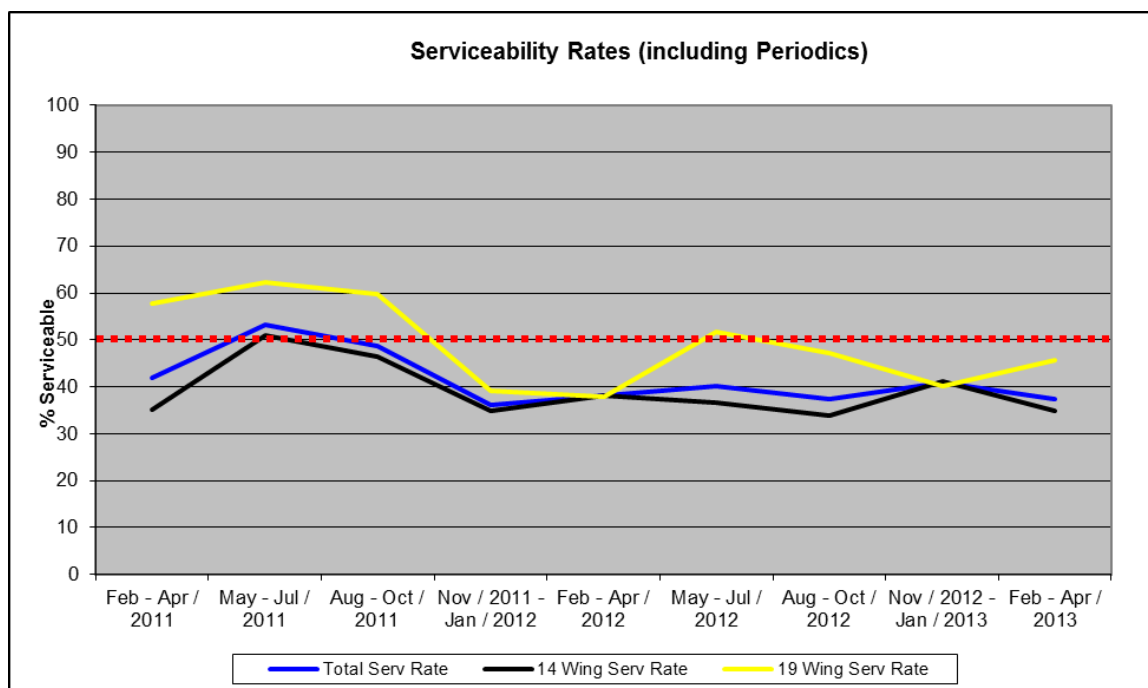
<sup>52</sup> DND, DGAEPM CP-140 Fleet Statistics, received August and September 2013.

<sup>53</sup> DND, CAS/RCAF, TARM, FY 2008/09 to 2012/13 (respective yearly edition).

<sup>54</sup> DND, DGAEPM High Priority Requests Statistics, received August 2013.

overhauling existing repairable components, limited stockpile of equipment specific to MAR AIR (e.g., mission avionics)<sup>55</sup> and periodic maintenance of an ageing fleet. In fact, the average maintenance per flight hour has increased by 50 percent over the last 20 years (see Figure 5).

In spite of an overall reduction in scheduled missions, technical unavailability and mission aborts still averaged 23 percent over the last five years (see Figure 6); the overall availability is further reduced when considering the number of aircraft undergoing Aurora Incremental Modernization Project (AIMP) and ASLEP project modifications. This lack of available aircraft does impact the ability of the fleet to meet FE demands. While the target for FE requests is generally being met (see 2.4.1.1), the high number of aborts means that the completion of assigned missions can at times be delayed by as much as a day.

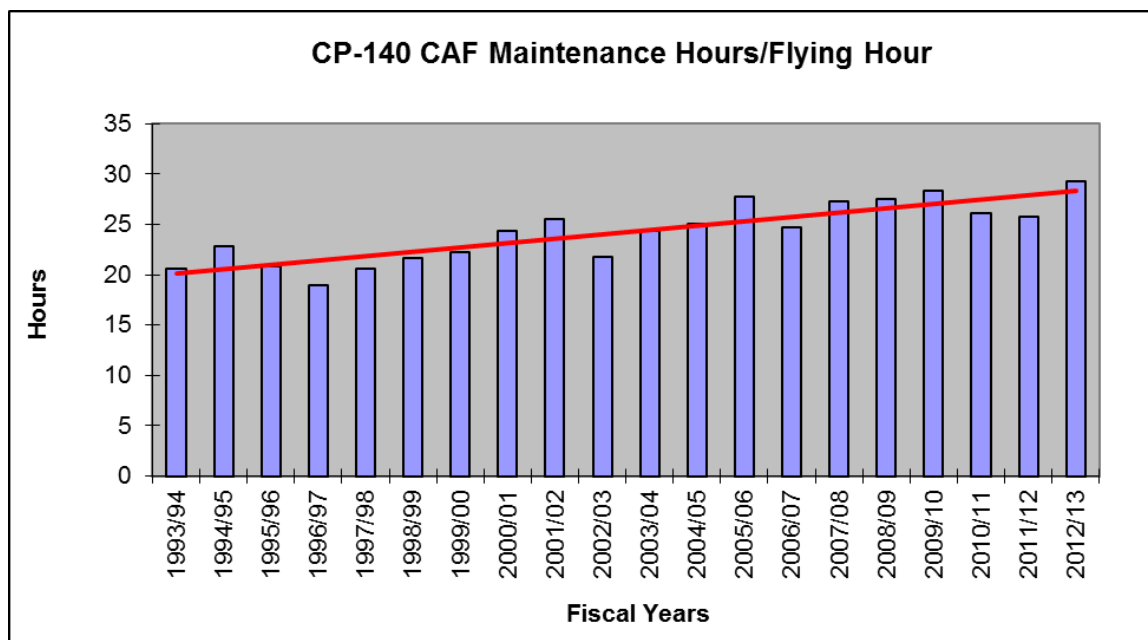


**Figure 4. Fleet Serviceability—CP-140.** This figure shows the required standard of 50 percent of aircraft to be available and the actual figures. The black line represents the CP-140s based in Greenwood, the yellow line represents those in Comox, while the blue line is the CP-140 fleet's total. The data is summarized in Table 7.

<sup>55</sup> DND, DGAEP, CH-124 and CP-140 Weapons System Manager, e-mail queries on technical supportabilities issues, September 2013.

Dates	Overall Serviceability Rate (+PER)	Serviceability Rate 14 Wing (+PER)	Serviceability Rate 19 Wing (+PER)
February – April 2011	42	35	58
May – July 2011	53	51	62
August – October 2011	49	46	60
November 2011 – January 2012	36	35	39
February – April 2012	38	38	38
May – July 2012	40	37	52
August – October 2012	37	34	47
November 2012 – January 2013	41	41	40
February – April 2013	37	35	46

**Table 7. Fleet Serviceability—CP-140.** This table presents, in percentages, the figures for the serviceability rate of the CP-140, including PER.

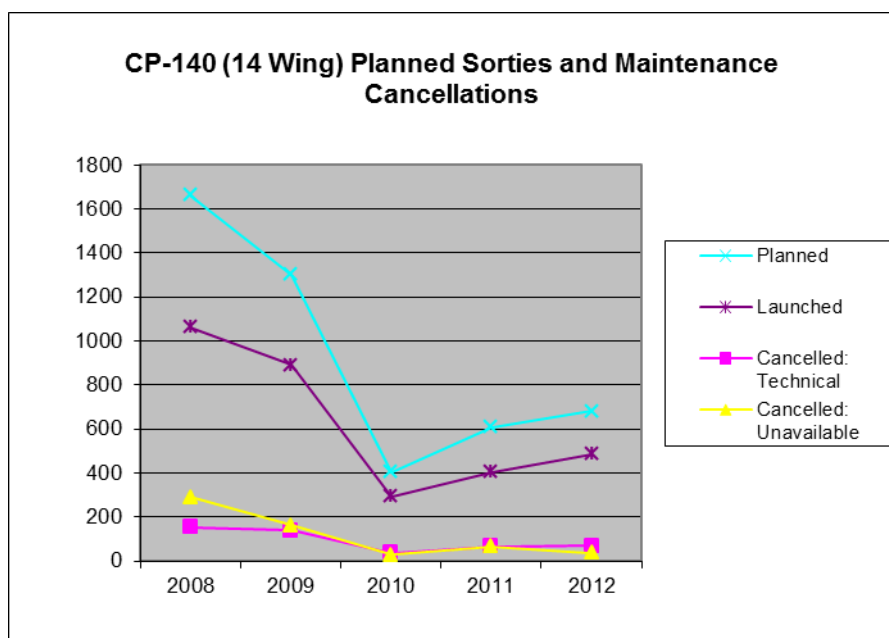


**Figure 5. Twenty-year trend of CP-140 Maintenance Hours per Flying Hours.** This figure shows the number of maintenance hours required for the CP-140 per hour flown. The trend is an increase from slightly more than 20 to just under 30 hours over the 20-year period. The data is summarized in Table 8.



Fiscal Year	Maintenance Hours per Flying Hour
1993/94	20.6
1994/95	22.8
1995/96	20.8
1996/97	18.9
1997/98	20.6
1998/99	21.7
1999/2000	22.2
2000/01	24.3
2001/02	25.5
2002/03	21.8
2003/04	24.3
2004/05	25
2005/06	27.7
2006/07	24.7
2007/08	27.3
2008/09	27.5
2009/10	28.3
2010/11	26.1
2011/12	25.7
2012/13	29.3

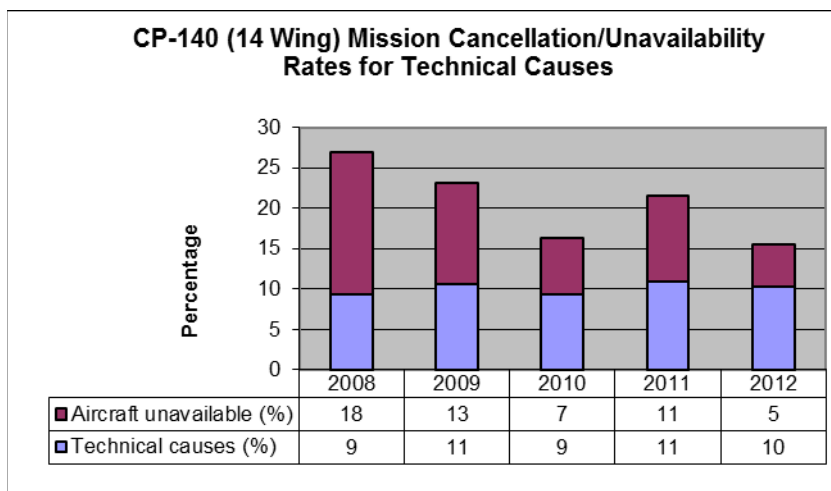
**Table 8. Twenty-Year Trend of CP-140 Maintenance Hours per Flying Hour.** This table lists the number of maintenance hours required for the CP-140 for every hour flown.



**Figure 6. CP-140 (14 Wing) Planned Sorties and Maintenance Cancellations.** This figure shows the overall reduction in the number of sorties over the period at issue. The data is summarized in Table 9.

CP-140 (14 Wing) Sorties	2008	2009	2010	2011	2012
<b>Planned</b>	1,663	1,302	404	607	681
<b>Launched</b>	1,064	890	295	405	485
<b>Cancelled: Technical causes</b>	155	139	38	66	70
<b>Cancelled: Aircraft unavailable</b>	292	164	28	65	36

**Table 9. CP-140 (14 Wing) Planned Sorties and Maintenance Cancellations.** This table lists the number of planned, launched, and cancelled sorties.



**Figure 7. CP-140 (14 Wing) Mission Cancellations for Technical Causes.** This figure shows the percentage of technical cancellations over the period. The data is summarized in Table 10.

Cancellations	2008	2009	2010	2011	2012
Technical causes	9	11	9	11	10
Aircraft unavailable	18	13	7	11	5
Total	27	23	16	22	16

**Table 10. CP-140 (14 Wing) Mission Cancellations for Technical Causes, by Percentages.** This table shows the percentages of technical cancellations over the relevant period.

Concerning the CP-140 upgrade, given that an average of five CP-140s are undergoing upgrades at any given time, a cancellation has a higher relative impact on this reduced pool of aircraft. The size of the available CP-140 fleet of aircraft used for MAR AIR was identified by senior leaders and program reports as a significant risk to readiness, particularly |

56

Given the current levels of operational availability of the Aurora LRPA fleet, and, in spite of the expected results of the AIMP and ASLEP projects, the RCAF has established that the resulting upgraded/modernized Aurora reduced fleet would not meet operational

<sup>56</sup> DND, CAS/RCAF, Total Air Resource Management (TARM), FY 2008/09 to 2012/13.

requirements nor allow sufficient leeway to procure the next generation of aircraft.<sup>57</sup> While the new Block III provides significantly enhanced sensor capabilities, it will still fly with the older propulsion and electrical generation systems. Thus, the associated maintenance and reliability issues will thereby remain. Overall mission effectiveness experienced with the current fleet size during the conversion is an indicator of what should be expected with the smaller fleet of 10 aircraft. The reduced fleet availability would directly increase the risk to equipment and to |||||

**Key Finding 6:** RADARSAT 2 and contracted air services have increasingly compensated for the reduced availability of the CP-140 in the conduct of surface MDA.

**RADARSAT 2.** From review of program documents and interviews with senior leaders and senior project cadre, the constant availability and high reliability of RADARSAT 2 allowed for frequent overflight across all of Canada’s maritime approaches. Its flexibility, excellent target resolution, and ability to detect at day or night, unimpeded by inclement weather, allowed for an improved detection rate of surface contacts. Whenever a more positive identification was deemed required, satellite information was used to cue other platforms.

