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CANADIAN FORCES COLLEGE / COLLÈGE DES FORCES CANADIENNES

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**DOES CANADA NEED A FIGHTER FORCE?**

**A LOOK BEYOND 2017**

By / par LCol Eric Kenny

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## ABSTRACT

In 2017, Canada's CF-18 fighter aircraft will reach their extended life expectancy. From 2017 to 2020 all 79 modernized CF-18s will be retired from service, leaving Canada with no fighter aircraft capability. Is this an issue? Does Canada need a Fighter Force beyond 2017? This paper will provide these answers by an objective and well-reasoned response to the following four questions: 1 – Can Canada afford fighter aircraft?; 2 – What future threats justify the need for Canadian fighter aircraft?; 3 – What capability gaps or deficiencies exist with the retirement of the CF-18?; and 4 – What other aerospace weapons systems can fill these gaps or deficiencies, and how well?

It will be shown that the Department of National Defence's (DND) budget increase and new accounting procedures will allow for the purchase of new aerospace weapons systems. With a future security environment that includes uncertainty, complexity, surprise, and global risks, a robust military will be required and airpower will play a significant role. By examining eighteen defined military scenarios, Capability Based Planning (CBP) has highlighted deficiencies from which associated missions are derived. By comparing the capabilities of three different weapons systems (Unmanned Combat Aerial Vehicles (UCAVs), attack helicopters, and fighter aircraft), this paper will argue that to meet the Conservative Government's "Canada First Defence Strategy", DND must purchase at least 100 multi-role fighter aircraft to replace the CF-18s. The primary justification will be for control of Canadian airspace, with a secondary requirement for aerospace support to ground forces. 100 multi-role fighters will be the minimum needed to meet Canada's NORAD and international Mission Specific Task Force (MSTF) Mission Ready (MR) fighter aircraft commitments.

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## INTRODUCTION

The simple fact is that New Zealand cannot afford modern combat aircraft and the weaponry needed to equip them, and also maintain adequate army and navy capabilities. The Air Force, therefore, will be refocused. Its key roles will be in maritime patrol and air transport.<sup>1</sup>

The New Zealand Defence Minister made this statement on 8 May 2001, following an earlier announcement withdrawing the Royal New Zealand Air Force (RNZAF) from a \$190 million deal to lease 28 Lockheed Martin F-16 fighter aircraft. Four months later, the United States was hit by the attacks of 9/11. What followed was the Global War on Terror (GWOT) involving Operation Enduring Freedom (OEF) in Afghanistan and Operation Iraqi Freedom (OIF) in Iraq. Just as critics, analysts, and governments were critiquing the need for a robust military, major international operations were being launched.

Meanwhile, domestic and continental defence has taken on a whole new meaning. According to Elinor Sloan, "Today, in the post-9/11 era, fighter aircraft are more relevant to homeland defence than they have been since bombers were displaced by ballistic missiles as the primary threat to North America in the early 1960s."<sup>2</sup> Elsewhere, countries with relatively small militaries such as Australia,<sup>3</sup> Bulgaria, Romania, Poland, Czech

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<sup>1</sup>Neil Baumgardner, "New Zealand to Scrap A-4s, Air Combat Capability by End of Year," *Defense Daily* 210, no. 28 (May 9, 2001): 1; <http://www.proquest.com>; Internet; accessed 8 January 2008.

<sup>2</sup>Elinor C. Sloan, *Security and Defence in the Terrorist Era – Canada and North America* (Montreal and Kingston: McGill-Queen's University Press, 2005), 88.

<sup>3</sup>Australia is buying 24 F/A-18F Super Hornets as an interim replacement for their retiring F-111 strike bombers, while still planning to purchase up to 100 Joint Strike Fighters (JSFs). There is also a strong lobby group in Australia calling for the purchase of F-22 Raptor aircraft instead of the JSF. Bradley Perrett, "Filling the Gap: RAAF Hedges JSF Bet With Super Hornet," *Aviation Week & Space Technology* 166, no. 1 (January 2007): 87; <http://www.proquest.com>; Internet; accessed 7 January 2008.



Republic, and Hungary are all looking at purchasing new fighter aircraft.<sup>4</sup>

In 2005, the Liberal Government released Canada's International Policy Statement (IPS), which included a defence section calling for a major restructuring of the Canadian Forces (CF) to meet the new threats of terrorism and failed and failing states, while placing a greater emphasis on the defence of Canada and North America.<sup>5</sup> In 2006, the Conservative Party of Canada was elected to power promoting a Canada First vision that required a "... strengthen[ing of] Canada's independent capacity to defend our [Canada's] national sovereignty and security."<sup>6</sup> Increased funding to the Department of National Defence (DND) followed these promises.

On the international front, OEF and OIF demonstrated the increased reliance by coalition countries on technology in the battlefield. In addition, there has been an increased shift towards unmanned (versus manned) aircraft supporting ground forces involved in a prolonged Counter-Insurgency (COIN) battle. So, while some defence and security experts cite a need for fighter aircraft to defend Canada and North America, others see an increasing role for Unmanned Aerial Vehicles (UAVs) in international, and potentially, domestic defence.

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<sup>4</sup>Romania is looking at purchasing 48 F-16s, Swedish Gripens, or EADS Eurofighters. Poland is purchasing 48 advanced F-16s and the Czech Republic and Hungary are purchasing Gripens. Adam J. Hebert, Executive Editor, "NATO, Version 2.0: When the Western Alliance Moved to the East, Things Changed – Radically," *Air Force Magazine* 90, no. 9 (September 2007): 39; [journal on-line]; available from <http://www.afa.org/magazine/sept2007/0907nato.asp>; Internet; accessed 13 December 2007.

<sup>5</sup>Government of Canada, *Canada's International Policy Statement - A Role of Pride and Influence in the World - DEFENCE* (Ottawa: Government of Canada, 2005), 1-4.

<sup>6</sup>Conservative Party of Canada, *Stand Up for Canada: Conservative Party of Canada Federal Election Platform 2006* (Ottawa: Conservative Party of Canada, 2006), 45; [report on-line]; available from <http://www.conservative.ca/media/20060113-Platform.pdf>; Internet; accessed 06 September 2007.

With an ill-defined threat, Western militaries have embraced Capability Based Planning (CBP) “. . . to advise on the most appropriate force options to meet government priorities.”<sup>7</sup> By examining specific missions that DND could realistically be tasked to support, the military is able to determine future capability requirements. This allows for a more holistic approach to new capital equior8(i capp 0 Tdm)(e)llows Tm(7)TjETEMC /P34MCID 2 BD

deficiencies, and how well? With fifth generation fighter aircraft such as the JSF predicted to cost between \$80 to \$100 million per aircraft<sup>10</sup>, these are fair questions that require an objective and well reasoned response. Therefore, the purpose of this research paper is not to justify the purchase of the JSF, nor is it to extol the virtues of a fighter aircraft. Instead the intent is to answer these four questions in a deliberate and thorough approach. In a defence and security environment that demands results in the most cost-effective manner, it behoves military commanders and governments to rationalize all expenditures in the most transparent manner possible.

In responding to these four questions, it will be shown that to meet the Conservative Government's "Canada First Defence Strategy" (CFDS), DND must purchase at least 100 multi-role fighter aircraft to replace the CF-18. The primary justification will be for control of Canadian airspace, with a secondary requirement for aerospace support to ground forces. 100 multi-role fighters will be the minimum needed to meet Canada's NORAD and international Mission Specific Task Force (MSTF) Mission Ready (MR) fighter aircraft commitments.

This argument will be substantiated by answering the four questions in four separate chapters. First, Chapter 1 will focus on the latest changes to DND's capital procurement process to set the scene for when a new weapons system needs to be purchased. Next, the increases to DND's budget over the last few years will be examined to show that money is available to purchase a new weapons system. Finally, new accounting practices such as accrual accounting and inclusion of life-cycle support costs

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<sup>10</sup>Cameron Stewart, "Pentagon to Push Sale of Fighter," *The Australian*, 5 December 2007; <http://www.theaustralian.news.com.au/story/0,25197,22872206-31477,00.html>; Internet; accessed 22 March 2008.

within contracts will be earmarked as positive and necessary steps for the recapitalization of DND's equipment. Chapter 2 will examine the potential impact of globalization, and define the current and emerging threats impacting the defence and security environment. From these threats, a link will be made to two categorizations of future warfare: irregular and conventional. Finally, the role of air power in the future security environment will be examined. Ultimately, it will be argued that the future defence and security environment will consist of surprise, uncertainty, complexity, and global risks, for which air power will play a critical role. Chapter 3 will then explain how CBP has evolved over the last eight years in the CF. By reviewing the identified gaps and risks derived from eighteen classified force development scenarios, two primary deficiencies will be presented: *aerospace effects* and aerospace weapons systems to support *land effects*. These deficiencies will come from the domestic and continental control and the international inter-state control scenarios. A possible undetermined deficiency will also be highlighted: aerospace weapons systems to support *land effects* in an international intra-state control scenario. Chapter 4 will take these deficiencies and break them down into specific aerospace missions. It will be shown that two missions are specific to the domestic and continental control scenarios, seven missions for the international inter-state control scenarios, and two for the international intra-state scenarios. Three weapons systems will be introduced: Unmanned Combat Aerial Vehicles (UCAVs), attack helicopters, and fighter aircraft. These weapons systems will then be analyzed to determine their capability to conduct the derived missions, allowing a ranking to be established. Finally, the analysis of the ranking will be used to determine the best aerospace weapons system(s) to replace the CF-18 in 2017.

## CHAPTER 1 – DEFENCE PROCUREMENT AND BUDGETING

The 1994 Defence White Paper tabled under the Liberal Government mandated a reduction in the number of operational CF-18s to between 48 to 60 aircraft. It also directed the Department of National Defence (DND) to radically restructure capital equipment purchasing plans. The Canadian Forces (CF) was directed to only acquire new equipment essential to maintaining core capabilities, while cutting planned acquisitions by at least \$15 billion over the next 15 years.<sup>11</sup> The basis of Canada's defence policy had not changed, but the perceived threat had - the Cold War was over. The 1994 Defence White Paper still mandated DND's three missions as the defence of Canada, defence of North America in cooperation with the United States, and contribution to international security<sup>12</sup>, but the subjectivity and costs associated with operationalizing these missions led to their classification as "... two strategic imperatives and one strategic choice."<sup>13</sup>

Before exploring whether the CF-18 should be replaced, it is important to understand how the capital acquisition program is conducted. It is also important to know if large capital acquisition projects, such as a replacement fighter, are affordable based on the budget allocated to DND. Therefore, this chapter will first discuss the positive changes that have taken place in defence procurement over the last eight years,

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<sup>11</sup>Department of National Defence, *1994 Defence White Paper* (Ottawa: Canada Communications Group, 1994), chap. 7; [report on-line]; available from <http://www.forces.gc.ca/admpol/content.asp?id={73B202D3-9656-4FDC-8A4A-E923C2F68A7E}>; Internet; accessed 8 January 2008.

<sup>12</sup>*Ibid.*, chap. 4, 5 & 6.

<sup>13</sup>Craig J. Stone and Binyam Solomon, "Canadian Defence Policy and Spending," *Defence and Peace Economics* 16, no. 3 (June 2005): 154; <http://ebsohost.com>; Internet; accessed 23 January 2008.

with particular emphasis after 2005. Next, this chapter will look at DND's budget and associate that with money available for capital equipment and infrastructure based on the new financial management procedures of accrual budgeting and the inclusion of life-cycle support costs. Finally, a review of current capital projects, along with probable future acquisitions will be highlighted to set the scene for the upcoming Investment Plan. Ultimately, this chapter will argue that the current capital procurement process, allocated DND budget, and new DND financial management procedures will provide enough flexibility for the Federal Government and senior military officials to purchase a replacement to the CF-18, if the capability is determined to be required for 2017 and beyond.

## **DEFENCE PROCUREMENT PROCESS**

In Alan Williams's book, *Reinventing Canadian Defence Procurement – A View from the Inside*, Canadians are provided a deeper insight into the latest processes that take place within and external to DND when it comes to military capital procurement. Although a great deal of detail is provided in Williams's book, capital procurement timelines and capability based planning continue to evolve. These recent changes are primarily due to transformation and operational requirements brought about by the Afghanistan mission, and will be described in greater detail later in this chapter and in Chapter 3. In the broadest sense, Canada's defence procurement process has been characterized as: “. . . slow, overburdened by non-defence considerations, overly bureaucratic, and shot through with political interference.”<sup>14</sup> Although Williams does not

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<sup>14</sup>Alan Williams was the Assistant Deputy Minister (Materiel) for DND from August 1999 to April 2005. Alan S. Williams, *Reinventing Canadian Defence Procurement – A View from the Inside* (Montreal and Kingston: McGill-Queen's University Press, 2006), xv.

necessarily dispute these generalizations, he does describe a process that has evolved and become more responsive to the needs of the CF.

Why does DND need to rigidly follow the capital acquisition process? Between 2003 - 2006, fifty-two percent of all government contracts that were in excess of \$100 million were for defence. In addition, DND's asset base accounts for fifty-six percent of the federal government's total.<sup>15</sup> As the prime governmental department when it comes to capital acquisition, it behoves DND to remain transparent in its processes and accountable for its actions.

DND works with Public Works and Government Services Canada (PWGSC) in the procurement process. In addition, Industry Canada is involved to ensure that industrial and regional benefits are provided to Canada when procuring defence materiel. A good example of Industry Canada's involvement is the 12 December 2006 announcement that Canada had signed a Memorandum of Understanding (MoU) to help fund the third phase of the Joint Strike Fighter (JSF) program, consisting of Production, Sustainment, and Follow-on Development (PSFD). This was not a commitment to buy the JSF, rather it was an Industry Canada and DND commitment to provide funding to the project in exchange for industrial participation opportunities for Canada's aerospace and defence industry worth up to \$8 billion.<sup>16</sup>

Within DND, the military defines the requirements while the Assistant Deputy Minister (Materiel) (ADM (Mat)) division delivers the solutions. For expenditures that

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<sup>15</sup>*Ibid.*, xix.

