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## TOWARDS AN EQUILIBRIUM BETWEEN RCAF AND CONTRACTED MINTENANCE FOLLOWING THE PROCUREMENT OF THE CF-188 REPLACEMENT(S)

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## ABSTRACT

The integration and proper balancing of contracted maintenance in military organizations is a challenge that the Royal Canadian Air Force (RCAF)'s leadership has to constantly address. Where should the focus be in outsourcing maintenance on military aircraft? What is the most efficient way of leveraging from this unique expertise? How much is too much contracted maintenance? These questions are vital given that the CF-188 fleet is looking at a transition phase towards a new platform. The RCAF's fighter fleet is aging and in this new era of conflicts where hybrid warfare and the involvement of non-state actors has supplemented conventional warfare, its role has to evolve to face the new reality.

With the recent announcement from the government of Canada to procure F/A-18 Super Hornets to cover a capability gap, there is an immediate requirement to look at how to properly integrate new flying assets from a maintenance perspective. The RCAF needs to analyze all possible avenues that will optimize support to operations, and contracted maintenance is one of them.

This paper demonstrates that if used diligently in certain areas, contracted maintenance can have a positive effect in support of the CF-188 replacement(s), especially with the challenges associated with current demographics and the level of expertise in the maintenance community. It argues that while certain functions such as first line and some specific second line maintenance tasks need to remain within the military to ensure a proper force projection, some other roles can be filled by contracted maintenance and enhance the overall maintenance productivity. More specifically, it recommends that the outsourcing focal points for the fighter fleet should be training, second line maintenance and an embedded contractor capacity. By doing so, the RCAF would set itself up for success in support of a new fighter and

would ensure optimal leverage of technical expertise provided by contracted maintenance.

## LIST OF ABBREVIATIONS

10 FTTS - 10 Field Technical Training Squadron

A2/AD - Anti Access / Area Denial

AAR - Air-to-Air Refuelling

ACS - Aircraft Structure Technicians

ADF - Australian Defence Force

ADM(Mat) - Assistant Deputy Minister (Materiel)

AMS - Aircraft Maintenance Squadron

AMSE - Aircraft Maintenance Support Equipment

AOP - Annual Operating Plan

APGM - Advanced Precision Guided Munition

ATE - Automated Test Station

AVN - Aviation Technicians

AVS - Avionic Technicians

AVS OWSM - Avionics Optimized Weapon System Management

AWST - Air Weapon Technicians

C2 - Command & Control

CAF - Canadian Armed Forces

CASS - Consolidated Automated Support System

CD - Competency Dictionary

CDS - Chief of Defence Staff

CFSATE - Canadian Forces School of Aerospace Technology and Engineering

CJOC - Canadian Joint Operations Command

CMIS - Chief Military Information System

CMP - Chief of Military Personnel



COIN - Counter-Insurgency

CWO - Chief Warrant Officer

DAEPM-FT - Directorate of Aerospace and Engineering Program Management  
Fighters and Trainers

DGMPPRA - Director General Military Personnel Research and Analysis

DND - Department of National Defence

DSR - Deployment Support Request

ECP - Engineering Change Proposal

EGI - Embedded Global Positioning / Inertial Navigation System

EW - Electronic Warfare

FCAG - Fighter Capability Advisory Group

FETP - Fleet Employment and Training Plan

FG - Flight Generation

FSR - Field Specialist Representative

GoC - Government of Canada

IMP - Incremental Modernization Project

ISO - Isochronal Inspections

ISR - Intelligence Surveillance & Reconnaissance

ISTAR - Information, Surveillance, Target Acquisition and Reconnaissance

IT&E - Individual Training and Education

IW - Irregular Warfare

JAM-GC - Joint Concept for Access and Maneuver in the Global Commons

JHMCS - Joint Helmet Mounted Cueing System

JIMP - Joint, Interagency, Multinational and Public (JIMP)

JTAR - Job Task Analysis Record

KSA - Knowledge, Skills and Attitude

LCMM - Life Cycle Materiel Managers

LOX - Liquid Oxygen

MDGU Multi-purpose Display Group

MES - Military Employment Structure

MIDS - Multifunctional Information Distribution System

MOB - Main Operating Base

NATO - North Atlantic Treaty Organization

NAVAIR - Naval Air Systems Command

NCM - Non-Commission Member

NDHQ - National Defence Headquarters

NDT - Non-Destructive Testing

NGOs - Non-Governmental Organizations

NORAD - North American Aerospace Defence Command

NSR - Non-Standard Repairs

OEM - Original Equipment Manufacturer

OJT - On-Job-Training (OJT)

OWSS - Optimized Weapon Systems Support

PAM - Professional Airpower Mastery

PAT - Periodic Augmented Team

PATS - Portable Automated Test Station

PAV - Primary Air Vehicle

PD - Professional Development

PDNA - Professional Development Needs Analysis

PER - Periodic Inspection Line

PGM - Precision Guided Munitions

PLAAF - People's Liberation Army Air Force

PMC - Private Military Company

PML - Preferred Manning Level

POM - Performance Of Maintenance

PY - Person-Year

RAAF - Royal Australian Air Force

RCAF - Royal Canadian Air Force

RF/ATMSS - Radio Frequency Automated Maintenance Support System

SAMA - Senior Aircraft Maintenance Authority

SDE - Senior Design Engineer

SLBM - Submarine Launched Ballistic Missile

SOA - Service Oriented Architecture

TES - trained effective strength

UAV - Unmanned Aerial Vehicle

UN - United Nations

UNSCR - United Nation Security Council Resolution

USAF - United States Air Force

YFR - Yearly Flying Rate

TCCA - Transport Canada Civil Aviation

TFS - Tactical Fighter Squadrons

TST - Technical Support Technician

WoG - Whole-of-Government

## CHAPTER 1: INTRODUCTION

*On July 16, the Government announced it is acquiring 65 F-35 Lightning II aircraft from Lockheed Martin under the Joint Strike Fighter memorandum of understanding as Canada's next generation fighter. Analysis of our mandatory requirements made it clear that we needed a 5th generation fighter; the F-35 Lightning II is the only 5th generation fighter available to us that meets all those requirements and represents the best value for Canada.*

Lieutenant General André Deschamps, Into the 21st Century –  
An Overview of Canada's Air Force in 2010

Following this announcement in 2010 from the Government of Canada, the Royal Canadian Air Force (RCAF) fighter community finally had an indication of what would be replacing the CF-188, a highly reliable platform since the early 1980s. The RCAF accepted this new acquisition with enthusiasm, including now retired LGen Deschamps, then Chief of the Air Staff and Commander of Air Command.

Nonetheless, a major capital acquisition of that magnitude implies a significant amount of planning and analysis. Such measures are needed in order to properly implement a strong "sundown/sunrise" program<sup>1</sup> that will see the CF-188 gradually retire and its replacement take over without impacting Force Employment mandates such as Canada's contribution to the North American Aerospace Defence Command (NORAD). The fighter operational community has much to reflect on, and the following questions comes to the fore: What will be the implications of a new aircraft on the current/future mandate? How does the RCAF ensure proper pilot training with that new aircraft? How will it integrate with the RCAF's air-to-air refuelling capability? What will the impact be on the maintenance community? How will they properly prepare and train their technicians to maintain a new aircraft? What

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<sup>1</sup> The concept of "sundown/sunrise" refers to the gradual reduction of a fleet's old assets while progressively incorporating the new platforms. A balance is required between the two to ensure a seamless transition and minimum impact on operations.

kind of new tooling and equipment will be required? What kind of preventive maintenance program will this imply?

Indeed, there are probably as many questions from a maintenance perspective that need to be asked and answered as on the operational side since one directly affects the other. The aerospace maintenance community is known to have a strong sense of pride and belonging to the Air Force because it is considered integral to operations.<sup>2</sup> But there is one main question that will require to be handled with care due to the huge resource implications: what will be the right balance of contracted maintenance and RCAF maintenance (commonly called "blue suiters" maintenance) to ensure optimal efficiency at home and abroad? This question is especially pressing given the technological aspect of that new aircraft that will be much more "avionics oriented" compared to the CF-188.

Of course, much has changed since the announcement in 2010. Canada has withdrawn from the procurement F-35 commitment and is conducting an option analysis to determine what will be the aircraft best suited to replace the CF-188. The government even went as far as recently announcing that they will "immediately explore the acquisition of 18 new Super Hornet aircraft to supplement the CF-188s until the permanent replacement arrives."<sup>3</sup> However, in this new era where contracted maintenance has become increasingly important to keep aircraft flying, the question of how to properly balance it with military maintenance remains. Can the RCAF withdraw benefits without having a negative impact on its operational mandate in the short and long term? This research paper will argue that contracting maintenance of

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<sup>2</sup> Allan English and Colonel John Westrop (Retired), *Canadian Air Force Leadership and Command: The Human Dimension of Expeditionary Air Force Operations* (Trenton, Ontario: Canadian Forces Aerospace Warfare Centre, 2007), 168.

<sup>3</sup> Valerie Insinna, "Canada Plans to Buy 18 Super Hornets, Start Fighter Competition in 2017," *DefenseNews*, (22 November 2016).

military aircraft in certain spheres at first and second line<sup>4</sup> can positively affect the RCAF's maintenance productivity following the procurement of the CF-188 replacement(s).

The study will be divided into three parts. Chapter 2 will focus on the current status of the RCAF maintenance workforce and how contracted maintenance is already playing a role in optimizing efficiency. It will start by describing the current requirements and structure of aircraft maintenance organizations. For several reasons, not all fleets are structured the same way, and the CF-188 fleet is certainly a complicated entity due to the armament aspect that has no equal in the rest of the air force. But it remains that there are several commonalities that need to be taken into account such as: proper establishment and manning; key qualifications/authorizations; and inter-operability across the different trades and level of maintenance. This chapter will therefore define the different levels of repairs in the aerospace maintenance management field and elaborate on the technical depth of each one (first, second and third line) to demonstrate the uniqueness of the fighter community. It will show that industry is already playing an important role in two of the three levels of maintenance. Right now, there is a defined CF-188 fleet employment training plan but some challenges like demographics and the level of expertise in the different technician trades will highlight gaps that need to be taken into consideration and addressed. There is a continuous challenge in optimizing the efficiency of maintenance organizations which is why it will be important to look at cross-referencing the depth of knowledge at each level of maintenance with the way the Canadian Armed Forces (CAF) talent manages its workforce and employs

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<sup>4</sup> First and second line maintenance are described below.

contractors. The RCAF/CAF military personnel management doctrine will also be consulted to add some depth to the analysis of the current situation.

Chapter 3 will then provide an oversight of where the future of the air force lies from a maintenance perspective based on projected doctrine and new capabilities. The recent announcement of the Government of Canada highlights the fact that "Canada's current fleet is now more than 30 years old and is down from 138 aircraft to 77. As a result, the RCAF faces a capability gap."<sup>5</sup> In fact, it was Minister of National Defence Harjit Sajjan who first brought forward the term "capability gap" and RCAF commander Lt.-Gen. Mike Hood explained that "it was the Liberal government that brought in a 'policy change' which required the RCAF to meet both its North Atlantic Treaty Organization (NATO) and NORAD commitments at the same time."<sup>6</sup> That created a CF-188 capability gap since meeting such a mandate would require a bigger fleet. This basically paved the way for the purchase of 18 Super Hornets.<sup>7</sup>

There is a strategic element that needs to be addressed based on the above statements since it indicates that there is a tangible shift in conventional warfare and that the current RCAF fighter fleet will not be able to face it in its current shape. Canada's interoperability with other nations is key; and so new capabilities, or as a minimum modernizing existing ones, is vital, and it starts with the technical expertise to maintain such upgrades. This issue will be addressed, including where contracted maintenance could fill the gaps to optimize efficiency and deployability. Chapter 3

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<sup>5</sup> "Canada will immediately explore the acquisition of 18 new Super Hornet aircraft to supplement the CF-18s until the permanent replacement arrives," the Canadian government announced in a release. "Canada's current fleet is now more than 30 years old and is down from 138 aircraft to 77. As a result, the Royal Canadian Air Force (RCAF) faces a capability gap." Valerie Insinna, "Canada Plans to Buy 18 Super Hornets, Start Fighter Competition in 2017", *DefenseNews*, (22 November 2016).

<sup>6</sup> LGen Michael J. Hood (speech to Canadian senators, 28 November 2016).

<sup>7</sup> David Pugliese, "Liberal's policy change created CF-18 'gap' – RCAF commander in the dark on decision," *Ottawa Citizen*, 29 November 2016.

will also discuss centralization as it is often brought forth as a way to better use resources whether it is within the military organization itself or in conjunction with industry.

Finally, Chapter 4 will provide different examples and practices used in the military for balancing military workforce and contracted maintenance, keeping in mind the “in-theatre” aspect where a certain level of autonomy is required due to the nature of the profession of arms. There are expectations from a member of the Canadian Armed Forces such as being deployed in a theatre of conflict and putting his/her life at risk that will never be requested from a civilian. This is why a deployed air component needs to be self-sufficient and able to fulfill the operational mandate without completely depending on a civilian company. Accordingly, this chapter will address the equilibrium when maintaining aircraft on deployment.

More specifically, it will discuss the CF-188 Avionics Optimized Weapon System Management (AVS OWSM) model and the Australian and American national experiences that denote how contracted maintenance can be integrated successfully. Combined with the study of doctrine, existing practices and interactions with industry, the author will conclude by using his experience and expertise in the fighter maintenance occupational community<sup>8</sup> to offer some modified and new perspectives on how to positively integrate contracted maintenance into military organizations in preparation for the arrival of a new platform(s).

## **Conclusion**

There is much to examine in order to establish a framework where contracted maintenance is properly integrated into military organizations. This study addresses

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<sup>8</sup> Allan English and Colonel John Westrop (Retired), *Canadian Air Force Leadership and Command: The Human Dimension of Expeditionary Air Force Operations* (Trenton, Ontario: Canadian Forces Aerospace Warfare Centre, 2007), 162-169.



some of the main concepts and factors considered critical to the discussion but will certainly not provide a complete picture. Some elements will require to be further developed in order to have a full comprehension of all the intricacies of this topic. However, this study will provide enough depth to draw comprehensive conclusions that can be used as a starting point to further analyze this complex debate.

It is first necessary to provide the foundation of where the CF-188's maintenance community stands and outline the current realities of the fleet. This will permit a better perspective of the upcoming challenges associated with the new era of conflicts and the roles the government of Canada is expecting its fighter aircraft to fulfill. It is essential to offer a projection of how to cope with expectations using contracted maintenance, given the current status of military maintenance organizations and the arrival of a new platform(s).

## **CHAPTER 2: CURRENT STATUS OF MILITARY MAINTENANCE ORGANIZATIONS**

### **Introduction**

The maintenance workforce consists of approximately 7,000 individuals.<sup>9</sup> To orchestrate an optimal support to operations with such an amount of workers has many challenges, ranging from training to organization structures, expertise retention and demographics to name a few. This is why that in order to properly address how contracted maintenance can positively affect RCAF's maintenance productivity, it is important to understand the background and current status of its maintenance organizations. In this regard, generic concepts and requirements with regard to how aircraft maintenance organizations are structured will be addressed. Before doing so, it is also necessary to examine the literature on the subject of RCAF maintenance and contracted maintenance in order to better situate the overall discussion of finding a balance between the two in this study.

After examining generic concepts and requirements, this chapter will next discuss the way the RCAF trains its technicians and what are the current challenges in optimizing the level of expertise when considering present demographics. It will then examine potential mitigation options to face today's challenges using contracted maintenance, and end with a brief discussion about CAF personnel management doctrine.

### **Literature Review**

The current author's institutional memory and experiences as a maintenance officer working on the CF-188 for twelve years will be leveraged in this paper. This

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<sup>9</sup> A4 Maintenance Directorate, *Chief Military Information System (CMIS) report: Air Techs Demographics* (printed 24 January 2017), 2.

experience includes various positions within the Hornet maintenance community, including manager of the CF-188 Incremental Modernization Project (IMP) production line, senior aircraft maintenance engineering officer and avionics engineering officer section head. In the latter, there was daily interaction with Harris Canada System Inc. through the avionics Optimized Weapon Systems Support (OWSS) contract which links with this paper and how military organizations should interact with contractors. These personal professional insights are essential to this study because the literature on military aircraft maintenance practices is quite sparse.

In the scope of improving maintenance practices, Robert Tripp, a senior management scientist at the RAND Corporation who has more than 35 years of experience in the areas of military logistics systems design, development, management and evaluation, provides the analysis of the C-130, F-16 and KC-135 fleets. In particular, his focus is on addressing the effect of consolidating certain aircraft maintenance tasks at centralized repair facilities. He pursues the idea of finding more efficient ways of supporting continuous operations with fewer people. The intent is to provide the same or better level of aircraft availability with a smaller pool of personnel in specific areas so that it frees up workforce that can then be used in core deployable functions and make the Air Force more expeditionary.<sup>10</sup> This is a recurring theme in this research since it confronts the core element of an operational squadron mandate which is to serve as a government's strategic asset at home and abroad. Contracted maintenance is a mean to this end, since properly leveraging from it allows military technicians to focus on the right tasks.

Deborah Kidwell provides additional insight into contracted maintenance and uses the term Private Military Company (PMC) in her case study in *Public War*,

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<sup>10</sup> Robert S. Tripp *et al.*, "A repair network concept for Air Force maintenance : conclusions from analysis of C-130, F-16 and KC-135 fleets", (Rand Paper, no. MG-919-AF, 2010).

*Private Fight? The United States and Private Military Companies*. She argues for the value added in using this avenue to deal with the increasingly complex logistical aspect of military operations. Although conceding that it is a facet to be considered and used, she also warns about the fact that PMC is not a panacea for all logistical problems. There are advantages and disadvantages to be considered with this combat multiplier,<sup>11</sup> and so there is a debate regarding the right distribution of contractors employment.

Peter Cappelli's article in the 2014 *Annual Review of Organizational Psychology and Organizational Behavior* is also a useful resource. Cappelli specializes in human capital issues and is the George W. Taylor Professor of management and Director of the Center for human resources at the Wharton School, University of Pennsylvania. His article provides an overview of the literature on talent management through the fields of management, human resources, industrial and organizational psychology, sociology, and economics. It focuses on the new themes in contemporary talent management: the challenge of open labour markets, including issues of retention as well as the general challenge of managing uncertainty, new models for moving employees across jobs within the same organization and strategic jobs for which investments in talent likely show the greatest return.<sup>12</sup> These themes are in line with military aircraft maintenance organizations and their use of contracted maintenance since the proper balance between the latter and blue suiters is directly linked to using the right workforce for the right jobs in relation to the RCAF mandate. In order to do so, there is a requirement for retention, an organizational structure that

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<sup>11</sup> Deborah C Kidwell, *Public War, Private Fight? The United States and Private Military Companies*, Global War on Terrorism Occasional Paper 12. Fort Leavenworth Kansas: Combat Studies Institute Press, 2005.

<sup>12</sup> Peter Cappelli and JR Keller, "Talent Management: Conceptual Approaches and Practical Challenges," *Annual Review of Organizational Psychology and Organizational Behavior* 1 (January 2, 2014, 2014), 305-331.

promotes the right skillset and a good foundation that develop workers towards the institution's objectives.

### **Aircraft Maintenance Organizations: Requirements and Structure**

The structure of an aircraft organization depends on a variety of factors. The Department of National Defence's (DND) Maintenance Policy of Aerospace Engineering and Maintenance Program Management C-05-005-P02/AM-001 has an exhaustive list of those factors. However, the ones that are of interest here are: accountability for operational effectiveness in peace and in war, readiness requirements, role, deployability requirements, availability of manpower, facilities and equipment.<sup>13</sup>

There is an important distinction to be made between an operational squadron and an aircraft maintenance squadron (AMS). Both are subject to the above factors but they each have a very distinctive role in the sense that one is there to support the other. Indeed, the distinction is important since they will be referred to often in the scope of this research paper. The operational squadron is viewed as the first line (defined below) entity where operations are taking place and where operational ready assets are located. The aircraft maintenance squadron on the other hand contains almost exclusively second line maintenance capabilities that are there to take care of intermediate level maintenance that cannot be done at first line (discussed below). More specifically, it includes both off-equipment component repair and on-equipment aircraft inspections.<sup>14</sup> One AMS can support multiple operational squadrons depending on the fleet structure and if it is viewed as the most effective way of

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<sup>13</sup> Department of National Defence, C-05-005-P02-AM-001, *Maintenance Policy of Aerospace Engineering and Maintenance Program Management* (Ottawa: Chief of the Defence Staff, 2010), 3-5.