**Contracted Air Services.** From review of program documents and interviews with senior leaders and staff, CRS found that, where feasible in the conduct of domestic operations, the CP-140 availability shortfalls were satisfactorily offset by increasing reliance on contracted air services (see Table 11 and Figure 9).<sup>58</sup> The contracted air services are made available by a collaborative arrangement with OGDs, which allows for further effective sharing of most information (this is discussed later in this report). The nature of the equipment suite used, and the high availability and responsiveness to surge, have allowed Commanders to maintain a satisfactory Recognized Maritime Picture and to build the Common Operating Picture within the available range of the contracted aircraft, namely, over the respective inshore areas (out to 200 nautical miles) of Canada’s east and west coasts.<sup>59</sup>

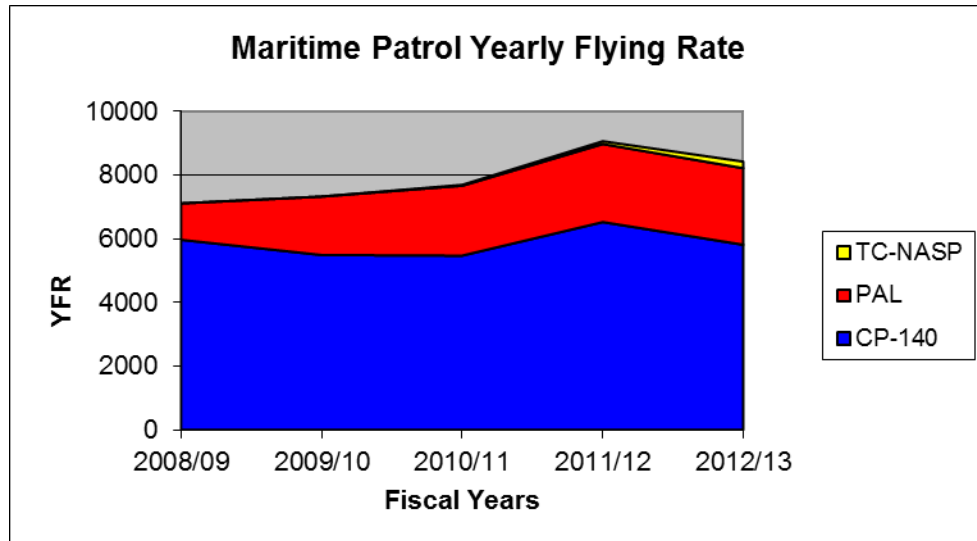
Yearly Hours Flown	2008/09	2009/10	2010/11	2011/12	2012/13
CP-140	5,970	5,493	5,474	6,527	5,816
Contracted Services	1,142	1,835	2,221	2,536	2,607
<b>Totals</b>	<b>7,112</b>	<b>7,327</b>	<b>7,694</b>	<b>9,062</b>	<b>8,423</b>
Ratio (in percentages)					
DND	84	75	71	72	69
Contracted Services	16	25	29	28	31

**Table 11. Comparison of CP-140 and Contracted YFR.** This table depicts the CP-140 entire YFR (i.e., FE and FG) per fiscal year, and the corresponding growth in FE usage of contracted services.

<sup>57</sup> DND Director Operational Research Maritime, Land, Air (DOR-MLA) Research Note 2003/02, Paper, April 2003; and 3554-1 (DRDC CORA), Analysis of fleet size requirement for the CP-140 AURORA Modernization, October 11, 2012; and DND, 3000-3 (DAR 3), Briefing Note for CAS, Minimum Fleet Size Requirement to Support Aurora ELE Extension, October 15, 2012.

<sup>58</sup> DND, Canada Command/CJOC, Annual YFR Allocation letters (multiple years); and DND, Staff Air Plans and Operations- J3 YFR Tracking Logs, September 2013.

<sup>59</sup> DND, Canada Command/CJOC, Semi-Annual Presence and Surveillance Reports (multiple years).



**Figure 8. Comparison of CP-140 and Contracted YFR.** This graph depicts the CP-140 YFR and the corresponding growth in usage of Contracted Services. Note that the CP-140 YFR data shows both FE and FGs. The data is summarized in Table 12.

FY	2008/09	2009/10	2010/11	2011/12	2012/13
CP-140	5,969.8	5,492.5	5,473.5	6,526.6	5,815.7
PAL	1,142.2	1,834.6	2,194.4	2,449.2	2,402.1
TC-NASP	0	0	26.2	86.5	205.3

**Table 12. Comparison of CP-140 and Contracted YFR.** This table lists the YFR by fiscal year for the CP-140 and PAL and TC-NASP contracted services.

**Key Finding 7:** Protracted implementation schedules of major capital projects for MH and LRPA assets have exacerbated challenges to personnel readiness.

As a result of capital procurement projects to replace the CH-124 Sea King helicopters and fleet modification upgrades of the CP-140 LRPA, namely the AIMP and the ASLEP, the CAF's capacity to deliver MAR AIR is currently challenged by a significant transition period.<sup>60</sup>

#### 2.4.1.3 Personnel Availability and Quality of Experience/Training

||||| since before 2008,<sup>61</sup> and have been addressed by varying degrees of risk management (i.e., mitigation or acceptance),<sup>62,63,64</sup> but delays in transitions have exacerbated these challenges.<sup>65</sup>

<sup>60</sup> DND, CAS, 1948-2 (Director Air Comptrollership Business Management), July 16, 2012, RCAF FY 2012/13 Program Assessment, page 3.

<sup>61</sup> The Strategic Assessment indicates the challenges in providing ||||| (Source: DND, CAS, Level One Strategic Assessment, FY 2006/07, paragraph 14 and 34.)

<sup>62</sup> DND, CAS, Strategic Risk Registers, 2005 v3; 2007; 2011/12; 2012/13.

Interviews and review of program documents have indicated that teams of air and ground crew—[REDACTED]—have been temporarily assigned to work up training for the new aircraft (e.g., Block III Auroras, CH-148).<sup>66</sup> This has left [REDACTED] [REDACTED], to address daily operational requirements.<sup>67</sup> Interviewees indicated that [REDACTED] has been further impacted by reduced tour lengths to expedite personnel training, in order to address [REDACTED] and trainer requirements.<sup>68</sup> Overall, there is evidence that a [REDACTED] opportunities is compounded by a diversion of [REDACTED] the protracted transition program, and this has posed risks to the readiness of MAR AIR [REDACTED] effectiveness in successfully conducting maritime operations, particularly those of a [REDACTED]

**Key Finding 8:** [REDACTED] may present growing risks to [REDACTED]

With respect to [REDACTED], although empirical evidence of readiness<sup>69</sup> nominally stated that the RCAF was able to complete all assigned tasks, interviews with senior leaders and program documents indicated that [REDACTED] of MAR AIR [REDACTED] skills were of significant concern.<sup>70</sup> Furthermore, the nature of the assigned tasks over the evaluation period did not match all of the capabilities that this program is expected to be able to deliver.

This is most acutely felt in development and retention of [REDACTED], that are arguably the more demanding, and which allow all other tasks to be carried out.<sup>71</sup> Compounding this situation is reductions in tour length [REDACTED] [REDACTED] — [REDACTED] — which is not only a poor return on investment, but also [REDACTED] [REDACTED]<sup>72</sup> Overall, competing operational tasks, lowered flying rate, smaller unit establishment, [REDACTED] [REDACTED] that have been steadily reduced over the last 20 years (see Figure 9), mean that crews are taking longer to reach the [REDACTED]

<sup>63</sup> DND, CAS, Level One Strategic Assessment FY 2006/07, November 14, 2005, Table 1 – AIRCOM Risk Severity Map for FY 2006/07.

<sup>64</sup> DND, RCAF, 1948-2 (Director Air Comptroller and Business Management), July 16, 2012, FY 2012/13 Program Assessment, Section 3.

<sup>65</sup> DND, CAS, 1948-2 (Director Air Comptroller and Business Management) RCAF FY 2012/13 Program Assessment, July 16, 2012; "From the Commander: Status of Capabilities," July 6, 2013. Retrieved from [http://winnipeg.mil.ca/cms/Libraries/FromTheCommander/Status\\_of\\_Capabilities.sflb.ashx](http://winnipeg.mil.ca/cms/Libraries/FromTheCommander/Status_of_Capabilities.sflb.ashx); and 3000-3 (Director Aerospace Requirements, or DAR 3), Trerice, Major R., and Whalen, Major J., Service Paper for Minimum CP-140 Fleet Size, Briefing Note for CAS, October 15, 2012, page 3, paragraph 10.

<sup>66</sup> DND, CAS/RCAF, TARM, FY 2008/09 to 2012/13.

<sup>67</sup> DND, CAS, From the Commander: Status of Capabilities, Level One Strategic Assessment FY 2006/07, November 14, 2005. Retrieved July 6, 2013 from [http://winnipeg.mil.ca/cms/Libraries/FromTheCommander/Status\\_of\\_Capabilities.sflb.ashx](http://winnipeg.mil.ca/cms/Libraries/FromTheCommander/Status_of_Capabilities.sflb.ashx), page 9, paragraph 34.

<sup>68</sup> DND, CRS, Air Maintenance Evaluation Report, 2012.

<sup>69</sup> DND, Annual CDS Directive—CAF Force Posture, multiple years; and associated Strategic Joint Staff (SJS) Quarterly Reports.

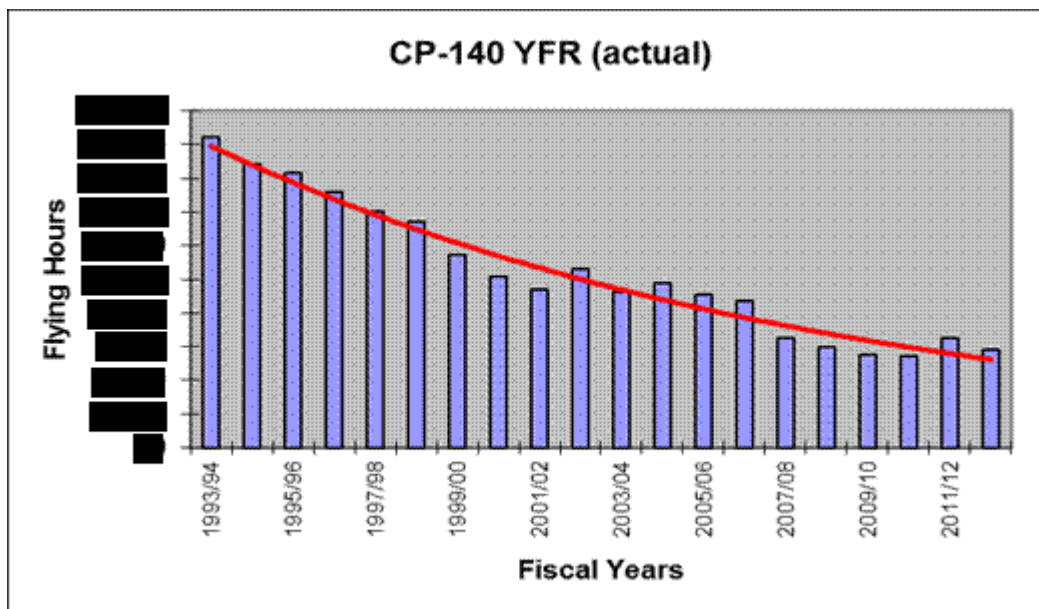
<sup>70</sup> DND, CAS, 1948-2 (D Air CBM), Level One Program Assessment FY 2011/12, November 29, 2010, pages 1-2; and 1180-1 (A3 Long-Range Patrol (LRP) Sqn), CMAAG Records of Discussion, November 5, 2010, Item 10-2-1.

<sup>71</sup> DND, CAS, 1180-1 (A3 LRP), CMAAG Records of Discussion, November 5, 2010, Item 10-2-1.

<sup>72</sup> DND, CRS, Air Force Training Evaluation Report, November 31, 2012, page 30.



In order to offset the lack of aircraft available for training, the program has strived to increase its use of simulation. Based on review of program documents,<sup>73</sup> site visits and interviews of Formation- and Unit-level leaders and instructional cadre, a significant resurgence in advanced training has been achieved in a simulation-based environment for the CP-140.<sup>74</sup> Unfortunately, the Sea King community is essentially awaiting the arrival of the new replacement MHP training suite. Senior leaders commented that the flight simulators' significant value still needs to be complemented with live, complex exercises. More details about the contribution of simulators are available in the Economy and Efficiency section of this report.



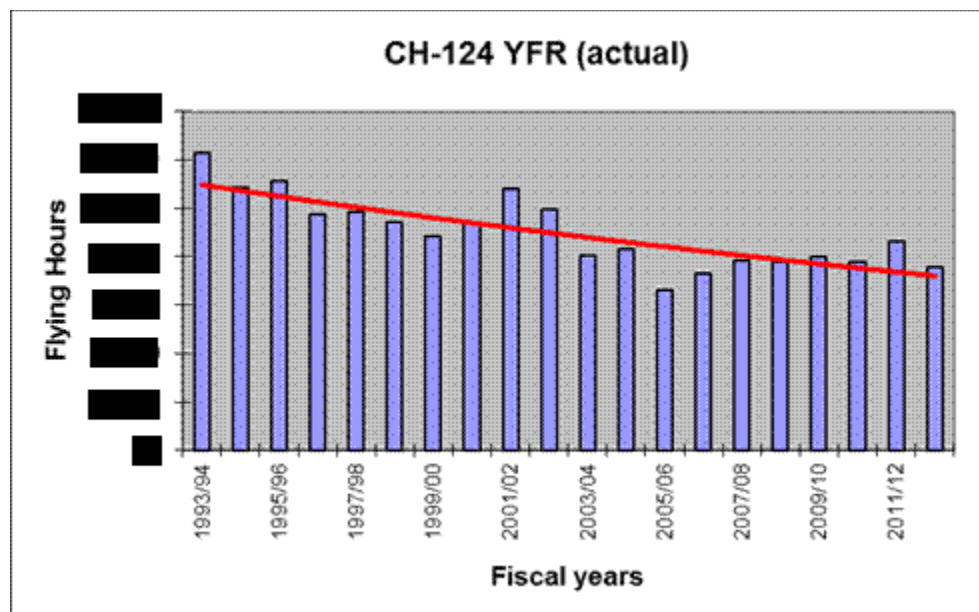
**Figure 9. Ten-Year YFR—CP-140.** This chart depicts the decreasing trend in YFR for the CP-140. The data is summarized in Table 13.