<sup>16</sup>Department of National Defence, "Canada's New Government Signs on to Phase III of Joint Strike Fighter Program and Secures Access to up to \$8 Billion in Possible Contract for Canadian Industry," News release GOC NR – 06.090, 12 December 2006; [http://www.forces.gc.ca/site/newsroom/view\\_news\\_e.asp?id=2167](http://www.forces.gc.ca/site/newsroom/view_news_e.asp?id=2167); Internet; accessed 13 December 2007.

exceed \$100 million or involve policy or economic issues, Cabinet approval is generally required.<sup>17</sup> This distinction is important because air force capabilities generally exceed the \$100 million cut-off, thereby requiring Cabinet approval. Although the force employment cost of air force units is generally low, the technological requirements add to the overall capital procurement costs, thereby necessitating additional reviews which increases the timeline required to get approval.<sup>18</sup>

The division between DND and PWGSC is as follows. DND is the technical authority, while PWGSC is the contract approval and signing authority.<sup>19</sup> One of the unique legislations that applies to the CF defence procurement process when compared to other Western allies is that all goods and services must follow a competitive process.<sup>20</sup> This also impacts the time to acquire new capital equipment; however, it provides a fair and transparent process. In addition to PWGSC and Industry Canada participation in defence procurement, other agencies such as Treasury Board Secretariat (TBS), the Finance Department, other government departments, regional agencies, and the Privy Council Office (PCO) also play a role.<sup>21</sup> Defence procurement is regulated by the Canadian Agreement on Internal Trade (AIT) and Treasury Board's (TB) government contract regulations under the Financial Administration Act (FAA).<sup>22</sup> Under TB

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<sup>17</sup>Alan S. Williams, *Reinventing Canadian Defence Procurement – A View from the Inside*, 4.

<sup>18</sup>Department of National Defence, *CFP A-GA-007-000 AF-002 2003 - The Aerospace Capability Framework (A guide to transform and develop Canada's Air Force)*, 26.

<sup>19</sup>Alan S. Williams, *Reinventing Canadian Defence Procurement – A View from the Inside*, 76.

<sup>20</sup>*Ibid.*, 7.

<sup>21</sup>Paul Manson and Howard Marsh, "Recognizing the Problem," in *Creating an Acquisition Model that Delivers – Vimy Paper 1* (Ottawa: Conference of Defence Associations Institute, 2006), 16.

<sup>22</sup>Alan S. Williams, *Reinventing Canadian Defence Procurement – A View from the Inside*, 7, 15.



guidelines, all capital projects above \$30 million must be submitted to them for approval, with the Minister of National Defence (MND) authorized to approve projects under this amount.<sup>23</sup>

Based on Williams's study of 241 project files in August 1998, the average acquisition time "... from identification of a deficiency to close-out of a project was 15.8 years." Paul Manson and Howard Marsh attribute this delay to the bureaucratic process within and external to DND, and fierce competition amongst Canada's defence industry.<sup>24</sup> In December 2003, the ADM (Mat) and Vice Chief of the Defence Staff (VCDS) issued a directive that aimed at reducing this cycle time to 9.25 years by 2006.<sup>25</sup> As seen with the arrival of the CC-177 on August 13, 2007 following its TB approval on June 22, 2006, that cycle time is now down to 7.6 years.<sup>26</sup> Figure 1.1 provides a summary of the reduction in the procurement timeline.

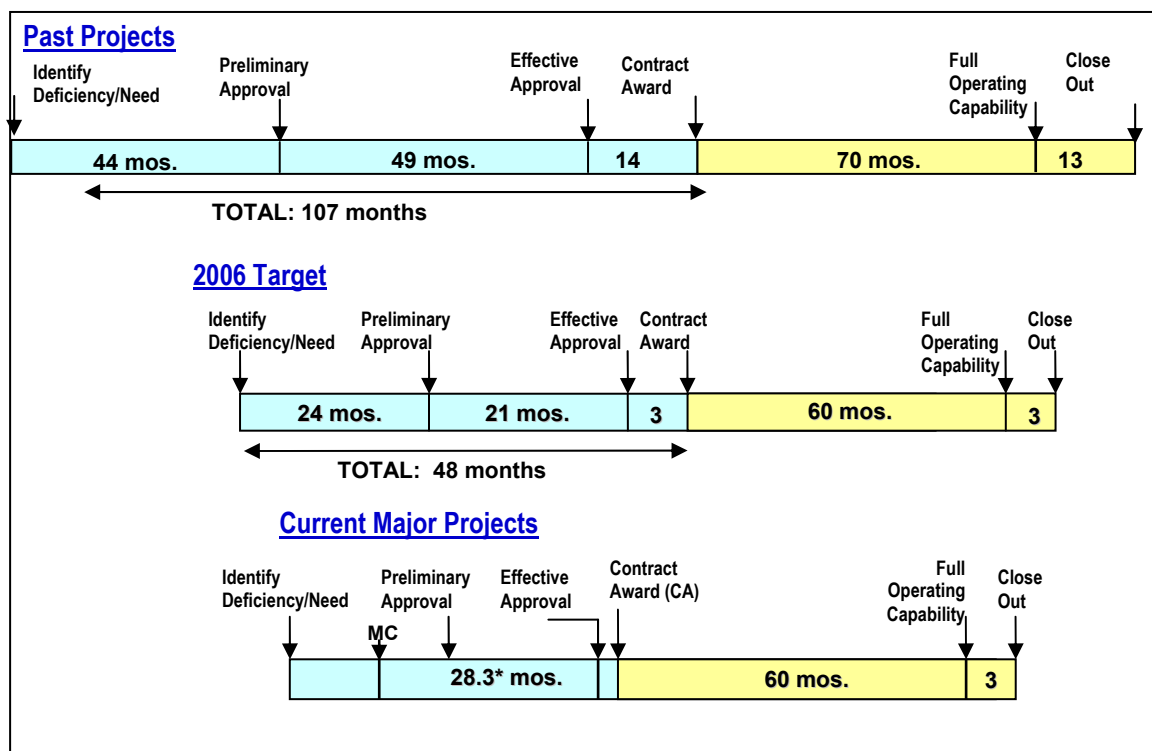
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<sup>23</sup>*Ibid.*, 38.

<sup>24</sup>Paul Manson and Howard Marsh, "Recognizing the Problem," 15.

<sup>25</sup>Alan S. Williams, *Reinventing Canadian Defence Procurement – A View from the Inside*, 95-96.

<sup>26</sup>Department of National Defence, *2007-2008 Report on Plans and Priorities* (Ottawa: Public Works and Government Services Canada, 2007), 37; [report on-line]; available from [http://www.tbs-sct.gc.ca/rpp/0708/nd-dn/nd-dn\\_e.pdf](http://www.tbs-sct.gc.ca/rpp/0708/nd-dn/nd-dn_e.pdf); Internet; accessed 7 January 2008.



**Figure 1.1 – Acquisition Timeline for Major Projects**

Source: Dan Ross, ADM(Mat), “CF and DND Materiel Management” (lecture, Canadian Forces College, Toronto, ON, January 15, 2008), with permission.

Knowing the acquisition timeline is important because as previously stated, the first of the modernized CF-18s will retire from service starting in 2017. In order to keep an airpower capability in Canada beyond this date, contract award would need to be announced no later than 2015, with preliminary approval required in 2012 or 2013.<sup>27</sup> But, can DND afford it?

## DND BUDGETING

Historically, the Canadian government has not allocated significant funding to defence. The primary reason is because the public does not perceive a real security threat

<sup>27</sup>This timeline assumes that a new capability can immediately replace the CF-18 without concerns over associated training, parts, infrastructure, and operational commitments. This would be a very dangerous assumption, however this timeline highlights the latest dates that a government could purchase a replacement without fully compromising a fighter capability in the future.

to Canada, and therefore sees no need for a large military. When Canadian governments have had to prioritize spending money on defence, health, education, or other social programmes, defence spending has been primarily based on what the government felt it could afford, instead of the defence policy it promoted.<sup>28</sup> Canadians in general see little direct benefits of a military, except when the military is called out under aid to the civil power or during national emergencies. This has led to a perception that defence requirements are subordinate to other Canadian needs.<sup>29</sup> In 1999, the government announced the first baseline funding increase to defence since the end of the Cold War however, it was for Quality of Life initiatives. Following the tragic events of 9/11, defence saw another baseline increase of \$1.2 billion by 2006/2007, but it was provided to fund new capabilities designed specifically to target terrorism rather than to replace older capital equipment. Budget 2003 went further by increasing baseline funding by \$800 million to ease existing sustainability pressures.<sup>30</sup> Budget 2006 provided the largest baseline increase, committing an additional \$5.3 billion over five years.<sup>31</sup> However the Standing Senate Committee on National Security and Defence (SCONSAD) stated that the allocated \$20 billion defence budget for 2011-2012 was not enough, and

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<sup>28</sup>Craig J. Stone and Binyam Solomon, "Canadian Defence Policy and Spending," 150.

<sup>29</sup>Douglas L. Bland and Sean M. Maloney, "Budgeting for National Defence in the 1990s," in *Campaigns for International Security: Canada's Defence Policy at the Turn of the Century*, ed. Douglas L. Bland and Sean M. Maloney (Montreal, QC: McGill-Queen's University Press, 2004), 156.

<sup>30</sup>*Ibid.*, 165-167.

<sup>31</sup>Department of Finance, *The Budget Plan 2006 – Focusing on Priorities* (Ottawa: Canada Communications Group, 2006), 135; [report on-line]; available from <http://www.fin.gc.ca/budget06/pdf/bp2006e.pdf>; Internet; accessed 14 January 2008.

recommended that DND be provided a budget of \$25 to \$35 billion by 2011-2012.<sup>32</sup> J. Craig Stone's analysis indicated that DND needed \$23.9 billion by 2020, but that was based on maintaining 60,000 regular force members, vice the 75,000 that the Conservative Government has mandated.<sup>33</sup> Seeing an additional baseline increase as recommended by SCONSAD or Stone is unlikely when one reviews historical budgeting patterns. In addition, the Conservative Government's tax cuts announced in the fall of 2007 have sharply reduced the flexibility of the federal government to increase future budget allocations to DND. Therefore, the military should continue to plan based on the current budget allocation taking into account the 1.5 percent (rising to 2.0 percent in 2011-2012<sup>34</sup>) inflation factor that is provided each year by the government to the Defence Services Program (DSP) baseline funding.<sup>35</sup>

When examining DND's budget and allocation, it must be viewed as a trade-off between three components: personnel, operations & maintenance, and capital.<sup>36</sup> As personnel costs rise due to increased benefits, salaries, and size of the military force, and operations' costs climb with commitments such as Afghanistan, capital is generally the

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<sup>32</sup>Standing Senate Committee on National Security and Defence, *Managing Turmoil – The Need to Upgrade Canadian Foreign Aid and Military Strength to Deal with Massive Change* (Ottawa: SCONSAD, 2006), 10.

<sup>33</sup>Craig J. Stone, "Planning Defence Budget Allocations for Canada's *Strategy 2020*," *Defence and Peace Economics* 16, no. 3 (June 2005): 245; <http://ebscohost.com>; Internet; accessed 23 January 2008.

<sup>34</sup>Department of Finance, *The Budget Plan 2008 – Responsible Leadership for Uncertain Times* (Ottawa: Canada Communications Group, 2008), 179-180; [report on-line]; available from <http://www.budget.gc.ca/2008/pdf/plan-eng.pdf>; Internet; accessed 24 March 2008.

<sup>35</sup>Craig J. Stone and Binyam Solomon, "Canadian Defence Policy and Spending," 149, 185.

<sup>36</sup>Craig J. Stone, "Planning Defence Budget Allocations for Canada's *Strategy 2020*," 229.

first category to be impacted.<sup>37</sup> From 1989 to 2003, personnel strength and the capital equipment budget was reduced radically to allow DND to remain within its allocated budget. Major expenditures such as infrastructure repairs were deferred.<sup>38</sup> This has led to a critical bow-wave of unfunded projects that require immediate attention.<sup>39</sup> Since it costs more to sustain and maintain new sophisticated equipment than to purchase it, this will put more pressure on DND's budget in the future.<sup>40</sup> To offset budget limitations and expensive sustainment costs, DND has implemented two new procurement procedures. The first is to have companies include life-cycle support costs when bidding for a major capital project. This holds the successful bidder accountable for providing life-cycle support at an agreed upon price, and allows DND to more accurately budget for total equipment costs in the future.<sup>41</sup> The second new procedure is the implementation of accrual accounting.

Accrual accounting was first implemented by DND in Budgets 2005 and 2006. However, it was TB that took the first step in bringing about accrual accounting when it changed the accounting system from expenditure-based accounting to accrual-based accounting back in 1995.<sup>42</sup> This shift by DND is part of the Defence Plan (DP) evolution through CF Transformation as the Conservative Government and DND

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<sup>37</sup>Douglas L. Bland and Sean M. Maloney, "Budgeting for National Defence in the 1990s," 172.

<sup>38</sup>*Ibid.*, 165.

<sup>39</sup>*Ibid.*, 184.

<sup>40</sup>Alan S. Williams, *Reinventing Canadian Defence Procurement – A View from the Inside*, 24.

<sup>41</sup>*Ibid.*, 28.

<sup>42</sup>Brian MacDonald, "Closing the Policy Gap," in *Transforming National Defence Administration*, ed. Douglas L. Bland (Kingston, Ontario: Queen's University, 2005), 46.

prepare the “Canada First Defence Strategy” (CFDS) which is supposed to be released in 2008.<sup>43</sup> Accrual accounting is used in private sector accounting practices and is seen as a positive and necessary step within DND. It allows capital equipment to be amortized over its expected life cycle.<sup>44</sup> This is important because DND’s capital acquisitions used to be done on a cash availability basis, and allocating several billion dollars for projects such as the CC-177 or CC-130J would have used up all the capital funding for several years. By using accrual accounting, DND is now paying the costs of these required assets over their projected lifespan. This provides in-year cash flexibility to manage other projects, as well as the continued financial pressures on operations & maintenance. In addition, it leaves capital funds available for additional accrual accounting purchases such as the projects announced in Budgets 2005 and 2006: medium to heavy lift helicopters, medium support vehicle system, joint support ship, Halifax-class modernization, and the howitzer M-777.<sup>45</sup> As reported by SCONSAD, “It is certain that accrual accounting will impact Department of National Defence budget planning and will free up considerable room for increased expenditures on capital equipment.”<sup>46</sup> Obviously as more military equipment is bought through accrual accounting, the less flexibility the military will have in buying additional equipment in the future. The only flexibility in these situations, without increasing the defence budget, will be to reduce

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<sup>43</sup>Department of National Defence, *2007-2008 Report on Plans and Priorities*, 15.