<sup>14</sup> Robert S. Tripp *et al*, *A repair network concept for Air Force maintenance : conclusions from analysis of C-130, F-16 and KC-135 fleets*, Rand Paper MG-919-AF (Library of Congress Cataloging-in-Publication Data, 2010), 8.

supporting the operational mandate. This is the common approach used in the military aviation, with the addition of a third line component which is more of a depot-level maintenance.<sup>15</sup> In order to properly grasp the above concepts and introduce the contracted maintenance component in military organizations, it is necessary to examine what the different levels of repairs entail generally in the aerospace maintenance management field and the technical depth of each one.

The first line or level of maintenance includes all servicing and corrective/preventive maintenance that can be accomplished without major disassembly of the aircraft. These are typically the first line maintenance tasks done at the operational squadron. It is also the depth of maintenance that blue suiters need to have a very high level of autonomy when it comes to deployed operations. These tasks are conducted on the flight line of duty whether it is at home or abroad, at peace or at war.<sup>16</sup>

The second level of maintenance primarily addresses major preventive/corrective maintenance inspection on the aircraft or off-aircraft component maintenance activities. In other words, it consists of maintenance actions of specialized workforce in specific facilities (shops) that requires training different than what is provided to technicians at the first line.<sup>17</sup> As such, second line maintenance is the scope of work specifically done by the AMS and where there is an argument to be made regarding contracted maintenance. This will be discussed in greater detail later in this study, but based on the author's experience, one can consider an operational squadron as the client of the AMS where the latter provides a service that needs to be tracked and monitored to ensure proper operational support. Besides, there are several

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<sup>15</sup> Department of National Defence, C-05-005-P02-AM-001, *Maintenance Policy of Aerospace Engineering and Maintenance Program Management* (Ottawa: Chief of the Defence Staff, 2010), 3-2-3.3.

<sup>16</sup> Ibid, 3-2.

<sup>17</sup> Ibid, 3-3.

civilian organizations and industries that provide parts of such a service. Taking into consideration the cost and resources associated with maintaining the AMS's specialized workforce, facilities and tooling, there is certainly a case to be made regarding contracting out more second line work instead of modernizing and revamping military resources to accommodate the CF-188 replacement(s).

Last is the third level maintenance, which encompasses more extensive activities such as replacement or restoration of major parts, assemblies or components, rebuilding and overhaul of equipment, mid-life improvements, life extension programs and more lengthy activities that require specialized facilities beyond those normally available at a Wing. This is why this type of work is typically done at a contractor's facilities using civilian workforce in support of the military.<sup>18</sup> This level of maintenance will not be discussed or debated in this paper since it is already an established practice that will not change regardless of the type of current or future platform.

In addition to the maintenance levels described above, there is a breakdown of specialized technicians grouped in different trades that covers the full spectrum of maintenance activities. More specifically for the CF-188, there are: aviation technicians (AVN), taking care of everything related to the propulsion group, landing gear and fuel system; the avionic technicians (AVS), maintaining electrical and electronic components; aircraft structure technicians (ACS) who encompass everything structural and all safety systems; and finally the air weapon technicians (AWST) who take care of all armament related maintenance, including internal armament systems and external stores.<sup>19</sup> To this can be added a myriad of support assignments (jobs that can be accomplished by any of the four trades) like tool

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<sup>18</sup> Ibid.

<sup>19</sup> Department of National Defence, *A-PD-050-500/PK-000, MOC 500 Common and AMSE On-Job Training Plan*. (Ottawa : DND Canada), 2-3.

control, aircraft maintenance control & record, and non-destructive testing (NDT) to name a few. Although all fleets are not structured the same way due to different aircraft configurations and systems, all flying organizations, whether military or civilian, have to cover the scope of work applicable to them using authorized individuals, be accredited under an airworthiness program, and be recognized by a Senior Design Engineer (SDE) or equivalent.<sup>20</sup>

### **Training Plan and RCAF Demographics**

Each RCAF fleet has a training plan called Fleet Employment and Training Plan (FETP) that specifies how each trade described above gets a newly enrolled individual to the level required to be qualified and authorized to work on an aircraft in a maintenance organization. For the CF-188 fleet, after conducting the apprentice level training at the Canadian Forces School of Aerospace Technology and Engineering (CFSATE) which takes several months, each technician will undergo 13 months of on-job-training and on-type course at 10 Field Technical Training Squadron (FTTS); consisting of 11 months for Legacy skills and 2 months of servicing/fleet specific training.<sup>21</sup> However, in addition to these training requirements, "technicians employed at the AMS are trained in their assigned shop to required authorization codes using applicable training and qualification standards."<sup>22</sup> This can add up to several months of courses depending on which shop the new technician is employed. It is therefore upwards of two years of training before a individual is employable at a squadron and can work under supervision of a more experienced technician (Level A tech). This is an important consideration since despite all the initial training, an individual then

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<sup>20</sup> Department of National Defence, C-05-005-P02-AM-001, *Maintenance Policy of Aerospace Engineering and Maintenance Program Management* (Ottawa: Chief of the Defence Staff, 2010), 7-3.

<sup>21</sup> Department of National Defence, A-PD-050-188/PA-000, *CF188 Hornet Fleet Employment and Training Plan* (Ottawa: DND Canada, 2016), 6-19.

<sup>22</sup> *Ibid*, 6-5.



requires several years working on an aircraft at the Performance of Maintenance (POM) level before being able to work autonomously as a Level A technician.<sup>23</sup> This point will be developed further below because the production capacity of a squadron is directly linked to the amount of Level A technicians.

Additional detail regarding the training associated with a fighter fleet technician is not necessary because what appears above gives an appreciation of the resources associated with the establishment of the workforce on a Wing and what bringing a newly enrolled individual at an employable state means. Training takes at least two years per person using two major training establishments with all associated courses infrastructure, training aids and staff. This is part of the basic requirements to have a fleet capable of conducting the strategic role as dictated by the government. However, certain questions need to be asked based on recent developments in Canada's fighter community. They include: Is the fleet efficient in the way they are training its personnel? Is there better way of supporting the fleet in certain areas? Does the fleet have the capacity to sustain the current and potential future mandate using the current way of doing business? Are there gaps in today's workforce that can be filled using outside of the military alternatives such as contractors? Before looking at these aspects and in particular the industry aspect, it is important to examine some demographics data that depicts today's reality.

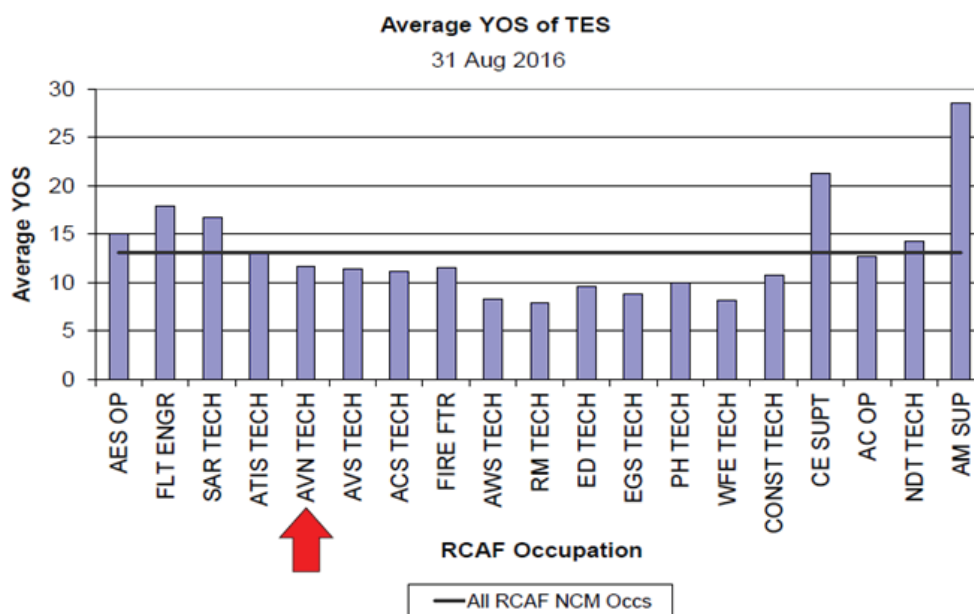
First, figure 2.1 below denotes that the average time in the military for most occupations in the RCAF is below 15 years.<sup>24</sup> This is fairly low if one takes into consideration the fact that as per above, two years are dedicated to training and bringing the newly enrolled technician to a level where he/she can be employed in a squadron under supervision. Therefore, for the four major trades in aircraft

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<sup>23</sup> Ibid, 6-15.

<sup>24</sup> A4 Maintenance Directorate, *SOA Briefing 2017* (Winnipeg: CWO Council, 21-24 November 2016), 13.

maintenance organizations (AVN, AVS, ACS and AWST), it shows about 9 years of real time in the job with the exception of AWST which is about 6 years.



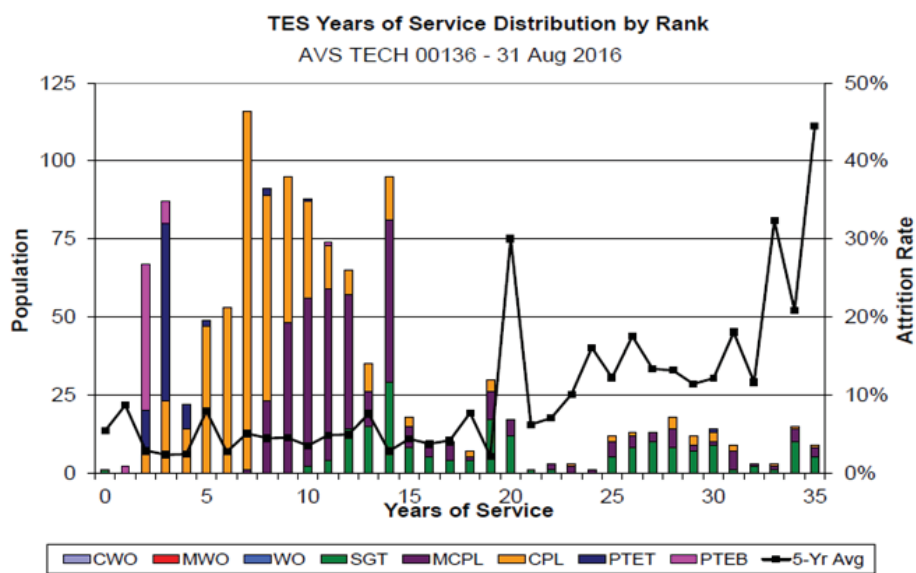
**Figure 2.1 - Average years of service of trained effective strength per trade**

Source: SOA Briefing 2017 - from CWO Council 21 - 24 Nov 2016

Figure 2.2 below is another representation, but this time it is specific to one of the major trade (avionics techs 00136 - AVS). It depicts the exact distribution per rank as per August 2016.<sup>25</sup> The majority are located between the 7 and 12 years of service mark and most of them are at the rank of corporal, one of the lowest rank in the non-commission member (NCM) community. Table 2.1 then shows that the average of this group is 33.8 years of age.<sup>26</sup> If one takes the average age of the entire AVS trade, the result is 34.14 which is very low compare to civilian industry. Considering that the preferred manning level is at 92% for this trade, this is the workforce that the RCAF will have to work with for the foreseeable future. Coming from the same sources, it is clear that the other trades have a comparable distribution.

<sup>25</sup> Ibid, 47.

<sup>26</sup> A4 Maintenance Directorate, *Chief Military Information System (CMIS) report: Air Techs Demographics* (printed 24 January 2017), 1.



**Figure 2.2 - Years of service - Distribution by rank for AVS trade**  
Source: Service Oriented Architecture (SOA) Briefing 2017 - from the Chief Warrant Officer (CWO) Council 21 - 24 Nov 2016

**Table 2.1 - RCAF members demographics as of January 2017**

*Member Demographics*

MOSID	Total	Rank	Subst	AL	Uniform			Gender		Avg Age
					Navy	Army	Air	Female	Male	
135 1	12	WO / PO1	1	11			12		12	43.4
135 1	284	Sgt / PO2	234	48			284	20	264	44.9
135 1	511	MCpl / MS	443	63			511	42	469	39.1
135 1	893	Cpl / LS	661	8		1	892	67	826	34.0
135 1	5	PteT / AB	5	0			5		5	25.7
135 2	117	Cpl / LS	9	18		1	116	3	114	30.7
135 2	94	PteT / AB	87	0			94	8	86	28.0
135 2	262	PteB / OS	238	0		2	260	34	228	25.0
135 2	32	PteR / OS	0	0	1		31	6	26	24.8
136 1	13	WO / PO1	1	12			13		13	44.6
136 1	185	Sgt / PO2	147	32			185	13	172	43.8
136 1	354	MCpl / MS	301	47			354	19	335	38.4
136 1	454	Cpl / LS	351	10			454	29	425	33.8
136 1	3	PteT / AB	2	0			3		3	25.5
136 2	1	MCpl / MS	1	0			1		1	29.6
136 2	102	Cpl / LS	7	33			102	2	100	31.2
136 2	118	PteT / AB	110	0			118	6	112	27.9
136 2	254	PteB / OS	235	0			254	22	232	26.6
136 2	43	PteR / OS	0	0			43	3	40	27.3

Source: SOA Air Techs Demographics - Chief Military Information System (CMIS) report.

In comparison with a civilian company that specializes in avionics and that supports the military at the 2nd and third level of maintenance (Harris Canada Systems, Inc), Table 2.2 shows that they have an average of 15.88 years of experience and 53.24 of age. So almost 20 years older and with about 6 more years of experience on average. This is a very significant difference in the aviation community.

**Table 2.2 - Harris Canada Systems, Inc demographics as of January 2017**

Airworthiness Equivalent	Rank Equivalent	Position	Years of Experience	Age
Level C	MWO	Operations Mgmt Mgr	34.32	54.82
Level C	WO	Repair Supv	21.32	49.15
Level A	SGT	Crew Chief	19.93	53.28
Level A	SGT	Crew Chief	26.17	49.65
POM	MCpl	Engineering Technician D	8.97	61.77
POM	MCpl	Engineering Technician D	20.63	54.96
POM	MCpl	Engineering Technician D	21.21	62.22
POM	MCpl	Engineering Technician D	24.83	63.78
POM	Cpl	Engineering Technician C	5.67	35.17
POM	Cpl	Engineering Technician C	5.82	61.17
POM	Cpl	Engineering Technician C	5.88	53.04
POM	Cpl	Engineering Technician C	6.48	41.83
POM	Cpl	Engineering Technician C	6.70	42.79
POM	Cpl	Engineering Technician C	9.72	60.82
POM	Cpl	Engineering Technician C	28.40	50.94
	Pte	Assembly D	7.99	56.47
		<b>Average</b>	15.88	53.24

Source: Mr Jim Gillespie - Director of Programs - Harris Canada Systems, Inc.

### **Challenges associated with the level of expertise and mitigation options**

Based on those demographics, an examination of key aspects that should be taken into consideration in order to optimize the use of military workforce for the different levels of maintenance is warranted. The definition from Brad Gladman regarding professional airpower mastery is an important starting point:

*Professional airpower mastery.* The aspirational level of airpower, professional airpower mastery (PAM), can be applied to an individual or the entire institution. For the RCAF it represents the institutional requirement to maintain expert levels of comprehension of airpower; ability to contemplate and debate airpower in future development terms; an understanding of organizational theory and institutional functions; a

professional awareness of the joint, combined, and interagency environments; and the ability to apply operational, strategic, and governmental decision-making constructs. All this in order to fully understand the science of airpower but also to be able to effectively apply the necessary art to be considered airpower and war-fighting experts.<sup>27</sup>

This concept offers an interesting perspective in the sense that although contracted maintenance offers a viable option to leverage from, the RCAF has that core requirement of maintaining a level of expertise throughout its organization in order to adapt to the current and future air power environment. Thus, that notion of balance between military and contracted maintenance becomes fundamental. It is therefore necessary to determine where the RCAF should focus its efforts based on the current situation and projected requirements. A focus on technical airpower mastery at the squadron level and below is of the essence instead of broader staff training and education. There is a requirement to provide opportunities through career courses or Individual Learning Programme that promotes long-term educational plans in the technical and personnel branches.<sup>28</sup>

Australian air power academic Sanu Kainikara also addresses the topic of technical airpower mastery in his article "Professional Mastery and Air Power Education." From an individual perspective, it relates to the competence necessary for a person to accomplish his/her assigned functions within the system that produces air power. From an organizational perspective, it is the proficiency of an individual to carry out activities at the unit level. The product of the technical mastery of all those individuals is what leads to the development and capacity of an entity such as an operational squadron to perform its dedicated role within the big picture. Technical mastery constitutes the foundation of an individual and therefore should be the focus

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<sup>27</sup> Brad Gladman et al., *Professional Airpower Mastery and the Royal Canadian Air Force: Rethinking Airpower Education and Professional Development* (Trenton: Canadian Forces Aerospace Warfare Centre, 2016), 3.

<sup>28</sup> Ibid, 13-15.

at the beginning of his/her career and through his/her development stages. Training must be structure in that sense since without adequate technical mastery, developing professional mastery is not possible.<sup>29</sup>

Beyond the issue of air power mastery, it is important also to examine recent demographic developments of Canada's air force. Notably, there was a restructuring of Canada's air force in the post-Cold War era. The 1994 Defence White Paper urged for reductions and called for "personnel levels [to be] cut back, operations and maintenance budgets shrinkage, defence infrastructure reduction and capital programs cancellation or delayed."<sup>30</sup> This generated a demographic disturbance referred to as the "uneven bell curve" by LGen Deschamps created by the loss of experience as the "baby boomers" retire, which the RCAF is still feeling the effects today.<sup>31</sup> It ties with the term "decade of darkness," a now-infamous expression originally coined by former head of the air force LGen Al DeQuetteville and popularized by former Chief of Defence Staff (CDS) General Rick Hillier It entailed that "the CAF became an institution that had been so depleted that its ability to deliver the expected political payoffs was now in jeopardy."<sup>32</sup>

As seen in the discussion of demographics above (specifically figure 2.2), this "uneven bell curve" translates into a very young workforce with a hole in the 20-25 years of experience due to the fact that recruiting was slowed down significantly in the 1990s. The RCAF is now experiencing a much younger management level

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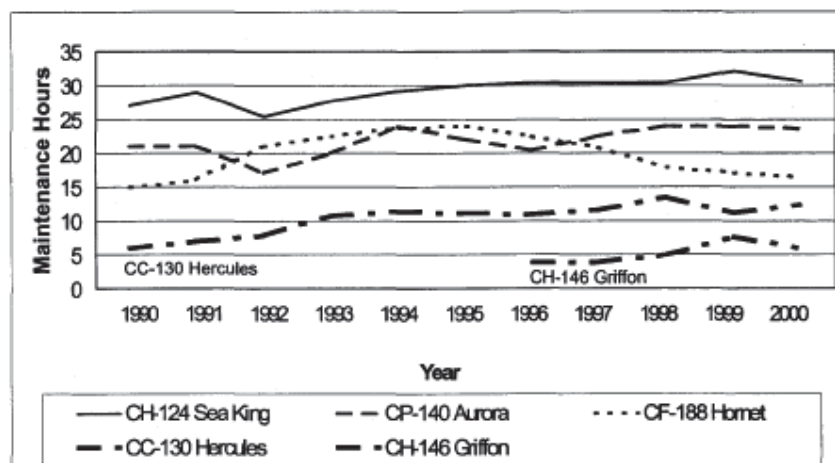
<sup>29</sup> Sanu Kainikara, Sanu, "Professional Mastery and Air Power Education," *Royal Canadian Air Force Journal* 3, no. 4 (Fall 2014): 48-49.

<sup>30</sup> Department of National Defence, *1994 Defence White Paper*, (Ottawa: Canada Communications Group, 1994), 14.

<sup>31</sup> André Deschamps, "Into the 21st Century – An Overview of Canada's Air Force in 2010", *Canadian Military Journal Volume* 10, no.4 (Autumn 2010), 63-64.