<sup>73</sup> GC, RARM-CH-124-2008-007, December 2, 2008.

<sup>74</sup> DND, RCAF, 14 Wing, 404 Sqn CRS Briefing Package, April 30, 2013.

FY	CP-140 YFR
1993/94	
1994/95	
1995/96	
1996/97	
1997/98	
1998/99	
1999/00	
2000/01	
2001/02	
2002/03	
2003/04	
2004/05	
2005/06	
2006/07	
2007/08	
2008/09	
2009/10	
2010/11	
2011/12	
2012/13	

**Table 13. Ten-Year YFR—CP-140.** This table shows the decreasing trend in YFR for the CP-140.



**Figure 10. Twenty-Year YFR—CH-124.** This chart depicts the decreasing trend in YFR for the CH-124. The data is summarized in Table 14.



Fiscal Year	CH-124 YFR
1993/94	
1994/95	
1995/96	
1996/97	
1997/98	
1998/99	
1999/2000	
2000/01	
2001/02	
2002/03	
2003/04	
2004/05	
2005/06	
2006/07	
2007/08	
2008/09	
2009/10	
2010/11	
2011/12	
2012/13	

**Table 14. Twenty-Year YFR—CH-124.** This table shows a decrease in the YFR for the CH-124 over a 20-year period.

Other training concerns involve participation in exercises. From interviews with senior leaders, the evaluation team found that, in addition to an increasing engagement outside the maritime domain, the number of advanced MAR AIR training opportunities and exercises has been limited over the period. Over the evaluation period, senior leadership indicated that MAR AIR crews have had access to fewer sea days for the HELAIRDETs, which are an essential upgrading step to MH aircraft captain level. Also noted were the limited joint exercise opportunities with the RCN caused by ship availability. Due to scheduling coordination issues, MAR AIR crews have also not had the priority to exercise as frequently with the USN and its Coast Guard, which have traditionally been strong FG partners for the MAR AIR community in the area of domestic and continental operations. From interviews, in both MH and Maritime Patrol crews and leadership, it was learned that, over a period longer than this evaluation’s five years, there has been a dearth of training involving ||||| and a limited availability of flight decks.<sup>75</sup> This is compounded by scheduling conflicts and a decreasing availability of aircraft.

<sup>75</sup> “Key Finding 5: In order to meet readiness levels and force posture requirements, the RCN has to rely more heavily on the use of MCDVs as a result of reduced Frigate availability during the period of the HCM. This represents a |||||”  
 (Source: DND, CRS, Naval Forces Evaluation Report (Draft), November 2013, pages 21 – 24.)



From interviews with senior, formation-level and unit leaders, a symptom of the lack of attention for MAR AIR may be demonstrated by missed training opportunities for the capability.

### CRS Recommendation

2. Give increased priority to operational training events that maximize the preservation and development of perishable core skill sets, |||||

**OPI:** RCAF

**OCI:** RCN

**Key Finding 9:** Strategic governance of MAR AIR is diffuse and lacks some mechanisms to foster a collaborative delivery of Joint Maritime Effects.

### 2.4.1.4 Governance

The Chief of Air Force provides leadership for all aerospace FG at the strategic level, including activities under the MAR AIR program. Traditionally, MAR AIR (as it pertains to joint maritime operations) stemmed from a collaborative partnership between the RCN and RCAF.

Based upon a review of the command structures and interviews with senior leaders, the influence of both the MAR AIR capability within the overall command structure and the role of the RCN within it appear to have diminished. One example is the dormancy of the Navy-Air Force Interoperability Working Group (NAFIWIG), which provided an oversight and collaborative planning forum for MAR AIR. This senior-level working group was terminated in 2006 and resurrected in 2008, but has been inactive since 2010.<sup>76</sup> |||||  
|||||  
|||||

At the operational level, with the introduction of the “Wing Concept”<sup>77</sup> in the late 1990s, there was a corresponding loss of the Commander of Maritime Air Group. As such, there is currently no representative for providing a holistic and comprehensive view of air operations in the maritime domain (i.e., a MAR AIR champion). With the advent of Operational Commands in 2006, the unique bilateral RCAF-RCN relationship was changed, whereby the RCN went from being a MAR AIR partner to just one of many other customers. This has been perceived by several senior leaders as a significant cultural shift that has diluted the unity of thought on how to achieve the best effects in the maritime domain. A transactional relationship, dealing with assigned tasks became

<sup>76</sup> DND, RCN, Minutes of NAFIWIG meeting of Jun 22, 2010, 3371-3255-1 (CMS/Director Maritime Policy Operations and Readiness/RDIMS #197575), June 28, 2010.

<sup>77</sup> DND, Canadian Forces Aerospace Warfare Centre (CFAWC), Canadian Air Force Leadership and Command: Implications for the Human Dimension of Expeditionary Air Force Operations, Defence Research & Development Canada, Toronto, CR 2006-297, November 2006, pages 64 – 68.

prevalent. The value of implicit tasks was apparently being overlooked by the higher command echelons. Only those interacting on a day-to-day basis with the supported Commands were left to craft the relationship.

The RCAF opted for a forward-deployed construct of a Canadian Air Division Headquarters (1 CAD) Air Component Command Element (ACCE) positioned on each coast to liaise with the RCN. The ACCE provides an air command role locally on the coasts, as well as maritime expertise to RCAF senior leadership located in Winnipeg. This essentially results in a centralized control and decentralized execution (coastal wing/sqns) governance structure. Interviews with senior leaders indicated that the geographic separation of the ACCE from the RCAF central command, compounded with limited resident MAR AIR expertise within 1 CAD, has resulted in reduced “visibility” of the MAR AIR capability at senior decision-making levels. This is further compounded by the recent down-ranking of the ACCE (Pacific) command. Concerns were expressed by interviewees that this was a further risk to the inclusion and credibility of the ACCE and MAR AIR representation at the decision-making table, especially where senior commanders from allied nations in the Pacific region could be involved.<sup>78</sup>

At the tactical level, Wing Commanders are entrusted with the FG remit. At this level, the only significant bodies that consider development of tactical aerospace doctrine in the maritime domain are the CMAAG and the Operational Implementation Working Group (CH-148) (OIWG), which is organized for the transition to the CH-148 Cyclone.<sup>79</sup> While both groups are formally meeting twice a year, are well attended and organized, their reach appears somewhat limited in the operational and strategic arenas.

In addition, specific doctrine related to MAR AIR is sparse and, as a result, the common practice is to adopt NATO procedures.<sup>80</sup> Review of program documents indicates that this issue has been raised during CMAAG and OIWG meetings but action appears to be of a reactive nature to a pressing demand, such as the introduction of a new piece of equipment (e.g., AIS, Common Tactical Data Link), rather than being a coordinated comprehensive body of knowledge. CRS also notes that, although an implementation strategy has been established to improve the integration of Lessons Learned into doctrine and operations, the process has been repeatedly delayed.

Another concern of governance was the lack of credible performance measurement. The current structure functions on a fleet-by-fleet approach, rather than one that is program-specific.<sup>81</sup> Activity data that was available for the evaluation appeared to be used mainly

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<sup>78</sup> From a historical perspective, it is worth considering that, in the period following unification the original MAR AIR advisor had the rank equivalent of a Major General. Incidentally, one of the catalysts for the reformation of Air Command and its subordinate Maritime Air Group was the “lack of strategic oversight and leadership.” After the reformation of Air Command in 1975, a Brigadier General led Maritime Air Group and embodied the holistic view of the Maritime Air Capability. (Source: Ibid., pages 46-68.)

<sup>79</sup> 1 CAD Orders Volume 1, 1-624 refers respectively to the Air Force Strategic Governance, the Air Force Development Committee and the Capability Advisory Groups to develop their respective tactical aerospace doctrine. (Source: DND, RCAF, ACO 1000-2, 1000-10.)

<sup>80</sup> DND, RCAF, CFAWC List of Publications. Retrieved August 12, 2013, from [http://trenton.mil.ca/lodger/CFAWC/CDD/Doctrine\\_e.asp](http://trenton.mil.ca/lodger/CFAWC/CDD/Doctrine_e.asp); 1 CAD Headquarters, MH and LRP Directives, B-GA-470, LRPA Ops, retrieved from AFCCIS network; and Director General Maritime Force Development, Concept for Maritime Unmanned Systems (Draft), February 2013.

<sup>81</sup> DND, CDS Readiness Level Report & Return; and VCDS/Chief of Programme Performance Measurement Tables, multiples semi-annual returns.

at the operational and tactical levels for short-term management; data was not collected and aggregated in a consistent manner across communities and was not evidently linked to long-term planning and strategic frameworks. For instance, when leaders below the Level 2 level were presented with the CAS's performance measurement framework; many were unfamiliar with the document.

In summary, each Wing functions somewhat independently, and there is a perceived growing tendency to give consideration to MAR AIR only on a task-by-task approach, treating the stakeholder partners of the program (i.e., RCN) as clients. This diffuse priority for doctrine, performance monitoring and assessment of MAR AIR has resulted in the lack of a clear and unified strategic direction. It has been determined that MAR AIR would benefit from clearer strategic priorities specific to the capability, linked to an appropriate performance monitoring strategy where trends can be identified and acted upon.

### **CRS Recommendation**

3. To further enhance the comprehensive partnership in the development and delivery of Joint Maritime Effects, improve the governance forums and mechanisms, such as by re-instating the NAFIWG, to establish clear strategic priorities; to address interoperability issues; and to provide for a comprehensive performance monitoring strategy.<sup>82</sup>

**OPI:** RCAF

**OCI:** RCN

### **2.4.2 Intermediate Outcome: Building and Maintaining Maritime Domain Awareness**

The evaluation team utilized the following indicators to make this determination:

- contribution to building MDA; and
- extent to which awareness is reliable/complete/actionable (quality, accuracy and confidence, risk-based, useful and timely, coordinated with other sources).

**Key Finding 10:** MAR AIR has conducted surveillance activities that have contributed to building and maintaining awareness in the maritime domain to such an extent that senior level managers have expressed a growing confidence in the effectiveness of MDA.

Based upon a review of program data, the evaluation team confirmed that MAR AIR assets contribute the majority of their routine operational hours to surveillance building

<sup>82</sup> The first session of the re-established NAFIWG was held on May 13, 2014 with senior RCN and RCAF membership.

and awareness. Whether embedded as a HELAIRDET with an RCN ship, flying long-range patrols using an Aurora aircraft, provision of UAV support, contracted air services, or through space-based support (RADARSAT 2), MAR AIR assets provide key over-the-horizon surveillance and detection capabilities in the maritime domain.

Senior commanders indicated to CRS that approximately 90 percent of domain awareness in maritime regions is generated from MAR AIR assets, which represents a significant contribution to building and maintaining awareness in the maritime domain. Program documentation also forecast a strong reliance on MAR AIR assets for surveillance well into the future.<sup>83,84</sup>

The evaluation found that the utility of the MDA function has significantly improved, even during the five-year period of the review. Recent changes in methodologies and requirements with respect to using and merging information obtained from multiple partners (e.g., OGDs and Allies), and integration procedures for surveillance and intelligence, occurred during the second half of the evaluation period. As a result, the program can now contribute to a common operating picture of the maritime domain. Interviews with senior leaders and review of program data demonstrated that the probability and confidence levels of detection have increased significantly and allowed for more effective and efficient use of MAR AIR assets. For example, RADARSAT can provide the overall surveillance that in the past had to be provided by long-range patrol aircraft—a costly and intensive undertaking that would provide reduced coverage. Now those platforms are mostly only needed to verify contact/targets, and to demonstrate the presence of the CAF.<sup>85</sup> Similarly, through interviews with project staff and in review of program documentation, the prospect of RADARSAT Constellation Mission will further improve this level of confidence by increasing the number of revisits over a given area, as well as by incorporating a higher level of resolution and degree of redundancy.<sup>86</sup> It is also important to note that RADARSAT CONSTELLATION MISSION requires a robust ground infrastructure to effectively support MAR AIR Operations and deliver accurate and timely MDA. This infrastructure will be delivered under DND project Polar Epsilon 2.<sup>87</sup>

The use of Contracted Air Services also significantly reduced the need for the long-range patrol aircraft as surveillance and verification platforms, providing a reliable and economical solution. Another recent development is the Small Uninhabited Air Vehicle (SUAV). From review of program documents and interviews with senior leaders and project staff, the SUAV capability was leveraged from the Canadian Army in preparation for Operation ARTEMIS, an operational deployment. It has recently been successfully employed in ships, and the contribution of SUAV is deemed complementary to the CH-

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<sup>83</sup> DND, VCDS, Capability Based Assessment 2011/12, April 2011.

<sup>84</sup> DND, VCDS, Formation Safety and Environment 2013 (Draft version 8).

<sup>85</sup> DND, Joint Task Force Pacific, Intelligence Surveillance and Reconnaissance (ISR) and Recognized Maritime Picture Validation Briefing to Rear Admiral Greenwood Commander Regional Joint Operations Center/Operational Research, 2010; and Operation LIMPID Concept of Operations (CONOPs), retrieved from the CSNI network.

<sup>86</sup> DND, VCDS Capability Initiative Database, RADARSAT Project documentation, accessed August 2013.

<sup>87</sup> DND, Chief of Force Development letter, December 16, 2013.



124. The longer-term potential of a SUAV capability is acknowledged,<sup>88</sup> but its future and eventual acquisition in some form remains to be determined.