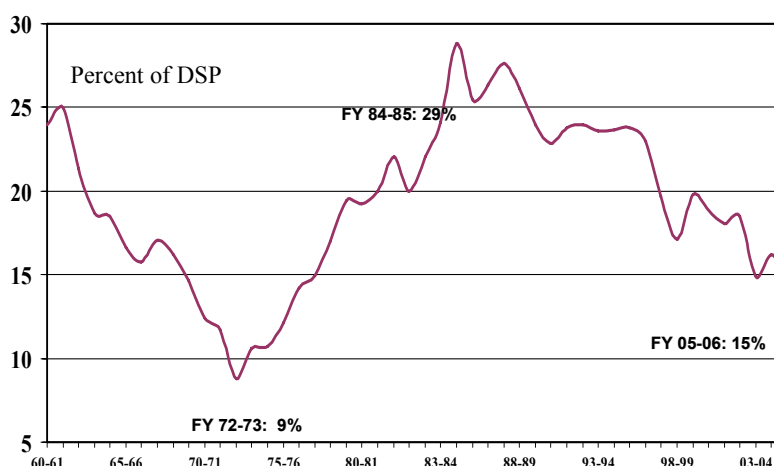
<sup>44</sup>Lieutenant-Colonel Ross Fetterley and Major Richard Groves, *Accrual Accounting and Budgeting in Defence* (Kingston, Ontario: Defence Management Studies Program, School of Policy Studies, Queen’s University, 2008), 19.

<sup>45</sup>Department of National Defence, *2007-2008 Report on Plans and Priorities*, 36-40.

<sup>46</sup>Standing Senate Committee on National Security and Defence, *The Government’s No. 1 Job – Securing the Military Options It Needs to Protect Canadians* (Ottawa: SCONSAD, 2006), 38.

operations & maintenance funding, re-profile projects that have slipped, or reduce or cut current capabilities. Therefore, there is still a limit to what capabilities the military can afford. However, in the short- to mid-term it allows DND to commence revitalizing its capabilities following a decade of cuts, and in the long-term, allows DND to more accurately forecast budget requirements over the next ten to twenty years.

One constant debate is how much of the defence budget should be allocated for capital (equipment and infrastructure). As can be seen in Figure 1.2, the percentage of the defence budget allocated to capital has varied considerably from as low as 9 percent to as high as 29 percent between the years 1960 to 2006.



**Figure 1.2 – Percentage of the Defence Budget Spent on Capital**

Source: Lieutenant-Colonel Ross Fetterley and Major Richard Groves, *Accrual Accounting and Budgeting in Defence*, 14.

In the 1990s, budget statements released by DND advocated spending between 20 to 30 percent of the budget on capital. *Strategy 2020*, released in 1999, set 23 percent as the target.<sup>47</sup> SCONSAD’s report in 2006 applauded the 23 percent goal, but said it was still too low to fix the considerable deterioration of equipment and infrastructure within

<sup>47</sup>Craig J. Stone and Binyam Solomon, “Canadian Defence Policy and Spending,” 157.

the Canadian military. They listed 25 percent as the goal of a healthy military force.<sup>48</sup>

As can be seen in Figure 1.2, the Canadian military has not come close to the 23 percent goal in the last ten years.

To accurately budget using accrual accounting for DND, personnel costs must be calculated first. Although the Conservative Government has mandated an increase to 75,000 Regular force members, DND has not received additional baseline funding to pay for this growth. The *2007-2008 Report of Plans and Priorities* has therefore set a limit of 68,000 regular force members and used this number as their assumption for projecting personnel costs in the future.<sup>49</sup>

Current and future capital equipment and infrastructure is directly tied to operations & maintenance expenditures. Therefore, an accurate prediction of the budget can be made based on capital equipment and infrastructure. As it currently stands, DND plans on increasing capital spending to just over 25 percent by 2009-2010 (\$4.9 billion).<sup>50</sup> This allows it to remain within its current budget allocation while procuring the approved major capital projects. This is a significant increase and directly attributable to the increased budget announced by the Conservative Government.

## **INVESTMENT PLAN**

What are the major combat capability replacement projects beyond 2010? Figure 1.3 displays the major capital equipment owned by DND and plots it in relation to existing system operational effectiveness and remaining life cycle. Based on this

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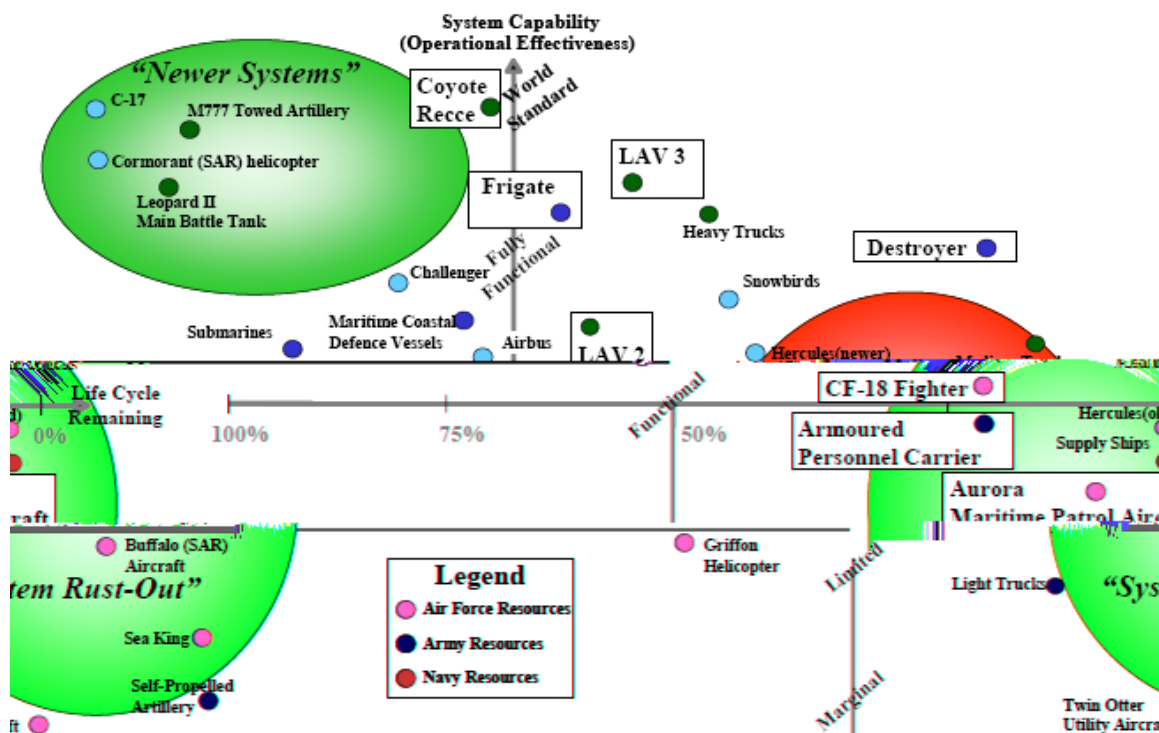
<sup>48</sup>Standing Senate Committee on National Security and Defence, *Managing Turmoil – The Need to Upgrade Canadian Foreign Aid and Military Strength to Deal with Massive Change*, 133.

<sup>49</sup>Department of National Defence, *2007-2008 Report on Plans and Priorities*, 73.

<sup>50</sup>*Ibid.*, 6.



graphical depiction, some of the probable major projects include: multi-mission aircraft (Aurora replacement), destroyer replacement, next generation fighter aircraft, and a frigate replacement. This assumes that replacements of these capabilities will be identified through Capability Based Planning and approved by the Government of Canada (GOC).



To respond to the expected bow-wave of upcoming major capital acquisition projects, force planning staff at National Defence Headquarters (NDHQ) have studied affordability and scheduling. This work will form a framework for an Investment Plan that has been requested by Treasury Board, as part of a pilot project for a wider program of departmental investment plans. Current CF planning lists the acquisitions and investments that will quite likely be required over the next twenty years. To this point, replacement of these capabilities is not approved, nor should it be implied that they

would be approved. The driving factor will be the CFDS, which will provide a long-term capability plan for DND and the CF.<sup>51</sup> CFDS will enable an accurate Investment Plan to be produced.

### **POSITIVE CHANGE**

In summary, there have been many positive changes in the last few years that will revitalize the CF to meet future challenges to Canada and the world. The capital acquisition process has been streamlined. Projects that once took an average of 15.8 years from initial identification of a deficiency to close-out of the project now take 7.6 years - a reduction of just over 50 percent. This is important to understand for two reasons. The first is because it gives an accurate prediction of how far in advance the military needs to seek approval for a project to ensure continued combat capability. The second is because capability requirements can be evaluated against the most recent technological advances before a specific platform type, or mix of platform types, needs to be selected. With an increased defence budget, DND is now able to upgrade or purchase new equipment and infrastructure after years of neglect and deferrals. By mandating bidders to include life-cycle support costs, they can be held accountable to meet these requirements within a defined budget, allowing DND to more accurately forecast defence spending over the next ten to twenty years. Most importantly, with the introduction of accrual accounting to DND, large capital projects that used to be paid for with residual in-year cash can be amortized over their life-span, freeing additional capital money for other concurrent capital projects.

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<sup>51</sup>Department of National Defence, *2007-2008 Report on Plans and Priorities*, ii.

The CFDS is important because it will provide a long term capability plan for DND and the CF. This will enable the formulation of an Investment Plan that includes acquisitions and investments that will quite likely be required over the next twenty years. However, despite all these positive steps over the last few years, it is questionable whether the current defence budget allocation will support a one-for-one replacement of all its current and desired capabilities. Nevertheless, this does not mean that the next generation fighter project is doomed to financial failure. The ultimate test will be founded on the emerging threats, the role airpower will play in the future security environment, and the capabilities that DND and the federal government determine as being required using capability based planning. There is financial flexibility to purchase new capital equipment within DND's latest budget, but the required capabilities will need to be prioritized, and the fleet sizes will need to be rationalized. This will be examined in greater detail in the following chapters.

## CHAPTER 2 – LOOKING INTO THE FUTURE

There are many opinions as to what the future security environment will hold beyond 2017, or for that matter, the next few years. Politicians, military leaders, academics, media personnel, and the general public all have differing views on what threatens their country, internally and externally. Defining current threats or deriving emerging threats is not a simple exercise of connecting the past with the present and the future. Because of this, there is often much debate over the roles that militaries will play in the future. These discussions are most prominent when it becomes time for governments to prioritize and allocate funding to competing national interests, needs, and wants. Without a clear understanding of the threats and the requirements for a military, getting political and public consensus on expensive military capital equipment is difficult and often controversial.

Therefore, this chapter will examine the evolving security environment and its justification of, and impact on, the military of tomorrow. This will be done by first examining the potential impact of globalization. Next, the current and emerging threats will be analyzed to set the scene for the types of warfare that may be encountered in the future: conventional and irregular. The final portion of this chapter will link the relevance of airpower to the future security environment. Ultimately, this chapter will argue that the future security environment will continue to be defined by surprise, uncertainty, complexity, and global risks, leading to the continued need for and use of Canada's military. In addition, it will be shown that airpower will play an important part in this uncertain and complex security environment, but its justification and effectiveness

will be directly linked to its adaptability and flexibility to provide the correct capabilities for current and future operations.

## GLOBALIZATION

When analyzing what the future may hold in terms of global security, most experts are quick to point out the significant role that globalization will play. However, defining globalization is difficult as there are disagreements over its connotation. R.J. Barry Jones sees globalization as an enhanced stage of internationalization,<sup>52</sup> whereas Joseph Nye sees globalization as “. . . the growth of worldwide networks of interdependence.”<sup>53</sup> Nye and his colleague Robert Keohane develop the idea of interdependence through three key elements: density of networks, institutional velocity, and “. . . transnational participation and complex interdependence.”<sup>54</sup> Others such as Stanley Hoffman divide globalization into three key parts: economic globalization, cultural globalization, and political globalization.<sup>55</sup> Although the previous definitions or interpretations of globalization may involve Hoffman’s economic, cultural or political aspects, they do not differentiate them. According to Joshua Goldstein and Jon Pevehouse, the most popular concept of globalization comes from the book *Global Transformations: Politics, Economics and Culture* which characterizes globalization as “the widening, deepening and speeding up of worldwide interconnectedness in all aspects

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<sup>52</sup>Paul J. Smith, *The Terrorism Ahead – Confronting Transnational Violence in the Twenty-first Century* (Armonk, New York: M.E. Sharpe, Inc., 2008), 64.

<sup>53</sup>Joseph S. Nye, Jr., *The Paradox of American Power: Why the World’s Only Superpower Can’t Go It Alone* (New York: Oxford University Press, 2002), 78.

<sup>54</sup>Paul J. Smith, *The Terrorism Ahead – Confronting Transnational Violence in the Twenty-first Century*, 64.

<sup>55</sup>*Ibid.*, 65.

of contemporary social life . . .”<sup>56</sup> This definition incorporates Nye and Keohane’s three key elements of increased interdependency, and provides a clear definition for the purposes of this research paper.

Just as there are disagreements over the exact definition of globalization, it should not be surprising that there are also differing conceptions of its impact. Goldstein and Pevehouse describe three of these diverging views. The first can be categorized as the optimistic view, whereby global markets will lead to “. . . an emerging global civilization.”<sup>57</sup> Transactions will no longer be restricted to state economies, and institutions, such as the International Monetary Fund (IMF), and non-state actors, will make traditional states obsolete. This would allow growth and prosperity to those who embrace new liberal economic principles.<sup>58</sup> This interconnection and integration of markets could also take care of social domains, thereby reducing intra-state and inter-state differences. Instead of focusing strictly on domestic concerns, governments would move towards multilateral and internationalist measures.<sup>59</sup> Paul Smith states that “. . . one could argue that nonstate actors are privileged by the processes of globalization . . .,” and this fundamental shift could mean that military superiority may not be the deterrence required for future challenges.<sup>60</sup> The empowerment of non-state actors, including

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<sup>56</sup>Joshua S. Goldstein and Jon C. Pevehouse, *International Relations*, 8<sup>th</sup> ed. (New York: Pearson Longman, 2008), 19.