<sup>32</sup> Christian Leuprecht and Joel Sokolsky, "Defense Policy 'Walmart Style': Canadian Lessons in 'not-so-grand' Grand Strategy", *Armed Forces and Society Vol.* 41(3), (2014): 552; Referring to the 1990s, Hillier stated specifically that "those actions, dollar deprived, have now led to some deep wounds in [ . . . ] the Canadian Armed Forces over this past, what I would call, a decade of darkness." "Liberals Accuse Hillier of Being a Prop for the Conservative Party," *Ottawa Citizen*, 16 February 2007.

supervising younger technicians. The ripple effect can be felt on the maintenance floor where the most experienced technician will have about 8-9 years experience working on the aircraft compare to close to 20 in the early 1990s. This combined with several aging platforms generated some maintenance and serviceability limitations. The Auditor General noted that there was a significant increase in the total maintenance hours to total flying hours from 1990 to 2000.<sup>33</sup> More specifically, "there has been a 16 percent increase and a 62 percent increase in maintenance man hours to flying hours for the CH-124 *Sea King* and the CC-130 *Hercules* respectively during this period."<sup>34</sup> The CF-188 did not escape from that phenomenon since as per DND and RCAF officials, there is a direct correlation to be made between the increase of maintenance and a combination of the age of the fleet, loss of experience and unavailability of parts. Figure 2.3 below shows the actual figures as they appear in the Auditor General report in 2001.



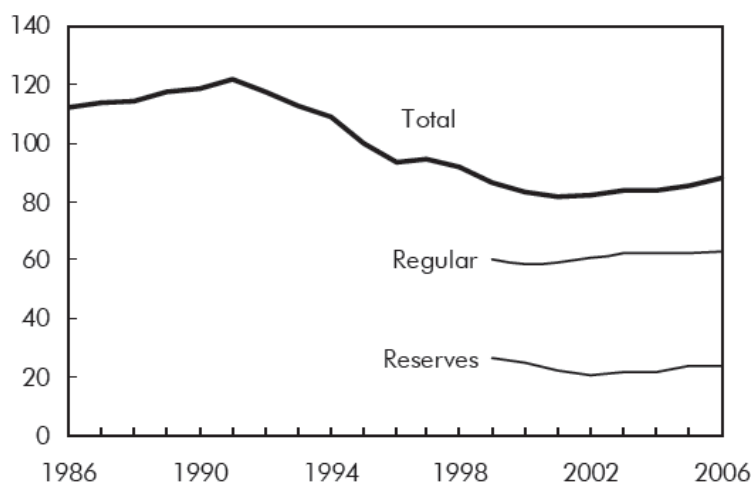
**Figure 2.3 - Maintenance Man Hours per Flying Hour (by aircraft type), 1990-2000**

Source: Report of the Auditor General of Canada, December 2001, 10.

<sup>33</sup> Kyle D. Christensen, "Out of the Sun and into the Ground: An assessment of the decline of the Canadian Air Force" (master's thesis, Dalhousie University, 2002), 65.

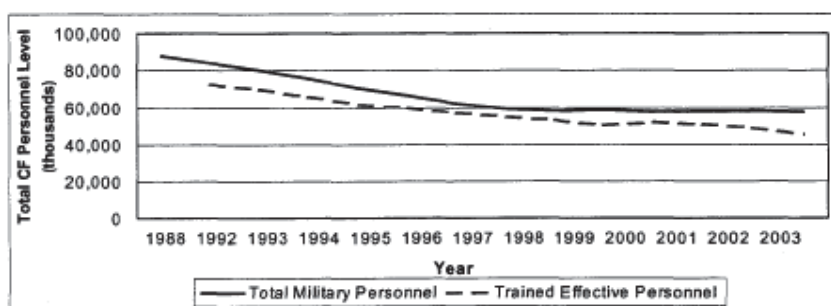
<sup>34</sup> Auditor General of Canada, *Report of the Auditor General of Canada to the House of Commons, December 2001 Chapter 10: National Defence - In-Service Equipment* (Ottawa: Minister of Public Works and Government Services, 2001), 10.

Those maintenance setbacks make the readiness of the different fleets an ongoing challenge to be dealt with over a prolonged period of time. The cause of this is not the professionalism of the workforce.<sup>35</sup> For several years the personnel assigned to the maintenance of aircraft have constantly proven that they would do anything within the constraints of the airworthiness program to ensure maximum platform availability.<sup>36</sup> The issue is that the CAF is simply leaner and with less experience than before as shown below.



**Figure 2.4 - Total CAF Personnel levels 1986-2006**

Source: Department of National Defence, Military personnel and wages and salaries.



**Figure 2.5 - Proportion of total military personnel to trained effective personnel, 1988-2002**

Source: Report of the Auditor General of Canada, April 2002, 4.

<sup>35</sup> Kyle D. Christensen, "Out of the Sun and into the Ground: An assessment of the decline of the Canadian Air Force" (master's thesis, Dalhousie University, 2002), 66.

<sup>36</sup> Based on author's experience in the maintenance community.



Therefore, looking into the future, a new platform will take away some factors negatively impacting maintenance production such as age of the fleet and unavailability of parts, but the two important aspects of trained effective strength (TES) and experience level will remain. To that one can expect an increase of maintenance hours per flight hour due to the learning curve associated with a new platform and possibly simply because the cost to pay for a technology sound aircraft will be a very high maintenance hours to flight hour ratio. The Naval Air Systems Command (NAVAIR) currently estimates the F-35 to take 50 hours of maintenance for every hour flown. This is three times as many as most fighter aircraft currently operated by Western air forces and is based on the first four years of their operational career.<sup>37</sup>

It is now important to examine the notion of Yearly Flying Rate (YFR) and how much the CF-188 fleet was able to support in the last couple of years with their TES. 425 "Alouette" ETAC (escadron tactique d'avion de chasse), which is one of the four tactical fighter squadrons (TFS) in the RCAF, will be used as a case study.<sup>38</sup>

Note that the figures presented are from the time where there was only two TFS in Canada (one per Wing), 425 (3 Wing) and 409 (4 Wing). Knowing that 425 Squadron was able to support a higher YFR on average in the last decade, what will be presented conservatively represents half of what the entire fleet was able to support. From data collected by the Senior Aircraft Maintenance Authority's (SAMA) cell at 425 squadron, Figure 2.6 below shows that a squadron can support about 350-400 hours per month (4200-4800 per year) taking into consideration that at the

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<sup>37</sup> Defence Aerospace, "Navair Sees F-35 Requiring Up to 50 Maintenance Hours per Flight Hour", last accessed on 24 January 2017, [http://www.defense-aerospace.com/articles-view/feature/5/179243/navair-projects-f\\_35-to-need-50-maintenance-hours-per-flight-hour.html](http://www.defense-aerospace.com/articles-view/feature/5/179243/navair-projects-f_35-to-need-50-maintenance-hours-per-flight-hour.html).

<sup>38</sup> Royal Canadian Air Force, "425 Tactical Fighter Squadron," last accessed on 18 February 2017, <http://www.rcaf-arc.forces.gc.ca/en/3-wing/425-squadron.page>. The frontline fighter squadrons are 425 & 409 and the newly created squadrons are 433 and 401.

moment the numbers were calculated, year 2015 was not completed. As entertained above, there is a strong correlation between the amount of Level A technicians (tech with airworthiness authority to sign for the release of an aircraft from maintenance following a maintenance task) and the YFR.<sup>39</sup>

2015	Moyenne mensuelle LvL A	19	YFR
	Moyenne mensuelle POM	34	332,6
	Moyenne mensuelle présent	66	
2014	Moyenne mensuelle LvL A	20	YFR
	Moyenne mensuelle POM	39	337,4
	Moyenne mensuelle présent	70	
2013	Moyenne mensuelle LvL A	23	YFR
	Moyenne mensuelle POM	38	436,1
	Moyenne mensuelle présent	65	

**Figure 2.6 - YFR supported by 3 Wing from 2013-2015 in relation to workforce**  
Source: Senior Aircraft Maintenance Authority Cell, November 2015.

Several factors are to be considered when looking at those numbers such as the serviceability rate, the nature of the repairs and operational tempo since they directly impact the YFR produced. However, this is a good representation of the amount of level A technicians that were physically there to work on aircraft on average per month. Breaking it down further, it is found that on a monthly basis:

- 2015 : 17.5 hours flown per Level A tech
- 2014 : 16.9 hours flown per Level A tech
- 2013 : 19 hours flown per Level A tech

<sup>39</sup> Senior Aircraft Maintenance Authority Cell 425 ETAC, *Effectifs MOB 2013-2015* (Bagotville, Quebec: e-mail from SAMA's cell to the Senior Aircraft Maintenance and Engineering Officer 425 ETAC, 4 Noember 2015 at 7:31 AM).

This equates to about 85 hours of flight generated every month for every 5 Level A technicians.<sup>40</sup> Based on the above factors (experience level, aging of the aircraft and spare levels), one can project that these numbers will not improve in the foreseeable future. Figure 2.3 illustrates that between 15-20 hours of maintenance is required for every flying hour. Compared to NAVAIR's predictions that about 50 hours of maintenance will be required for every flying hours of an F-35, 2-3 times less YFR that can be supported by today's maintenance capabilities. If one takes an optimistic factor of 2.5, instead of 4200-4800 flying hours per year per wing, it will be about 1680-1920 hours per year per Wing.

The purpose of the analysis above is intended to put in perspective that depending on what the government will expect, there might be a gap in what the maintenance workforce can support and the amount of YFR wanted. As depicted above in the demographics, the fleet is facing challenges regarding the level of expertise of aircraft technicians, substantiating the requirement to look at alternatives to leverage from like contracted maintenance.

Pursuing with this line of thought, several options are available for the RCAF with regard to enhancing the challenged level of expertise within its ranks. Although a more thorough analysis would be required for each of them, a couple possibilities will be examined from a generic standpoint.

The first addresses hiring expertise as an embedded capacity. Cappelli and Keller propose the hiring in the private sector to mitigate some of the challenges referenced above. Such an initiative allows for acquire knowledge, implement enhance capacity to innovate, and acquire people who can influence or expand

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<sup>40</sup> Ibid.

business.<sup>41</sup> Those benefits are very much applicable to the military and the current situation the RCAF is facing. Although this would come at a cost, a business case would probably show that the return on investment would be beneficial due to the extensive experience they bring, their productivity and the continuity aspect. In addition, it would probably attract former military members with years of experience working on military aircraft, capitalizing on the investment from the Crown on those individuals.<sup>42</sup>

The CF-188 community did go back and forth several times with this idea of having embedded contractors within its maintenance teams. From 2010 to 2014, the fleet was employing a well established Technical Support Technician (TST) line through L-3 MAS located in Mirabel. The scope of work included the provision of 24 personnel from various trades to reinforce the different maintenance organizations at 3 Wing Bagotville and 4 Wing Cold Lake in support of flying operations. It encompassed a variety of tasks such as first line maintenance, second line maintenance and training. From 2008 to 2010, they also supported an entire periodic line under the Periodic Augmented Team (PAT) program to supplement the ones already established by the CF-188 military units.<sup>43</sup> The requirement for such an endeavour was to cover for the fact that the level of YFR required by the fleet was too high for the production capacity of military periodic inspection lines (PER). Those thorough inspections that are required every 400 hours of flying by a specific platform

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<sup>41</sup> Peter Cappelli and J.R. Keller, "Talent Management: Conceptual Approaches and Practical Challenges," *Annual Review of Organizational Psychology and Organizational Behavior* 1 (January 2, 2014): 321.

<sup>42</sup> J.L.K. Armstrong, "Confluence of concepts towards professional airpower mastery: Contextualizing talent management and the CAF leader development model" (Directed Research Paper, Canadian Forces College, 2016), 15.

<sup>43</sup> Caroline Fortier, Director of programs CF-188 Hornet L3-MAS, e-mail conversation with the author with subject line: TST line - L-3 MAS feedback related to PAT Line and TST since 2008, 1 February 2017.

(now 600 under the newly improved periodic card deck),<sup>44</sup> was a 45 working days job for a team of 8-10 blue suiter technicians. Because of the factors discussed above (aging of the aircraft causing extra work during the periodic inspection and loss of experience), the 45 days became 50 days. The contracted PER line was able to complete a periodic inspection within 37 working days with the same amount of technicians due to the experience level that they had and the fact that there was no extra-curricular activities for them to do other than working on the aircraft which is not always the case for military technicians (this will be discussed later).<sup>45</sup>

The TST line was dismantled in March 2014 by the the Directorate of Aerospace and Engineering Program Management Fighters and Trainers office (DAEPM-FT) due to budget constraints. However, the effect has been felt from that moment on and a PAT line was reopened a year later in April 2015 to complete 4 periodic inspections for that particular fiscal year<sup>46</sup> to support the high YFR caused by the force employment of the CF-188 abroad during Operation IMPACT in Kuwait.<sup>47</sup> This is in addition to the numerous periodic inspections that have been conducted directly at the contractor's facility in Mirabel since. Finally, as agreed at the Fighter Capability Advisory Group (FCAG) on 11 May 2016, in order to increase 4 Wing

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<sup>44</sup> Periodic Inspections are in-depth preventive maintenance conducted every 400 airframe hours +/- 10%. It involves the completion a of a card deck where each card is a maintenance action for a specific specialty occupation. An analysis of the card deck conducted by L-3 MAS and approved by the CF-188 Senior Design Engineer in 2013 authorized Periodic inspections to be conducted every 600 airframe hours +/- 10%.

<sup>45</sup> L-3 MAS Canada, *Response to SOR (AOP 2009-2010) - CF-18 Periodic Augmentation Team – BFC Bagotville – Project 0009 - GAP-000-0083, Rev (Basic)* (Mirabel: PQ, February 2009), B-3.

<sup>46</sup> Caroline Fortier, Director of programs CF-188 Hornet L3-MAS, e-mail conversation with the author with subject line: TST line - L-3 MAS feedback related to PAT Line and TST since 2008, 1 February 2017.

<sup>47</sup> National Defence and the Canadian Armed Forces, "Operation Impact," accessed 18 February 2017, <http://www.forces.gc.ca/en/operations-abroad-current/op-impact.page>.

Cold Lake PER effectiveness, there was an agreement to amalgamate military technicians with L3 MAS technicians to form two PER lines.<sup>48</sup>

The second generic category to be examined is retention and use of reserve units. This obvious strategy is often looked into since it is one of the cornerstones of ensuring healthy demographics. Even if the RCAF has the best recruiting strategy in place, without a good retention program, it would be difficult to progress towards a more experienced maintenance workforce. This approach will not be discussed in detail because it is outside the scope of this paper, but there are some military DND publications,<sup>49</sup> research from government departments<sup>50</sup> and studies from former CFC students<sup>51</sup> that offer a strategic approach when it comes to retention. Elaboration on the use of reserve units, however, is relevant as it offers a viable approach to mitigate the experience deficiency in the military.

For years, 3 Wing Bagotville has used reservists to supplement its regular workforce, and has done so to the Wing's advantage. Those reservists have a defined scope based on what the Wing needs and again do not have all the extra curriculum activities a regular member has. In addition, they usually are technicians with years of experience that still want to work as a military member but without the risk of being posted out.<sup>52</sup> This is in line with the total force concept of the Air Force personnel doctrine which states that "air reservists are fully integrated in units,

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<sup>48</sup> Fighter Capability Advisory Group (FCAG), *Decision on the use of contractors as an embedded capacity within 1 AMS PER line* (Winnipeg: MB, 11 May 2016).

<sup>49</sup> Department of National Defence, DAOD 5002-0, *Defence Administrative Orders and Directives: Military Personnel Requirements and Production* (Ottawa: DND Canada, 2015), 2.

<sup>50</sup> Nancy Otis and Michelle Straver, *Review of Attrition and Retention Research for the Canadian Forces* (Defence Research & Development Canada - Centre for Operational Research and Analysis: Technical Memorandum TM 2008-030, 2008), 70.

<sup>51</sup> M. A. Jacula, "Two Factor Theory for Innovative Retention in the Canadian Armed Forces" (Master of Defence Studies research project, Canadian Forces College, 2014), 120; J.L.K. Armstrong, "Confluence of concepts towards professional airpower mastery: Contextualizing talent management and the CAF leader development model" (Directed Research Paper, Canadian Forces College, 2016).

<sup>52</sup> Many technicians want to remain at the same location in preparation for their retirement and choose to transfer to a reserve unit for that purpose. This is definitely an avenue that has paid dividends and should be pursued as much as possible.

contribute directly to the day-to-day operation as well as to deployed operations. Any job can be performed by either a reservist or Regular Force member; therefore they must have equivalent competencies."<sup>53</sup>

It is also instructive to explore the option of second line maintenance leverage through contractors. This option will be discussed in further detail in Chapter 4, which examines balancing contracted maintenance and “blue suiters” maintenance. The CF-188 OWSM model and other national experiences in Australia and the US will serve as examples. For now, it is sufficient to state that second line maintenance is probably the one level that requires the most scrutiny when it comes to defining what should fall within the scope of military maintenance and what could be contracted out. Considering the AVS Optimize Weapon System Management (OWSM) contract for example, it was put in place for the repair of second and third line avionics items in addition to the management of avionics components spare pools.<sup>54</sup> They have proven to be an efficient way of doing business due to their level of expertise and the fact that they are much more proficient at defining true requirements for a specific operation. The military supply system could never compete against their historical data and analytical tools such as Maintenix.<sup>55</sup> They can adjust production and provide just in time delivery at Main Operating Base (MOB) or in theatre of operations within the constraints of the annual operating plan (AOP).

In addition, contractors hired to perform second and third line repairs are often the original equipment manufacturer (OEM) of components and test equipment which means that nobody is more efficient than them to perform the maintenance. Taking

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<sup>53</sup> Department of National Defence, B-GA-407-001/FP-001, *Air Force Personnel Doctrine* (Ottawa: Chief of the Air Staff, 2010), 2-2.

<sup>54</sup> Public Works and Government Services Canada, *OWSS CF-18 AVIONICS Contract No W8485-07AN05/001/BB* (Ottawa, DND, 2010).

<sup>55</sup> MXI, "Maintenix Operator Edition", last accessed 31 January 2016, <http://www.mxi.com/products/maintenix/overview/>.

the 3 Wing CF-188 avionics labs as an example, a business case was done to transfer a Radio Frequency Automated Maintenance Support System (RF/ATMSS) from the 3 Wing AVS lab to Harris Canada Systems Inc facilities since they were the only one able to conduct the upgrades and repairs on this automated test station (ATE). The justification was that "it was going to provide flexibility in future support of the RF/ATMSS at greatly reduced costs while freeing up 4.5 military personnel for higher priority operational requirements."<sup>56</sup> This is an illustration of how contracted maintenance can help support productivity at a lower cost without impacting in-theatre autonomy when it comes to repair capability in support of operations.

Lastly, there is the idea of limiting the amount of extra-curricular activities for technicians from the regular force. This point has been alluded to above and deserves to be mentioned as a way to address the optimization of the level of expertise and military production capacity. Part of being a member of the CAF is adhering to a code of conduct which includes carrying any task in line with the service. This means that one could be asked to conduct tasks outside the scope of one's primary military occupation such as secondary duties, parades, courses or any other extra duty the chain of command orders. This seems like a rather benign notion but when added up together, a military aviation technician who has unique expertise for which he/she receives a specialist pay, could spent almost 50% of his/her working hours doing things other than his/her primary job. This is what the private company KPMG noticed and commented on when it was hired by the government to investigate on best practices within the RCAF. They came to 3 Wing in January 2016 and this was the very first observation they made during their outbrief to the higher chain of command and decision makers. They concluded that "maintainer time is sometimes

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<sup>56</sup> Harris Canada System Inc., *Report on Future Support Options Analysis for Radio Frequency Automated Maintenance Support System (RF/ATMSS)* (Calgary: AB, 2011), 8.



seen as free (sunk cost), rather than a scarce resource to be assigned to technical tasks linked to readiness and asset preservation. There are some in-garrison tasks that may be performed by non-wrench-turning roles.<sup>57</sup> It would definitely be in the RCAF's interest to free maintainers from non-maintenance duties through task reallocation.

### **CAF Military Personnel Management Doctrine**

Before looking at future aspects to consider in the next chapter and extrapolate from there on where the CAF should focus to optimize the use of aviation technicians and contracted maintenance, it is instructive to look at the current status and initiatives put together by the CAF in professional development, employment and career management in order to be in line with them as much as possible.