Overall, these improvements in surveillance procedures have resulted in greater command confidence in maintaining the recognized maritime picture and MDA. However, from a review of program documents and interviews with senior leaders and project staff, processes and tools used for fusing the information from these multiple sources in MDA are still work-intensive, often relying on manual processes. The advent of increased capabilities sensors, such as RADARSAT, CP-140 Block III and, eventually, MHP, will significantly increase the volume of data being received. Concerns were raised that a Data Management Concept of Operations had not been identified to adequately manage this increased volume, nor had the personnel and training required for this task. Moreover, this situation will apply both for domestic and international operations.<sup>89</sup> This requires a significant personnel effort to produce strategic-level monitoring data that will meet the needs of Command decision-makers. While much more reliable than ever before, this workload could present an undetermined risk of error or saturation, and increase the risks to readiness.<sup>90</sup>

#### **CRS Recommendation**

4. Given the expanded capabilities of new sensors being introduced in CP-140 Block III and MHP, develop a comprehensive concept of operations for processing the significant increase in information volume and complexity.

**OPI:** RCAF

**OCI:** CJOC

#### **CRS Recommendation**

5. Support the timely implementation of RADARSAT Constellation Mission.

**OPI:** VCDS

**OCI:** CJOC

### **2.4.3 Intermediate Outcome: Contribution of Maritime Domain Control**

The evaluation team utilized the following performance measures to make this determination:

- ability to counter Air Threats;
- ability to counter Surface Threats; and

<sup>88</sup> DND, Provision of UAV Capability to RCN High Readiness Ship, Director Naval Requirements Briefing Note to Chief of Staff ADM(Mat), July 19, 2013.

<sup>89</sup> DND, 1 Canadian Air Division, CMAAG Minutes, December 17, 2009, item 27.

<sup>90</sup> CJOC Semi-Annual Surveillance Reports, retrieved September 3, 2103, from the CSNI network.





- ability to counter Sub-surface Threats.

Data is based upon program documentation that includes Lessons Learned, briefings, program data and stakeholder interviews.

**Key Finding 11:** MAR AIR operations have contributed to control activities in the maritime domain in past and current operations. However, the planned reduction of the CP-140 fleet combined with its ||| may present |||

### 2.4.3.1 Air Threats

In interviews with subject-matter experts, the CF-188 was acknowledged as being capable of effectively providing Defensive and Offensive Counter-Air over RCN assets at sea. Due to competing priorities, the CF-188 has been exercised with RCN and allies as an asset in the maritime domain, but this has only occurred on a limited number of occasions.<sup>91</sup> Furthermore, the Evaluation found no documented specific doctrine relative to Maritime Operations.

### 2.4.3.2 Surface Threats

Traditionally, MAR AIR assets have been instrumental in Surveillance and Presence-type activities (surface and sub-surface) that contribute to the control spectrum in the maritime domain. Program data highlighted that MAR AIR assets have been effective in Surveillance and Presence operations in support of maritime-based missions,<sup>92</sup> including the monitoring and interception of vessels smuggling illegal migrants.<sup>93</sup> Weekly briefings to the respective Commanders and semi-annual reports to CJOC<sup>94</sup> reviewed by the evaluation team further demonstrated the significant extent of the contribution of MAR AIR operations to Presence and Surveillance.

Some limitations were, however, noted. The Aurora and Sea King are not equipped with surface-effects ordnance, and the CF-188 is limited to its internal cannon and precision guided munitions optimized for stationary targets (which do not present stand-off capabilities to a potential target). Therefore, the feasibility to effect control in the maritime domain by imposing up to lethal force against surface vessels is limited, and must rely upon the cueing of naval platforms for possible boarding or application of force.

<sup>91</sup> DND, RCAF, CFAWC Doctrine. Retrieved November 18, 2013, from [http://trenton.mil.ca/lodger/CFAWC/Council for Defence Diversity/Doctrine\\_e.asp](http://trenton.mil.ca/lodger/CFAWC/Council%20for%20Defence%20Diversity/Doctrine_e.asp); and RCAF Doctrine, retrieved from the CSNI network.

<sup>92</sup> Operation LIMPID, Operation LEVIATHAN, Operation SEA LION, Operation QIMMIQ.

<sup>93</sup> Operation POSEIDON.

<sup>94</sup> DND, Capability Based Planning 2011/12; and Joint Task Force Pacific and Joint Task Force Pacific Atlantic Quarterly Surveillance Reports to CJOC, retrieved from the CSNI network.



### 2.4.3.3 Sub-surface Threats

As the ||||| of supporting prosecution-type control in the sub-surface maritime domain, MAR AIR operations are instrumental in sub-surface interdiction. Examples of contributions made by MAR AIR operations to sub-surface prosecution is limited for the evaluation period as the CAF has not engaged in significant sub-surface interdictions since the end of the Cold War.

However, MAR AIR operations have demonstrated the capability to contribute to control in the sub-surface domain during exercises conducted recently during bi-annual RIMPAC, Semi-annual Task Group Exercises and EX TRIDENT FURY (with NATO in United Kingdom waters), and Ex PROUD MANTA as well as during combined training with the USN. Interviews with senior commanders and reviews of after-action report documents<sup>95</sup> indicate guarded confidence in the MAR AIR ability to contribute positively to control the maritime domain. As discussed previously, they voiced concerns about the ability of MAR AIR to sustain a more protracted operation, such as that required to support |||||

For example, while the cueing from satellite<sup>96</sup> and increased usage of contracted air services<sup>97</sup> help to offset some deficiencies in surface operations, these platforms are |||||  
||||| provided by the LRPA and MH. Operationally, control in the maritime domain would also require continuous coverage, either by air or sea, and thus require the availability of several aircraft. The concerns regarding the operational availability of the Aurora and Sea Kings discussed previously in this report may have a significant impact on the capacity of MAR AIR assets to deliver sustained maritime control support. As a result, should a scenario require a sustained surveillance presence by MAR AIR assets, these limited aircraft numbers and availability may lead to increased reliance on an already limited number of available RCN vessels.<sup>98</sup> In addition, some of the RCN ships are ill-suited for such tasks (e.g., Maritime Coastal Defence Vessel (MCDV) as Ready Duty Ship) or are handicapped (e.g., Helicopter Frigates without a HELAIRDET). Ultimately, resorting to increased reliance on allies might be warranted, although this may present potential sovereignty concerns.

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<sup>95</sup> Operation SCYLLA.

<sup>96</sup> DND, Canada Command/CJOC, Semi-Annual Presence and Surveillance Reports.

<sup>97</sup> DND, Canada Command/CJOC Joint Staff Operations Survey, queries responses and program data, August – November 2013.

<sup>98</sup> CDS Readiness Posture Directives; and DND, CRS, Naval Force Evaluation (Draft), November 2013, pages 21 – 24.

## CRS Recommendation

6. Given serviceability and availability trends, validate the surge readiness requirements of the CP-140. If unchanged, expand the fleet beyond the ten original Block III/ASLEP modified aircraft,<sup>99</sup> while allocating a sufficient number of additional crews.

**OPI: SJS/CJOC**

OCI: RCAF

**Key Finding 12:** Due to a lack of self-defence equipment, maritime domain control operations conducted by MAR AIR assets are |||

A final concern for all control activities is the spectrum of operations in which the existing air fleets can operate. Although MAR AIR assets are equipped to impose a measure of control in the maritime domain, their employment could be |||||  
|||||<sup>100</sup> Currently, with the exception of some minor add-on  
defensive equipment to the CH-124 Sea King helicopters, neither the CH-124 nor the CP-  
140 MAR AIR assets possess self-protection suites.

The risks to MAR AIR assets involved in providing control in the maritime domain would be | | | | | | | | | | | | | | | | | | | | | | If engaged in fluid operations, such as Operation MOBILE, where tasks evolved beyond initial expectations, | | | | | | | | | | | | | | | | | | | | | | | | | | | |

## CRS Recommendation

7. 101

**OPI: RCAF**

#### 2.4.4 Ability to Provide Support to Other Aerospace Tasks

The evaluation team utilized the following indicators to make this determination:

- proportion of OAT to overall MAR AIR Capability mission and tasks; and

<sup>99</sup> During the drafting of this report, the MND announced that an additional four CP-140 aircraft (for a total of 14) would undergo the ASLEP. In addition to three new capability enhancements, the additional aircraft will allow the LRPA capability to be effectively extended to 2030. Retrieved from <http://news.gc.ca/web/article-en.do?nid=826509>.

<sup>100</sup> DND, VCDS, Capability Based Planning, 2011/12.

<sup>101</sup> During the drafting of this Evaluation, the MND also announced the addition of a Self-Defence Suite that will allow the current LRPA capability to be operationally effective to 2030. Retrieved from <http://news.gc.ca/web/article-en.do?nid=826509>.

- result of OAT on MDA and maritime domain control (competing priorities/resources).

**Key Finding 13:** Senior leaders indicated satisfaction with support provided by MAR AIR assets to OAT; however, the expanded non-maritime employment may present |||| ||||| of core MAR AIR competencies.

With a reputation for versatility and performance, MAR AIR assets have been, and should continue to be, capable of providing versatile air support. Over the evaluation period, MAR AIR assets have provided support to various aerospace tasks, such as back-up SAR operations, utility (ship-to-ship and ship-to-shore), and increasing support to predominantly over land operations.

Based on interviews with local commanders and supervisors, it was noted, however, that the program is taking on more diversified tasks and is displaying considerable flexibility and resourcefulness in adapting to these new demands. As shown in Table 15, a full 51 percent of the YFR for the CP-140 was dedicated to FE operations, and, of those, fully 18 percent was spent mainly on overland missions.

DOMAIN	COMMAND	ALLOCATED YFR	ACTUAL YFR	DELTA (%)	RATIO (%)
<b>Force Generation</b>				-9	49
<b>Force Employment – Mainly Maritime</b>	Canada Command/ CJOCC Continental			3	34
	CMS			-3	
<b>Force Employment – Mainly Overland</b>	CEFCOM/ CJOCC Expeditionary			7	18
	CANSOFCOM			-2	
	CLS			17	
	CAS			16	
<b>Force Employment – Total</b>				8	51
<b>CP-140 Fleet Total (FG and FE)</b>				-1	100

**Table 15. FE YFR by Commands—CP-140.** This table depicts the year-over-year YFR usage by the respective Commands, emphasizing the primary domain of activity.

The concern is that this high level of operations and overland focus presents limited training value<sup>102</sup> to core capabilities, compounding the existing resource pressures on the maintenance of skills |||||<sup>103</sup>

<sup>102</sup> Examples raised during formal interviews and site visits included the following: the limited transferable value of Overland Tasks for the Wet Sensors operators; up to general aircraft handling over land, with more defined horizons and multiple navigation features; limited crew coordination due to no weapons delivery profile; and does not incorporate the complexity of coordinated attack with

With respect to assisting in SAR, while records were limited, the evaluation team noted from interviews with unit-level leaders that the number of demands for CP-140 SAR backup has increased due to serviceability issues with the primary SAR fleets. Conversely, they have declined for the Sea King due to better serviceability rates with the Cormorant fleet. It should also be noted that, while the SAR standby requests were numerous, the actual launching of MAR AIR assets was actually infrequent. Senior leaders expressed to CRS that they have been satisfied with support provided to OAT by the MAR AIR community.

#### **2.4.5 Contribution to DND/CAF Missions**

The evaluation team utilized the following indicator to make this determination:

- Evidence of contributions.

**Key Finding 14:** MAR AIR contribution was instrumental to the success of the missions examined.

To assess this outcome, key stakeholders were interviewed and After Action reports and program documents were reviewed, all of which indicated that MAR AIR contributed significantly to the success of several real-world operations. The following are a representative sampling of the range of missions undertaken.

#### **Operation LIMPID**

Operation LIMPID is an ongoing Domestic Surveillance and Presence operation focused on surface shipping traffic in Canada's coastal areas of responsibility, conducted in concert with other government departments. The progressively increased usage of information from partners and other sources, such as RADARSAT and Contracted Air Services, have yielded excellent results. Review of program documentation, site visits and interviews of senior leaders indicated that substantial progress has been achieved, particularly when the methodology was expanded to account for the merging of information from multiple sources to gain a much improved MDA.<sup>104</sup>

#### **Operation MOBILE**

Operation MOBILE was conducted in support of a NATO response to security events in Libya in the February to November 2011 timeframe. MAR AIR contribution consisted of two CP-140s based in Sigonella, Italy; and one CH-124 embarked in Her Majesty's Canadian Ship CHARLOTTETOWN. Review of program documentation and interviews

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other assets, such as MH, Surface Combatants and Submarines. In a similar fashion, deployed MH crews are mainly involved in surface action, such as anti-piracy, instead of the more complex and demanding | | | | | | | |

<sup>103</sup> DND, RCAF, 1180-1 (A3 LRP), CMAAG Records of Discussion, November 5, 2010, item 10-2-1.

<sup>104</sup> DND, OP LIMPID Plans; and Semi-Annual Surveillance and Presence Reports, FYs 2009/10 to 2012/13.



with senior leaders indicate that both types of assets provided substantial value. Five issues are particularly noteworthy:

- As an organic asset, the CH-124 extended the range of the ships' sensors. The Maritime Patrol Aircraft capability was in great demand and the CP-140 contribution was greatly valued by allies.<sup>105</sup>
- CH-124 and CP-140 units, crews and support personnel demonstrated great flexibility in conducting rapid deployment<sup>106</sup> and by being able to adapt to a dynamic situation by expanding their mission sets.<sup>107</sup>
- |||||
- The limited size of the operational establishments meant that a significant portion of the available crews, aircraft and annual allocated YFR were taken away from domestic operations, while the fleet was already limited due to the Avionics Upgrade Program/ASLEP projects. The domestic operational impact was successfully mitigated by offsetting this loss through the increasing use of contracted air services.<sup>108</sup>
- The ||||| imposed a reduction in flying rates around the mid-point in the operation. ||||| were either not available or not deployed, and a reduced operational tempo had to be imposed.<sup>109</sup>

## CONPLAN/Operation SCYLLA<sup>110</sup>

**Key Finding 15:** Exercises are conducted mainly at the Tactical level while the Operational and Strategic levels are infrequently exercised.