<sup>57</sup>*Ibid.*, 19.

<sup>58</sup>*Ibid.*, 19.

<sup>59</sup>Saskia Sassen, “Governance Hotspots: Challenges We Must Confront in the Post-September 11 World,” in *Worlds in Collision – Terror and the Future of Global Order*, ed. Ken Booth and Tim Dunne (New York: Palgrave MacMillan, 2002), 316.

<sup>60</sup>Paul J. Smith, *The Terrorism Ahead – Confronting Transnational Violence in the Twenty-first Century*, 65.

terrorists, raises concerns in the US, evidenced by US Director of National Intelligence, J. Michael McConnell's statement that "Globalization has broadened the number of threats and challenges facing the United States."<sup>61</sup> Ultimately, the globalization optimists do not see the relevance of militaries in the future. Instead, they believe that the interdependency of the markets will drive an economic deterrence for resolving political conflict.

The second view of globalization can be categorized as the skeptical or pessimistic outlook. These skeptics do not see an integration of world markets into a single global market. Nor do they believe that the economic prosperity divide between the North and South will change.<sup>62</sup> Instead they point to an increasing divide between the global North and South. As the global North embraces globalization and profits from it, they see the global South becoming more in debt, with rising unemployment and continued health and social service problems. Saskia Sassen raises two dangers with this growing divergence. The first is the increased risk of global order destabilization, and the second is the increased potential for acts of desperation by dejected minorities in the global South, to include violence, sabotage, or terror, thereby impacting investments made by the global North.<sup>63</sup> The implicit logic of such a scenario argues for the

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<sup>61</sup>Director of National Intelligence, J. Michael McConnell, *Annual Threat Assessment of the Director of National Intelligence for the Senate Select Committee on Intelligence* (Washington, DC: Office of the Director of National Intelligence, 2008), 3.

<sup>62</sup>"The North includes both the West (the rich countries of North America, Western Europe, and Japan) and the old East (the former Soviet Union and its bloc of allies). The South includes Latin America, Africa, the Middle East, and much of Asia." "Within the global North, Russia and Eastern Europe lag behind in income levels. . . . In the global South, the Middle East, Latin America, and (more recently) China have achieved somewhat higher income levels than have Africa and South Asia, which remain extremely poor." Joshua S. Goldstein and Jon C. Pevehouse, *International Relations*, 19, 21, 23.

<sup>63</sup>Saskia Sassen, "Governance Hotspots: Challenges We Must Confront in the Post-September 11 World," 317.

continued utility of military force at the international level because of the destabilizing effects produced by a further imbalance between the rich and poor countries, ultimately leading to an increase in failed states.

The third concept of globalization provided by Goldstein and Pevehouse can be categorized as the neutral view. This school of thought recognizes the emergence of non-state actors and institutions such as the World Trade Organization (WTO), but also sees the continued need for state power which “. . . is not so much strengthened or weakened by globalization, but transformed to operate in new contexts with new tools.”<sup>64</sup> In other words, globalization will lead to a new hierarchy of institutions and leaders, although state power will continue to play an important part in the future security environment. The neutrals generally recognize a need for a military, but the size and role of that military is often debatable.

As can be seen, just as the definition of globalization is contested, so is its potential impact on the future security environment. A 2004 National Intelligence Council report stated that “we see globalization . . . as . . . a force so ubiquitous that it will substantially shape all the other major trends in the world of 2020.”<sup>65</sup> This may be so, but how it will shape 2017 and beyond is not clear, nor is there a consensus amongst academics. What can be derived is that globalization will connect organizations, non-state actors, and states closer than in the past. This social, political, and economic interconnection will create interdependence such that events that occur in one country

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<sup>64</sup>Joshua S. Goldstein and Jon C. Pevehouse, *International Relations*, 20.

<sup>65</sup>Paul J. Smith, *The Terrorism Ahead – Confronting Transnational Violence in the Twenty-first Century*, 66.



will impact another, for better or for worse. Ultimately, the impact of globalization is not clear, but it can be deduced that it will add uncertainty and complexity to the future security environment. It is also argued that although economic deterrence measures may work in many cases, it will not work in all; and a state-based military may be the last resort for exerting sovereignty in this future, interconnected world.<sup>66</sup>

## THREATS

On a planet that is daily becoming smaller, more overcrowded, and more overheated, the local politics of world politics will be fuelled by the combustible interplay of interstate conflict, globalization, population growth, extremist ideologies, apparently unstoppable technological momentum, terrorism, consumerism, tyranny, massive disparities of wealth, rage, imperialism, nuclear-biological-chemical weapons, and brute capitalism – as well as more traditional cultural threats to peoples security as a result of patriarchy and religious bigotry. Confronted, locally and globally, by such multidirectional dangers, one understandable response would be to give way to a sense of helplessness.<sup>67</sup>

As insinuated by Ken Booth, there are many perceived and real threats that can place governments and their peoples in harm's way. The attacks of 9/11 were a surprise. These attacks highlighted security vulnerabilities and clearly showed the Western world that countries may have to confront these threats, whether they want to or not. Despite the professed benefits of globalization and integration of domestic and international markets, the current global security environment has been plagued by surprise.<sup>68</sup> This has placed a renewed emphasis on having a capable military, as seen by the recent budget

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<sup>66</sup>Graeme Cheeseman, "Military Force(s) and In/security," in *Critical Security Studies and World Politics*, ed. Ken Booth (Boulder: Lynne Rienner Publishers, Inc., 2005), 70.

<sup>67</sup>Ken Booth, "Critical Explorations," in *Critical Security Studies and World Politics*, ed. Ken Booth (Boulder: Lynne Rienner Publishers, Inc., 2005), 1.

<sup>68</sup>Directorate of Maritime Strategy, *Securing Canada's Ocean Frontiers: Charting the Course from Leadmark* (Ottawa: Chief of the Maritime Staff, 2005), 13.

increases to DND discussed in Chapter 1. Nevertheless, who threatens Canada and its alliance members?

In 2006, SCONSAD listed non-state actors such as Hezbollah, Hamas, Al Qaeda, and the Tamil Tigers as threats to world security. They also listed Syria, Iraq, and the Israeli-Palestinian conflict as areas where Islamic radicalism continues to thrive despite the US declared GWOT.<sup>69</sup> Reports by the Canadian Security Intelligence Service (CSIS) have listed international terrorism as the primary threat to Canadians, reinforced through statements by Osama Bin Laden in November 2002 listing Canada as a target of retribution.<sup>70</sup> The US Department of Defense (DoD) publication *Joint Operating Environment – Trends & Challenges for the Future Joint Force Through 2030*, released December 2007, recognizes many of these same threats, but links globalization with these threats as such: “While current ethnic fault lines tend to be geographically centered, in the next twenty years globalization will likely unite ethnic Diasporas around the world . . .”<sup>71</sup> This DoD publication also assesses Al Qaeda’s threat to the US as likely to continue, focusing “. . . on prominent political, economic, and infrastructure targets designed to produce mass casualties, visually dramatic destruction, significant economic aftershocks, and/or fear among the population.”<sup>72</sup>

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<sup>69</sup>Standing Senate Committee on National Security and Defence, *Managing Turmoil – The Need to Upgrade Canadian Foreign Aid and Military Strength to Deal with Massive Change*, 17-18.

<sup>70</sup>Elinor C. Sloan, *Security and Defence in the Terrorist Era – Canada and North America* (Montreal and Kingston: McGill-Queen’s University Press, 2005), 18-19.

<sup>71</sup>Department of Defense, *Joint Operating Environment – Trends & Challenges for the Future Joint Force Through 2030* (Washington, DC: U.S. Government Printing Office, 2007), 13.

<sup>72</sup>*Ibid.*, 6.

In addition to the threats posed by humans, it is also assessed that environmental factors, specifically climate change, “. . . will seriously exacerbate already marginal living standards in many Asian, African, and Middle Eastern nations, causing widespread political instability and the likelihood of failed states.”<sup>73</sup> Christopher Coker sees this as a different challenge since “. . . it has no political or moral standing independent of the interests that political actors invest in it.”<sup>74</sup> Coker goes on to state that the climate change debate has incorrectly labelled states as the problem, vice the solution. Once again, another threat with no clear consensus on its future impact.

What about conventional war against potential inter-state threats such as North Korea, Iran, and China? Thomas Hammes argues that these threats are overemphasized. He states that the threat posed by North Korea is strictly a nuclear threat, since years of economic sanctions have reduced their military force to an ineffective organization. Hammes sees Iran’s primary military or political action involving a blockade of the Strait of Hormuz to stop the flow of oil – an action that would invoke a swift world reaction. However, he states that this could easily be resolved through the use of conventional naval forces to neutralize Bandar Abbas and open up the Strait of Hormuz. Finally, despite China’s build-up of military forces, he does not see them provoking a conventional forces battle, nor does he envision a willingness by the US to fight on mainland China.<sup>75</sup> Hammes argues that the main threat will come in the form of irregular

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<sup>73</sup>*Ibid.*, 11.

<sup>74</sup>Christopher Coker, *Globalisation and Insecurity in the Twenty-first Century: NATO and the Management of Risk* (New York: Oxford University Press Inc., 2002), 43.

<sup>75</sup>Thomas X. Hammes, *The Sling and The Stone: On War in the 21<sup>st</sup> Century* (St. Paul, MN: Zenith Press, 2004), 249-258.

warfare which he defines as fourth generation warfare (4GW).<sup>76</sup>

The 2008 US *Annual Threat Assessment of the Director of National Intelligence for the Senate Select Committee on Intelligence* listed some fundamental differences to Hammes's evaluation of North Korea, Iran, and China. It concurred that North Korea's primary threat was nuclear, but its concern was the proliferation of nuclear weapons vice their use for defensive or aggressive action. Also, although North Korea's military has been severely constrained by economic sanctions, ". . . it could inflict hundreds of thousands of casualties and severe damage on the South [Korea]."<sup>77</sup> The threat assessment recognized the growing ballistic missile and naval power projection of Iran, specifically in the Strait of Hormuz, however the bigger concern was Iran's capability to produce nuclear weapons by 2015.<sup>78</sup>

networks, has forced the North American Air Defence (NORAD) organization to focus on threats within North America, in addition to threats attempting to penetrate from outside.<sup>80</sup> At the same time, Russia has increased long-range aviation (LRA) training flights in the Arctic causing NORAD to react by scrambling fighters to intercept the Bear bombers as they approach Canadian and US airspace. Russia continues to maintain a relevant and global military force, although still nowhere near as capable as seen during the Cold War.<sup>81</sup>

Once again, there is a divergence in opinions of the future threats posed by terrorists, non-state actors, and states. Even non-traditional threats such as climate change and water shortages are being discussed in security analysis reports. According to Coker, globalization has caused governments to tackle these threats through “. . . the distribution of risk.”<sup>82</sup> Not all threats need to be dealt with by military force. By sharing risks with other private and voluntary sectors, more effective solutions may be developed, and just as important for governments, criticism of the response cannot necessarily be placed on the ruling party or decision makers.<sup>83</sup> As explained by Coker and Ernest Gellner, globalization has expanded risk outside of national borders. These global risks are becoming more difficult to manage and will determine “. . . the discourse of

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<sup>80</sup>Elinor C. Sloan, *Security and Defence in the Terrorist Era – Canada and North America*, 87.

<sup>81</sup>Director of National Intelligence, J. Michael McConnell, *Annual Threat Assessment of the Director of National Intelligence for the Senate Select Committee on Intelligence*, 28.

<sup>82</sup>Christopher Coker, *Globalisation and Insecurity in the Twenty-first Century: NATO and the Management of Risk*, 57.

<sup>83</sup>*Ibid.*, 57.

security.”<sup>84</sup>

Although military assessments tend to highlight the terrorist and conventional military threats, there is now an increased focus on non-conventional threats such as non-state actors, and failed and failing states. Most analysts agree that there are real and emerging threats; however, their impact to Canada remains uncertain. While the Canadian military’s number one priority is defence of Canada, it should not be viewed as a purely domestic role. In fact, Graeme Cheeseman argues that “Contrary to realist expectations, military forces today are being employed less and less in the defense [sic] of the state and more and more on broader regional and international security tasks.”<sup>85</sup> Canada’s security is intertwined with North American security and international security.<sup>86</sup> This was clearly witnessed when the US shut down the US-Canada border immediately following the surprise attacks of 9/11. The integration of markets between Canada and the US has led to an enormous interdependency, especially in trade. Events that occur outside Canadian borders can and will impact Canadians directly. This has led to statements advocating a need to “. . . address threats to our [Canada’s] security before they reach ourselves [Canada].”<sup>87</sup> Is it realistic to expect that these threats will not impact Canada? In an era plagued by surprise, uncertainty, complexity, and increased

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<sup>84</sup>*Ibid.*, 59-60.

<sup>85</sup>Graeme Cheeseman, “Military Force(s) and In/security,” 71.

<sup>86</sup>Director of National Intelligence, J. Michael McConnell, *Annual Threat Assessment of the Director of National Intelligence for the Senate Select Committee on Intelligence*, 4.

<sup>87</sup>LGen Steve Lucas, “The Future of Air Power for Small Air Forces: Perspectives from Canada,” Presentation to Australian Chief of Air Force Air Show Conference on “Smaller Air Forces and the Future of Air Power,” 19 March 2007; [http://www.defence.gov.au/RAAF/airpower/html/publications/conferences/caf07/05\\_Canada.pdf](http://www.defence.gov.au/RAAF/airpower/html/publications/conferences/caf07/05_Canada.pdf); Internet; accessed 11 February 2008.

global risk, this research paper asserts that a credible, robust, and effective military is, and will continue to be, required. Globalization and the emerging threats will require Canada to have a military that not only provides defence, but also responds to global events in an expeditionary capacity.