It is essential to acknowledge three independent L1 initiatives that have been undertaken to ensure CAF personnel are able to effectively perform their job.<sup>58</sup> They are the 2005 RCAF front-end analysis process to create a Job Task Analysis Record (JTAR) aimed at Military Employment Structure (MES) development and staffing and individual training and education (IT&E)<sup>59</sup>, the initiative by the Director General Military Personnel Research and Analysis (DGMPRA) to develop a CAF competency dictionary (CD) in support of Chief of Military Personnel (CMP) renewal initiative<sup>60</sup> and the Professional Development Needs Analysis (PDNA) intended to support MES

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<sup>57</sup> KPMG, *Phase 5 – Roll-out Site Visit: outbrief to 3 Wing, Bagotville* (Alouette: PQ, 20 January 2016).

<sup>58</sup> Major Marcel Ducharme, "A new Front-End analysis framework for the Canadian Armed Forces" (Exercise Solo Flight, Canadian Forces College, 2014), 2.

<sup>59</sup> Royal Canadian Air Force, *Job task analysis Record (JTAR): JTA Process Aid Memoire* (Winnipeg, MB: 2 Cdn Air Div, n.d.), 1.

<sup>60</sup> Chief of Military Personnel, *Canadian Armed Forces Competency Dictionary* (Ottawa: DGMPRA, 2014), 1.

specification development and staffing similar to the Job Task Analysis Record JTAR but in a broader perspective.<sup>61</sup>

These initiatives closely align with the concept of knowledge, skills and attitude (KSAs)<sup>62</sup> to perform a job and closing performance gaps and how an organization can use this approach "when a new system or technology must be implemented, when existing training programs must be revised or updated or when new job responsibilities must be assumed by people."<sup>63</sup> This will be especially relevant in the scope of this research paper. There is also that notion of ensuring professional development (PD) activities across the sub-components of the four pillars of training, education, experience and self development<sup>64</sup> that needs to be taken into consideration to ensure KSAs and competencies are developed to the full potential.

## Conclusion

The main consideration is that while the RCAF has a defined training plan as described above, it will be important to link back to those CAF Military Personnel Management initiatives when looking at optimizing the way to develop and employ the aviation technicians in conjunction with contractors. If the RCAF wants the workforce to evolve with the right skill sets, to enhance experience levels and to optimize production in defined areas like deployed operations while leveraging up

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<sup>61</sup> Canadian Army, *Canadian Army Order 24-08: Canadian Army IT & PME Policies and Procedures* (Kingston: COS ATA, 2014), 16-17.

<sup>62</sup> "Knowledge is an organized body of facts, principles, procedures, and information acquired over time... Knowledge is a prerequisite for learning skills... A skill is a proficiency at being able to do something rather than just knowing how to do it. By skills, we mean the capacities needed to perform a set of tasks... Attitudes are employee beliefs and opinions that support or inhibit behaviour"; Nick Blanchard and James Thacker, *Effective Training: Systems, Strategies, and Practices, Fifth ed.* (Upper Saddle River, NJ: Pearson, 2013), 17-19.

<sup>63</sup> Kavita Gupta, *A Practical Guide to Needs Assessment* (San Francisco, CA: Jossey-Bass, 1999), 115.

<sup>64</sup> Canadian Forces Leadership Institute, *Duty With Honour: The Profession Of Arms In Canada* (Ottawa: DND Canada, 2003), 18.

contractor's mastery, it needs to understand how to properly integrate training, professional development and personnel employment across RCAF organizations.

This chapter demonstrated that the RCAF has a well defined structure and training plan but that does not negate the fact that aviation technicians require several years of training and "on-the-job training" in order to achieve the status of Level A technician that is directly tied to production capacity and support to operations. There is currently a gap of experience within the RCAF created by the 1990 budget cuts and reduction initiatives. The demographics depict an "uneven bell curve" phenomena that clearly shows an absence of workforce in the 20-25 years of experience interval. This translates into challenges in optimizing the level of expertise since the limited knowledgeable resources have a hard time coping with their dual responsibility of production and training of younger technicians. There are some options to address these challenges. In particular, it was question of hiring contracted expertise as an embedded capacity, retention and use of reserve units, second line maintenance leverage through contractors and limiting the amount of extra-curriculum activities for technicians from the regular force.

The next chapter will look at what challenges the RCAF will be facing in the foreseeable future in this new era of conflict brought by the 21st century. From a maintenance perspective, several considerations are required to be able to prepare for the integration of the CF-188 replacement(s) and some concepts such as interoperability and capability gaps will be at the centre of the discussions on projected technical expertise and maintenance requirements. Some key initiatives such as maintenance centralization will be examined in order to set the table for the last chapter that will offer specific avenues and a proposal on how to leverage from contracted maintenance to optimize efficiency of military maintenance organizations.

### CHAPTER 3: MEETING AIR POWER'S CHALLENGES IN THE 21<sup>ST</sup> CENTURY

#### Introduction

Now that the current realities and challenges the RCAF is dealing with from a personnel perspective have been considered, it is important to discuss what air power in general is facing in today's security and defence environment. Such an examination is especially essential given the emerging threats in this new era of warfare where modern militaries are slowly dissociating from conventional warfare to deal with conflict resolution and non-state actors.<sup>65</sup> Because the Canadian government refers to a capability gap in its current fighter fleet, an insight into the impacts of today's conflicts on the RCAF and what can be done to face it is necessary, as there is a direct impact on flying units and the maintenance teams attached to them.

In order to do so, this chapter will first examine potential roles and requirements for fighters today to remain relevant, expanding on interoperability and the notion of capability gaps. It will then debate what those operational challenges mean for the military maintenance community and their technical expertise, putting an accent on future maintenance requirements. It will end with a discussion on centralization which is often referred to as a good way to optimize maintenance efficiency, whether it is within military organizations only or combined with contracted maintenance.

#### 21<sup>st</sup> Century Air Power and Requirements to Meet the New Era of Conflicts

Recently the Canadian government has announced that it will explore the acquisition of Super Hornet aircraft to cover a foreseen gap in Canadian fighter

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<sup>65</sup> Peter Gizewski and Lieutenant-Colonel Michael Rostek, "Vers une Force terrestre dotée d'une capacité interarmées, interorganisationnelle, multinationale et publique (IIMP)", *Le Journal de l'Armée du Canada* 10, no. 1 (printemps 2007): 58.

capabilities. This is admitting in a certain way that the CF-188 will not be able to serve Canada's interest in the foreseeable future and that it cannot even get to the "sundown/sunrise" bridge with the new long term platform that will replace it. In the article "Transforming Canada's Air Force: Vectors for the Future," Lieutenant-General Ken Pennie (then Chief of the Air Force) discusses the "Strategic Vectors" document produced by the government in 2002. It states that "the intent is to transform the air force into an expeditionary, network-enabled, capability-based and results focused Force. Its mission is the control and exploitation of the aerospace environment wherever needed to contribute to national objectives."<sup>66</sup> With this in mind, it is important to understand the upcoming challenges in warfare for air power since it directly affects how the fighter fleet will be employed.

In addition to traditional conventional armed conflict, today's militaries are faced with additional challenges such as conflict resolution, irregular (non-conventional) warfare, and the influence of non-state actors on the international scene such as terrorists organizations, organized crime and smuggling activities. Irregular warfare (IW) can be defined as "a violent struggle among state and non-state actors for legitimacy and influence over the relevant populations. IW favors indirect and asymmetric approaches, though it may employ the full range of military and other capabilities."<sup>67</sup> This new enemy combines kinetic and non-kinetic capabilities with the goal of disrupting the conventional armed forces' will to fight. Their objective is

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<sup>66</sup> Lieutenant-General Ken Pennie, "Transforming Canada's Air Force: Vectors for the future", *Canadian Military Journal* Vol 5, no 4 (Winter 2004-2005): 41.

<sup>67</sup> John Malevich, "Irregular Warfare Theorists And Practitioners Brief" (lecture, Canadian Forces College, Toronto, ON, 12 December 2016), with permission.

taking over deficient governments or ungoverned territories by influencing populations masses in urban areas.<sup>68</sup>

Air power and especially fighters have developed largely in the context of conventional warfare, but if employed properly, are still very relevant in today's irregular warfare security and defence environment.<sup>69</sup> As per DND's *Air Force Vectors*, there is a requirement to contribute from a joint aspect at the tactical and operational level while answering to strategic objectives independently. The RCAF has to be an adaptable and flexible instrument of national power which means that it requires the "ability to participate in operations on a global basis as mandated by the government... and must be prepared to lead and support coalition operations across the spectrum of conflict."<sup>70</sup> The following key capacities are critical to achieve this purpose: aerial attacks, air mobility and intelligence surveillance & reconnaissance (ISR).<sup>71</sup>

Since today's conflicts largely revolve around urban areas and counter-insurgency (COIN), the kinetic effect that the fighter force brings is criticized and judged as being increasingly less effective. However, if used in a joint approach, it can still bring a lot to the fight. Strikes can enable military forces in a joint COIN environment, leveraging from the elements of speed and precision in support of ground forces in operations. It offers quick geographical coverage using very little manpower.<sup>72</sup> Today's enemy is dispersed and it is hard to identify a distinct centre of

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<sup>68</sup> Peter Gizewski et Lieutenant-colonel Michael Rostek, "Vers une Force terrestre dotée d'une capacité interarmées, interorganisationnelle, multinationale et publique (IIMP)", *Le Journal de l'Armée du Canada* 10, no. 1 (printemps 2007), 58.

<sup>69</sup> James S. Corum and Wray R. Johnson, *Airpower in small wars: fighting insurgents and terrorists* (Lawrence, Kansas: University Press of Kansas, 2003), 423-439.

<sup>70</sup> Department of National Defence, A-GA-007-000/AF-008, *Air Force Vectors* (Ottawa: Director General Air Force Development, 2014), 26.

<sup>71</sup> Department of National Defence, B-GA-400-000/FP-001, *Canadian Forces Air Doctrine* (Ottawa: Commander Royal Canadian Air Force, November 2016), 34-36.

<sup>72</sup> North Atlantic Treaty Organization, AJP-3.4.4 *Allied Joint Doctrine for Counterinsurgency* (Brussels: NATO Standardization Agency, February 2011), 5-30.

gravity where firepower can be applied. But hitting operations centres and preventing non-state actors to retreat into safe havens and support land operations through integrated means is still very much within the fighter platform's scope of operations.<sup>73</sup>

Looking at counter-insurgency theorist Roger Trinquier's three phase approach, the best way to fight insurgents was to re-establish security within the population through sanitization of urban areas, then rural areas and finally destroying safe havens.<sup>74</sup> A good example of this is Operation Anaconda where air power was the key to mission success in the end, providing air strikes to support Special Forces on the ground in the Shahi-Kot Valley (al-Qaeda's safe haven). Fighters are able to answer quickly in support of land operations by hitting designated targets and scouring the battlefield, offering interdiction and deterring the enemy.<sup>75</sup> Also of note, "the ability to strike using firepower far in excess of what the insurgent can mount is a very powerful asymmetry. This capability can greatly limit an insurgency's ability to mount large-scale operations or develop command and logistics infrastructures."<sup>76</sup> To summarize, when coordinated with good ISR, air power in COIN and the new era of conflicts can be very effective.<sup>77</sup>

The above does not negate the fact that there is still a conventional threat to be dealt with, especially concerning resurgent Russia, China and Iran. In this respect, Lieutenant Colonel Andreas Schmidt discusses the term Anti Access / Area Denial (A2/AD) which objective is to "prevent the attacker from bringing its forces into the

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<sup>73</sup> Wing Commander David Glasson, "Big War Air Power for Small War Operations", *The Royal Canadian Air Force Journal* Vol.3, no. 1 (Winter 2014): 19.

<sup>74</sup> John Malevich, "Irregular Warfare Theorists And Practitioners Brief" (lecture, Canadian Forces College, Toronto, ON, 12 December 2016), with permission.

<sup>75</sup> Richard L. Kugler, *Operation Anaconda in Afghanistan: a case study of adaptation in battle Case studies in defense transformation* (National Defense University, Center for Technology and National Security Policy, Fort Lesley J. McNair BG 20, Washington, DC, 20319, 2007), 20.

<sup>76</sup> United States Air Force, *Air Force Doctrine Document 2-3 Irregular Warfare*, (August 2007), 44.

<sup>77</sup> Craig Harmon, "Successful Application of Air Power in COIN rests on the foundations of good Doctrine", (MDS Directed Research Project, Canadian Forces College, 2016), 30.

contested region (A2) or to prevent the attacker from freely operating within the region and maximizing its combat power (AD)."<sup>78</sup> Defensive in nature, it can be viewed as Russia's and China's response to western force projection, precision strike, and highly-networked Command & Control (C2) capabilities. They have developed new capabilities that can be broken down in two categories: counter-ISR and counter-Precision Guided Munitions (PGM). For the latter, it simply relates to the destruction of the PGMs or the carrier itself. Examples are the Russian S-300 (SA-20 Gargoyle) or Chinese HQ-9 that can provide coverage of up to 200 km and the newly introduced S-400 (SA-21 Growler), with a range of up to 400km. As for counter-ISR, since accurate targeting information is crucial for the opponent, the aim is to deny ISR data collection through jamming sensors.<sup>79</sup>

In an answer to those new defence capabilities, Western countries need to identify specific counter-A2/AD capability gaps to maintain an acceptable level of conventional deterrence. This entails investment in technology that can successfully penetrate an A2/AD zone and create a desired effect, and new concepts for using existing technology and Counter A2/AD Capability Development, including a NATO doctrine review. A2/AD capabilities might be defensive in nature but could easily be used in conjunction to offensive operations as required.<sup>80</sup>

In his report on the future allied air power, Brad Gladman indicates that the US attention towards the Middle East is what permitted the resurgence of the Russians. For example, war games and studies have shown that there is a requirement for a minimum of 260 combat-ready F-22s to compensate the continuing development of Russian and Chinese fifth-generation fighters if they want to keep air dominance.

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<sup>78</sup> Lieutenant-Colonel Andreas Schmidt, "Countering Anti-Access/Area Denial: Future Capability Requirements in NATO," *Joint Air Competence Centre Journal*, Edition 23 (2016).

<sup>79</sup> Ibid.

<sup>80</sup> Ibid.



They are now short of this number since they have reduced to 187 in 2012 before Defense Secretary Robert Gates closed the production line.<sup>81</sup>

The US strategic thinking now lies in the Joint Concept for Access and Maneuver in the Global Commons (JAM-GC – previously called AirSea Battle) concept, which has capability development implications for the RCAF and CAF in general. The USAF is also seeking to find an optimal way to project effective air power into moderate conflicts such as the ongoing mission in Syria. Assuming Canada is in line with the US regarding conventional threats, it needs to ensure the understanding of the US agenda in terms of air power if they want to advance their own interest and keep having a role in regional operations. It is crucial that efforts is put towards gaining awareness of the full Joint Operational Access Concept and subordinate Joint Concept for Entry Operations which comprise JAM-GC.<sup>82</sup> Given their lack of capabilities, Canada needs to focus on roles and missions it can and could conduct and which provide the Government of Canada (GoC) with its desired end-states at home and abroad. Gladman adds that "all of these efforts would be assisted greatly through a comprehensive understanding of how close allies view the world and its threats and challenges, and how they plan to face them."<sup>83</sup>

Control of the air through air superiority is still one of the top strategic objectives in warfighting since it allows freedom of action on the ground. The fighter community is the best at accomplishing this air power mission.<sup>84</sup> Such an advantage is a force multiplier and as stated by Royal Australian Air Force (RAAF)

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<sup>81</sup> Brad Gladman, *The future of allied air power: The United States Air Force*, DRDC Scientific Report DRDC-RDDC-2014-R82 (Trenton: Canadian Forces Aerospace Warfare Centre and DRDC Centre for Operational Research Analysis, October 2014), i.

<sup>82</sup> Ibid, 54; Michael E. Hutchens, William D. Dries, Jason C. Perdew, Vincent D. Bryant, and Kerry E. Moores, "Joint Concept for Access and Maneuver in the Global Commons," *Joint Force Quarterly*, Volume 84 (1<sup>st</sup> Quarter 2017): 134-140.

<sup>83</sup> Gladman, *The future of allied air power: The United States Air Force*, 54-55.

<sup>84</sup> Ministère de la Défense nationale, B-GA-400-000/FP-001, *Canadian Forces Air Doctrine* (Ottawa: Commander Royal Canadian Air Force, Novembre 2016), 33.

Air Marshal Ray Funnell following Operation Desert Storm: "Air power has transformed today's warfare... Control of the air is essential to success. With it, everything is possible but without it, everything is difficult."<sup>85</sup> On the other hand, Commander (ret.) Jay Ballard's argues that in future conflicts, one may not have the option of going to war with air superiority due to modern air denial technology: "If not planned for and trained for, it can result in a failed operation and significant losses to NATO personnel and equipment. Using the Cold War past as a guide to future operations may help show the way to avoid this."<sup>86</sup>

Adding to the debate of relevance of fighter platforms in the future is the fact that they will be increasingly efficient at leveraging their multi-role aspects such as surveillance and reconnaissance. For example, the Rafale, F-22 and even the CF-188 with the Sniper pod have the capacity to offer commanders imagery and information in a timely fashion that are very beneficial in decision making, doing so undetected and several kilometres away from an operating base. The advance technology these aircraft offer have demonstrated that they can quickly achieve strategic objectives and minimize vulnerability of personnel, infrastructures and equipment against any adversary anytime. In fact, when used properly, air power can substitute land forces for many important strategic functions.<sup>87</sup>

Roger Cliff *et al* argue that there are two critically important concepts that come up repeatedly in writings on air force employment concepts. They are "the integration of air and space and preparing both the offensive and defensive."<sup>88</sup>

According to the China Air Force Encyclopedia, these two concepts have been at the

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<sup>85</sup> Benjamin S. Lambeth, *The Winning of Air Supremacy in Operation Desert Storm*, (Rand Paper, no. P-7837, 1993), 12.

<sup>86</sup> Jay Ballard, "What's Past is Prologue: Why the Golden Age of Rapid Air Superiority is at an End," *Joint Air Power Competence Centre Journal*, Edition 22 (2016): Conclusion.

<sup>87</sup> *Ibid*, 16.

<sup>88</sup> Roger Cliff *et al*, *Shaking The Heavens And Splitting The Earth : Chinese Air Force Employment Concepts In The 21St Century*. eBook collection (Santa Monica, Calif: RAND Corporation, 2011), 50.

centre of air force strategy since 2004: "Air force strategy has shifted and the People's Liberation Army Air Force (PLAAF) has moved toward building a force that will integrate space-based information and operations and a more offensive orientation."<sup>89</sup>

Major Nathan Burgess also indicated in his research that:

Operational factors, such as the introduction of sub-orbital vehicles, will necessitate the integration of air and space operations into a seamless aerospace traffic management system. These contextual factors further reinforce the notion that air and space will become increasingly integrated as a seamless operational environment.<sup>90</sup>

The Canadian government thus needs to capitalize on the evolution of air/space support to ground operations through the procurement of long term new high capable fighter aircraft that provide both kinetic and non-kinetic effects.<sup>91</sup>

A counter argument to that would be that manned aircraft are becoming increasingly irrelevant as drone warfare comes of age.<sup>92</sup> Indeed, Unmanned Aerial Vehicles (UAV) offer several advantages that makes them a viable military asset for many state. The first one and the more obvious is that it is unmanned and therefore, eliminates the casualty risk when conducting operations. Additionally, UAVs make the search-and-rescue requirement following a downed pilot irrelevant, reducing once again the risk index but also the cost. The element of persistence is also enhanced since a UAV can patrol a specific area for a longer period of time without constraints, increasing the chance of identifying the right target and avoid collateral damage. In addition, systems like Reapers and Predators are relatively simple to operate. One can

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<sup>89</sup> Ibid, 51.

<sup>90</sup> Major Nathan Burgess, "Royal Canadian Aerospace Force? An examination of the conceptual utility and organizational implications of the aerospace concept," (Paper Prepared for the Canadian Forces Aerospace Warfare Centre, Trenton, 24 January 2015), 36.

<sup>91</sup> P.J. Doyle, "Canada's Air Force kinetic capability for the 21st century: what is needed?" (Directed Research Paper, Canadian Forces College, 2010), ii.