Based on interviews with senior leaders and instructional cadre, the use of exercises usually only involves the aircrews. Recently, simulation exercises have been extended to include the participation of the Wing Staff, providing significant benefits to the Command and Control (C2) readiness posture. However, while contingency plans are being reviewed when required, there has only been recent evidence of a corresponding C2 exercise for CONPLAN scenarios being undertaken through the chain of command for some of the time-sensitive critical scenarios.<sup>111</sup> During the five-year period, there has been at least one instance where a contingency plan could have benefitted by being

<sup>105</sup> DND, Operation MOBILE Daily Sitrep Number 30, March 30, 2011.

<sup>106</sup> Ibid., Number 24, March 24, 2011.

<sup>107</sup> Ibid., Number 30, March 30, 2011.

<sup>108</sup> DND, Operation LIMPID Initial YFR Allocation FY 2011/12; and Amended YFR Allocation, February 2011.

<sup>109</sup> DND, Operation MOBILE Daily Sitrep Number 42, April 11, 2011.

<sup>110</sup> DND, CDS Directive for the Provision of Maritime Surveillance Forces, April 8, 2011. Retrieved from the CSNI network.

<sup>111</sup> DND, CJOC, After-Action Report, January 2013.



exercised on a more regular basis.<sup>112</sup> This status contrasts with the well-developed NORAD series of exercises involving 1 CAD and higher headquarters. Since 2012, however, CJOC has been holding a series of C2 exercises for staffs and partners, which is a positive step.<sup>113</sup>

### **CRS Recommendation**

8. Continue the expansion of CONPLAN exercises, especially those requiring the participation of higher headquarters.

**OPI:** CJOC

**OCI:** RCAF

## **2.5 Demonstration of Efficiency and Economy**

**Evaluation Question: Were resources utilized efficiently to produce the outputs and outcomes of maritime air capability?**

The evaluation team utilized the following indicators to make this determination:

- cost of activities (training, maintenance) and outputs (personnel, equipment, infrastructure) per planned/stated activity rate;
- major limiting factors (impediments/obstacles); and
- utilization rates, relative to the optimum.

This section examines the efficiency and economy of MAR AIR operations. This included examining the cost of air platforms and satellite technology utilized to conduct MDA and control, and in support of OAT. The data has been derived from financial statements, interviews with senior leadership, program documentation, and performance data (e.g., YFR) and fleet size.

**Key Finding 16:** The costs for the CP-140 long range patrol aircraft have remained stable over the five-year evaluation period in spite of being an ageing weapons system.

With respect to the CP-140, overall costs, including training, maintenance, national procurement, capital expenditures,<sup>114</sup> operational costs, and base support remained relatively constant over the study period. In fact, despite salary increases and other

<sup>112</sup> DND, CJOC, Operation SCYLLA After-Action Report. Retrieved from the CSNI network.

<sup>113</sup> DND, CJOC, Exercises Determined Dragon 12 and Determined Dragon 13, retrieved from the CSNI network.

<sup>114</sup> National Procurement costs include predominantly spare parts, repairs and overhauls of major components. Capital expenditures include major upgrades that replace unsupportable equipment or enhance the aircraft's capability.



inflationary pressures, overall costs of CP-140 operations have only increased by 6.9 percent over the past five years. At the same time, the YFR expended has remained relatively constant, averaging ||||| hours annually over the five-year period with one notable surge for Operation MOBILE. As a result, the actual cost per flying hour has only increased by 3.9 percent over the five-year period. For comparison purposes, during the same period, inflation in the Canadian economy increased by 16 percent.<sup>115</sup>

The evaluation determined that there were two primary reasons that the increases in costs for the LRPA fleet have remained below inflation. First, the actual usage of the CP-140 (based upon hours flown) has not significantly increased, despite, as noted in the effectiveness section of this report, an increase in the overland role. While this created some issues with respect to availability for training or other traditional uses, it has ensured that costs have not been impacted by increased demand. The utilization of contracted air services (i.e., PAL) and RADARSAT/space-based AIS has also offset the need for the CP-140 to conduct surveillance flights within Canada's littoral borders, leaving the CP-140 to conduct longer-range patrols, such as those to the Arctic or the outer edges of the AOR, as it is the only aircraft capable of such autonomous operations.<sup>116</sup>

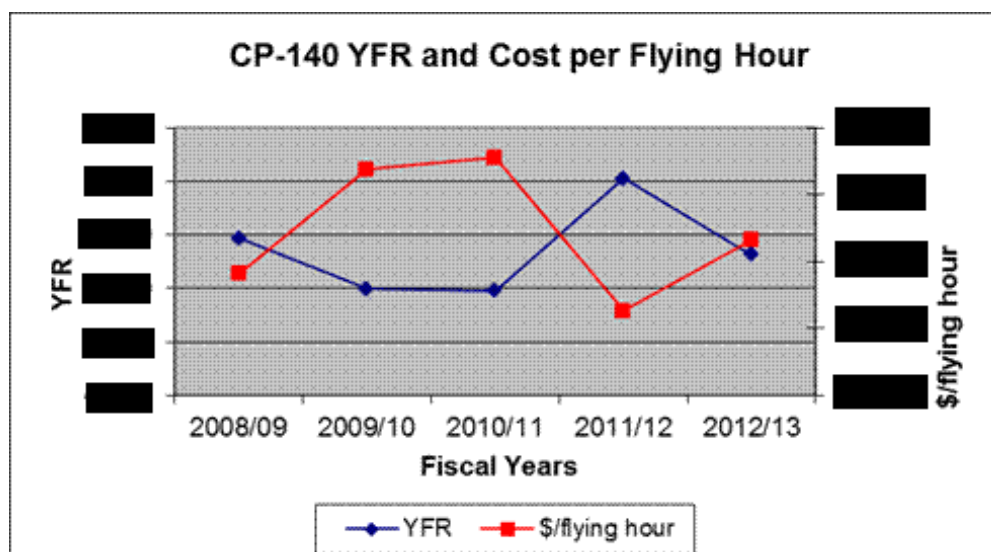
Second, the actual number of airframes available has been reduced as aircraft go through the modernization period. The total amount of hours flown is maintained by flying the remaining aircraft more often, which is a more efficient practice (at least for the short term—the concern being the impact on overall aircraft life-span). This also is a reflection of the fact that there is a significant portion of overall costs made up by fixed base support costs. As a result, the cost per flying hour is relatively lower when a smaller fleet is flying a larger number of hours.

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<sup>115</sup> The inflation rate for FY 2012/13 was not available; therefore, the average inflation rate was calculated over 4 years.

<sup>116</sup> Given the long distance, scarcity of suitable recovery airfields and prevailing climate conditions, the CP-140 is the only aircraft that can conduct long-range patrol surveillance missions to the Arctic. (Source: DND, 3371-1180-1 (CAS/Director Air Force Readiness ), Record of discussion - NAFIWG Meeting on September 10, 2008, paragraph 9).





**Figure 11. CP-140 YFR and Cost per Flying Hour.** This chart depicts the costing trends in relation to the varying YFR for the CP-140 aircraft. The data is summarized in Table 16.

FY	2008/09	2009/10	2010/11	2011/12	2012/13
CP-140 YFR					
\$ per flying hour					

**Table 16. CP-140 YFR and Cost per Flying Hour.** This table lists the CP-140 YFR over the relevant period, and the corresponding costs per hour flown.

**Key Finding 17:** Given its impending replacement, the CH-124 maintenance costs remained at or slightly below the inflation rate by selective adjustments of the maintenance practices.

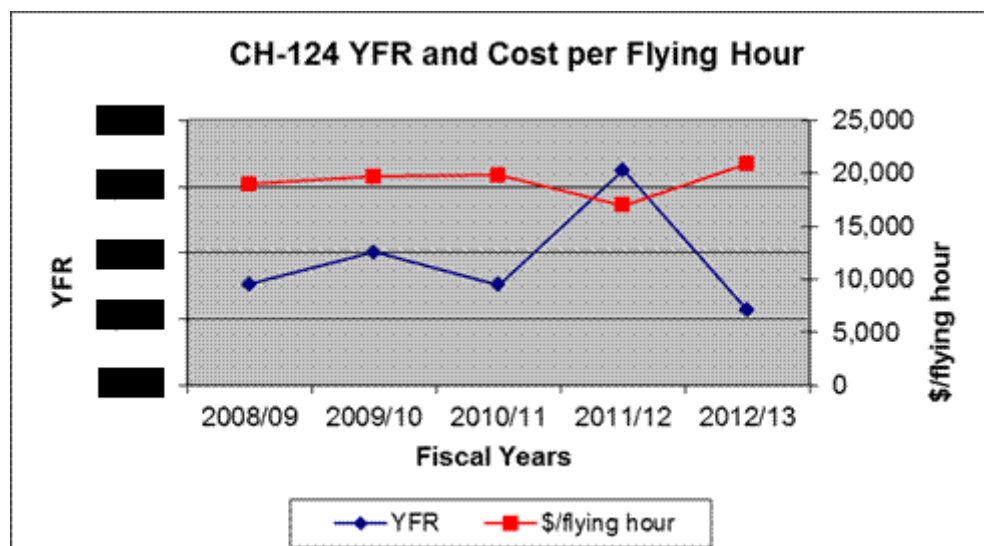
The evaluation team found that costs associated with the CH-124 also have been held in check, despite the fleet's advanced age (50 years of service by 2013). Overall costs per aircraft—including training, maintenance, national procurement, capital expenditures,<sup>117</sup> operational costs, and base support related to the CH-124—have increased by 16.4 percent over the past five years, essentially at pace with inflation. Despite age and losses (over the evaluation period the fleet size has decreased from 26 flyable<sup>118</sup> aircraft to 24 due to accidents), the YFR expended has remained relatively consistent, averaging ||||| hours annually. The cost per flying hour only increased 10.3 percent over the five-year period.

Based upon interviews with senior staff and on program data, the evaluation found that the costs for the CH-124 have only increased slightly above the inflation rate, mostly due

<sup>117</sup> The inflation rate for FY 2012/13 was not available. Therefore, the average inflation rate was calculated over four years.

<sup>118</sup> Official fleet size remains stable at 27 aircraft, but reactivation of stored damaged aircraft would take at least six months. (Source: e-mail query to ADM(Mat) and Director Aerospace Equipment Program Management (Maritime), September 30, 2013).

to the reduction of the number of Sea King HELAIRDETs from the usual 14 to 6. This meant that there were fewer aircraft that had to be kept at a high rate of availability, and, therefore, a reduced maintenance effort was required and fewer crews were necessary. Essentially, the same applies to the CP-140 with fewer aircraft and crews flying more hours in order to contain costs. Both of these reduction initiatives are part of a mitigation strategy to meet prioritized RFEs during the prolonged transition period of the MHP.



**Figure 12. CH-124 YFR and Cost per Flying Hour.** This chart depicts the costing trends in relation to the varying YFR rate for the CH-124 helicopter. The data is summarized in Table 17.

FY	2008/09	2009/10	2010/11	2011/12	2012/13
CH-124 YFR					
\$ per flying hour	18,939	19,702	19,819	16,963	20,879

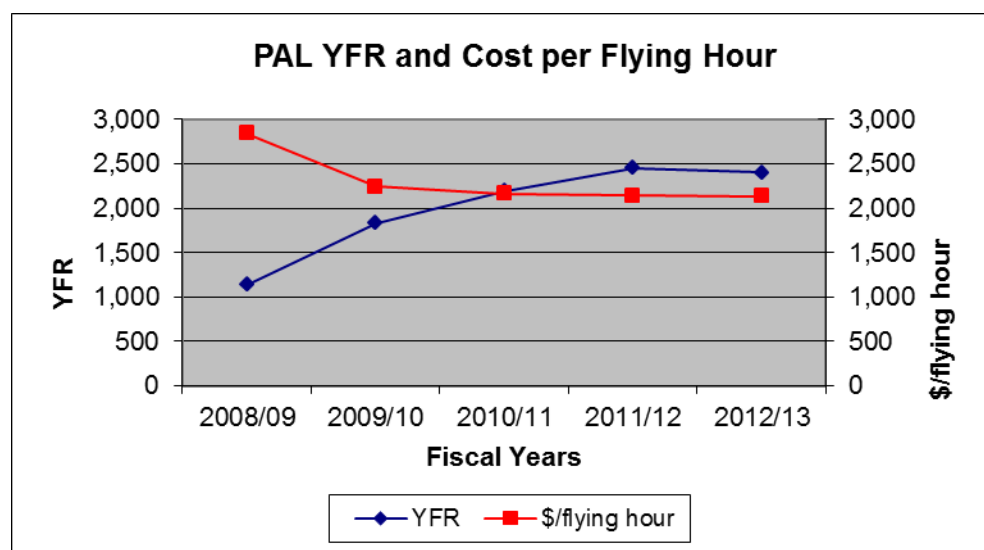
**Table 17. CH-124 YFR and Cost per Flying Hour.** This table lists the CH-124 YFR used per fiscal year and the corresponding cost per hour flown.

**Key Finding 18:** The addition of satellite technology (e.g., RADARSAT-2) and partnership in using contracted air services (e.g., PAL and TC/NASP) has proven to be very efficient methods of conducting MDA.

With respect to other platforms, the evaluation noted that the YFR expended by contracted air surveillance use through PAL has increased 108 percent over the five-year evaluation period. At the same time, the PAL cost per flying hour has decreased by 24 percent due to contractual efficiencies gained from increased use.