### **CONVENTIONAL VERSUS IRREGULAR WARFARE**

A military is only credible, robust, and effective if it is able to achieve the end state mandated by its government. To accomplish this, it is important to understand the types of conflict that militaries may be tasked to fight in the future. For the purposes of this argument, the US Air Force (USAF) warfare categorizations of conventional and irregular will be used. Conventional warfare is primarily viewed as state-on-state war, often referred to as inter-state war or major armed conflict. Irregular Warfare (IW) on the other hand is most often associated with intra-state war and is defined in the US *Quadrennial Defense Review Report* of 2006 as “. . . operations in which the enemy is not a regular military force of a nation-state.”<sup>88</sup> This report states that IW is now the primary form of warfare to threaten the US and its allies.<sup>89</sup> Although IW is viewed as the primary threat, the number of non-state conflicts over the past 15 years has fallen from approximately 32 a year in the timeframe 1989-1991, to about 19 in 2004. In addition, the number of smaller wars, sometimes referred to as 4GW, have also decreased from 43 to 19.<sup>90</sup> Therefore, as conventional warfare has declined, so has IW. However, since IW

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<sup>88</sup>Benjamin R. Maitre, “The Paradox of Irregular Airpower,” *Air & Space Power Journal* 21, no. 4 (Winter 2007): 36; <http://www.proquest.com>; Internet; accessed 23 January 2008.

<sup>89</sup>*Ibid.*, 36.

<sup>90</sup>Albert A. Nofi, *Recent Trends in Thinking about Warfare* (Alexandria, Virginia: CNA Cooperation, 2006), 25-26.

conflicts tend to be protracted affairs, they can prove to be a greater challenge for governments and their militaries when it comes to strategy, public support, and cost. Equipping a military to conduct conventional warfare is expensive. Equipping a military to conduct IW requires a new focus with increased use of non-conventional means such as Information Operations (IO), Psychological Operations (PSYOPS), and integrated operations with other government departments (OGDs), and non-government organizations (NGOs). Therefore, the types of warfare will be discussed further to show that future war may include both conventional warfare and IW, but the primary focus over the next twenty years will be on IW.

Conventional warfare tends to be fought by identifying an enemy's centre of gravity (COG) and attacking it directly or indirectly while protecting one's own COG.<sup>91</sup> Conventional warfare is best described as a professional military force fighting another professional military force. Most modern day militaries are structured to fight conventional warfare, and there are advocates who see a continued need to maintain this capability. Dennis Drew and Donald Snow provide three reasons. The first is for deterrence. By having a modern conventional force that is reasonably sized, technologically sophisticated, and experienced in operational art, other countries are deterred from attacking it.<sup>92</sup> The second is that conventional forces may be called upon

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<sup>91</sup>Dennis M. Drew and Donald M. Snow, *Making Twenty-First-Century Strategy – An Introduction to Modern National Security Processes and Problems* (Maxwell Air Force Base, Alabama: Air University Press, 2006), 82; [report on-line]; available from [http://www.maxwell.af.mil/au/aul/aupress/Books/Drew\\_Snow/DrewSnow.pdf](http://www.maxwell.af.mil/au/aul/aupress/Books/Drew_Snow/DrewSnow.pdf); Internet; accessed 23 January 2008.

<sup>92</sup>The need for a military deterrence force is disputed by the globalization 'optimists.' They believe economic deterrence will prevail. However, as previously argued, the surprise, uncertainty, complexity, and risk created by globalization and emerging threats, do not all lend themselves to economic solutions. In these rare cases, a military force may be the last option available to governments.



to aid other countries, as seen in Kuwait in 1991, Bosnia during the 1990s, and Kosovo in 1999. The third reason relates to the US strategy of waging pre-emptive war as witnessed in 2003 with the invasion of Iraq (OIF).<sup>93</sup> Albert Nofi also agrees with the need to maintain a conventional military force, arguing that a conventional force provides flexibility along the entire scale of conflict.<sup>94</sup> The US DoD review of trends and challenges states that the emerging great powers, such as India, China, and Russia, will be able to develop powerful conventional military capabilities that could equal that of the US by 2030. It goes on to state that the “Emerging great powers will seek to project power farther from their borders and develop expeditionary capabilities to secure energy sources and supplies of natural resources.”<sup>95</sup> Although the advocates of future conventional warfare tend to derive from US defence or intelligence circles, they do raise valid concerns, especially when trying to predict the future beyond 2030. Based on their latest assessment, the US DoD review listed conventional warfare as “Problem #2” for a US notional joint force of the future, with “Problem #1” being IW.<sup>96</sup>

Irregular warfare poses a challenge for conventionally equipped and minded militaries because the enemies tend to have little regard for the Laws of Armed Conflict

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<sup>93</sup>Dennis M. Drew and Donald M. Snow, *Making Twenty-First-Century Strategy – An Introduction to Modern National Security Processes and Problems*, 223.

<sup>94</sup>Nofi’s paper is written for the US Naval War College. Most countries are unable to afford militaries that can cover the full spectrum of conflict, and therefore need to make tough budgetary decisions to provide effective, multi-purpose capabilities that fit their unique situation and perceived threats. Albert A. Nofi, *Recent Trends in Thinking about Warfare*, 88.

<sup>95</sup>This US DoD review derives its information from multiple sources. It basis this particular conclusion on a 2004 report from the National Intelligence Council called *Mapping the Global Future: Report of the National Intelligence Council’s 2020 Project*. In this source, the likely emergence of China and India is compared to the rise of Germany in the 19<sup>th</sup> century. Department of Defense, *Joint Operating Environment – Trends & Challenges for the Future Joint Force Through 2030*, 38-39.

<sup>96</sup>*Ibid.*, 69.

(LOAC). In addition, it is very difficult to find an enemy that blends in with the local population,<sup>97</sup> or an enemy who works in the local police force during the day, and acts as an insurgent at night. These insurgents have been able to master IO through the use of globalized information networks, while attempting to appeal to a support base that they understand more than the occupying military force. Also, destroying the enemy's COG could very well result in the destruction of one's own COG - support of the local population.<sup>98</sup> This method of warfare goes against the Clausewitzian view of war, and questions whether nations will be able to adapt their capabilities and approach.<sup>99</sup> Thomas Hammes classifies this type of warfare as 4GW vice IW, and states that 4GW “. . . is an evolved form of insurgency.”<sup>100</sup> He also states that it started near the end of WWII, continues today, and will continue into the future. Instead of trying to directly attack a superior military force, 4GW insurgents attempt to destroy the coalition's political will, attacking the minds of decision makers by making it appear that the goals are unachievable or too costly.<sup>101</sup> However, Hammes does recognize that wars are often a combination of conventional warfare and 4GW. For example, OIF saw an initial conventional war involving a joint attack against Iraq's military, followed by a low-tech, 4GW struggle that still continues today – five years later.<sup>102</sup> Likewise, during OEF in

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<sup>97</sup>Albert A. Nofi, *Recent Trends in Thinking about Warfare*, 82.

<sup>98</sup>Dennis M. Drew and Donald M. Snow, *Making Twenty-First-Century Strategy – An Introduction to Modern National Security Processes and Problems*, 141.

<sup>99</sup>Albert A. Nofi, *Recent Trends in Thinking about Warfare*, 5.

<sup>100</sup>Thomas X. Hammes, *The Sling and The Stone: On War in the 21<sup>st</sup> Century*, 2.

<sup>101</sup>*Ibid.*, 2.

<sup>102</sup>*Ibid.*, 4.

Afghanistan, a large-scale conventional force was used to fight what initially appeared to be a conventional war against the Taliban.<sup>103</sup> Since that conventional attack over six years ago, it has continued as what Hammes would classify 4GW.

Based on the assessments and counter-arguments presented, it is asserted that IW will be the primary focus for most militaries over the next twenty years. However, as witnessed during OIF and OEF, both conflicts started as conventional wars, not IW. In addition, if potential threats posed by countries such as Iran, North Korea, and China cannot be controlled by globalization and diplomacy, then conventional warfare could break out. This threat is not necessarily expected in the next twenty years, but neither were the attacks of 9/11 anticipated. Ultimately, militaries will need to be equipped and trained to conduct both IW and conventional warfare because either is possible in the future, and often it will be a mix of both as seen during OIF and OEF.

## **CHANGING ROLE OF AIRPOWER**

Allen Peck stated, “Innovation and adaptation are hallmarks of airpower.”<sup>104</sup> If this is the case, then how must airpower adapt to meet the challenges of 2017 and beyond? This is fundamental in determining whether Canada needs to replace the CF-18, and if so, with what type of capability. If militaries will be primarily used for IW conflicts over the next twenty years, then air forces need to adapt, equip, and train their personnel for this new reality. At the same time, airpower needs to be able to respond to potential conventional warfare. The CF-18 will be in DND’s inventory for just over

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<sup>103</sup>Rebecca Grant, “An Air War Like No Other,” *Air Force Magazine* 85, no.11 (November 2002): 30; [journal on-line]; available from <http://www.afa.org/magazine/nov2002/1102airwar.asp>; Internet; accessed 23 January 2008.

<sup>104</sup>Allen G. Peck, “Airpower’s Crucial Role in Irregular Warfare,” *Air & Space Power Journal* 21, no. 2 (Summer 2007): 11; <http://www.proquest.com>; Internet; accessed 23 January 2008.

thirty-five years. If a replacement is purchased, that weapons system will likely be in use until at least 2050. The weapons system must be able to fight in a conventional war, and not just an IW conflict. In fact, even if IW dominates the wars of the future, they will quite likely include periods of conventional fighting as seen during OIF and OEF.

Therefore, what is the real change to the role of airpower?

Robert Dudney states that airpower is crucial for both conventional warfare and IW. In both Iraq and Afghanistan (OIF and OEF), airpower platforms were required to fight a conventional war against the Iraqi army and the main Taliban forces respectively.<sup>105</sup> Although 75 percent of the fighter strike missions for OEF were launched from naval aircraft carriers, they were still providing airpower.<sup>106</sup> Now these operations have degraded to IW, yet airpower continues to support them through Close Air Support (CAS) and air interdiction missions. As stated by Secretary of the [US] Air Force, Michael Wynne, "I guarantee you that if airpower were not there [Iraq and Afghanistan], it would be an entirely different war." He goes on to argue that airpower has limited the size of enemy forces to groups of ten or twenty vice hundreds or thousands. They have been able to do this by achieving air dominance, allowing intelligence, surveillance, and reconnaissance (ISR) assets to conduct unrestricted tracking of the operational battlespace. Once ISR platforms find and identify enemy

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<sup>105</sup>Robert S. Dudney, "On Fighting Irregular War," *Air Force Magazine* 90, no. 10 (October 2007): 2; [journal on-line]; available from <http://www.afa.org/magazine/oct2007/1007edit.asp>; Internet; accessed 23 January 2008.

<sup>106</sup>Rebecca Grant, "An Air War Like No Other," 32-33.

forces, they are targeted by airpower before they can mass into larger formations.<sup>107</sup> This appears to be an excellent adaptation of airpower for IW conflicts. Kenneth Beebe categorizes this as a supporting role in counter-insurgency (COIN) warfare, a subset of IW, whereby the air force provides surveillance, air mobility, communication support, and CAS to the ground commander and other agencies.<sup>108</sup>

Canada's Chief of the Defence Staff (CDS), General Rick Hillier, has argued that "Insurgency is the war of the future . . . and large scale state-to-state warfare is largely a relic of the past."<sup>109</sup> The US Air Force (USAF) has recognized the importance of IW and the associated COIN engagements that go along with it. However, they also recognize a need to preserve conventional capabilities. In addition to conventional capabilities, the USAF is looking at two new mission sets. The first is being able to effectively track and strike the enemy using airpower in COIN engagements, and the second is to develop an organization that can build up airpower within the partner nation. This second approach is being used in OIF whereby the US is building up an Iraqi Air Force.<sup>110</sup> Clearly this is not a task suited for small air forces like Canada's.

Based on the observations provided by various military leaders and academics, a deduction can be made that the primary change to using airpower will be in IW conflicts.

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<sup>107</sup>Adam J. Hebert, Executive Editor, "The Future Is On the Line," *Air Force Magazine* 90, no. 11 (November 2007): 28; [journal on-line]; available from <http://www.afa.org/magazine/nov2007/1107future.asp>; Internet; accessed 23 January 2008.

<sup>108</sup>Kenneth Beebe, "The Air Force's Missing Doctrine: How the US Air Force Ignores Counterinsurgency," *Air & Space Power Journal* 20, no. 1 (Spring 2006): 28; <http://www.proquest.com>; Internet; accessed 23 January 2008.

<sup>109</sup>Janice Gross Stein and Eugene Lang, *The Unexpected War: Canada in Kandahar* (Toronto: Viking, 2007), 210.

<sup>110</sup>Robyn Read, "Irregular Warfare and the US Air Force," *Air & Space Power Journal* 21, no. 4 (Winter 2007): 44, 46; <http://www.proquest.com>; Internet; accessed 23 January 2008.

In these conflicts, airpower will need to be more responsive to the supported ground commander. In addition, airpower weapons systems will need persistence, speed, and precision to target insurgents during fleeting opportunities. For Canada's military, technological developments of new weapons systems may change the tools used to conduct IW. These new capabilities will be further defined in Chapter 3. Otherwise, it is expected that the role of airpower during conventional warfare will remain similar to that seen today.

### **A NEED FOR AIRPOWER IN THE FUTURE**

In summary, the surprise, uncertainty, complexity, and global risks experienced in today's security environment will continue to manifest themselves beyond 2017.

Although the future impact of globalization is not clear, the social, political, and economic interconnection it creates will manifest interdependence such that events that occur in one country will impact another, for better or for worse. Economic deterrence may work for some states in a global market, but its impact on poorer countries such as those found in the global South may be less effective, creating an increased risk of more failed states. In addition, globalization has empowered non-state actors and terrorists, thereby creating other threats. These threats listed by SCONSAD, CSIS, and the US Director of National Intelligence clearly emphasize the continued risk of international terrorism.

Meanwhile, the US continues to watch countries such as China, India, and Russia which they view as potential emerging global powers beyond 2020. Not only are these countries becoming emerging global powers, but they are also building technologically advanced militaries. At the same time, North Korea poses a nuclear proliferation threat,

and Iran may be capable of producing nuclear weapons by 2015. Beyond 2020, it is conceivable that conventional threats from new global powers may provoke confrontations that cannot be resolved through globalization.

DND's first priority is the protection of Canada; however, a defensive approach will not prevent all threats, as witnessed on 9/11. A military expeditionary capability will also be required to strike threats outside the borders that directly threaten Canada, Canada's national interests, and global stability. The CF-18 has been well suited to fill this mandate, whether it is in an air-to-air role with NORAD, or in an air-to-ground role with a coalition or alliance nation. It has been able to do this because of its multi-role capability.