<sup>92</sup> Paula Thornhill, "Innovation and America's 21st Century Air Force", *The Rand blog*, 26 November 2013, <http://www.rand.org/blog/2013/11/innovation-and-americas-21st-century-air-force.html>.

learn how to fly them and accomplish a strategic effect a lot quicker than a manned aircraft, making them cheap.<sup>93</sup>

Of course, one cannot ignore the increasing importance and efficiency of UAVs to conduct an information, surveillance, target acquisition and reconnaissance (ISTAR) role. The Canadian Armed Forces recognized the need by deploying the Heron in Afghanistan,<sup>94</sup> though today's RCAF does not currently employ a UAV capability.<sup>95</sup> One can argue that ISR missions are more effective when conducted by a combination of manned/unmanned platforms and satellite capacities.<sup>96</sup> However, the interesting debate outside the scope of this research would be whether Canada will ever replace manned platforms with UAVs for kinetic effects. The advantages from the RAND study mentioned above suggest that it would be worth exploring.

### **Interoperability and Capability Gaps**

In June 1999, DND released "Shaping the Future of Canadian Defence: A Strategy for 2020."<sup>97</sup> This "strategic guidance" offers an overarching framework on how to properly integrate military assets in decision making and planning for the foreseeable future.<sup>98</sup> The term "interoperability" appears several times in this document and it is defined as "the ability of systems, units or forces to provide services to and accept services from other systems, units or forces and to use the

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<sup>93</sup> Lynn E. Davis et al, *Armed and Dangerous? UAVs and U.S. Security*, RAND Corporation (Arlington: International Security and Defence Policy Center, RAND National Security Research Division, 2014), 11.

<sup>94</sup> Wing Commander David Glasson, "Big War Air Power for Small War Operations," *The Royal Canadian Air Force Journal* Vol.3, no. 1 (Winter 2014), p.22.

<sup>95</sup> Danny Garrett-Rempel, "Will JUSTAS Prevail? Procuring a UAS Capability for Canada", *RCAF Journal* 4, no.1 (Winter 2015), 19-31; Conrad Edward Orr, "Can Unmanned Aircraft Systems Meet Canadian Air Power Needs?", *RCAF Journal* 5, no. 3 (Summer 2016), 15-28; Gary Schaub, "JUSTAS for All, Innovation and the UAVs in the CF", *Defence Studies* 15, no 2 (Copenhagen: University of Copenhagen Press, 2015): 124-142.

<sup>96</sup> Lt Gen Denis Mercier, "Thinking about Air and Space Power in 2025," *Air and Space Power Journal* 26, no. 3 (May-June 2012): 26.

<sup>97</sup> Department of National Defence, *Shaping the Future of Canadian Defence: A Strategy for 2020* Ottawa: DND Canada, 1999).

<sup>98</sup> *Ibid*, Foreword.

services so exchanged to enable them to operate effectively together."<sup>99</sup> This means that Canada needs to be interoperable with United Nations (UN), NATO, and coalition forces (primarily the US) with capable and affordable assets.<sup>100</sup> The issue of integration persists today; as *Air Force Vectors* states:

Interoperability is achieved by similar doctrine, joint exercises, and a network of systems that have the ability to share information. Interoperability between elements of two or more CAF environments is critical, but interoperability within the RCAF is the necessary start point and must also extend to interaction with any Canadian partner organization, agency, or allies involved in security activities influencing the conduct and results of military operations. However, it is also people collaborating with people that provides the level of networking required to achieve full-spectrum situational awareness. This will include traditional and non-traditional military activities being carried out collaboratively within the whole-of-government (WoG) / joint, interagency, multinational and public (JIMP) approach.<sup>101</sup>

Good examples of where Canada came up short in terms of interoperability are the 1991 Gulf War and Operation Allied Force. CF-188 Hornets were not able to take part efficiently to the bombing effort that went on during any of those conflicts since they were lacking the interoperable capabilities with the United States forces. During the Gulf War, for instance, they could not keep up with their counterpart the US F/A-18 fleet. Specifically, the CF-188 Hornets did not have the Link-4 computer communications system that allowed for secure ship-to-aircraft transmissions; and the lack of "HaveQuick" secure voice radio communications required a change in coalition bombing missions to reduce the possibility of mid-air collisions. In addition, the fleet had a capability gap in the precision guided munitions (PGM) department.<sup>102</sup>

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<sup>99</sup> W. Danford, W. Middlemiss and Denis Stairs, *The Canadian Forces and the Doctrine of Interoperability: The Issues* Vol.3, No.7 (Institute for Research on Public Policy, Policy Matters, June 2002), 11.

<sup>100</sup> Kyle D. Christensen, "Out of the Sun and into the ground - An assessment of the decline of the CAF" (master's thesis, Dalhousie University, 2002), 15.

<sup>101</sup> Department of National Defence, A-GA-007-000/AF-008, *Air Force Vectors* (Ottawa: Director General Air Force Development, 2014), 36-37.

<sup>102</sup> W. Danford, W. Middlemiss and Denis Stairs, *The Canadian Forces and the Doctrine of Interoperability: The Issues*, Vol.3, No.7 (Institute for Research on Public Policy, Policy Matters, June 2002), 21.

It was a similar situation during Operation Allied Force in 1999. CF-188 Hornet pilots lacked night-vision goggles, helmet-mounted bombsight "cueing" systems, Nite Hawk FLIR and LANTIRN pods, an independent Air-to-Air Refuelling (AAR) capability, and most importantly, secure data link voice communications up to "HaveQuick" or Link-16 standards. Again, there was also a PGM deficiency in the fleet's inventory.<sup>103</sup> Despite that, it was Canada that led the most combat mission over Serbia and Kosovo out of the 14 NATO countries (apart from the US). This demonstrated the potential of the Canadian fighters, which only needed that little push to interoperate at a level where it could make a much bigger difference and "punch above its weight."<sup>104</sup>

It is with this in mind that the Assistant Deputy Minister (Materiel) (ADM(Mat)) went forward and approved the implementation of the Engineering Change Proposal 583 and 583R2 (ECP 583 and ECP 583R2) in the late 1990s and early 2000s respectively. This was to be part of the overarching CF-188 Incremental Modernization project (which included the advanced precision guided munition (APGM)), managed by the DGAEPM(FT). The aim was the replacement of obsolete systems and parts by more technologically advanced ones in order to be interoperable with allies.<sup>105</sup> ECP 583R2 was the largest piece of this effort and implemented the Multi-purpose Display Group (MDGU), the Joint Helmet Mounted Cueing System (JHMCS), the countermeasures Dispensing System AN/ALE-47 and more importantly in this interoperability discussion, the Multifunctional Information

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<sup>103</sup> Ibid, 22; David L. Bashow, Dwight Davies and André Viens, "Mission Ready: Canada's Role in the Kosovo Air Campaign," *Canadian Military Journal* Vol 1, No 1 (spring 2000), 55-61; Paul Johnston, "Canadian Hornets over Kosovo: A Small Part of a Future Model for Air Power," in *Sic Itur Ad Astra: Canadian Aerospace Power Studies Volume 2: Big Sky, Little Air Force*, edited by W.A. March (Ottawa: Her Majesty the Queen as represented by the Minister of National Defence, 2009), 117-124.

<sup>104</sup> David L. Bashow *et al*, "Mission Ready: Canada's Role in the Kosovo Air Campaign," *Canadian Military Journal* Vol 1, No 1 (Spring 2000), 58.

<sup>105</sup> DAEPM(FT), "CF-188 Projects", last accessed on 6 February 2017, <http://materiel.mil.ca/en/air-equipment/cf188-projects.page>.

Distribution System (MIDS), required to be able to interact with the other nations' more advanced platforms.<sup>106</sup>

An interesting point in the scope of this research paper is that it was L-3 MAS Canada that was awarded the contract to upgrade the 80 CF-188 aircraft at its Mirabel facility. The military workforce did not have the manpower or the expertise to do the work, and this triggered a transfer of the second line maintenance of new components to contractors instead of the avionics labs in 3 Wing and 4 Wing.<sup>107</sup> One can therefore project that a similar approach can be envisioned when talking about the procurement and integration of new technological advanced capabilities in the pursue of interoperability.

One of the mission themes highlighted in Lieutenant-General Ken Pennie's article based on the Canadian Forces Leadership Institute's doctrinal publication *Duty with Honour* is to be "interoperable and networked to enable greater effectiveness in operations. In order to contribute effectively to the security of Canada, we need to continue to enhance our interoperability with our allies, sister services and security partners."<sup>108</sup> LGen Hood also stated at House of Commons Standing Committee on National Defence that:

Canada's defence and security responsibilities are also shaped by the overarching requirement to be seamlessly interoperable with our U.S. air force counterparts in the air and space domain... This interconnectedness and interoperability contribute to the fact that we are a well-known and trusted air power partner at home and when operating together abroad.<sup>109</sup>

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<sup>106</sup> National Defence and Canadian Armed Forces, "CF-18 Modernization", last accessed on 11 February 2017, <http://www.forces.gc.ca/en/news/article.page?doc=cf-18-modernization/hnps1ums>.

<sup>107</sup> Ibid.

<sup>108</sup> Lieutenant-General Ken Pennie, "Transforming Canada's Air Force: Vectors for the future", *Canadian Military Journal* Vol 5, No 4 (Winter 2004-2005): 41.

<sup>109</sup> House of Commons, Standing Committee on National Defence, *Evidence*, 1<sup>st</sup> Session, 42<sup>nd</sup> Parliament, 14 April 2016, 0850.

Indeed, one of the key domestic missions of the fighter fleet is the NORAD, and it is crucial that within the scope of this mandate that the RCAF remains interoperable with the United States Air Force (USAF).<sup>110</sup> As per its website, the NORAD mission statement is: "The North American Aerospace Defense Command conducts aerospace warning, aerospace control and maritime warning in the defense of North America."<sup>111</sup> In order to accomplish these missions, the commander, an American four-star officer who is responsible to both the US president and the Canadian prime minister, needs to constantly adjust the concept of operations in order to meet the evolving threat.

For the aerospace control mission, NORAD uses a satellite network, ground-based radar, airborne radar and fighters to detect, intercept and engage any perceived air menace to the Canada-US region.<sup>112</sup> After 9/11, the CF-188 became vital in this role since the protection of domestic airspace, infrastructure, and human life climbed at the top of the air force's priority list, something that the government stresses on at every opportunity.<sup>113</sup> This include the Arctic, an area gaining in importance in world geopolitics and security issues and where a gap remains. As the NATO Association of Canada's paper "Our Northern Vanguard: What Next for NORAD?" states, "The Pentagon is open to Canada's playing an increased role in the Arctic, particularly in the fields of multi-sensor systems for detecting incoming ballistic missiles, ships and aircraft,"<sup>114</sup> making the interoperability critical between US NORTHCOM and the Canadian Joint Operations Command (CJOC). Fighter aircraft conduct several

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<sup>110</sup> Department of National Defence, A-GA-007-000/AF-008, *Air Force Vectors* (Ottawa: Director General Air Force Development, 2014), 37.

<sup>111</sup> North American Aerospace Defense Command, "About NORAD," last accessed on 21 April 2017, <http://www.norad.mil/About-NORAD/>.

<sup>112</sup> Ibid.

<sup>113</sup> D.E. Molstad, "CF-18s in combat from Iraq to Lybia: The strategic dividend of fighters" (Directed Research Paper, Canadian Forces College, 2011), 51.

<sup>114</sup> NATO Association of Canada, "Our Northern Vanguard: What Next for NORAD?", last accessed on 21 April 2017, <http://natoassociation.ca/our-northern-vanguard-what-next-for-norad/>.



exercises such as Operations Nanook<sup>115</sup> and Vigilant Shield<sup>116</sup> in order to train and validate the interoperability piece. This is crucial since Russia resumed Arctic training and made notable improvements through financial injections into the defence program. This include the next generation multiple warhead ICBM – the SS-27 Topol, the multiple warhead Sarmat ICBM and the Bulova submarine launched ballistic missile (SLBM). Fighter aircrafts are one the main assets to counter these emerging threats.<sup>117</sup> While the head of both countries continuously adjust thier way to respond to today's menace, NORAD has proven to be a reliable and will remain vital to the region's defense.<sup>118</sup>

Abroad, Canada's air force will need to be interoperable with its NATO allies and coalition forces.<sup>119</sup> The strategic vectors as highlighted in the "Vectors 2020" publication are the following:

- Results-Focused Operational Capability
- Responsive Expeditionary Capability
- Transparent Interoperability
- Transforming Aerospace Capabilities
- Transformation-Enabling Leadership
- Multi-Skilled and Well Educated People
- Expanded Strategic Partnerships
- Improved Resource Stewardship<sup>120</sup>

It is through these eight factors that the air force needs to focus their efforts.

Operational interoperability will be achieved by ensuring that the RCAF acquires the proper technology and capabilities to operate effectively in a domestic joint

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<sup>115</sup> National Defence and the Canadian Armed Forces, "Operation Nanook," last accessed on 21 April 2017, <http://www.forces.gc.ca/en/operations-canada-north-america-recurring/op-nanook.page>.

<sup>116</sup> Government of Canada, "NORAD begins annual VIGILANT SHIELD exercise," last accessed on 21 April 2017, <http://news.gc.ca/web/article-en.do?nid=1138959>.

<sup>117</sup> C.J. Marks, "Flying Canada into a bi-national defence agreement: Is NORAD worth the jet fuel?" (Solo Flight Paper, Canadian Forces College, 2015), 11.

<sup>118</sup> North American Aerospace Defense Command, "About NORAD", last accessed on 21 April 2017, <http://www.norad.mil/About-NORAD/>.

<sup>119</sup> Ibid, 42.

<sup>120</sup> Department of National Defence, *Vectors 2020: An Air Force Strategic Assessment* (Ottawa: DND Canada, 2000), 1; Department of National Defence, A-GA-007-000/AF-008, *Air Force Vectors* (Ottawa: Director General Air Force Development, 2014), 33.

environment as well as abroad with all the required actors mentioned above. This means that Canada's air force must be able to communicate efficiently and in a secure fashion by data link and be able to use PGM in concert with others in network-enabled joint operations.<sup>121</sup>

Interoperability goes even beyond the capability to work with other environments and coalition partners. The demands of the new era of conflicts and National Security Policy make it "imperative that equipment, doctrine and planning take into account requirements to work with other government departments and agencies, international aid agencies and Non-Governmental Organizations (NGOs)."<sup>122</sup>

With the recent government's announcement of a capability gap, it is now another point in time where there is a requirement to enhance the fighter fleet, similar to when it was decided to modernize the CF-188 twenty years ago. It is a necessity to meet the "policy change" which requires the RCAF to meet both its NATO and NORAD commitments at the same time.<sup>123</sup> While it is understood that a long-term replacement for the CF-188 is required, it is necessary to expand on the interim solution of procuring 18 Super Hornets before discussing specific technical expertise and maintenance requirements to address the above issues.

Recently, in a letter addressed to Prime Minister Justin Trudeau, thirteen former RCAF commanders challenges the government's decision to purchase interim Super

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<sup>121</sup> Lieutenant-General Ken Pennie, "Transforming Canada's Air Force: Vectors for the future", *Canadian Military Journal* Vol 5, No 4 (Winter 2004-2005), 43; Department of National Defence, A-GA-007-000/AF-008, *Air Force Vectors* (Ottawa: Director General Air Force Development, 2014); House of Commons, Standing Committee on National Defence, *Evidence*, 1<sup>st</sup> Session, 42<sup>nd</sup> Parliament, April 2016, (Lieutenant-General Michael Hood); Lieutenant General Michael J. Hood, Commander, Royal Canadian Air Force: "The Royal Canadian Air Force and NATO: In Preparing for Domestic Continental Missions, the RCAF prepares for NATO Operations," interview in the *Joint Air Power Competence Centre Journal*, Edition 23, 2016.

<sup>122</sup> Department of National Defence, *Securing an Open Society, National's policy, Canada's National Security Policy* (Ottawa: DND Canada, April 2004); Department of National Defence, A-GA-007-000/AF-008, *Air Force Vectors* (Ottawa: Director General Air Force Development, 2014).

<sup>123</sup> LGen Hood (speech to Canadian senators, 28 November 2016).

Hornets and to instead move immediately to a fighter jet competition.<sup>124</sup> The main arguments in this correspondence are that the interim solution is ill-advised, costly and unnecessary. More specifically, they state that it would impair the RCAF and have a negative effect on the defence posture, leveraging from the fact that the fighter community has always been able to fulfill all the commitments simultaneously through balancing strategic risks and available resources.<sup>125</sup> The retired generals added that:

. . . purchasing Super Hornet aircraft would imposing a heavy burden on the already challenged resources without really increasing platforms' availability . . . The Super Hornet does have some commonality with the CF-18s, but it is a different airplane, requiring its own training system for pilots and technicians, as well as new flight simulators, logistic support and maintenance organizations . . . Instead, Canada should focus on recruiting and training for the interim period leading to CF-18 replacement and if the government feels compelled to acquire additional fighters for the interim, it should seriously examine the prospect of purchasing so-called legacy that are increasingly becoming available as Canada's partner nations replace their older Hornet fleets with the F-35.<sup>126</sup>

In an answer to this and in support that the Super Hornet will fill the capability gap, Boeing said that the Super Hornet was designed specifically to ensure an easy transition from the legacy Hornet: "The Super Hornet, while a completely new, highly survivable aircraft, was designed to have common maintenance procedures with the legacy Hornet. It takes just 120 hours for Classic Hornet maintainers and one month for aircrews to transition to Super Hornets."<sup>127</sup> They also stated that the RCAF needs a modern aircraft to properly fulfill their NORAD and NATO obligations and that the Super Hornet was the answer to the capability gap for the following reasons:

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<sup>124</sup> David Pugliese, "Retired RCAF generals roar in protest over the Super Hornet deal and the Liberals shrug," *Ottawa Citizen*, 26 February 2017.

<sup>125</sup> Paul Manson *et al*, "Open Letter to the Prime Minister from Former Air Force Commanders," in *Retired air chiefs urge Liberals to ditch 'costly and unnecessary' plan to buy Super Hornet jets*, ed. John Ivison (*National Post*, 22 February 2017).

<sup>126</sup> *Ibid*

<sup>127</sup> *Skies Magazine*, "Boeing strikes back at former air force commanders," *Skies Magazine*, 27 February 2017.

Adding F/A-18 Super Hornets to the Canadian fleet will automatically and immediately increase fighter availability, as well as the capability of the entire fleet through buddy tanking, advanced sensors and data-sharing capabilities. The Super Hornet, with its designed-in stealth, premiere AESA [active electronically scanned array] radar, and multi-role capabilities, will bring the latest generation of technologies to the RCAF.<sup>128</sup>

In addition, to the retired Commanders' argument that the interim solution should be the procurement of legacy CF-188, Boeing answered that the age of the legacy CF-188 makes its support increasingly expensive and time-consuming due to the lack of spare parts. Getting more legacy jets might appear to be cheaper but the maintenance costs and required modifications for these jets would be much higher than that of new F/A-18 Super Hornets. Boeing concluded that "By any measure, the interim buy is a cost effective and smart way to ensure the RCAF can meet Canada's commitments."<sup>129</sup> A follow-up article in the *Ottawa Citizen* declared that the "Liberal government had no intention of reversing its decision on the interim Super Hornet purchase."<sup>130</sup> Consequently, the RCAF can expect its integration in the foreseeable future but keeping in mind that the long-term solution might be a different platform. Either way, ensuring a proper usage of technical expertise and a smart approach in the development of maintenance requirements will be key.

### **Technical Expertise and Projected Maintenance Requirements**

Support from industry and contracted maintenance will be required to integrate new capabilities. This is a reality that existed 20 years ago and continues today, especially when taking into consideration the demographics and challenges the

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<sup>128</sup> Ibid.

<sup>129</sup> Ibid.

<sup>130</sup> David Pugliese, "Retired RCAF generals roar in protest over the Super Hornet deal and the Liberals shrug," *Ottawa Citizen*, 26 February 2017.

RCAF is facing with technical expertise. While specific considerations on how to balance contracted and blue suitors maintenance will be discussed in more detail in Chapter 4, it is instructive to look at two main challenges where the maintenance community will need to adjust and adapt: personnel and tooling.