Compared to the CP-140, PAL provides extremely economical services. For example, the average annual cost for PAL contracted services is approximately \$4.5 million,<sup>119</sup>

While the PAL service cannot provide all of the operational capability of the CP-140 (range, sensors, ASW, weapons) it does provide a very economical solution for simple surface patrol or contact verification. In fact, with a yearly average of 5,670 additional hours, the contracted aerial surveillance program currently provides 67 percent of the domestic aerial surveillance, while the CP-140 is now concentrated on missions that cannot be accomplished by contracted assets such as



**Figure 13. PAL YFR and Cost per Flying Hour.** This chart depicts the relative cost of contracted flying services. The data is summarized in Table 18.

FY	2008/09	2009/10	2010/11	2011/12	2012/13
<b>PAL YFR</b>	1,142.2	1,834.6	2,194.4	2,449.2	2,402.1
<b>\$ per flying hour</b>	2,842	2,243	2,167	2,145	2,138

**Table 18. PAL YFR and Cost per Flying Hour.** This table shows PAL YFR used per fiscal year and the corresponding cost of each hour flown.

Similarly, the use of RADARSAT-2 has increased significantly. RADARSAT costs are based upon “scene acquisitions” (essentially, downloads of images). While the number of scene acquisitions had increased by 503 percent over the past five years, the cost per scene<sup>121</sup> has decreased by 23 percent due to volume discounts. The overall cost of the RADARSAT for DND in FY 2012/13 was \$13.5 million, or less than 2 percent of the

<sup>119</sup> This includes the fee per flying hour (\$997.00) plus fuel costs, and a flat annual payment of \$2 million that provides access to the flight data from OGDs. (Source: e-mail queries to CJOC Air Operations Surveillance, September – October 2013.)

<sup>120</sup> DND, e-mail queries to CJOC Air Operations Surveillance, April 2, 2013.

<sup>121</sup> A “scene” is a RADARSAT-2 picture of a specific maritime area.

MAR AIR budget. Therefore, compared to the cost of conducting airborne patrols, it is very cost-effective, in particular since RADARSAT provides frequent revisits coverage over areas beyond the range of the PAL program, and is equivalent to only 200 hours of CP-140 flying time. In interviews with senior leadership, it was noted that data from satellite technology is used to focus efforts on detecting and identifying vessels of potential threat approaching Canada's AOR. The cumulative sum of multiple sources of information yields a very efficient use of limited assets.

**Key Finding 19:** The expanded use of the CP-140 simulators to conduct FG has been cost-effective.

The evaluation team noted<sup>122</sup> the significant increase in the use of simulators for advanced training for the CP-140.<sup>123</sup> For example, in 2012, approximately 4,200 training hours were conducted using the CP-140 simulators,<sup>124</sup> which is an increase of 32 percent or 1,000 hours since 2009.<sup>125</sup>

It has been estimated that each hour utilizing the simulators costs approximately \$14,000, as compared to approximately \$45,000<sup>126</sup> for each hour using the CP-140 aircraft. Using 2009 as the baseline (see Figure 16) of CP-140 simulator usage, the cumulative additional use (some 4,349 hours) would have resulted in an approximate cost avoidance of \$29.4 million during the evaluation period. Therefore, the expanded use of flight simulators could be claimed to have contributed significantly to reducing budgetary pressures.<sup>127</sup>

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<sup>122</sup> GC, Record of Airworthiness Risk Management, CH-124-2008-007, December 2, 2008.

<sup>123</sup> The Sea King community is essentially awaiting the arrival of the MHP training suite as resource investments are no longer being applied to the CH-124 simulators.

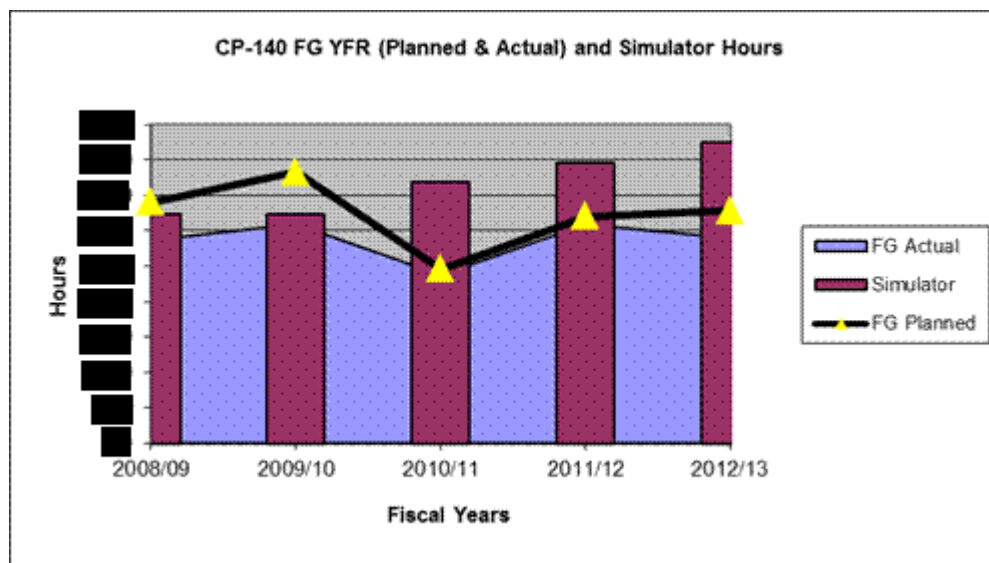
<sup>124</sup> DND, 14 Wing, 404 Long Range Patrol & Training Sqn, Welcome to the Aurora Simulation, presentation package, April 30, 2013.

<sup>125</sup> Ibid.

<sup>126</sup> Ibid. The \$14,000 figure reflects only the Variable Costs portion of the Cost-Factor Manual as the full-up cost (\$45,000) would double count such fixed costs as the personnel pay. Variable Costs do not include base and fixed overhead costs.

<sup>127</sup> Ibid. Using only the Variable Costs of the CP-140. (Source: DND, Cost Factor Manual FY 2011/12, CP-140, pages 35-39).





**Figure 14. Trend in Operational Availability of Maritime Air Assets—CP-140.** The data is summarized in Table 19.

	2008/09	2009/10	2010/11	2011/12	2012/13
<b>FG Actual</b>					
<b>FG Planned</b>					
<b>Simulator</b>	3,240	3,240	3,688	3,955	4,250

**Table 19. Trend in Operational Availability of MAR AIR Assets—CP-140.** This table shows the CP-140 planned and actual number FG YFR per fiscal year, in comparison to the number of hours trained in the simulator.

Interviews with simulator staff indicated that parity between the CP-140 fleet and the simulators has not been consistently maintained. For the CH-124, its simulators are presently outdated and are of limited use in developing and maintaining skilled crews. As the number of actual flying hours required to achieve and maintain the proficiency of CP-140 crews has increased, the use of simulator training has led to cost savings. It was confirmed that the use of the simulators costs less than flying actual aircraft. Consequently, there is also reduced wear and tear on the fleet, and more hours are available for FE tasks. There is significant value in maintaining parity between the aircraft and their training simulators.

### CRS Recommendation

9. Adopt a policy of maintaining parity between simulation devices and the operational fleets.

**OPI:** RCAF

**OCI:** ADM(Mat)

**Evaluation Question: Were resources utilized economically to produce the outputs and outcomes of maritime air capability?**

The following indicators were utilized to make this determination:



- planned spending versus actual spending;
- primary cost drivers (i.e., what is monopolizing funds?);
- alternatives in design and/or delivery of maritime air capability (rate, tasking-additional/new, different resources, processes); and
- cost compared to relevant OGDs, allies, private industry.

**Key Finding 20:** The total expenditures directed at Canada's MAR AIR capability<sup>128</sup> have remained virtually flat over a five-year period, even though salary, wages, and inflation<sup>129</sup> costs have increased during the same period.

The overall MAR AIR budget was found to be a relatively small percentage of the overall DND budget. The average annual budget for MAR AIR is just over \$600 million,<sup>130</sup> and has remained at that level for the five-year evaluation period despite inflation of 16 percent<sup>131</sup> over the same period. MAR AIR annual expenditures represent approximately three percent of the overall DND budget (See Table 20). As indicated in the effectiveness section of the report, MAR AIR is responsible for conducting MAR AIR surveillance and control of the maritime domain, in the maritime AOR and littoral regions of Canada, including the Arctic. MAR AIR has contributed to each of the six CFDS missions throughout the last five years, including expeditionary missions such as Operation MOBILE in Libya in 2011/2012.

	2008/09	2009/10	2010/11	2011/12	2012/13	Average
<b>MAR AIR Budget (\$M)</b>	583	627	620	630	619	616
<b>DND Budget (\$M)</b>	19,185	19,856	20,298	20,419	19,978	19,947
<b>Percent MAR AIR</b>	3.04	3.16	3.05	3.08	3.10	3.09

**Table 20. MAR AIR Budget.** This table provides the actual budget expenditures related to MAR AIR for the five-year evaluation period and the percentage this represents of the total DND budget.

Total MAR AIR expenditures are the sum of all output costs, as described in the logic model ([Annex C](#)), including: trained personnel, ready equipment (e.g., number of aircraft, maintenance hours, national procurement and capital expenses), operations (e.g., YFR), base support (e.g., administration and overhead), and operational plans and orders (e.g., doctrine and direction). The efficiency of outputs will be discussed later in this section.

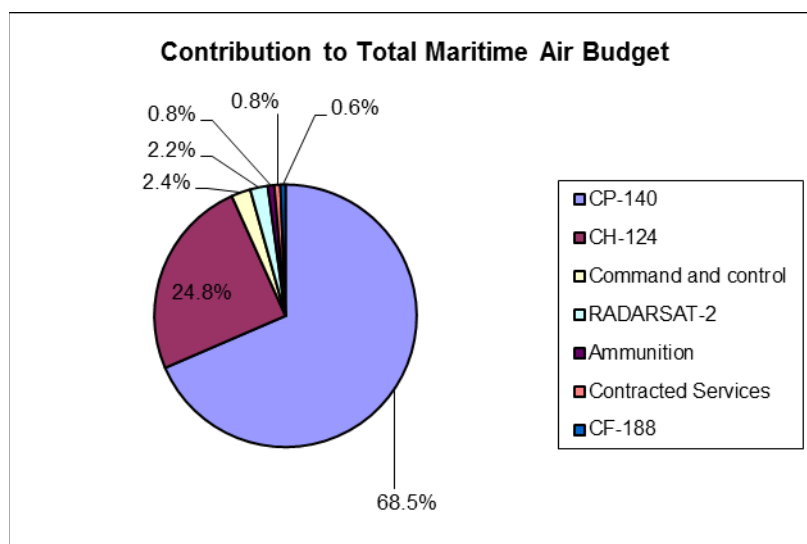
<sup>128</sup> Financial data was obtained from 12, 14, and 19 Wing, 1 CAD, ADM(Mat), CJOC and VCDS/Director General Space.

<sup>129</sup> Inflation rates used in this report were calculated by DND for operating expenditures and found in the DND Economic Model Historical Rates – 2012 Edition Document.

<sup>130</sup> Expenditures have been averaged over the 5 year evaluation period.

<sup>131</sup> The inflation rate for FY 2012/13 was not available; therefore, the average inflation rate was calculated rate over 4 years.

Overall, 69 percent<sup>132</sup> of the MAR AIR budget is expended on supporting the CP-140 Weapon System, 25 percent<sup>133</sup> on the CH-124 (Sea King) Weapon System, 2 percent<sup>134</sup> on the C2 function,<sup>135</sup> 2 percent on RADARSAT-2/Polar Epsilon capabilities, and less than 1 percent for each of contracted air services, CF-188s for MAR AIR operations, and ammunition (including sonobuoys).



**Figure 15. Contribution to Total MAR AIR Budget.** This figure depicts the relative budget share of the various fleets and components used for MAR AIR. The data is summarized in Table 21.

	Contribution to Total MAR AIR Budget (in Percentages)
<b>CP-140</b>	68.5
<b>CH-124</b>	24.8
<b>C2</b>	2.4
<b>RADARSAT-2</b>	2.2
<b>Ammunition</b>	0.8
<b>Contracted Services</b>	0.8
<b>CF-188</b>	0.6

**Table 21. Contribution to Total MAR AIR Budget.** This table shows the percentage of the total MAR AIR budget of each fleet and listed components.

The average personnel costs<sup>136</sup> of Regular and Reserve Force, as well as civilian employees, has remained flat despite annual salary increases averaging 1.6 percent,<sup>137</sup> over the 5-year period. In total, these costs account for 41 percent of the MAR AIR

<sup>132</sup> Includes salaries for Regular and Reserve Force, and civilian employees.

<sup>133</sup> Capital expenditures have been averaged over the 5-year evaluation period.

<sup>134</sup> Ibid.

<sup>135</sup> Given the shared functions, the C2 costs were calculated on the basis of the overall costs of 1 CAD, including ACCE (Atlantic and Pacific), divided by the respective YFR of MAR AIR against all other fleets.

<sup>136</sup> Regular Force salaries were calculated by using an average salary of \$66,049 multiplied by the number of Regular Force members as reported by 12, 14, and 19 Wing, and 1 CAD. In addition, 20 percent was added for employee benefits to the salary totals of regular force and civilian personnel.

<sup>137</sup> The rate of pay increase for FY 2012/13 was not available. Therefore, the pay increase was compiled by DND by averaging the four years of available data.



budget. The actual number of military and civilian personnel employed by MAR AIR was obtained from the Wings and 1 CAD.<sup>138</sup> Over the five-year evaluation period, personnel numbers increased slightly, by 1.6 percent.<sup>139</sup> Interview data, gathered on the effects of the Strategic Review and the Deficit Reduction Action Plan, indicated that no effects had been observed to date.