Airpower is adaptable and flexible. The primary change for airpower in the future will be the increased focus on supporting COIN operations during IW. This means that airpower weapons systems must be able to respond with persistence, speed, and precision to take advantage of fleeting opportunities. These airpower operations will be in support of land commanders and will primarily involve CAS and air interdiction. The conventional roles of airpower will also remain relevant. Due to Canada's unique bilateral agreement with the US through NORAD, an air-to-air fighter role will continue to be required for two primary purposes: to intercept aircraft attempting to penetrate Canada's sovereign airspace, such as Russian Bear bombers, and to intercept domestic aircraft in cases of emergency, distress, hijacking, or terrorism. By adapting airpower capabilities and seeking new technological advances, the air force will continue to be relevant and will be required to support future operations.

### CHAPTER 3 – CAPABILITY BASED PLANNING

To execute any [defence] policy adopted by governments, money must be converted into military capabilities appropriate to that policy. We can see from this definition, then, that capabilities are not merely about numbers of troops or ships or planes, even though people and equipment are essential to their development. Neither are capabilities solely about money, but money is required to create them. Capabilities are more than just assets or ‘platforms’, they are the effect that can be achieved through the use of these things.<sup>111</sup>

As expressed by Christopher Ankerson, capabilities provide effects, while on the flip side, effects drive requirements. Purchasing capabilities to achieve effects requires money, and as asserted in Chapter 1, the increase to DND’s budget in the past three years, along with the use of accrual accounting, provide the Canadian military more flexibility in pursuing these capabilities. However, there is a limit to how much the Canadian government will allocate to defence. The Canadian military cannot purchase equipment based on arguments of ‘we had it before, so we will continue to need it in the future.’ Technology and the ever-changing security environment will make militaries that have such a mindset, irrelevant, and incapable of dealing with new challenges.

Chapter 2 characterized the future security environment as one filled with surprise, complexity, uncertainty, and global risks. For this very reason, militaries will continue to be required in the future, as they are today, and have been in the past. The future military could find itself fighting conventional warfare or irregular warfare, or potentially both at the same time. It is highly likely that IW will dominate the types of missions that the CF will be involved in over the next ten to twenty years. However, as

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<sup>111</sup>Christopher Ankerson, “Capabilities and Capacities,” in *Transforming National Defence Administration*, ed. Douglas L. Bland (Kingston, Ontario: Queen’s University, 2005), 12.



this century progresses, the likelihood of major inter-state wars cannot be ruled out. The air force will have a role to play in the future, but to what extent?

This chapter will explain how the CF plans for the future security environment, specifically with respect to determining what military capabilities will be required in order to remain relevant and responsive, and ultimately able to achieve the effects mandated by the government. This will be done by reviewing how capability based planning (CBP) has evolved from traditional threat based planning. Next, the current CBP process will be explained which will lead into the eighteen force development scenarios created by the staff of the VCDS and approved by the CDS. From the review of the scenarios, a link will be made to the aerospace capabilities and effects required beyond 2017. Ultimately, this chapter will argue that today's security environment led to the requirement for CBP within the CF. Based on CBP, it will also be shown that for certain scenarios, Canada will not have the capability to provide *aerospace effects*, nor the aerospace capability to support some *land effects*. This capability gap must lead to the procurement of a new aerospace weapons system, or combination of weapons systems.

## **EVOLUTION OF CAPABILITY BASED PLANNING**

During the Cold War, the Canadian military used threat based planning to determine what capabilities would be required in the future. Each service, Air Force, Army, and Navy, analyzed the perceived future threats to determine and justify current and future capital equipment and capability purchases. This analysis and justification of capabilities was often done in service stovepipes leading to long-term capability plans

driven from the bottom up when it came to the CF operating in a joint environment.<sup>112</sup> Since the threat throughout the Cold War remained somewhat constant, it was logical to apply threat based planning to determine capabilities. However, problems arose when it came time to fund all the capabilities each service wanted. In addition, the efficiencies derived by developing capabilities in a holistic joint CF environment were lacking. Finally, the inter-service rivalry competing for scarce funding detracted from the unity of purpose for the CF. Threat based planning continued to be used by DND until 2000, at which time it was determined to be ineffective – the threat was no longer definable, nor had it been since the end of the Cold War.<sup>113</sup>

In 2000, a capability based planning approach was instituted by DND. Instead of basing procurement on an uncertain threat, DND decided to base capability requirements on the types of activities it foresaw the military being used for in the future security environment. Therefore, DND developed “. . . 11 Force Planning Scenarios, including such diverse things as search and rescue in Canada, peace support operations, and collective defence.”<sup>114</sup> DND and other Western militaries such as Australia, United Kingdom, and United States, saw this as the next step in the evolution of future planning.<sup>115</sup> Ultimately, DND released a Strategic Capability Investment Plan (SCIP) in

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<sup>112</sup>Elinor Sloan, *The Strategic Capability Investment Plan: Origins, Evolution and Future Prospects* (Calgary: Canadian Defence & Foreign Affairs Institute, 2006), 3.

<sup>113</sup>*Ibid.*, 3.

<sup>114</sup>*Ibid.*, 13.

<sup>115</sup>Department of National Defence, *CDS Action Team 3 Final Report – Operational Capabilities*, 6.

December 2003, based on this new planning approach.<sup>116</sup>

With the release of the IPS (Defence) in 2005, the CDS established Action Teams to develop implementation plans for this new CF vision.<sup>117</sup> Action Team 3 was mandated to review the capability based planning approach. They produced their final report on 2 August 2005, recommending the use of a revised version of Capability Based Planning (CBP). The Action Team recommended that the implementation of this revised version of CBP process be taken on carefully and warned that it would take time to achieve.<sup>118</sup> One of the criticisms of the older CBP scenarios was their lack of fidelity due to the decision to keep them unclassified. Therefore, the new CBP process not only looked at likely classified scenarios where the Canadian Government could employ the Canadian military, but it also looked at how an adversary might fight with the capabilities they owned, thereby leading to a more robust capability requirements list than the SCIP produced in 2003.<sup>119</sup> Ultimately, the recommended CBP process “. . . represents an attempt to break down traditional stovepipes and provide top down direction for force development in the Canadian Forces.”<sup>120</sup>

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<sup>116</sup>Elinor Sloan, *The Strategic Capability Investment Plan: Origins, Evolution and Future Prospects*, 11.

<sup>117</sup>All the CDS Action Team reports can be found at the following location: Department of National Defence, “CF Transformation: From Vision to Mission,” [reports on-line]; available from [http://www.cds.forces.gc.ca/cft-tfc/pubs/cat\\_e.asp](http://www.cds.forces.gc.ca/cft-tfc/pubs/cat_e.asp); Internet; accessed 13 December 2007.

<sup>118</sup>Department of National Defence, *CDS Action Team 3 Final Report – Operational Capabilities*, 6, 30.

<sup>119</sup>Craig J. Stone, “Planning Defence Budget Allocations for Canada’s *Strategy 2020*,” 225.

<sup>120</sup>Department of National Defence, *CDS Action Team 3 Final Report – Operational Capabilities*, 6.

## CAPABILITY BASED PLANNING IN 2008

The development of defence capabilities is complex and multi-dimensional. When planning and acquiring capabilities, the CF must predict Canada's strategic circumstances over several decades, and determine the situations ("scenarios") in which a military response might be required. . . . Future security environment and strategic operating concepts analysis will continue to be used, in conjunction with approved classified scenarios, to help detail how the CF will operate as an integrated team.<sup>121</sup>

As described in DND's *2007-2008 Report on Plans & Priorities*, determining and prioritizing military capabilities for the future is complicated. CBP has therefore been broken down into two separate components: Capability Planning (CP) and Capability Management (CM). CP identifies the capabilities required to meet the government and CDS's vision based on an examination of the scenarios. CM then determines ". . . the means to best deliver the capabilities."<sup>122</sup>

The CP process relies on the following key documents: Defence and Security policy, Defence Strategic Guidance, Future Security Environment, Strategic Operating Concept, and the Force Development (FD) scenarios.<sup>123</sup> Some documents such as the Defence Strategic Guidance and the Strategic Operating Concept are still being produced or can only be found in draft versions. Meanwhile, the Defence Policy is being rewritten into the CFDS. The FD scenarios have been created and approved by the CDS - there are eighteen in total.<sup>124</sup>

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<sup>121</sup>Department of National Defence, *2007-2008 Report on Plans and Priorities*, 16-17.

<sup>122</sup>Department of National Defence, *The Capability Planning Process* (Ottawa: DRDC, 2007), 1.

<sup>123</sup>*Ibid.*, 4.

<sup>124</sup>*Ibid.*, 6.

Within DND, the Chief of Force Development (CFD) is responsible to chair the Capability Development Board (CDB), which validates the capability requirements by using a modified version of the Operational Planning Process (OPP)<sup>125</sup> for each of the eighteen scenarios. During the analysis portion of the OPP, the capability framework is validated based on sixteen capabilities that are grouped under six domains: command, sense, act, shield, sustain, and generate.<sup>126</sup>

The VCDS chairs the Joint Capability Requirements Board (JCRB) which takes the CDB recommendations and “. . . provide[s] direction for the development of multi-purpose Canadian Forces (CF) capabilities including the Long Term Capital Plans and Future Capability Plans.”<sup>127</sup> Following the JCRB, the VCDS chairs the Program Management Board (PMB) which oversees and endorses project submissions for review and approval by the CDS and Deputy Minister.<sup>128</sup> It is then up to the CDS to recommend project approvals to the MND based on a final analysis by the Defence Management Committee (DMC).<sup>129</sup> Once these steps are completed, the procurement process described in Chapter 1 is followed.

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<sup>125</sup>The OPP “. . . enables the commander to translate strategy and goals into a unified plan for military action by describing how operations and logistics will be used to achieve success within a given space and time.” The OPP is a prescribed series of stages and steps used by military forces to develop campaign plans that can achieve the strategic end state set by the Government. Department of National Defence, *B-GJ-005-500/FP-000 CF Operational Planning Process* (Ottawa: J7 Doctrine, 2002), 2-7.

<sup>126</sup>Department of National Defence, *The Capability Planning Process*, 12-13.

<sup>127</sup>Department of National Defence, “Terms of Reference – Joint Capability Requirements Board (JCRB),” [http://www.vcds.forces.gc.ca/dgsp/pubs/commit/jcrb\\_e.asp](http://www.vcds.forces.gc.ca/dgsp/pubs/commit/jcrb_e.asp); Internet; accessed 31 March 2008.

<sup>128</sup>Department of National Defence, “Terms of Reference – Program Management Board (PMB),” [http://www.vcds.forces.gc.ca/dgsp/pubs/commit/pmb\\_e.asp](http://www.vcds.forces.gc.ca/dgsp/pubs/commit/pmb_e.asp); Internet; accessed 31 March 2008.

<sup>129</sup>*Ibid.*, n.p.

Overall, the refined CBP process is a straightforward, yet detailed approach to determine what capabilities the CF will need in the future. This new centralized approach will allow the DM, CDS and VCDS to “. . . shape the priorities and guide the organization.”<sup>130</sup> The SCIP introduced in December 2003 and approved in 2004, will be replaced by the Investment Plan, due to TB by November 2008.<sup>131</sup> The importance of this new procedure cannot be underestimated because as stated by Christopher Ankersen, “. . . the CF is only as effective today as current capabilities allow. And, in future, it will only be as effective as investments in new capabilities made today will allow.”<sup>132</sup>

### **FORCE DEVELOPMENT SCENARIO ASSESSMENT**

Based on a briefing provided to the CDB on 23 January 2008 by the Capability Management (CM) team, eight of the eighteen scenarios had been analyzed.<sup>133</sup> The specific scenarios are classified, but can be broken down into the following two unclassified groupings: domestic and continental control or stabilize, and international (inter- or intra-state) control or stabilize. Although only eight of the eighteen scenarios have been analyzed, it is assessed by CFD that this provides 75 percent of the analytical foundation for determining future capability requirements. Based on the latest analysis of the eight scenarios, the capability outlook shows the CF unable to provide *aerospace*

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<sup>130</sup>Alan S. Williams, *Reinventing Canadian Defence Procurement – A View from the Inside*, 32.

<sup>131</sup>Department of National Defence, *Investing in the Future – A Ten Year Strategic Investment Plan Framework for the Department of National Defence*, 32.

<sup>132</sup>Christopher Ankersen, “Capabilities and Capacities,” 11.

<sup>133</sup>The eight scenarios assessed to date cover the broad spectrum of operations that the CF may be tasked to participate in, to include: domestic and continental emergency and security issues, peace support operations, COIN operations, and combat operations. More detail of the exact scenarios cannot be given due to their security classification.

*effects* starting in 2017. This is due to the retirement of the CF-18 fleet, Air Defence Anti-Tank System (ADATS), and air defence capability on the DDH 280 Iroquois destroyers. A risk assessment has also been done to highlight the capabilities' state of health for individual categories of specific scenarios. Based on a domestic and continental control scenario, the CF will not be able to accomplish its mission as of 2017 due to the inability to provide *aerospace effects*. The CF will also be unable to meet its mission for the international inter-state control scenario for many reasons, including the lack of *aerospace effects* beyond 2017 and the inability to support some *land effects* from the air. Only two of the six scenarios involving intra-state COIN operations have been reviewed. These two specific scenarios did not highlight a deficiency in aerospace means to support *land effects*<sup>134</sup>, however it is anticipated that the remaining four scenarios will highlight this deficiency based on the arguments presented in Chapter 2.

## **AEROSPACE EFFECTS**

What do *aerospace effects* include? The *2007-2008 Report on Plans and Priorities* specifically states: "Canada needs a multi-role, combat-capable air force to defend our sovereignty, control our airspace, provide surveillance of our vast territory, . . . provide protection to North American aerospace and contribute to integrated Canadian Forces operations abroad."<sup>135</sup> It goes on to say that "The air force will continue to generate and deliver aerospace power to the CF by delivering accurate combat firepower and acting as a deterrent in engagements."<sup>136</sup> This vision is in line with the CBP

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<sup>134</sup>D Mil CM Team, "Capability (and Risk) Outlook" (Powerpoint presentation to Capability Development Board on 23 January 2008, NDHQ, 2008).