The first thing to consider is of course the personnel. There will be a requirement to carefully assess options on how to optimize production despite the fact that the RCAF is currently looking at a less experienced workforce. How one ensures the right base maintenance support while keeping a capable deployed capability is one of the core elements. It is the author's professional opinion that first line capabilities should remain military to a maximum extent to ensure an independent and efficient force projection. If the RCAF is to operate abroad in international conflicts, it needs to be able to rely on its own resources to do so (this shall be expanded on later in this study). As per English and Westrop, the structure of a deployed maintenance organization is different in the sense that a higher level of responsibility and autonomy is expected from its first line personnel. Communications and chain of command are altered and there is usually no more official link between the detachment and home base. The culture is for the deployed unit to assume aggregate roles for maintenance and be able to operate despite to limited support.<sup>131</sup> Therefore, discussion of the second line concept and where RCAF could benefit from contracted support is warranted.

As already established, second line maintenance requires additional training on top of the basic first line instruction since it entails more in depth maintenance using specialized equipment in a workshop environment. It can take several years before a technician is comfortable in the full spectrum of tasks required in a specific

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<sup>131</sup> Allan English and Colonel John Westrop (Retired), *Canadian Air Force Leadership and Command: The Human Dimension of Expeditionary Air Force Operations* (Trenton, Ontario: Canadian Forces Aerospace Warfare Centre, 2007), 166.

workshop and the training is usually conducted in an on-job-training (OJT) format using the more experienced personnel. Taking into consideration the fact that personnel are dispersed between two wings, the length of the training and the RCAF' demographic challenges, there is a lot of pressure applied on a very limited workforce to simultaneously repair parts and train new technicians. CF-188 second line units often find themselves in a situation where they do not have enough people to support both those mandates efficiently.<sup>132</sup>

In addition, although some the second line special tools and equipment are deployable such as the Portable Automated Test Station (PATS), most of the second line repairs require very specific infrastructure and expertise which makes it more challenging to integrate into theatre of operations. This combination of factors creates the debate of how much of the non-deployable second line maintenance should be contracted out so that military workforce can focus on specific deployable functions. This will expanded on in Chapter 4.

Also, one must look at the long-term deployment capability to support an extended mission abroad. The footprint of first line maintenance personnel definitely has been a challenge during Operation Impact and should be factored in: in order to support a basic 6-pack of CF-188 Hornets, the requirement is for about 65 personnel which consist of an entire squadron. The usual approach has been alternating between 3 Wing and 4 Wing, and with two squadrons per wing, one can assume this is manageable. However, some critical trades such as ACS (safety systems) and AWST have historically been a challenge to source entirely from the same Wing for multiple

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<sup>132</sup> C.O.G. Corneau, "Centralisation d'activités de maintenance de deuxième ligne pour le CF-188" (Service Paper, Canadian Forces College, 2016), 5; Department of National Defence, *A-PD-050-188/PA-000, CF188 Hornet Fleet Employment and Training Plan*. (Ottawa: Canada, 2016).

rotations.<sup>133</sup> Again, therefore, the notion of resource management and concentration of force in specific functions will be worth discussing later.

The second challenge that will be touched on is tooling. Extra tooling, aircraft maintenance support equipment (AMSE) and ATE) to name a few will be required to support new capabilities. Technicians are important but so are the various electronics and mechanical tools they employ.<sup>134</sup> The ideal situation is that the Super Hornet will require very limited extra tooling, AMSE and ATE in comparison to the CF-188 Hornet. However, as stated above in the letter from the former commanders, they should be treated as different platforms and a more thorough analysis will be necessary. Despite what Boeing says, it might indicate that a significant amount of extra resources will be required to maintain them. At this stage, without being too specific, one can argue that there is an opportunity to look at procurement avenues that could benefit both the interim solution (Super Hornet) and the long-term solution. An example is the electronic Consolidated Automated Support System (eCASS). The basic CASS has been in use for decades in support of both the RCAF and U.S. Navy. For the RCAF, the CASS is the station that repairs the most avionic components in support of the CF-188 fleet (operated by Harris Canada Systems Inc) but it is non-deployable. The eCASS is the new improved CASS and on top of being deployable, runs 20 percent faster, is more reliable, has long-range upgrade capabilities, and is compatible with technologically advanced platform such as the the F-35.<sup>135</sup> This is only one example but it shows that tooling, AMSE and ATE have some avenues

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<sup>133</sup> CF-188 Manual of Aerospace Procedures, *TO&Es in support of 6 aircrafts - Op Impact* (3 Wing & 4 Wing , October 2014 to March 2016).

<sup>134</sup> Military and Aerospace Electronics, "Combat aircraft with advanced avionics by Courtney Howard", last accessed 1 February 2017, <http://www.militaryaerospace.com/articles/print/volume-25/issue-2/special-report/combat-aircraft-with-advanced-avionics.html>.

<sup>135</sup> Ibid.

worth looking into in order to optimize support effectiveness and personnel management in the future.

### **Maintenance Centralization**

Before concluding this chapter, a discussion of the issue of centralization is warranted. It is a specific initiative that has yet to be implemented in depth but could be very beneficial for the CF-188 fleet in the future. One can argue that it is vital to face current deficiencies and improve second line productivity in preparation for the arrival of new capabilities.<sup>136</sup> Centralization can be accomplished by using only military workforce or a combination of contractors and blue suitors like it is the case right now with the periodic line at 4 Wing. As decided at the FCAG on 11 May 2016, in order to increase 4 Wing Cold Lake PER effectiveness, there was an agreement to amalgamate military technicians with L3 MAS technicians to form two PER lines.<sup>137</sup>

An analysis of C-130, F-16 and KC-135 fleets by Robert Tripp *et al* shows that centralized maintenance outperforms decentralized maintenance in terms of weapon-system availability and that personnel savings more than offset increased transportation cost. One of the main reasons highlighted by that same research is that the centralized maintenance organization can absorb random spikes without having an impact on flying operations since it simply utilizes a higher percentage of the personnel.<sup>138</sup> This cannot be accomplished with limited resources split in half like it is the case for the CF-188 community. Figure 3.1 is a representation of this very concept

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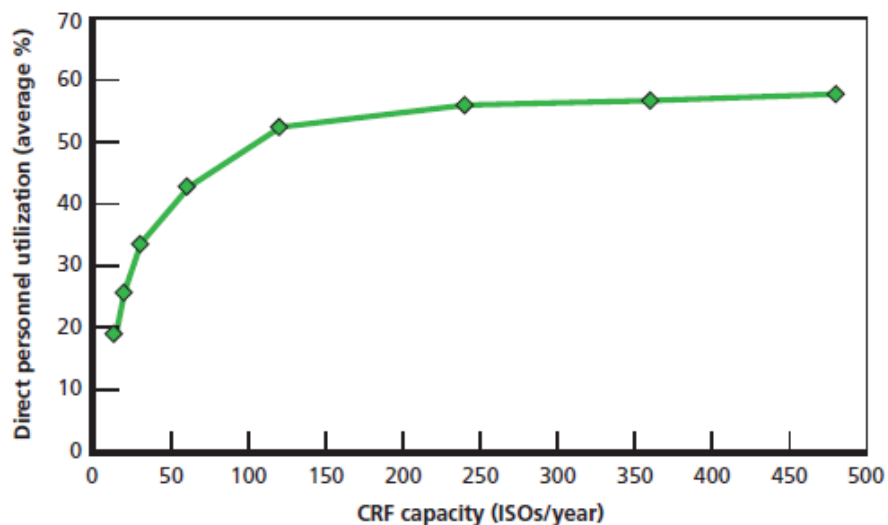
<sup>136</sup> Robert S. Tripp *et al*, "A repair network concept for Air Force maintenance : conclusions from analysis of C-130, F-16 and KC-135 fleets", (Rand Paper, no. MG-919-AF, 2010); C.O.G. Corneau, "Centralisation d'activités de maintenance de deuxième ligne pour le CF-188" (Service Paper, Canadian Forces College, 2016).

<sup>137</sup> Fighter Capability Advisory Group (FCAG), *Decision on the use of contractors as an embedded capacity within 1 AMS PER line* (Winnipeg: MB, 11 May 2016).

<sup>138</sup> Robert S. Tripp *et al*, "A repair network concept for Air Force maintenance : conclusions from analysis of C-130, F-16 and KC-135 fleets", (Rand Paper, no. MG-919-AF, 2010), 4, 13.



where the more personnel one has at the same facility, the more one can absorb an increase of isochronal inspections (schedule inspection or ISO inspections) without impact.

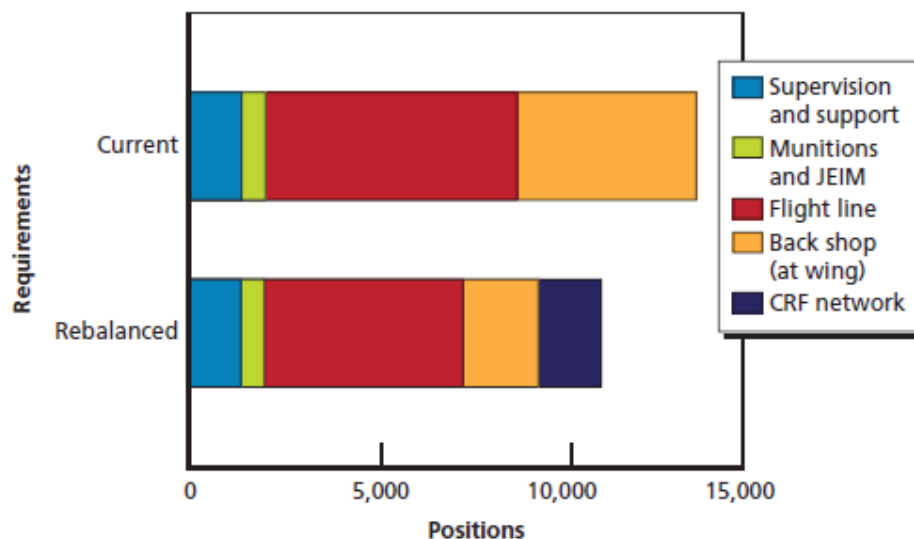


**Figure 3.1 - Labour Utilization Rates**

Source: Tripp, *A repair network concept for Air Force maintenance : conclusions from analysis of C-130, F-16 and KC-135 fleets*, 16.

Figure 3.2 is another illustration of the same theory but this time, it depicts the difference of personnel required to accomplish a given workload for the C-130 when comparing "current" (work done by each Wing separately) and "rebalanced" (with a centralized concept). It shows that the same work can be performed with about 2,500 fewer authorizations when using a centralized approach.<sup>139</sup>

<sup>139</sup> Ibid, 18.



**Figure 3.2 - C-130 Unit and Centralized Repair Facility Active-Duty and Reserve Personnel Requirements**

Source: Tripp, *A repair network concept for Air Force maintenance : conclusions from analysis of C-130, F-16 and KC-135 fleets*, 19.

It is therefore important to consider where centralization could potentially be applied for the CF-188 community. Such an initiative does not mean that the RCAF needs to close one of the two AMSs but rather optimizing work turnaround and use of resources. By centralizing some capacities, the air force can reinforce the effectiveness of a specific shop but still remain Person-Year (PY) neutral<sup>140</sup> at the fleet level.<sup>141</sup>

That being said, some capacities cannot be centralized for the simple reason that they are required in proximity of aircraft and aircrew due to their scope of work. It is the case for the NDT shop, the fuel bay, the safety system (survival equipment) shop, the ejection seat shop, the liquid oxygen (LOX) building and structural shops.

<sup>140</sup> The term PY refers to a "person-year" and in this context equals to a technician that occupies and produces in a specific position for the entire year. By stating "PY neutral", it means that we are not adding anybody over and above the current manning level.

<sup>141</sup> C.O.G. Corneau, "Centralisation d'activités de maintenance de deuxième ligne pour le CF-188" (Service Paper, Canadian Forces College, 2016), 6; Robert S. Tripp *et al.*, "A repair network concept for Air Force maintenance : conclusions from analysis of C-130, F-16 and KC-135 fleets", (RAND Paper, no. MG-919-AF, 2010), 31.

All of these are capacities that are used directly or indirectly for "on-aircraft" maintenance and it would not be practical or cost-efficient to centralize them. For example, fly an aircraft from 3 Wing to 4 Wing or vice versa to carry out structural repairs would be counter-productive. In some cases like internal fuel snags, the aircraft is simply not in a condition to fly.<sup>142</sup>

Where one can see a good return on investment are those shops that work on component or systems that can build a spare pool and where the supply system can then be used to ensure just-in-time availability and minimize downtime of aircraft. More specifically, there is the component shop where spare parts and expertise are limited. Other ones are armament capacities such as the gun shop and the rack & release section that uses multiple spare parts for repairs which can then all be located at the same location for maximum convenience. Finally, anything related to avionics such as generators and displays could be centralized since once again, those are "remove and installed" component and first line maintainers could feed from a spare pool produced by second line maintainers.<sup>143</sup>

By centralizing, there is a potential for improved production as seen above and there might even be an economy of resources that could then be reallocated in more critical positions such as first line deployable ones. In addition, all expertise would be at the same location, improving the dual mandate of production and training. As mentioned at the beginning of this section, there could even be embedded contractors working in those shops which would bring even more depth and continuity.

Centralization is therefore something to strongly consider since consolidation of resources can increase efficiency and effectiveness of second line shops and

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<sup>142</sup> Department of National Defence, C-05-005-P07-AM-001, *Maintenance Program Implementation - Corrective Maintenance* (Ottawa: Chief of the Defence Staff, 2010), 2-1 - 2-2.

<sup>143</sup> C.O.G. Corneau, "Centralisation d'activités de maintenance de deuxième ligne pour le CF-188" (Service Paper, Canadian Forces College, 2016), 8.

optimize the use of the limited resources. All of this would result in minimizing aircraft downtime and increase serviceability which are the main purposes of the maintenance community.

## **Conclusion**

This chapter has taken a glimpse into the challenges of modern warfare and what air power needs to consider to face the new enemy with proficiency. More specifically, it has discussed the capabilities of the fighter community and the fact it needs to adjust and remain adaptable to both kinetic and non-kinetic aspects. Despite the argument that they have been developed through conventional warfare with specific functions, fighters can increase their flexibility in the joint environment through multi-role functions. There was a clear indication from the government that there is a capability gap to manage in the fighter fleet in order to properly meet both its NATO and NORAD commitments at the same time. To do so, military doctrine and Air Forces Vectors 2020 indicate that interoperability with allies and more particularly the United State is essential; which is why an upgrade of the fleet through the procurement of 18 Super Hornets is the immediate mitigation action undertaken.

All of this has a direct impact on the operational community and the repair organizations supporting it, which is why the two main challenges of maintenance personnel and tooling have been quickly discussed. Finally, this chapter examined centralization and the benefit of such an initiative to optimize repairs efficiency, whether it is within military organizations or combined with contracted maintenance. The next chapter will provide a more in-depth review of the CF-188 AVS OWSM model and national experiences (Australia and US) that use contracted maintenance. This will help in the debate of balancing military and contracted maintenance, taking

into consideration the level of autonomy required in theatre of operation. The analysis shall conclude with avenues and a potential way ahead in that regard to optimize the integration of the CF-188 replacement(s).

## **CHAPTER 4: BALANCING MAINTENANCE FOR CF-188'S REPLACEMENT(S)**

### **Introduction**

As seen in Chapter 2, orchestrating a sound maintenance organization in support of RCAF's operations is a complex endeavour involving a significant amount of resources. From organizational structures to training and efficient use of resources, many controllable variables need to be taken into consideration, and a multitude of additional factors such as demographics and expertise levels come into play to make the situation even more demanding. In addition, the new era of conflicts discussed in Chapter 3 highlighted some key aspects of air power that require scrutiny from the fighter fleet since it challenges its relevance and roles in future warfare. The capability gap the government of Canada pointed out triggered the examination of a Super Hornet interim platform in order to ensure proper interoperability in Canada's NORAD and NATO mandates while the long-term replacement is determined. This will have a direct impact on the maintenance workforce. However, there are approaches that can be used to mitigate repercussions.

This chapter will demonstrate how contracted maintenance can positively optimize blue suiter maintenance. More particularly, it will address the debate of how contracted maintenance can be a combat multiplier, which will then lead to a discussion on the right balance of resources when it comes to deployed operations. This will be followed by a display of existing military organizations that use contracted maintenance as a leverage and what the related effects are, before closing with recommended avenues on how to efficiently use contracted maintenance in the fighter fleet's maintenance organization to better answer the upcoming integration of a new platform.

## **Contracted Maintenance as Combat Multiplier and Deployed Operations**

There are different avenues that can be explored when it comes to using contracted maintenance as leverage to military maintenance organizations. More particularly, as debated previously in this study, initiatives such as hiring expertise as an embedded capacity and pushing second line maintenance to contractors have been and are currently being used as a method to optimize production capacity in the RCAF. It will be shown that it can be a combat multiplier when it comes to supporting operations. As per RCAF doctrine, combat multiplier can be defined as "a capability provided to a force that enhances the probability of success in mission accomplishment."<sup>144</sup> The CF-188 avionics OWSM contract mentioned earlier is a core example that will be expanded upon in this chapter. However, it is important to consider another aspect in line with this facet of contracted maintenance as a combat multiplier: deployed operations.

As the previous chapter showed, demographically, there is a substantial difference between the experience level of military maintenance and industry such as Harris Canada System Inc. This is precisely what the 498th Medical Company (Air Ambulance) leveraged. This unit used 15 UH-60A Black Hawk helicopters during Operation Iraqi Freedom. It was placed with the Marines in direct support of combat operations.<sup>145</sup> However, there was some concern with the level of expertise of military technicians which prompted the need to look at alternatives to ensure soldiers were capable of providing proper maintenance support in theatre. As Jack Leach, Klyle Campbell, and Robert Goodman have observed, Lockheed Martin was the only candidate that showed interest and their involvement in individual and collective

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<sup>144</sup> Department of National Defence, B-GA-400-000/FP-001, *Canadian Forces Air Doctrine* (Ottawa: Commander Royal Canadian Air Force, November 2016), Gloss-5.

<sup>145</sup> GlobalSecurity.org, "498th Medical Company (Air Ambulance)", last accessed on the 25 February 2017, <http://www.globalsecurity.org/military/agency/army/498med-co.htm>.

training made a big difference. They were directly responsible for the increase in combat readiness of the unit.<sup>146</sup> They provided seven skilled and mature personnel with an average of fifteen years of experience. These individuals had a immediate impact on productivity through different support activities such as providing guidance to the junior leaders on technical maintenance decisions, helping in the performance of all unit-level maintenance and presenting alternative sources of supplies, helping reduce delivery times for critical parts. To summarize, the signed agreement and involvement of Lockheed Martin were beneficial for both parties and an example from which other aviation units can learn.<sup>147</sup>

Another example from the author's experience is the contracted support provided to the CF-188 during Roto 0 of Operation Mobile. In March 2011, 425 Squadron was tasked to deploy seven CF-188 to Trapani-Birgi, Italy under Task Force Libeccio. Its purpose was to assist in the effort to enforce a no-fly zone over Libya in order to protect civilians and civilian-populated areas in Libya pursuant to United Nation Security Council Resolution (UNSCR) 1973.<sup>148</sup> As Richard Mayne has written, "Six CF-188s is the RCAF standard deployment package, as it permits a four-aircraft sortie missions, while the two "spares" serve as backups that cover the detachment's maintenance requirements and improves its serviceability rate."<sup>149</sup> However, when the CF-188 detachment arrived in theatre of operations, there was a surge of EW components malfunctions due to the fact that these systems were not maintained with assiduity for years. Indeed, in order to increase the serviceability rate

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<sup>146</sup> Jack R. Leech, Kyle D. Campbell, and Robert L. Goodman, "Aviation contract maintenance: A true combat multiplier", *Army Logistician Volume* 34, Issue 3 (May/June 2002): 11, <http://search.proquest.com/docview/197287878?accountid=9867>.

<sup>147</sup> Ibid, 10-11.

<sup>148</sup> National Defence and the Canadian Armed Forces, "ARCHIVED Op Mobile", last accessed on the 25 February 2017, <http://www.forces.gc.ca/en/operations-abroad-past/op-mobile.page>.