FY	2008/09	2009/10	2010/11	2011/12	2012/13	Average
<b>Regular Force</b>	2,448	2,547	2,550	2,536	2,492	2,515
<b>Reserve Force</b>	383	391	380	396	400	390
<b>Civilian</b>	433	435	432	432	423	431
<b>Total</b>	3,264	3,374	3,361	3,365	3,315	3,336

**Table 22. Total Personnel.** This table depicts the categories and number of personnel employed in delivering the MAR AIR capability by fiscal year over the evaluation period.

FY	2008/09	2009/10	2010/11	2011/12	2012/13
<b>CP-140</b>	18	18	18	18	17
<b>CH-124</b>	26	26	25	24	24
<b>Total</b>	44	44	43	42	41

**Table 23. Total Aircraft.** This table depicts the number of aircraft per fleet by fiscal year, over the evaluation period, used to deliver the MAR AIR capability.

Alternative methods of conducting MDA are currently being studied, such as the use of UAVs. However, this work remains in its preliminary stages.

For DND purposes, given the distances involved, further expansion of contracted services would require larger, more capable aircraft. However, as demonstrated on specific occasions, such as Operation PODIUM (Vancouver Olympics) and Operation MOBILE, a surge in the use of contracted services is appropriate to respond to time-limited demands.

It is important to note that the United Kingdom government recently terminated its LRPA program (i.e., the NIMROD), and has since reported a gap<sup>140</sup> in its MAR AIR capability as a result.

<sup>138</sup> The Wings provided actual personnel numbers employed by MAR AIR. 1 CAD calculated MAR AIR personnel using YFR for MAR AIR fleets divided by the overall YFR for all fleets under their command.

<sup>139</sup> The number of MAR AIR personnel dedicated to the capability is not officially tracked. These personnel approximations include positions that also support other RCAF capabilities.

<sup>140</sup> United Kingdom, House of Commons, Defence Committee, Future Maritime Surveillance: Government Response to the Committee's Fifth Report of Session 2012–13, Fifth Special Report of Session 2012–13, December 2012, retrieved July 3, 2013, from <http://www.publications.parliament.uk/pa/cm201213/cmselect/cmdfence/827/827.pdf>.

|||||<sup>141</sup> Attempts were made to compare CAF MAR AIR capabilities with allied partners' counterparts, although since concept of operations and accounting measures differ significantly across nations, no suitable examples of matching costs and activities were found. For example, the United States Navy has its own fleet of shipborne helicopters, and the Australian Border Customs and Border Protection Service is mandated to conduct maritime surveillance.

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<sup>141</sup> Observed by the evaluation team during visits at 14 Wing Greenwood, May 2013.



## Annex A—Management Action Plan

### CRS Recommendation

1. Given the force-multiplier value of organic shipborne helicopters, completion of the MHP should remain a top priority for the Department.

### Management Action

The Maritime Helicopter Project remains a high priority within the department, which is devoted to expediting the delivery of a maritime helicopter capable of meeting the operational requirements of the CAF. An intensive examination of the options has been done, and the recommendations resulting from these efforts are currently under consideration by the GC. Implementation of the approved course of action will remain a high priority within the Department.

**OPI:** RCAF

**Target Date:** Ongoing

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### CRS Recommendation

2. Give increased priority to operational training events that maximize the preservation and development of perishable |||||

### Management Action

With close coordination between the 12/14/19 Wings, ACCE (Atlantic/Pacific) and 1 CAD, every effort is made to ensure that all exercises that provide advanced FG are leveraged to the fullest extent. External financial and operational pressures are weighed against benefits to Maritime Aircrew training and upgrades. Due to crew size and location of exercises (southern United States or Europe), CP-140 advanced FG is expensive. This financial challenge is further complicated with a perceived push for domestic integration with the Canadian Army and the reduction in Joint Exercise and Training Account funding for international exercises.

Still, 1 CAD Sqn Standing Orders ISR has been tasked to initiate dialogue between operational leaders of the RCAF and RCN, with the goal of reinvigorating the NAFIWG, which will help meet the CRS recommendation.

**OPI:** RCAF

**OCI:** RCN

**Target Date:** Ongoing

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### **CRS Recommendation**

3. To further enhance the comprehensive partnership in the development and delivery of Joint Maritime Effects, improve the governance forums and mechanisms, such as by re-instating the NAFIWG, to establish clear strategic priorities; to address interoperability issues; and to provide for a comprehensive performance monitoring strategy.<sup>142</sup>

### **Management Action**

1 CAD Sqn Standing Orders ISR has been tasked to initiate dialogue between operational leaders of the RCAF and RCN with the goal of reinvigorating the NAFIWG. A letter will be drafted and sent to senior RCN leaders on each coast in order to recommence discussions on mutually important topics with respect to MAR AIR. A currently inactive/underutilized Service Level Agreement between the RCAF and RCN will be reviewed, updated and put in place to aid in providing support to the RCN.

**OPI:** RCAF

**OCI:** RCN

**Target Date:** June 2014

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### **CRS Recommendation**

4. Given the expanded capabilities of new sensors being introduced in CP-140 Block III and MHP, develop a comprehensive concept of operations for processing the significant increase in information volume and complexity.

### **Management Action**

Both MAR AIR fleets face significant challenges downloading, analyzing, and transmitting/distribution data collected during missions. Both 12 and 14 Wings are working together with CDI in order to develop best practices and SOPs for the dissemination of mission-related data. A CONOPs will be developed once delivered capabilities and the needs of the end users are better known. The work that Air Intelligence and security at 1 CAD is doing with their Processing, Exploitation and Dissemination Project is helping to shape the battle space and better define their needs. 14 Wing Operations will be standing up a Qualification Standards Writing Board in the near future to identify the tasks and associated skills required of personnel working in Wing Operations who will be responsible for data analysis and distribution. The CH-148 will be delivered with a Mission Planning and Analysis System, which will aid operators in their data analysis and distribution tasks. Currently, the CH-124 Augmented Surface Plot project has highlighted some of these shortfalls, and has allowed 12 Wing to make some headway in finding solutions to these challenges.

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<sup>142</sup> The first session of the re-established NAFIWG was held on May 13, 2014, with senior RCN and RCAF membership.



**OPI:** RCAF

**OCI:** CJOC

**Supplementary comments from OCI.** As the primary FE of CP-140 Block III and MHP with expanded capability sensors, CJOC will support RCAF initiatives under AIMP and MHP with the RCN and Assistant Deputy Minister (Information Management) to upgrade processing and data transmission networks to handle the increased volume and complexity of sensor data. Coastal RJTF Commanders, who operate Regional Joint Operations Centres, will be the primary points of contact domestically. As expeditionary operations are normally conducted within a coalition construct, any processing and transmission capabilities must be compatible with NATO and Allied Command, Control, Communications, Computers Intelligence Surveillance and Reconnaissance networks.

**Target Date:** July 2015

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#### **CRS Recommendation**

5. Support the timely implementation of RADARSAT Constellation Mission.

#### **Management Action**

VCDS/ Chief Force Development Director General Space is the DND lead in collaborating with the Canadian Space Agency to acquire the RADARSAT Constellation Mission consisting of an additional 3 satellites that will replace/supplement the existing RADARSAT 2 satellite which was launched in December 2007. DND supports the planned launch date of Jul 2018. The RADARSAT Constellation Mission constellation offers significant enhancements over RADARSAT 2 including a much higher performance Synthetic Aperture Radar as well as onboard satellite Space-Based AIS. Although RADARSAT 1 far exceeded its projected 5 year lifespan, recently ceasing operations after nearly 18 years of service, RADARSAT 2 is now nearing its projected 7 year lifespan, and so the risk of losing this valuable space based sensor exists until the projected launch of the RADARSAT Constellation Mission satellites. The 3 satellite RADARSAT Constellation Mission constellation (4 satellites if RADARSAT 2 continues to function), featuring onboard Synthetic Aperture Radar and Space-based AIS, will provide the CAF with much more complete and timely MDA coverage (data delivered to Regional Joint Operations Centers within 10 minutes of capture) of the Canadian AOR, especially in Arctic regions, as well as over any AOR worldwide due to the increased number of satellite passes per day. The RADARSAT Constellation Mission constellation will connect with upgraded DND satellite downlink facilities located in Aldergrove, BC and Masstown, NS which will in turn feed the DND real time ship detection processing facility in Aldergrove BC. This upgrade is being carried out under DND Project Polar Epsilon 2 which will deliver MDA capability in line with the 2018 RADARSAT CONSTELLATION MISSION launch date.

**OPI:** VCDS/CFD DG Space



**OCI: CJOC**

**Target Date:** June 2018

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### **CRS Recommendation**

6. Given serviceability and availability trends, validate the surge readiness requirements of the CP-140. If unchanged, expand the fleet beyond the ten original Block III/ASLEP modified aircraft, while allocating a sufficient number of additional crews.<sup>143,144</sup>

### **Management Action**

There is no change in the surge readiness requirements for the CP-140. The CAF must be able to respond to defence, security or safety events at the outer limits of the domestic AORs or internationally and must have the capacity to maintain that response over an extended period of time. ||||| will assist in meeting this requirement.

**OPI: SJS/CJOC**

**OCI: RCAF**

**Target Date:** Ongoing

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### **CRS Recommendation**

7. |||||<sup>145,146</sup>

### **Management Action**

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**OPI: RCAF**

**Target Date:** March 2020

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<sup>143</sup> Recommendation No 6: During the drafting of this evaluation report, the MND announced that an additional four CP-140 aircraft (for a total of 14) would undergo the ASLEP. In addition to three new capability enhancements, the additional aircraft will allow the LRPA capability to be effectively extended to 2030.

<sup>144</sup> DND, MND Announcement, March 19, 2014, <http://news.gc.ca/web/article-en.do?mthd=index&ctr.page=1&nid=826499> (retrieved April 19, 2014).

<sup>145</sup> Recommendation No 7: During the drafting of this evaluation report, the MND announced the addition of a Self-Defence Suite that will allow the current LRPA capability to be operationally effective to 2030.

<sup>146</sup> DND, MND Announcement, March 19, 2014, "definition and implementation of three new capability enhancements, Link 16 Datalink, Beyond Line of Sight (BLOS) communications system and a Self-Defence Suite, that are needed to ensure fleet effectiveness until the 2030 timeframe." Retrieved <http://news.gc.ca/web/article-en.do?mthd=index&ctr.page=1&nid=826499> on April 19, 2014.



## **CRS Recommendation**

8. Continue the expansion of CONPLANs exercises, especially those requiring the participation of higher headquarters.

### **Management Action**

CJOC will continue to develop CONPLAN exercises that require the participation of Higher Headquarters. Upcoming examples include Operation NANOOK 2014, which will deal with a Major SAR event in the eastern Arctic and USN-led Biennial *Rim of the Pacific* Exercise (RIMPAC) 2014, the world's largest international maritime warfare exercise held biannually on even years, which will include senior Canadian augmentees into the various Joint Headquarters stood up to support the exercise. MAR AIR activity is built into the annual Exercise Determined Dragon, a CJOC headquarters exercise conducted to execute various scenarios in defence of North America and global defence operations, through Exercise Frontier Sentinel, an RJTF (Atlantic)/United States Fleet Forces Command regional exercise. This includes migrant smuggling, contraband importation, and vessels of interest racking scenarios. In 2013, this provided a framework for a theatre ASW exercise. The biennial Jointex, held on odd years, would also permit higher headquarters participation should MAR AIR activity be incorporated into the subordinate RCN Exercise Trident Fury.

**OPI:** CJOC

**OCI:** RCAF

**Target Date:** Ongoing

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## **CRS Recommendation**

9. Adopt a policy of maintaining parity between simulation devices and the operational fleets.

### **Management Action**

The RCAF has formed the Directorate of Simulation and Training within the Air Staff organization in Ottawa. This will allow the RCAF to focus and dedicate resources to the effective development and utilization of its training systems to include the simulation systems it possesses or will take delivery of in the future. One of the specific focus areas is ensuring that the overall weapons system within the RCAF includes the training suite for each operational fleet, and that concurrency/configuration with the fleet is maintained. Discussions with ADM(Mat) have begun to formulate a policy that will ensure the training devices associated with each operational fleet are maintained as part of the overall weapons system, to ensure that they maintain parity with the operational fleet.

**OPI:** RCAF

**OCI:** ADM(Mat)

**Target Date:** July 2014

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## **Annex B—Evaluation Methodology and Limitations**

### **1.0 Methodology**

#### **1.1 Overview of Data Collection Methods**

The evaluation of MAR AIR included the use of multiple lines of evidence and complementary research methods to strengthen the rigour and reliability of the assessment. Consultations were also conducted in the evaluation's planning phase with an advisory group (i.e., Level 2, Director General or director-level) and a separate working group (i.e., Lieutenant-Colonels, Majors, Managers) of representatives from the RCN, RCAF, CJOC, Special Operations Forces Command, and ADM(Mat). These consultations focused on project scope and evaluation frameworks (e.g., logic model, evaluation matrix) for the project. Working group members were further consulted throughout this process to facilitate the identification of key documents, personnel and subject-matter experts.

These lines of evidence were considered in this evaluation:

- literature and program document review;
- key informant interviews;
- case studies; and
- financial data.

Data from the multiple lines of evidence was assessed using fidelity analysis, optimization analysis, and comparison to alternatives. Fidelity analysis was used to compare planning to actual outputs/outcomes for performance effectiveness. Optimization analysis was used to assess where efficiencies may be gained (i.e., performance efficiency), particularly with respect to trends in activity rates and resource consumption for personnel, equipment and infrastructure. As an extension of optimization, a basic comparison to alternatives was conducted to establish quantitative benchmarks (personnel, equipment) against relevant allies (e.g., United Kingdom, Australia). Lessons learned, best practices and emerging trends in allied forces and the relevant aerospace industry were also used as benchmarks against which to compare options for performance efficiency and economy.

Following data collection and analysis, preliminary evaluation findings were presented to both the advisory group and working group. Discussions from these presentations helped to further refine and clarify the findings and recommendations that are presented in this report.

The evaluation matrix that illustrates where each line of evidence was used to assess the evaluation issues/questions can be found in [Annex D](#).