<sup>135</sup>Department of National Defence, *2007-2008 Report on Plans and Priorities*, 23.

<sup>136</sup>*Ibid.*, 23.

scenarios, and the required capabilities deduced from their analysis. It implies an ability not only to provide *aerospace effects* for domestic and continental control, but also combat firepower for joint international operations.

### **CAPABILITY VERSUS CAPACITY**

Choosing relevant capabilities is important, but so is deciding the depth of those capabilities. Canada has a small air force that needs to cover a large geographical area, requiring multiple capabilities to achieve all its responsibilities. This limits its ability to support domestic and international operations concurrently.<sup>137</sup> As Christopher Ankerson states, “There is a significant difference (in terms of capability) between being able to perform a function once, or only once in a while, or only with the help of others. This qualitative measure links military capability inseparably to capacity . . .”<sup>138</sup> Governments can create military forces that possess all the capabilities with little capacity or depth, or they can create forces with limited capabilities backed by great capacity. However, most governments cannot afford to do both – it is too costly. When studying the three missions of the Canadian military, the air force capacity required for defence of Canada is much different than the capacity required for contributing to international peace and security. The risk assessment conducted during the CBP process takes into account capacity. However, to date, the CBP process has lacked specific capacity data in the scenarios. In addition, government expectations need to be sought to determine the number of concurrent missions that the CF could be reasonably expected to support.

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<sup>137</sup>Department of National Defence, *CFP A-GA-007-000 AF-004 2004 Strategic Vectors* (Ottawa: Director General Air Force Development, 2004), 21.

<sup>138</sup>Christopher Ankerson, “Capabilities and Capacities,” 16.



Once these inputs are provided, the capacity required will be easier to identify and the risk assessments will be more complete.

The capability-capacity distinction is important because there are many capabilities that are purchased specifically for Canada's defence that could also be used for international security operations. It is the capacity or depth of that capability that often determines if it will be employed on the international arena. The reduction to 79<sup>139</sup> modernized CF-18s from the initial purchase of 138 has severely limited the Canadian government's ability to deploy CF-18s on international operations. Using the following formula found in *The Aerospace Capability Framework*:

... with a fleet of 100 aircraft, if 20% are assigned to an Operational Training Unit (OTU), 15% are undergoing heavy maintenance, 5% are assigned to a test establishment and one aircraft (at any one time) is used for technical training, 59 aircraft would be available for assignment to operational units. Given a serviceability rate of 70%, the number of MR [Mission Ready] aircraft would be 42. The number of MR aircraft would be further reduced if aircraft were removed from the fleet for other reasons such as a major modernization or fatigue life management. The key point to be made here is that it is the number of MR aircraft in a particular fleet that is important, not the total fleet size.<sup>140</sup>

As stated, Canada has reduced its fighter capacity to 79 CF-18s, of which half are still in the process of completing the second phase of its modernization. Without the modernization, the best case scenario would see 32 MR aircraft available based on a 70

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<sup>139</sup>The initial CF-18 modernization contract included 80 CF-18s, however one crashed on 16 August 2005 near 3 Wing Bagotville and was not replaced, leaving 79 modernized CF-18s. The news release on the 2005 crash can be found at the following internet link: [http://www.mdn.ca/site/newsroom/view\\_news\\_e.asp?id=1718](http://www.mdn.ca/site/newsroom/view_news_e.asp?id=1718). The following reference confirms the reduction to 79 modernized CF-18s: Department of National Defence, *Chief of the Air Staff Air Force Plan (AFP) FY 07/10* (Ottawa: CAS, 2007), Part 1, 16/27; [report on-line]; available from <http://airforce.mil.ca/daircbm/subjects/BusinessPlanningDocuments/BusinessPlan/FY07-10/AFP%20FY07-10%20-%20Final%20-%20Signed%20by%20CAS%20-%20as%20formatted%20for%20publishing.doc>; DWAN Intranet; accessed 27 March 2008.

<sup>140</sup>Department of National Defence, *CFP A-GA-007-000 AF-002 2003 - The Aerospace Capability Framework (A guide to transform and develop Canada's Air Force)*, 20.

percent serviceability rate. Based on the worst case serviceability rate provided in *The Aerospace Capability Framework* of 50 percent, only 23 MR aircraft would be available. According to the Chief of the Air Staff (CAS) Planning Guidance for 2007, Canada has a commitment to provide up to 36 CF-18s in support of NORAD, and an additional six CF-18s to respond to international events requiring a Mission Specific Task Force (MSTF).<sup>141</sup> With increased NORAD commitments for Operation Noble Eagle (ONE) and Bear bomber intercepts in the Arctic, the requirement to conduct force generation (FG), and ongoing modernization, Canada's ability to provide six MR CF-18 aircraft for international operations must be questioned. In fact, the ability to provide 36 MR aircraft for NORAD must also be questioned. If future NORAD commitments remain the same, and there is no reason to suspect they would not, 79 aircraft could potentially mean no Canadian fighter capability to support international operations. Based on the formula in *The Aerospace Capability Framework*, at least 100 aircraft would be required to provide 42 MR aircraft to meet NORAD (36) and international MSTF (6) commitments using a 70 percent serviceability rate. Therefore, when reviewing the *aerospace effects* requirements, the capability and capacity must be linked.

## **DEDUCTIONS**

In summary, today's uncertain security environment led to the requirement for CBP within the CF. With budget cuts throughout the 90s, and the inability to determine what the major threats were to Canada, DND's use of the Cold War threat based planning

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<sup>141</sup> Department of National Defence, *Chief of the Air Staff Planning Guidance 2007* (Ottawa: CAS, 2006), A-1/6; [report on-line]; available from <http://airforce.mil.ca/daircbm/subjects/BusinessPlanningDocuments/PlanningGuidance/FY2007/CASPG2007-signed7Sep06-DMCS-10845.pdf>; DWAN Intranet; accessed 27 March 2008.

process was no longer effective in determining future capability requirements. The capability based approach was the first step towards rectifying the joint prioritization process, but the eleven generic scenarios did not provide enough fidelity to objectively determine future requirements. The CDS initiation of a revised CBP in 2005 has led to eighteen classified scenarios that are much more detailed and take into account the enemy's capabilities, vice just the generic mission.

By using a modified OPP on a cross section of the eighteen scenarios, CFD has a 75 percent analytical foundation for determining capability requirements when applied to the six domains of act, command, sense, shield, sustain, and generate. CFD has also identified risks associated with these eight specific scenarios. *Aerospace effects* beyond 2017 for domestic and continental control is a major concern – Canada will be unable to provide any. The CF will also be unable to meet its mission for the international interstate control scenarios for many reasons, including the lack of *aerospace effects* beyond 2017, and the inability to support some *land effects* from the air. Although no deficiency has yet been highlighted for *aerospace effects* or aerospace means to support *land effects* in IW COIN operations, it is anticipated that the remaining four scenarios will raise this capability gap.

Ultimately, having a capability is one aspect, but its capacity or depth is another. With 79 CF-18s, Canada's ability to generate enough MR aircraft for its NORAD and international MSTF commitments must be questioned. In fact, based on the formula in *The Aerospace Capability Framework*, an increase to 100 CF-18s would be required to achieve Canada's commitment of 42 MR aircraft.

## CHAPTER 4 – ASSESSMENT OF THE OPTIONS

Effects are outcomes, events, or consequences resulting from specific actions; effects should contribute directly to desired military and political outcomes. This requires commanders and planners to explicitly and comprehensively link, to the greatest extent possible, each tactical action to strategic and operational objectives.<sup>142</sup>

As stated in Chapter 3, the most recent CF CBP process has deduced that Canada will be unable to provide *aerospace effects* starting in 2017. In addition, Canada will lack aerospace means to support *land effects* in some of the eighteen scenarios. Since the scenarios are classified, this research paper will not be able to analyze the specific effects required on a case-by-case basis. However, based on the groupings of the scenarios (domestic and continental control, and international inter- or intra-state control), a link can be made to the types of operations required of aerospace power.<sup>143</sup> It should be recognized that surface and maritime-based assets could also assist in providing *aerospace effects*. For example, an integrated early warning system (IADS) consisting of early warning radars, surface-to-air missiles (SAMs) and well-trained operators can engage and/or prevent hostile aircraft from flying over certain areas. Also, a Navy destroyer can protect itself and other nearby ships using its early warning radar and on-board SAMs to engage incoming aircraft. However, these fixed systems are unable to cover large regions of sea or land. Canada's vast geographical size makes it unfeasible to rely solely on these types of systems. Instead, a combination of these systems along with

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<sup>142</sup>United States Air Force, *AFFD 1, Air Force Basic Doctrine* (Washington, DC: United States Air Force, 2003), 38.

<sup>143</sup>“Aerospace power is defined as that component of military power that is applied within or from the aerospace environment to achieve effects above, on and below the surface of the Earth.” Department of National Defence, *CFP A-GA-007-000 AF-002 2003 - The Aerospace Capability Framework (A guide to transform and develop Canada's Air Force)*, 5.

aerospace power is required. Since aerospace power achieves its effects through platforms<sup>144</sup>, defining the operations derived from the CBP shortfalls will allow an objective analysis of what weapons systems might be required. In this case, two primary aerospace operations can be derived from the scenarios: aerospace control, and aerospace operations against surface forces.

Using *The Aerospace Capability Framework* as the primary Canadian Air Force source of aerospace missions, this chapter will break down these two aerospace operations, aerospace control and aerospace operations against surface forces, into specific missions that need to be accomplished to fulfill the CBP identified deficiencies. With the missions clearly established, it will then be possible to look at generic aerospace weapons systems and assess their ability to accomplish these missions. Therefore, the following approach will be taken. First, the missions will be identified and segregated into those required for aerospace control in both the domestic and continental control and international inter-state control scenarios. Then, the missions required for aerospace operations against surface forces in the international inter- and intra-state control scenarios will be presented. Next, the capabilities of three generic weapons systems, Unmanned Aerial Vehicles (UAVs), attack helicopters, and fighter aircraft, will be described. A more detailed capability analysis will be done on UAVs than the latter weapons systems due to their more recent introduction into modern warfare. Each weapons system will be assessed to determine its capability to accomplish the missions identified. Finally, deductions will be drawn from the analysis to show that multi-role fighter aircraft are the most capable weapons system to accomplish all the missions. In

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<sup>144</sup>*Ibid.*, 5.

addition, this chapter will argue that fighter aircraft are the only feasible option for the domestic and continental control scenarios, whereas all three generic weapons systems may be strong contenders to fill the international inter- and intra-state control scenarios.

## **AEROSPACE CONTROL**

Control of the overhead airspace is vital to the effective operations of army and naval formations in combat, and to the provision of tactical air support of these formations through ground and anti-ship attack, interdiction, and reconnaissance. At home, control of Canadian airspace is an essential requirement for defence against hostile incursions, whether by foreign nations or terrorists, and for the enforcement of national sovereignty.<sup>145</sup>

In *The Aerospace Capability Framework*, aerospace control is listed as the fundamental and primary operational function of an air force. It includes both surveillance and control, whereby control implies “. . . having the ability to actively respond to and control (and potentially eliminate) unauthorized or unwanted activity.”<sup>146</sup> Also as previously mentioned, aerospace control is required to achieve *aerospace effects*, one of the key shortfalls identified by the CBP process. Doctrinally, aerospace control is operationalized as Counter Air and divided into Offensive Counter Air (OCA) and Defensive Counter Air (DCA). OCA operations “. . . limit, disrupt or destroy an adversary’s aerospace power as close to its source as possible . . .”<sup>147</sup> Whereas, DCA

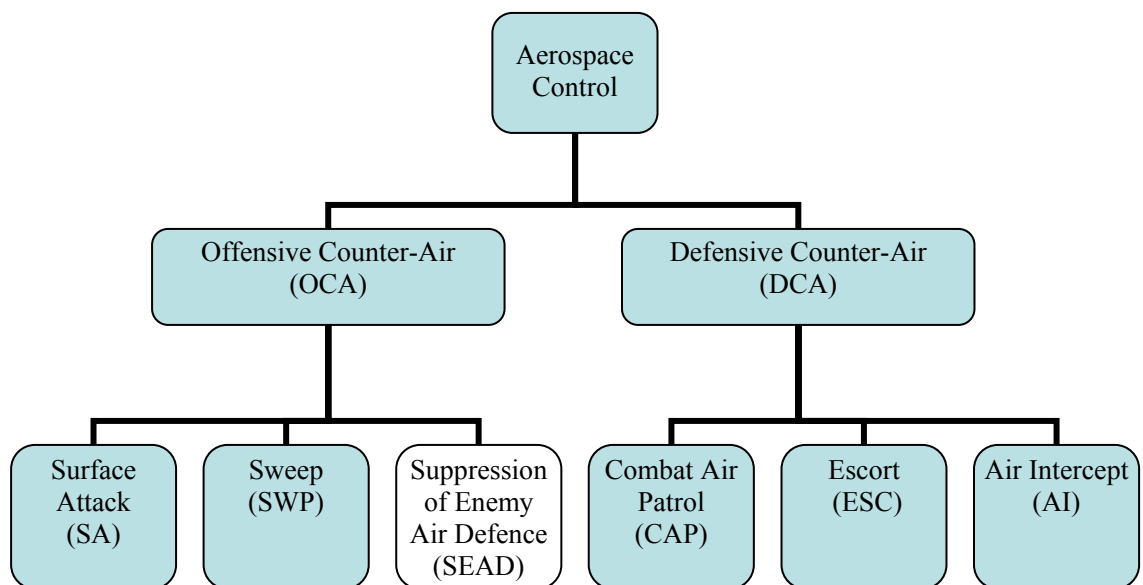
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<sup>145</sup>Paul Manson argues that without fighter aircraft, “there is no *force* in air force.” Paul Manson, “Air Force Acquisition,” in *Creating an Acquisition Model that Delivers – Vimy Paper 1* (Ottawa: Conference of Defence Associations Institute, 2006), 44.

<sup>146</sup>Department of National Defence, *CFP A-GA-007-000 AF-002 2003 - The Aerospace Capability Framework (A guide to transform and develop Canada’s Air Force)*, 9.