<sup>149</sup> Richard Mayne, "The Canadian Experience: Operation Mobile," in *Precision and Purpose: Airpower in the Libyan Civil War*, ed. Karl P. Mueller (Santa Monica, CA: RAND Corporation, 2015, 250.



and keep up with the MOB's flight generation (FG) tempo, the tendency was to defer the repairs of Electronic Warfare (EW) systems that were often deemed non-essential for training missions. Since it was the first time the fleet was deployed on a large-scale deployment since the 1990s (Op Echo), the aircraft accumulated years of snags on EW systems such as the ALQ-126 and ALQ-162B.<sup>150</sup>

The ripple effect of this was an unprecedented amount of repairs and overtasking of CF-188 avionics technicians at the beginning of Task Force Libeccio's operations. The decision from the maintenance leaders was to deploy an avionics Field Specialist Representative (FSR) from CAE inc. for the remainder of Roto 0. The experience, expertise and support of the FSR was directly responsible for the quick restoration of the problematic systems to an operational status and an increase in combat readiness. More specifically, on top of being an extra asset to work on the aircraft, he was providing direct mentorship to the AVS technicians in situ, guiding them through the troubleshooting procedures as required. The FSR also had access to supplemental technical documentation and had direct connection with third line contractors such as Lockheed Martin when it came to very complex repairs. In addition, he was readily available to facilitate non-standard repairs (NSR), a contractor led process (will be explained further below).<sup>151</sup>

These two examples are clear displays how contracted maintenance can positively affect deployed operations and act as a combat multiplier. However, it

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<sup>150</sup> Northrop Grumman, "AN/ALQ-162(V)6 Countermeasures System", last accessed on the 25 February 2017, <http://www.northropgrumman.com/Capabilities/ANALQ162/Pages/default.aspx>; Deagel.com, "AN/ALQ-126B", last accessed on the 25 February 2017, [http://www.deagel.com/Aircraft-Protection-Systems/ANALQ-126B\\_a000897001.aspx](http://www.deagel.com/Aircraft-Protection-Systems/ANALQ-126B_a000897001.aspx). The ALQ-162 countermeasures set is a compact, lightweight system that provides self-protection against a wide variety of sophisticated continuous wave (CW) and pulse Doppler (PD) terminal radar threats. The AN/ALQ-126 "Charger Blue" is an electronic countermeasures (ECM) system manufactured by Sanders and evolved from the AN/ALQ-100. ALQ-126 protects aircraft communications generating noise jamming for potential enemy listeners.

<sup>151</sup> Based on author's experiences as TF Libeccio (Operation Mobile) CF-188 Maintenance Officer during Roto 0 conducted March to May 2011.

prompts the debate on how much the RCAF can rely on contracted maintenance in theatre and where it should draw the line. In other words, what is the balance between blue suiter and contracted maintenance and how much dependency on the latter is too much? How complex can communication become with a third party? Despite the success stories above, it is essential that the RCAF maintain a high level of autonomy in theatre. First line capabilities should remain military to a maximum extent to ensure an independent and efficient force projection.

Kainikara articulates five major detrimental factors of contracted maintenance in his study *Seven Perennial Challenges to Air Forces* which clearly support such a stance. First, there is the notion that civilian organization will not necessarily have the capacity or the will to be sent into a theatre that could potentially be austere.<sup>152</sup> One of the CAF's principles of war is flexibility<sup>153</sup> and tied to this is the Canadian statement of military professionalism regarding the fact that "the profession of arms is distinguished by the concept of service before self, the lawful, ordered application of military force, and the acceptance of the concept of unlimited liability."<sup>154</sup> A fighter squadron is a good example of such flexibility and military professionalism.

On standby it could be requested to deploy within a 24-48 hours window anywhere in the world. An example of this is when 425 Squadron deployed in support of Operation Mobile. After the maintenance team departed in the strategic airlift, it was still undecided where it was going to land. It was while in the air that an inter-

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<sup>152</sup> Sanu Kainikara, *Seven Perennial Challenges to Air Forces* (Canberra: Air Power Development Centre, 2009), 37; Kainikara addresses the term civilianization in in this reference, a key term to understand. He defines it as the outsourcing of military functions, diminishing and conducting to an eventual loss of core competencies. Civilianization will reduce the overall number of personnel who would have had military service experience. This affects the nation in the long term and the force almost immediately.

<sup>153</sup> Department of National Defence, B-GA-400-000/FP-001, *Canadian Forces Air Doctrine* (Ottawa: Commander Royal Canadian Air Force, November 2016), 14.

<sup>154</sup> Canadian Forces Leadership Institute, *Duty With Honour: The Profession Of Arms In Canada* (Ottawa: DND Canada, 2003), 9.

governmental agreement was put in place to operate from Trapani, Italy.<sup>155</sup> Mayne records:

The RCAF responded rapidly to the government's order to deploy. Less than a day after the passage of UNSCR 1973, seven CF-188 fighters and two CC-150T tanker aircraft were on their way to join Operation Odyssey Dawn (the name given to the U.S.-led coalition to enforce the no-fly zone and arms embargo). They arrived in Italy on March 19 and were in combat a little less than 48 hours later. To put things in perspective, the Mission Support Flight, an expeditionary unit designed to provide air operations and bases with essential infrastructure and services, could not arrive in theater until days after air operations had already commenced, a price of achieving rapid tactical and operational effect with very little warning time.<sup>156</sup>

A civilian organization is not tied to the Canadian statement of military professionalism and having them meet such commitment would contractually be difficult, which relates to the next detrimental factor, the work ethic.

This second element is related to the "can do" attitude of personnel in uniform which is unique to military organizations. Members of a squadron will put countless hours in support of an operation or even an exercise. Civilian companies have regulations that restrict such dedication. As stated by Kidwell, the contractor is only responsible towards what has been officially agreed upon on paper.<sup>157</sup> In line with this is the requirement of working with explosive ordinance and safety hazards unique to military operations which would potentially increase compensation and insurance when conducted by civilians.<sup>158</sup> As alluded to in *Duty With Honour*, a defining document for Canada's profession of arms, members of the CAF have a unique dedication and self-sacrifice aspect that require them to oblige to any task or mission

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<sup>155</sup> Based on author's experiences as TF Libeccio (Operation Mobile) CF-188 Maintenance Officer during Roto 0 conducted March to May 2011.

<sup>156</sup> Richard Mayne, "The Canadian Experience: Operation Mobile," in *Precision and Purpose: Airpower in the Libyan Civil War*, ed. Karl P. Mueller (Santa Monica, CA: RAND Corporation, 2015), 249.

<sup>157</sup> Deborah C Kidwell., *Public War, Private Fight? The United States and Private Military Companies*, (Global War on Terrorism Occasional Paper 12. Fort Leavenworth Kansas: Combat Studies Institute Press, 2005), 4.

<sup>158</sup> Sanu Kainikara, *Seven Perennial Challenges to Air Forces* (Canberra: Air Power Development Centre, 2009), 38.

sanctioned at the strategic level, as dangerous as it may be, and this, 24 hours a day, seven days a week.<sup>159</sup>

Third, relying heavily on contractors would reduce the amount of personnel who have military experience. As per *Duty with Honour*, CAF members have a unique set of skills and military knowledge acquired through their respective career paths, allowing them to efficiently accomplish the mission at hand.<sup>160</sup> Reducing the military experience is detrimental to this part of the Canadian statement of military professionalism. Kainikara argues that it would affect the service almost immediately through recruiting and retaining difficulties since it would change the way they are perceived and reserve units would see their numbers decrease dramatically.<sup>161</sup> Reserve units was touched upon in Chapter 2 with the total force concept of the Air Force personnel doctrine. They are an important component of the workforce since they are an integrated capability with experienced aviation technicians. These individuals usually have extensive military careers as a background with specific expertise. They have been of significant importance when dealing with the cutbacks and staff reduction, filling empty non-deployable positions such as AVS techs in labs, tool control, IT support and out-of-trade employment.<sup>162</sup> They want to keep working for the RCAF but without having to be frequently posted. As military professionals, they have a long-term commitment to the military institution that the contractors do not have. The level of expertise is problematic and skilled matured regular force member have a hard time coping with production and training younger technicians at

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<sup>159</sup> Canadian Forces Leadership Institute, *Duty With Honour: The Profession Of Arms In Canada* (Ottawa: DND Canada, 2003), 13-14; Donna Winslow, Canadian Society and its Army, *Canadian Military Journal* 4. no 4., (Winter 2003-2004): 21.

<sup>160</sup> Canadian Forces Leadership Institute, *Duty With Honour: The Profession Of Arms In Canada* (Ottawa: DND Canada, 2003), 9.

<sup>161</sup> Sanu Kainikara, *Seven Perennial Challenges to Air Forces* (Canberra: Air Power Development Centre, 2009), 38-39.

<sup>162</sup> Allan English and Colonel John Westrop (Retired), *Canadian Air Force Leadership and Command: The Human Dimension of Expeditionary Air Force Operations* (Trenton, Ontario: Canadian Forces Aerospace Warfare Centre, 2007), 166.

the same time. Therefore, one does not want to negatively affect the amount of reservists since they are a potential source to help address current demographics issues through their corporate knowledge and the continuity aspect that they bring.<sup>163</sup>

As Kainikara has put it, "The reduction in the reservist numbers, which will be an immediate fallout of civilianization, will have a cascading effect on the preparedness of the air force, particularly in the fighting units."<sup>164</sup>

Fourth, although difficult to fully expressed (but from the author's experience, is one of the most important aspects), there is the loyalty, fighting spirit, esprit de corps and the cohesiveness of an operational unit. A civilian group will inevitably be alienated from such a facet which should not be underestimated. In other words, and as explained in Kainikara's *Seven Perennial Challenges to Air Forces*:

Only personnel in uniform will have the sense of pride (that term being used for want of a better word) in a unit sufficiently developed to actually put themselves in dangerous and lifethreatening situations knowingly to ensure that the honour of the unit, and, therefore the force, is not tarnished. This is a combination of intangible elements like courage, camaraderie, a sense of self-worth, confidence in oneself and others in the unit etc., which is difficult, if not impossible, to inculcate in a 'civilian' group with fragile and limited loyalty to the group or organisation. The absolute need to fight and win—the basics on which air forces are built—gets skewed with the introduction of a civilianisation process.<sup>165</sup>

Lastly, the long-term rotation capacity of the fleet is also a key concern. If not maintained at a preferred manning level (PML), the frequency of rotation and duration of deployment can reach an unsustainable level.<sup>166</sup> That aspect is where contracted maintenance could play a key role: by supporting and manning the non-

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<sup>163</sup> Department of National Defence, B-GA-407-001/FP-001, *Air Force Personnel Doctrine* (Ottawa: Chief of the Air Staff, 2010), 2-2-2-3.

<sup>164</sup> Sanu Kainikara, *Seven Perennial Challenges to Air Forces* (Canberra: Air Power Development Centre, 2009), 39.

<sup>165</sup> *Ibid.*

<sup>166</sup> *Ibid.*, 40.

core, non-deployable functions, the military workforce can focus on specific deployable functions.

Now considering second line maintenance and to assure consistency of the narrative, the work required in proximity of aircraft and aircrew should be military as well since they are considered deployable tasks NDT, fuel bay, safety system (survival equipment), ejection seat, liquid oxygen LOX and structural shops). However, in line with the centralization of maintenance discussed above, the focus of outsourcing could be on those shops that work on component or systems that can build a spare pool and where the supply system can then be used to ensure just-in-time availability and minimize downtime of aircraft.<sup>167</sup> A counter-argument to this is that even though outsourcing can be a useful alternative to in-house provision of non-core functions, that success is not guaranteed due to the increase of communication complexities.<sup>168</sup> For example, the repair station technician or inspector must deal with not just Transport Canada Civil Aviation (TCCA), but also the military airworthiness program. Although intertwined, they are two distinct organizations with their own sets of rules.<sup>169</sup>

To summarize, there are important considerations to take into account for contracted maintenance. The potential advantages to the RCAF as a combat multiplier makes it an option that is worth exploring in greater detail. For first line maintenance and deployed operations, there might be a benefit using contractors for core functions for a short period of time, but it should not be a permanent capacity because of the

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<sup>167</sup> Department of National Defence, C-05-005-P07-AM-001, *Maintenance Program Implementation - Corrective Maintenance* (Ottawa: Chief of the Defence Staff, 2010), 1-1 - 1-2.

<sup>168</sup> Colin G. Drury, Kathryn P. Guy and Caren A. Wenner, "Outsourcing Aviation Maintenance: Human Factors Implications, Specifically for Communications," *The International Journal of Aviation Psychology Review* 20, no.2 (2010): 126.

<sup>169</sup> Transport Canada, "Civil Aviation," last accessed on 4 March 2017, <https://www.tc.gc.ca/eng/civilaviation/menu.htm>; Department of National Defence, C-05-005-001/AG-001, *Technical Airworthiness Manual (TAM)* (Ottawa: Chief of the Defence Staff, 2015).

national security aspect that can prompt vulnerability, as examined above. The focus should be on using them for non-core, non-deployable functions. Before making final recommendations on avenues the fighter fleet should entertain with regard to contracted maintenance in support of the future aircraft, the next section will look at the CF-188 AVS OWSM model and other nations experiences where outsourcing has been leveraged from with a positive effect.

### **Examples of Contracted Maintenance in Military Organizations**

First, the CF-188 AVS OWSM model will be examined. DAEPM (FT) had a requirement for an airworthiness accredited contractor to provide long term in-service support for designated CF188 Avionics systems (AVS), ATE and CF188 specialized support equipment.<sup>170</sup> The in-service support contract with Harris Canada Systems Inc. contains program management support, engineering support, maintenance support, materiel support and technical information support. They are directly responsible and accountable for CF-188 avionics parts availability and performance through day-to-day management, direction, control of program activities and resources in support of the National Defence Headquarters (NDHQ), Ottawa, and the two CF-188 MOB at 3 Wing Bagotville, Quebec and 4 Wing Cold Lake, Alberta.<sup>171</sup>

Harris Canada System Inc. in Calgary became the prime source of most in-service AVS/ATE support for the RCAF. More specifically, their scope of work covers 2nd and all 3rd level maintenance including repair, overhaul, maintenance,

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<sup>170</sup> Public Works and Government Services Canada, *CF188 Avionics (AVS) Optimized Weapon System Support (OWSS): Request for proposal* (Ottawa: DND, 2008).

<sup>171</sup> Public Works and Government Services Canada, *OWSS CF-18 AVIONICS Contract No W8485-07AN05/001/BB* (Ottawa: DND, 2010).

modification and calibration and supply chain management of materiel defined as repairable and consumable.<sup>172</sup>

The CF-188 AVS OWSM concept is described as a success story due to the continuous efficiency and extensive avionics network the company provides to the fighter community. Their sound expertise allows for detailed logistical analysis and projection to mitigate on-going challenges associated with managing a complex aircraft such as the CF-188. DND's life cycle materiel managers (LCMM) and supply item managers could never achieve the same level of depth. A prime example is the Deployment Support Request (DSR) form system that was put in place to support exercises and deployed operations. Whenever a squadron leaves for operations away from MOB, it simply needs to provide data such as location, number of aircraft and number of flying hours through the DSR form and the contractor, using capable analytical tools and historical data, automatically generates a pack-up kit with all the avionics items required to support the tasking.<sup>173</sup>

Another service provided is the "Window Concept" where Harris Canada Systems Inc. offers a counter at each of the two CF-188 MOB that supplies spare parts to the first and second line units. This could be compared to a customer service approach where a military aviation technician arrives with an order at the counter and the Harris employee instantly provides him/her with the parts requested from his storeroom. A request is then automatically generated to replace the parts from the warehouse in Calgary through just-in-time delivery.<sup>174</sup>

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<sup>172</sup> Ibid. Of note, the CP-140 has a similar contract in place with *L-3 Electronic Systems* in Enfield, Nova Scotia. Defense Industry Daily, "Maintaining Canada's CP-140 Aurora Fleet", last accessed on 4 March 2017, <http://www.defenseindustrydaily.com/canada-moves-to-longterm-performancebased-contracts-for-its-p3-fleet-01474/>.

<sup>173</sup> Harris Canada Systems Inc., *Deployment Support Request Form*, (Calgary, AB, 2013).

<sup>174</sup> Public Works and Government Services Canada, *OWSS CF-18 AVIONICS Contract No W8485-07AN05/001/BB* (Ottawa, DND, 2010).



The RAAF's perspective on outsourcing maintenance of military aircraft is also instructive. As per the Australian Department of Defence, outsourcing non-core functions was introduced as a result of a change in government policy, and has been a practice the RAAF has used for over a decade.<sup>175</sup> In line with what has been highlighted earlier, the main benefit the RAAF has identified is that outsourcing non-core functions allows for military personnel to focus on operational duties and was deemed to be cost beneficial.<sup>176</sup> This supports the Canadian Report on Transformation 2011 produced by the transformation team established in 2010 that was mandated to generate avenues that enhances efficiency and effectiveness in daily operations. Their ultimate objective was to lead the required organizational adjustment for the DND/CF of tomorrow. In this report, it was question of the debate of minimizing defence administrative "tail" and increasing operational "teeth":

The consistent guidance to the team was to focus on developing options that would reduce the tail in order to increase the teeth, a goal repeatedly articulated by senior government officials and the CDS. This analogy was used to convey the intent to seek out opportunities to improve Defence productivity, to reinvest in operational capability, and to maximize the operational return on taxpayers' dollars.<sup>177</sup>

Returning to the RAAF, the Australians are using a balance between contracted and Australian Defence Force (ADF) maintenance. For example, their F/A-18 Hornet fleet uses a combination of in-house ADF and contractor support from Boeing for deeper maintenance. A similar approach was to be put in place for the new Boeing F/A-18F Super Hornets, where it will have a mix of original equipment manufacturer

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<sup>175</sup> Emma Kelly, "Australia benefits from outsourcing military aircraft," *Flight International*, 25 April 2008.

<sup>176</sup> Ibid; Armin Krishnan, *War as Business: Technological Change and Military Service Contracting*. (Aldershot United Kingdom: Ashgate Publishing Limited, 2008), 108.

<sup>177</sup> National Defence and the Canadian Armed Forces, "Report on Transformation 2011," last accessed on 27 March 2017, <http://www.forces.gc.ca/en/about-reports-pubs/transformation-report-2011.page>.

support through the US Navy and some direct commercial arrangements with industry.<sup>178</sup>

Another example is the maintenance of Australian Army Black Hawks. Similar to the RAAF example, the Australian Army assessed that outsourcing decreases ADF involvement in intermediate and deeper level maintenance, permitting utilization of military resources for first line maintenance and other core capability support functions. It allows for the relocation of military personnel from support areas to the operational squadrons.<sup>179</sup> It also provides the use of incentives through performance-based contracts to encourage industry to go above and beyond expectations and innovate, making this approach a win-win for both parties.<sup>180</sup> The Australian Army even goes as far as embedding military personnel in industry for short periods of time to develop and maintain military personnel skills to the appropriate level for the demands of operations.<sup>181</sup>

From a US perspective, rather than looking at specific fleets outsourcing maintenance, it is important to focus on advantages and disadvantages associated with the outsourcing of Air Force functions. The first advantage is the improved continuity. The posting cycle means that military personnel move frequently, which is not the case for an equivalent civilian employee. Consequently, one can argue that there is a value added having personnel staying in the same position for an extended period of time since it improves stability and experience at a given task, while

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<sup>178</sup> Emma Kelly, "Australia benefits from outsourcing military aircraft," *Flight International*, 25 April 2008; Aerospace Center, *Air power and joint forces: the proceedings of a conference held in Canberra by the Royal 8-9 May 2000*, ed. Wing Commander Keith Brent (RAAF Base Fairbairn: National Library of Australia, 2000), 158-159.

<sup>179</sup> Emma Kelly, "Australia benefits from outsourcing military aircraft," *Flight International*, 25 April 2008.

<sup>180</sup> Ibid; Aerospace Center, *Air power and joint forces: the proceedings of a conference held in Canberra by the Royal 8-9 May 2000*, ed. Wing Commander Keith Brent (RAAF Base Fairbairn: National Library of Australia, 2000), 158-159.