### 1.1.2 Literature and Program Document Review

A review of available documents was conducted to provide CRS with a background and contextual understanding of the concepts related to MAR AIR. These include federal/departmental accountability documents (e.g., Throne Speech, federal budget, performance reports, reports on plans and priorities); Treasury Board Submissions; Memoranda to Cabinet; previous audits and evaluations; strategic and operational program documents (e.g., plans, orders, doctrine reports, briefing notes, Departmental databases); and relevant academic literature and publications from other departments, allies and relevant authorities. The document review was integral in the assessment of relevance of the Program, as well as to support performance findings from other lines of evidence.

### 1.1.3 Key Informant Interviews

Interviews with key informants were conducted with DND/CAF personnel directly involved in the development, generation, employment and sustainment of MAR AIR at all levels of the organization. A total of 40 interviews were conducted with relevant personnel at Maritime Forces Pacific, 19 Wing Comox, Maritime Forces Atlantic, 12 Wing Shearwater, 14 Wing Greenwood, 1 CAD in Winnipeg, and at DND headquarters in Ottawa. Table B-1 provides further detail on the number of interviews conducted. Key informants were asked a set of pre-established interview questions tailored to their position and rank, regarding the continued need for MAR AIR as well as performance issues, informed by the document review. Information gained by CRS from the interviews was cross-referenced against documentation and other lines of inquiry, where relevant.

Interview Category	Number of Interviews
MARPAC	7
19 Wing Comox	3
MARLANT	7
12 Wing Shearwater (includes 443 Sqn Pat Bay)	4
14 Wing Greenwood	5
1 CAD	8
NDHQ	6
<b>Total</b>	<b>40</b>

**Table B-1. Interviews.** This table shows the distribution of key informant interviews conducted at the seven locations where they took place.

Site visits were also conducted during the conduct phase field work. These site visits consisted primarily of familiarization work for the CRS team in order to gain a contextual understanding of MAR AIR at the tactical and operational levels, and a situational awareness for the physical assets and infrastructure used to deliver MAR AIR. These site visits took place at most of the locations where key informant interviews were conducted.



### 1.1.4 Case Studies

Two recent operational missions (Operations MOBILE and LIMPID) and one contingency plan (CONPLAN SCYLLA) were selected as case studies. The case studies focused on how MAR AIR was employed in the domestic and expeditionary context, as appropriate. This data was used to inform the issue of relevance (e.g., previous employment) as well as to illustrate how MAR AIR has contributed to the six DND/CAF core missions (e.g., performance).

### 1.1.5 Financial Data

Financial data from the various program stakeholders was reviewed for the assessment of efficiency and economy (performance). Data was retrieved from business plans, capability-based plans, annual planning directives, strategic cost models and cost centres, budgets, expenditure reports and financial databases. Financial comptrollers at headquarters, 1 CAD and the Wings were consulted extensively to identify the location of required information as well as to provide CRS with context on the origin and limitations of gathered information.

## 2.0 Limitations

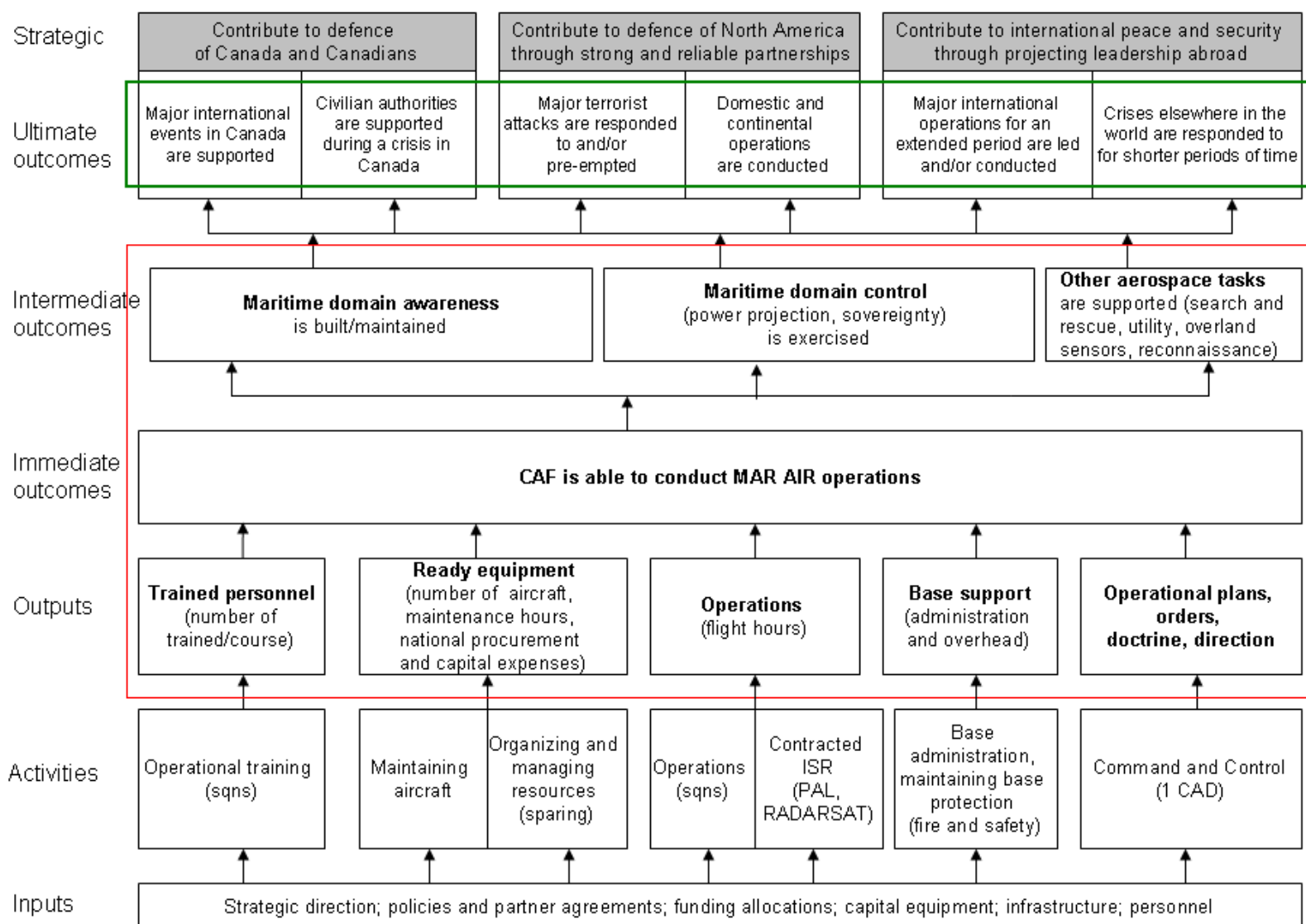
The following table identifies the constraints and limitations of the evaluation (viz., limitations of design, methods and consultations; actual/potential biases; reliability of the data and the impact on evaluation findings) and how the evaluation attempted to mitigate the limitations.

Limitation	Mitigation Strategy
Limited availability of MAR AIR-relevant performance information	Seek and compare multiple sources at strategic, operational and tactical levels
Limited availability of MAR AIR-specific financial information	Compare business plans and actual spending financial records; coordinate with comptroller staffs at multiple levels
Biased testimony as a result of military rank and concern for potential reprisal by superiors	Members advised that interview is protected by access to the <i>Privacy Act</i> and that only aggregated results are shown
Strategic planning of responses to interview questions to maintain consistent messages	Interview questions are customized to the audience; multiple data sources sought (planned and actual); copies of original documents requested, including notes

**Table B-2. Evaluation Limitations and Mitigation Strategies.** This table lists the limitations of the evaluation and the corresponding mitigation strategy.



## Annex C—Logic Model



**Table C-1. Logic Model.** This logic model illustrates how inputs, activities and outputs link to immediate, intermediate and ultimate outcomes, as well as to the Department's strategic outcomes.



## Annex D—Evaluation Matrix

Evaluation Matrix—Relevance							
1.0 Evaluation Issues/Question	Indicators	Literature/Document Review <sup>D-1</sup>			Financial Information	Interviews Site Visits	Case Studies
1.0 Does maritime air capability address an actual and ongoing need?	1.1 Previous MAR employments (frequency, type, intensity; Use of MAR AIR by/in allied forces including NATO)	No	D	P	Yes	Yes	Yes
	1.2 Likelihood of future need for MAR AIR(threats)	L	D	P	No	Yes	Yes
	1.3 Uniqueness of MAR AIR to CAF (i.e., CAF without MAR AIR)	L	D	P	No	Yes	Yes
2.0 Is maritime air capability consistent with GC, DND/CAF objectives and priorities?	2.1 Alignment with or inclusion of MAR AIR in stated government priorities	No	D	No	Yes	Yes	No
	2.2 Alignment with or inclusion of MAR AIR in DND/CAF priorities	No	D	P	Yes	Yes	Yes
3.0 Is it the role or responsibility of the federal Government (and DND specifically) to deliver maritime air capability?	3.1 Alignment with or inclusion of MAR AIR in relevant acts, legislations and Government directives	No	D	P	Yes	No	No
	3.2 Congruence in roles/ responsibilities of OGD to DND/CAF to deliver MAR AIR (i.e., duplication, gaps)	No	D	P	Yes	Yes	Yes
	3.3 Assessment of MAR AIR complements/augments/duplicates private industry or other level-government	L	D	P	Yes	Yes	Yes

**Table D-1. Evaluation Matrix—Relevance.** This table indicates the data collection methods used to assess the evaluation issues/questions for determining the relevance of the program.

<sup>D-1</sup> Includes literature (L); departmental documents (D); internal program documents (P)



Evaluation Matrix—Performance Effectiveness							
Evaluation Issues/Questions	Indicators	Literature/Document Review <sup>D-2</sup>			Financial Information	Interviews Site Visits	Case Studies
Immediate Outcomes							
4.1 Is the DND/CAF able to conduct maritime air operations?	4.1.1 Readiness status met (e.g., sustained, follow-on) for DOM, CONT, INTL employment *Pillars	No	D	P	Yes	Yes	Yes
	4.1.2 Extent to which assigned missions were met (impact/ quality, number, type, frequency, intensity, length, nature, priority)* four CFDS Pillars	No	D	P	Yes	Yes	Yes
Intermediate Outcomes							
4.2 To what extent has MAR AIR contributed to building and maintaining MDA?	4.2.1 Extent to which awareness is reliable/ complete (quality/ accuracy, quantity versus requirements (i.e., risk-based), confidence, coherent/ corroboration with other sources)	No	D	P	No	Yes	Yes
	4.2.2 Extent to which awareness is actionable (utility/ usefulness, timely: internal and external to CAF)	No	D	P	No	Yes	Yes
4.3 To what extent has MAR AIR contributed to maritime domain control?	4.3.1 Level of influence (ability to control/deter/act)	No	D	P	No	Yes	Yes
	4.3.2 Level of visibility (to self, Parliament, population, allies, opponents )	L	D	P	No	Yes	Yes
	4.3.3 Risk mitigation in maritime domain control	L	D	P	No	Yes	Yes
	4.3.4. Allied/CAF levels of mutual usage of maritime domain control capabilities (participation, satisfaction)	L	D	P	No	Yes	Yes

<sup>D-2</sup> Includes literature (L); departmental documents (D); internal program documents (P)



Evaluation Issues/Questions	Indicators	Literature/Document Review <sup>D-2</sup>			Financial Information	Interviews Site Visits	Case Studies
4.4 Through MAR AIR, is DND/CAF meeting expectations to provide support to OAT?	4.4.1 Proportion of OAT to overall MAR AIR mission and tasks	No	D	P	Yes	Yes	Yes
	4.4.2 Result of OAT on MDA and MD control (competing priorities/ resources)?	No	D	P	Yes	Yes	No
Ultimate Outcomes							
4.5 How does MAR AIR contribute to the six DND/CAF missions?	4.5.1 Evidence of contributions	L	D	P	No	Yes	Yes
Unintended Outcomes							
4.6 Have there been any unintended outcomes?	4.6.1 Evidence of unintended outcomes (positive or negative)	L	D	P	Yes	Yes	Yes

**Table D-2. Evaluation Matrix Performance—Effectiveness in Achieving Expected Outcomes.** This table indicates the data collection methods used to assess the issues/questions for determining the performance effectiveness of the Program.

<sup>D-2</sup> Includes literature (L); departmental documents (D); internal program documents (P)





Evaluation Matrix—Performance Efficiency and Economy							
5.0 Evaluation Issues/Question	Indicators	Literature/Document Review <sup>D-3</sup>			Financial Information	Interviews Site Visits	Case Studies
5.1 Were resources utilized efficiently/economically to produce the outputs and outcomes of maritime air capability? (design & delivery)	5.1.1 Cost of activities (training, maintenance) and outputs (personnel, equipment, infrastructure) per planned/stated activity rate	No	D	P	Yes	No	No
	5.1.2 Planned spending versus actual spending	No	D	P	Yes	No	No
	5.1.3 Cost compared to relevant OGDs, allies, private industry	L	D	P	Yes	Yes	No
	5.1.4 Primary cost drivers (what is monopolizing funds?)	No	D	P	Yes	Yes	No
	5.1.5 Major limiting factors (impediments/obstacles)	No	D	P	Yes	Yes	Yes
	5.1.6 Utilization rates relative to optimum	No	D	P	Yes	Yes	Yes
	5.1.7 Alternatives in design and/ or delivery of maritime air capability (rate, tasking—additional/new, different resources, processes)	L	D	P	Yes	Yes	Yes

**Table D-3. Evaluation Matrix Performance—Demonstrating Efficiency and Economy over the Period's Five Years.** This table indicates the data collection methods used to assess issues/questions for determining the performance efficiency and economy of the program.

<sup>D-3</sup> Includes literature (L); departmental documents (D); internal program documents (P)