<sup>181</sup> Emma Kelly, "Australia benefits from outsourcing military aircraft," *Flight International*, 25 April 2008.

reducing the constant training of new personnel and production time lost during the transition of labour force.<sup>182</sup>

A second advantage identified is greater flexibility. When a new maintenance requirement arises, the government can simply turn to the contractor without having to train military members in new skills or creating a new field of expertise. The constant advances in technology require greater specialization within the military workforce and a demographically challenged organization such as the RCAF would never cover a spectrum of capabilities like in the commercial market.<sup>183</sup> A third advantage is the focus on core functions. Regardless of cutbacks and stagnancy of the Air Force's workforce, outsourcing can bridge the gap and ensure there is no disruption of operational tempo.<sup>184</sup> The last advantage identified is the notion of fresh perspective – especially that of new personnel. As per J. Palmby's paper, *Outsourcing the Air Force mission: A strategy for success*: "Not having gone through traditional blue-suit training programs and coming from a culture that differs from the military's could allow contract personnel to make improvements to existing processes."<sup>185</sup>

Counter-arguments to the advantages discussed above are the following disadvantages. First, there is the problem of combatant versus non-combatant and the security aspect of contractors.<sup>186</sup> This relates to the concept of unlimited liability in the Canadian statement of military professionalism mentioned above and the fact that the profession of arms is distinguished by the obligation of service before self that a

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<sup>182</sup> William J. Palmby, "Outsourcing the Air Force mission: A strategy for success" (Walker Paper No.4, Air University press, Maxwell Air Force base, Alabama, 2006), 25.

<sup>183</sup> Ibid, 26; Steven J Zamparelli, "Contractors on the Battlefield: What Have we Signed up For?" *Air Force Journal of Logistics* 23, no. 3. (Fall 1999): 12; United Kingdom Ministry of Defence, "Operations in Iraq: Lessons for the Future", (London: Directorate General Corporate Communications, July, 2003), 45.

<sup>184</sup> Lt Col William Arrington, chief, Operations and Joint Matters Branch, Headquarters USAF/DPPRO, interview by William J. Palmby, 2 March 2005, transcript, Walker Paper No.4, Air University press, Maxwell Air Force base, Alabama.

<sup>185</sup> J. Palmby, "Outsourcing the Air Force mission: A strategy for success" (Walker Paper No.4, Air University press, Maxwell Air Force base, Alabama, 2006), 27.

<sup>186</sup> Ibid.

contractor does not have.<sup>187</sup> Second, is the aspect of control over the military forces and the Air Force function "Command." As per Canadian Forces air doctrine, "Command provides vertical and horizontal integration through the 'command' and 'control' of military forces and other elements as allocated as well as through the five command and control (C2) activities."<sup>188</sup> Military leaders will always prefer using troops to contractors since they can exercise a greater control over them.<sup>189</sup> Personnel are obliged to carry out orders (or commands) issued by superiors. A contractor will always be bound by the terms of their contract and this can be suboptimal from an operational perspective. In addition, civilian contractors, due to their status, can in all legitimacy "abandon ship" by using labour codes to get out of tasks they do not want to perform or perform other actions that impede the ability to conduct a mission.<sup>190</sup> A third disadvantage are the budget issues. Although there are potential cost savings associated with using contractors, a contract is a "must pay" item for the government and this can translate into budget constraints and offsetting other priorities.<sup>191</sup>

Another drawback is the reduced innovation. Outsourcing is a double edge sword in that aspect since as stated above, the service can leverage from the vast expertise from contractors but it also reduces blue-suitor troubleshooting capabilities. Finally, one last downside worth mentioning is retention. Military members could opt to leave the ranks in favour of a similar job that pays more and does not involve moving as often. A US example of that are the retention problems incurred to military

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<sup>187</sup> Donna Winslow, Canadian Society and its Army, *Canadian Military Journal* 4. no 4., (Winter 2003-2004): 21.

<sup>188</sup> Department of National Defence, B-GA-400-000/FP-001, *Canadian Forces Air Doctrine* (Ottawa: Commander Royal Canadian Air Force, November 2016), 20.

<sup>189</sup> National Security and International Affairs Division, *DOD Force Mix issues* (Washington, DC: United States General Accounting Office, 1996), 4.

<sup>190</sup> William J. Palmby, "Outsourcing the Air Force mission: A strategy for success" (Walker Paper No.4, Air University press, Maxwell Air Force base, Alabama, 2006), 28; Richard Cardinali. "Does the future of military logistics line in outsourcing and privatization? Accountants – the new gatekeepers of war-time operations," *Work Study*, 50, no 3. (2001): 110.

<sup>191</sup> William J. Palmby, "Outsourcing the Air Force mission: A strategy for success" (Walker Paper No.4, Air University press, Maxwell Air Force base, Alabama, 2006), 28.

workforce following the financial compensations offered by contractors for security services in Iraq.<sup>192</sup> Other incentives related to retention are that going for a contractor occupations does not come with the concept of unlimited liability discussed above<sup>193</sup> and they are not bound to the Law of Armed Conflict as they are non-combatants.<sup>194</sup>

The above CF-188 AVS OWSM model and national experiences from Australia and US demonstrate how contracted maintenance can be leveraged from without impacting core functions and affecting the autonomy of military organizations on deployments and at home. On the other hand, one must consider the downfalls of relying on contracted maintenance such as the non-combatant notion, the control aspect and the potential budget constraints. The next section will now debate that with the right approach, balancing blue suiter and contracted maintenance can benefit the RCAF and the integration of the CF-188' replacement(s).

### **Maintenance Proposal and Avenues for the Next CAF Fighter Aircraft**

This research paper highlighted some complexities the RCAF fighter fleet's maintenance community is and will be facing in the process of integrating a new platform(s). Whether it is for the Super Hornet as an interim/long-term solution or another alternative such as the F-35, ensuring optimal operational support is an endeavour that requires an extensive analysis that is above and beyond the scope of this study. However, this section will offer a broad maintenance proposal and avenues on how the fleet can prepare for it and where a leverage from contractors could harbour a positive effect in this venture. A good account of various options was already discussed including hiring expertise, using reservists, second line maintenance

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<sup>192</sup> Ibid, 29.

<sup>193</sup> Canadian Forces Leadership Institute, *Duty With Honour: The Profession Of Arms In Canada* (Ottawa: DND Canada, 2003), 9.

<sup>194</sup> Steven J Zamparelli, "Contractors on the Battlefield: What Have we Signed up For?" *Air Force Journal of Logistics* 23, no. 3. (Fall 1999): 14.

leverage through contractors and limiting the amount of extra-curriculum activities for technicians from the regular force. It is therefore instructive to expand further through two main themes: the main focus of military workforce and the three main avenues from where contracted maintenance can positively be leveraged.

First, it is instructive to explore the theme of where the focus of the military workforce should be and how this translates in preparing the technicians of tomorrow in the training facilities. In order to do so, there is a requirement to define what is considered a maintenance essential task for the fighter fleet. In the scope of this paper and in support of the argument that the fleet should ensure an independent and efficient force projection, essential tasks are defined as all first line maintenance tasks associated with the four main maintenance military occupations AVS, AVN, ACS and AWST and the second line maintenance tasks required in proximity of aircraft and aircrew due to their scope of work (NDT, fuel bay, safety system (survival equipment), ejection seat, LOX and structural shops). The RCAF should establish a strong succession plan to ensure covering those functions with redundancy, putting an accent on critical trades such as ACS (safety systems) and AWST as already discussed.<sup>195</sup> Redundancy means that a squadron can independently deploy for a period of four to six months without having to rely on another unit to supplement them or fill gaps.

An in-depth analysis shall then be conducted to define what additional skills and expertise are required for those functions to account for the new platform and incorporated them into the training curriculum. A consideration towards conversion training will be required to ensure current workforce (legacy technicians) are able to

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<sup>195</sup> CF-188 Manual of Aerospace Procedures, *TO&Es in support of 6 aircrafts - Op Impact* (3 Wing & 4 Wing , October 2014 to March 2016).

perform maintenance and airworthiness responsibilities to the same extent they currently do on the CF-188.

Next is the theme of where contractors can positively support military maintenance organizations with regard to the future platform(s). Several aspects can be considered but three will be explored. The first is training, which is complementary to the first theme and critical to an adequate transition. As discussed earlier, the CF-188 community is suffering from a shortage of experienced and qualified technicians and the instruction at 10 FTTS that brings an apprentice out of CFSATE to a CF-188 POM level draws his staff from operational units.<sup>196</sup> Having to absorb the training of legacy technicians on the new platform on top of the next generation of technicians will likely be unachievable with the limited resources, especially at the beginning of the transition where these resources will themselves need a conversion training on the new aircraft. This is an area where contractor expertise can be leveraged. A hybrid RCAF-Contractor training option can be beneficial for all parties where embedded contractors can ensure education of 10 FTTS instructors and legacy technicians at both the training and operational units, limiting the amount of experienced technicians removed from first line units where they are the most needed.<sup>197</sup>

Taking a step further, although training is a critical task, it is also a non-deployable assignment and one that civilians could have a bigger footprint having the benefits of reducing extra-curriculum activities for technicians from the regular force as well as enhancing continuity due to a much lower turnover of contractor instructors. 10 FTTS is drawing a great deal of experienced personnel away from the

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<sup>196</sup> Department of National Defence, A-PD-050-188/PA-000, *CF188 Hornet Fleet Employment and Training Plan* (Ottawa: DND Canada, 2016), 6-19.

<sup>197</sup> Based on author's experiences as Aircraft Maintenance Officer (AMO) of 425 ETAC from 2009-2011 and as Senior Aircraft Maintenance Engineering Officer (SAMEO) of 425 ETAC from 2014-2016.

operational units to provide the expertise needed to train new technicians.<sup>198</sup> The RCAF could take this opportunity of transitioning to a new platform to reallocate assets from 10 FTTS to first and second line deployable positions in favour of contractor instructors. A certain ratio of military instructors could remain and benefit from working with contractor experts, enhancing their skills for the demands of operations just like the RAAF is successfully doing.<sup>199</sup>

The second avenue that should be considered for contractor's leverage are off-aircraft maintenance repairs and overhaul of second line components and systems achieved by non-deployable positions. This was touched on earlier in the centralization discussion and again highlighted above with Harris Canada System Inc. that covers this aspect from an avionics perspective. Added to this is the other sustainment element of structural or mechanical systems and components such as fuel system components, hydraulic system components, landing gear, and Environmental Conditioning System (ECS) components.<sup>200</sup> Canada's industries such as L-3 MAS and Harris Canada System Inc. has developed a sound repair and modification capability of those 2nd line items that require specialized labour, equipment, tooling, facilities and ATE. They are able to maximize the amount of second line items they repair in-house and limit the flow of repairables going to OEMs outside of Canada, contributing positively to operational availability and costs.<sup>201</sup> DND should therefore take advantage from this and put a maximum amount of second line components and systems repaired through non-core functions under contract. They can then be

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<sup>198</sup> Based on author's experiences as Aircraft Maintenance Officer (AMO) of 425 ETAC from 2009-2011 and as Senior Aircraft Maintenance Engineering Officer (SAMEO) of 425 ETAC from 2014-2016.

<sup>199</sup> Emma Kelly, "Australia benefits from outsourcing military aircraft," *Flight International*, 25 April 2008.

<sup>200</sup> Department of National Defence, C-05-005-P07-AM-001, *Maintenance Program Implementation - Corrective Maintenance* (Ottawa: Chief of the Defence Staff, 2010), 1-1 - 1-2.

<sup>201</sup> Public Works and Government Services Canada, *OWSS CF-18 AVIONICS & OWSS CF-18 PAV Annual Operating Plans* (Ottawa, DND, 2016).



managed through spare pools and a commercialized just-in-time delivery method from contractors. In line with this, DND should also look at initiatives that could magnify the benefits of such an avenue like centralization of second-line maintenance and investing in new capabilities like the eCASS indicated previously. Once again, such an approach would allow for military personnel to focus on operational duties.

The third positive usage of contractors in military maintenance organizations that will be considered here in preparation for the CF-188 replacement is having some embedded contractor expertise at first and second line at the MOBs. A benefit of having a FSR was highlighted above when the CF-188 fleet was deployed on Operation Mobile. Even though the argument made is that tactical fighter squadrons need to be self sufficient in order to provide an autonomous force projection at home and abroad, having embedded contractors with specific area of expertise to supplement the military workforce allows for extra flexibility and depth in case of needs. These needs can translate into surge in operational theatre, the implementation of a new system such as the new antenna on the EGI (Embedded Global Positioning / Inertial Navigation System),<sup>202</sup> or simply in facilitating a NSR. NSRs are "repair schemes which are not found in the repair and overhaul instructions nor in the manufacturer's approved listings as approved by the Design Authority."<sup>203</sup> They are divided into two categories, critical and non-critical; and an engineering contractor has the responsibility to manage and resolve them. An embedded contractor can manage this process and expedite those repairs based on his expertise and direct link to the engineering contractor. They happen on a regular basis and an FSR in coordination with the engineering contractor at third line can provide in a timely

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<sup>202</sup> Department of National Defence, C-12-188-000/CD-215, *INSTALLATION OF GPS ANTI-JAM ANTENNA (CRPA)* (Ottawa: DND Canada, 2013).

<sup>203</sup> Department of National Defence, C-05-005-P07-AM-001, *Maintenance Program Implementation - Corrective Maintenance* (Ottawa: Chief of the Defence Staff, 2010), 3-1.

fashion a "summary consisting of a quantitative static strength analysis and a qualitative analysis of effects upon (but not limited to) fatigue, damage tolerance, inspectability, corrosion, weight/balance, stability/control, performance and interchangeability."<sup>204</sup> The CF-188 fleet is currently employing such specialists at first line and the recommendation is to continue and strengthen this practice, especially with the implementation of a new platform. Both 3 Wing and 4 Wing should have a specialist for each of the major components breakdown on the aircraft; one FSR for avionics, one for anything that falls into the primary air vehicle (PAV) category (i.e., landing gear, flight controls and structure) and one for engines.

As for second line, embedded contractors in specific shops should also be entertained to facilitate centralization, continuity and expertise for specialized tasks such as the conception of hydraulic lines.<sup>205</sup> In addition, another embedded capability at second line which is in line with the non-deployable capability argument above is the one already mentioned in having a contracted PER line at each Wing. Once again, it serves the same purpose of freeing military assets that can be employed in deployable positions. The discussion on this in Chapter 2 pointed out the increase of efficiency that such a capability provides and how it augments production. There would still be a requirement for military PER line, but having contractors in house can be leveraged for maintenance support, expertise and enhancing military technician skills.

## **Conclusion**

To summarize, the above two themes offer a proposal highlighting the main avenues the fighter fleet should consider to properly prepare the maintenance

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<sup>204</sup> Ibid, 3-2-3-3.

<sup>205</sup> Ibid, 1-1-1-2.

community for the integration of the CF-188 replacement(s). First was an examination of where the focus of the military workforce should be followed by specifics on how to positively use contracted maintenance as a leverage. A proper identification of the essential and core tasks the RCAF wants the military technicians to carry out autonomously is the first step in the process.

In order to use the fighter fleet as a strategic asset, an independent force projection is key and contracted maintenance is certainly a mean to this end if used properly. The three related aspects suggested above in the second theme in training, off-aircraft maintenance repairs and overhaul of second line components and systems, and embedded contractors at first and second line are certainly tangible avenues worth pursuing. They can have a strong positive effect on the CF-188 maintenance organizations in preparation for the upcoming challenges.

## **CHAPTER 5: CONCLUSION**

The complexities behind exploiting and controlling airspace is very much indicative of the ever-changing nature of the cooperation between public and private sectors. This study was an attempt at putting in perspective a very small fraction of this relationship by establishing where industry and contracted maintenance can tally with Canadian military maintenance organizations, specifically the fighter community, to better absorb the implementation of the future platform and enhance operational support through a positive influence.

How to address this complex debate could have been presented in many different ways. This paper offered a chronological approach which first addressed the current situation with regard to the maintenance workforce in the fighter fleet, including the organizational structure, training framework, demographics and challenges associated with it such as the level of expertise. It then examined how to prepare the fighter fleet to meet air power's upcoming challenges in the 21st century by first discussing the new era of conflicts versus conventional warfare, then looked at the interoperability concept and the notion of capability gap and associated projected maintenance requirements, before ending with a consideration towards centralization. It then analyzed avenues on how to balance contracted and blue suiter maintenance putting in perspective the necessities towards deployed operations and national experiences of military organizations that uses contracted maintenance, including the CF-188 AVS OWSM model.

Clearly, there are issues with the current maintenance demographics in the CF-188 community. The level of expertise is limited due to an "uneven bell curve" phenomena that clearly shows an absence of workforce in the 20-25 years of

experience interval caused by the 1990 budget cuts and reduction initiatives in the RCAF. Despite a well defined training foundation, there are difficulties keeping up with the operational tempo since the limited knowledgeable resources have a hard time coping with their dual responsibility of production and training of younger technicians. In order to address the situation, there is a requirement to put in place some mitigation actions such as hiring contracted expertise as an embedded capacity, retention and use of reserve units, second line maintenance leverage through contractors and limiting the amount of extra-curriculum activities for technicians from the regular force.

Modern warfare has erupted as a reality check for a fleet that developed and optimized to face "cold war type" of conflicts. Air power needs to adapt in order to proficiently face both traditional conventional state adversaries and the new non-state actor enemy. The capabilities of the fighter community needs to adjust and remain adaptable to both kinetic and non-kinetic aspects by increasing their flexibility in the joint environment through multi-role functions. Regarding the future mandate of the Canadian fighter fleet, the Government of Canada pointed out a capability gap that needs to be addressed to meet both its NATO and NORAD commitments, which is what motivated their initiative of procuring 18 Super Hornet as an interim measure to augment the current CF-188 fleet. Military doctrine and Air Forces Vectors 2020 also highlights the need for a long-term replacement in the near future since it indicates that interoperability with allies and more particularly the United States is essential, something for which the CF-188 is becoming deficient. The impact of this on the maintenance organizations is a requirement to put in place a transition plan in order to absorb the implementation of a new platform(s) while ensuring an optimal support to

operations in the short, medium and long term. Initiatives such as centralization and leverage from contracted maintenance are means to this end.

Finally, this paper has shown how contracted maintenance can represent a combat multiplier and provide an edge in support of operations at home and abroad. However, it is important to determine how much contracted maintenance is too much when it comes to deployed operations. In order for a fighter fleet to be employed as an efficient strategic asset, there is a requirement for it to remain autonomous and capable of acting as an independent force projection. Some essential deployable functions such as first line maintenance and second line capabilities in direct support of flying assets need to remain military to a maximum extent. There are currently several nations that use contracted maintenance in their military organizations efficiently with a positive influence on the service. Examples are the AVS and PAV contracts on the CF-188 Hornet and CP-140 Aurora. The RAAF and US are also supportive of such a practice, highlighting some key advantages such as improved continuity, greater flexibility and most importantly, allowing for military personnel to focus on operational duties through outsourcing non-core functions. There are however some downfalls worth being concerned about when contracting maintenance. These include the combatant versus non-combatant and the security aspect of contractors, the aspect of control over the military force, and reduced innovation.

### **Recommendations**

The final objective of this research paper was to provide a final recommendation on avenues the fighter fleet community should consider to optimize the transition towards a new platform from a maintenance perspective using

contractors. To this end, a proper identification of the essential and core tasks the RCAF wants the military technicians to carry out autonomously is required. In order to use the fighter fleet as a strategic assets, an independent force projection is key and contracted maintenance is a decisive mean to this end if used properly. It is therefore recommended that management considers maximizing contracted maintenance's footprint in the following three aspects: on-type training of technicians on the new platform(s), off-aircraft maintenance repairs and overhaul of second line components and systems carried out by non-deployable functions and an embedded contractor capacity at first and second line MOB, specifically in the form of FSRs, independent periodic line(s) and technical expertise for specialized tasks such as the conception of hydraulic lines. A caveat here that the above three facets are in addition to 3<sup>rd</sup> line maintenance, which is contractor led by default.

Adopting this proposal can have a strong positive effect on the RCAF fighter fleet's maintenance organizations in preparation for the upcoming challenges such as the implementation of the CF-188's replacement. From the author's experience and as shown during Operation Mobile,<sup>206</sup> the most critical military maintenance requirement in support of on-going operations, whether it is at home for the NORAD mandate or during deployed operations, is the ability to conduct efficient on-aircraft maintenance. This starts with having the right depth of personnel and expertise at first line and related deployable second line functions. From there, it does not matter who carries out off-aircraft maintenance of components managed through spare pools and non-deployable functions. As long as the in-flow of spares is ensured by a proper supply line and that the foundation of the operational ready state like training and

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<sup>206</sup> National Defence and the Canadian Armed Forces, "ARCHIVED Op Mobile", last accessed on the 25 February 2017, <http://www.forces.gc.ca/en/operations-abroad-past/op-mobile.page>.

periodic inspections is solid, aircraft serviceability and force projection will remain optimal.



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