<sup>147</sup>*Ibid.*, 9.

operations “. . . neutralize opposing aerospace forces that threaten friendly forces and/or installations . . .”<sup>148</sup> Figure 4.1 lists the six missions associated with OCA and DCA operations.



**Figure 4.1 - Aerospace Control Operations**

## DOMESTIC AND CONTINENTAL CONTROL

Since domestic and continental control is a defensive operation for Canada’s aerospace power, DCA operations are required to achieve the *aerospace effects* for these specific scenarios. Combat Air Patrol (CAP) and Air Intercept (AI) are the two missions that derive from the CBP scenarios. CAP involves defending a point or area from attack by opposing aerospace forces. An example of this would be the use of CF-18s, in combination with other air and ground assets, to provide point defence for the G-8 summit in Alberta in 2002. AI involves intercepting aerospace forces and usually occurs while holding alert or flying a CAP mission.<sup>149</sup> As part of NORAD, fighter aircraft in

<sup>148</sup>*Ibid.*, 9.

<sup>149</sup>*Ibid.*, 10, 55.

Canada and the US have been launched more than 1500 times since 9/11 to conduct AI against aircraft suspected of potential hijackings.<sup>150</sup> Therefore, to provide aerospace control for the domestic and continental control scenarios, a weapons system is required that can conduct both CAP and AI missions.

### **INTERNATIONAL INTER-STATE CONTROL**

For the international inter-state control scenarios, both OCA and DCA operations would be required. The CF-18 is capable of fulfilling five of the six missions associated with Counter-Air operations. The Suppression of Enemy Air Defences (SEAD) mission is not considered core to Canada's Air Force due to its smaller size, and is therefore not a mission that Canada trains for.<sup>151</sup> Consequently, it is assessed that Canada would rely on coalition partners to accomplish this mission in the future.

The first priority of a coalition in these scenarios would be the protection of their own forces. This requires the CAP and AI missions to gain and maintain air superiority over the host country and coalition forces. In addition, as a follow-on priority, Canada could be called upon to perform Surface Attack (SA), Sweep (SWP), and Escort (ESC) missions to achieve aerospace control. SA looks at targeting the source of an enemy's aerospace power, to include targets such as aircraft on the ground, airports, and early warning and control facilities. SWP is generally performed to attack enemy aircraft in the air, while ESC involves defending friendly aircraft from enemy aircraft attack.<sup>152</sup>

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<sup>150</sup>Elinor C. Sloan, *Security and Defence in the Terrorist Era – Canada and North America*, 86.

<sup>151</sup>Department of National Defence, *CFP A-GA-007-000 AF-002 2003 - The Aerospace Capability Framework (A guide to transform and develop Canada's Air Force)*, 36.

<sup>152</sup>*Ibid.*, 9-10.



Canada's CF-18s conducted CAP, AI, SWP, and ESC missions during Operation Scimitar (CF-18 participation in Desert Storm) in 1991, and CAP, AI, and SA missions during Operation Allied Force in 1999, in addition to some other missions that will be described later under aerospace operations against surface forces.<sup>153</sup> Since a small air force cannot be expected to fill all the missions in a particular conflict, based on past operational use of CF-18s and Chapter 2's study of future inter-state threats, it is assessed that future Canadian aerospace platforms would need to be able to conduct the five Counter-Air missions in the following priority: CAP, AI, SA, SWP, and then ESC. Effectively, the priority of missions would be defensive, followed by offensive operations.

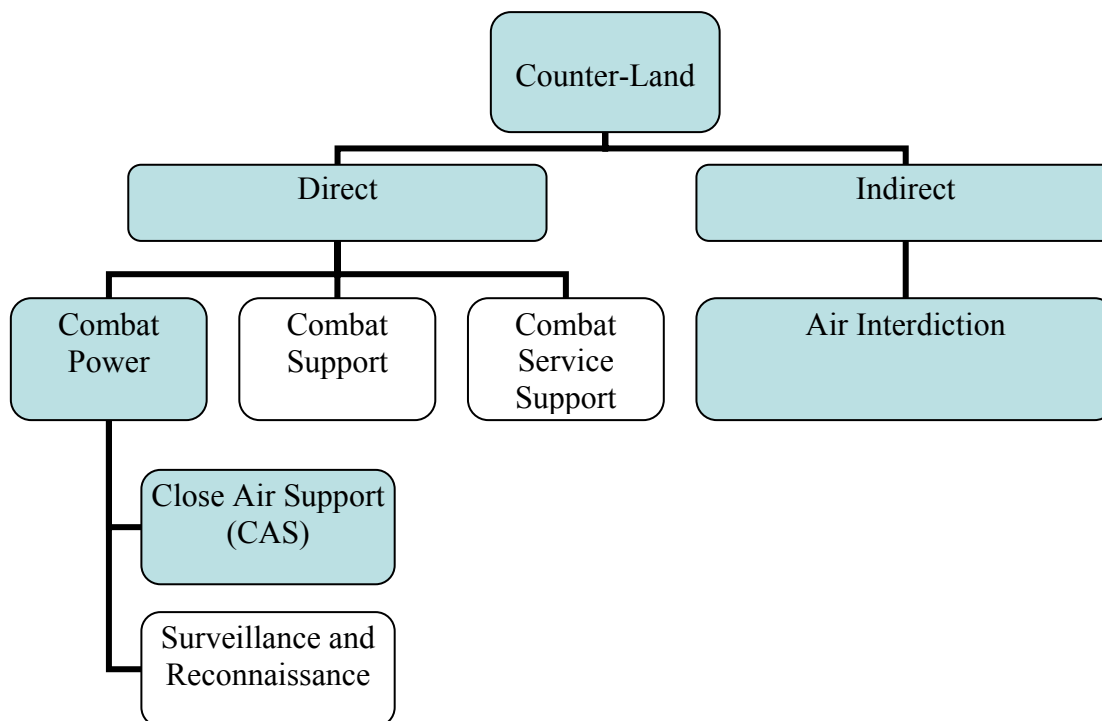
#### **AEROSPACE OPERATIONS AGAINST SURFACE FORCES**

Based on the international inter-state control scenarios, Canadian and coalition land forces would need aerospace means to support *land effects*. Aerospace operations against surface forces is considered a contributing air force function "... that contribute[s] to the achievement of objectives of other services or organizations."<sup>154</sup> Doctrinally, aerospace operations against surface forces are operationalized as Counter-Sea and Counter-Land. These contributing functions are further broken down into direct and indirect operations. Based on the deficiencies identified in Chapter 3, this paper will focus on Counter-Land operations, and not on Counter-Sea operations. Figure 4.2 shows the break down of missions associated with direct and indirect Counter-Land operations.

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<sup>153</sup>*Ibid.*, 36.

<sup>154</sup>*Ibid.*, 8.



**Figure 4.2 – Counter-Land Operations**

With the recent contract awards for the purchase of the Chinook helicopters and C-130Js, Canada’s Air Force will continue to have the aerospace means to provide direct Combat Service Support.<sup>155</sup> Combat Support, which includes “communications assistance and the direction and control of fires,”<sup>156</sup> does not relate to the loss of the CF-18, and is being partially filled by Unmanned Aerial Vehicles (UAVs) such as the Sperwer. DND is in the process of acquiring a replacement UAV to provide a more robust capability for Combat Support. In addition, although the CF-18 can provide some surveillance and reconnaissance capability in support of Combat Power, this is primarily done through the use of UAVs, satellites, and other coalition aerospace assets such as the

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<sup>155</sup>Combat Service Support involves “airlift of personnel, equipment and supplies.” *Ibid.*, 11.

<sup>156</sup>*Ibid.*, 11.

Joint Surveillance and Target Attack Radar System (JSTARS).<sup>157</sup> Therefore, the Combat Support, Combat Service Support, and Surveillance and Reconnaissance missions will not be examined further in this paper. Instead, the focus will be on the Close Air Support (CAS) and Air Interdiction missions as they relate to aerospace operations against surface forces.

### **INTERNATIONAL INTER- AND INTRA-STATE CONTROL**

As of 2017, Canada will no longer have the capability to provide direct and indirect force to support ground forces from the air. The specific missions associated with this are CAS and air interdiction. CAS missions “. . . aim to halt attacks, help create breakthroughs, cover and guard flank of Army forces.”<sup>158</sup> As asserted in Chapter 2, CAS support will be critical in future IW COIN operations involving intra-state conflicts, and it will continue to be required for inter-state conflicts. Air interdiction missions “. . . aim to destroy, neutralize or delay an adversary’s military potential before it can be brought to bear effectively against friendly forces.”<sup>159</sup> Examples of this include targeting logistic supply hubs, lines of communication such as railways, roads or bridges, or command and control facilities. This type of mission would be most prevalent in an inter-state control scenario, because as mentioned in Chapter 2, the standard targets associated with air

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<sup>157</sup>“JSTARS provides ground situation information through communication via secure data links with air force command posts, army mobile ground stations and centres of military analysis far from the point of conflict. JSTARS provides a picture of the ground situation equivalent to that of the air situation provided by AWACS. JSTARS is capable of determining the direction, speed and patterns of military activity of ground vehicles and helicopters.” Airforce-technology.com, “JSTARS Joint Surveillance and Target Attack Radar System, USA,” <http://www.airforce-technology.com/projects/jstars/>; Internet; accessed 22 March 2008.

<sup>158</sup>Department of National Defence, *CFP A-GA-007-000 AF-002 2003 - The Aerospace Capability Framework (A guide to transform and develop Canada’s Air Force)*, 11.

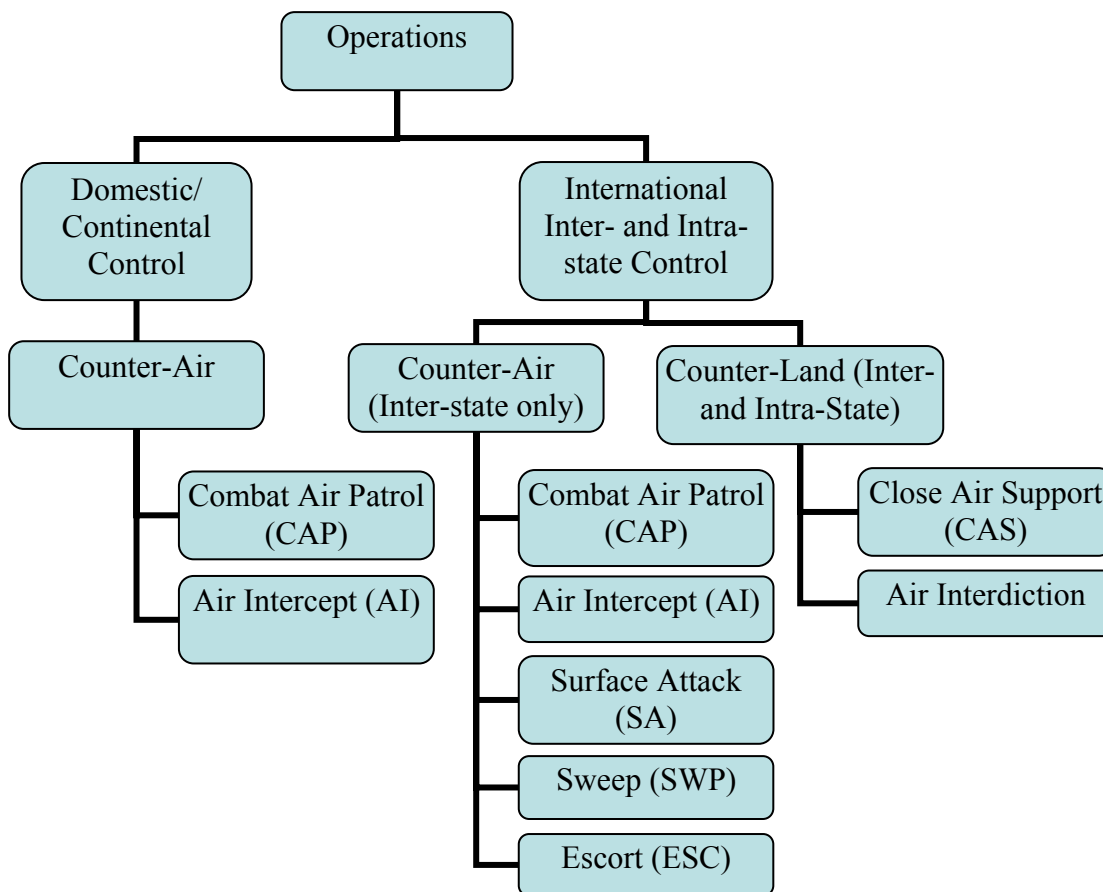
<sup>159</sup>*Ibid.*, 11.

interdiction do not necessarily exist in an IW intra-state conflict.

Therefore, for international inter-state control scenarios, CAS and air interdiction will be required for aerospace operations against surface forces. For intra-state control scenarios, the primary emphasis will be on CAS, with a limited need for air interdiction.

### **SUMMARY OF DERIVED MISSIONS**

Based on the arguments presented above, a weapons system or mix of weapons systems will be required by 2017 to fill the missions summarized in Figure 4.3. Of note, the weapons system(s) needs to only fill two missions in the domestic and continental control scenarios: CAP and AI. In the international intra-state control scenario, only two missions were identified as well, however they focus on support to land forces and include CAS and air interdiction. The most robust mission requirements derive from the international inter-state control scenarios (conventional warfare) which should not be surprising, but is important to highlight due to the on-going debate over the likelihood of such a scenario. Remember that whatever weapons system is bought by 2017, it will quite likely be in service until 2050. With the uncertainty, complexity, surprise, and global risks associated with the future security environment, governments must decide if they need, want, and can afford to prepare for inter-state conflicts.



**Figure 4.3 – Derived Missions**

## **WEAPONS SYSTEM OPTIONS**

In June 2003, Thierry Gongora of DND’s Operational Research Division (ORD) released a report titled *Future Combat Air Operations System: Initial Assessment of Roles and Options*. His report focused on what type of weapons system could replace the CF-18 in both the homeland security and expeditionary roles. He reviewed eleven weapons systems and ranked them based on their potential to fulfill thirteen different missions (i.e. CAP, AI, SWP, CAS, etc.). These thirteen missions were based on the eleven generic force development scenarios that the VCDS’s staff were using at that time. The potential scoring for each weapons system was based on an ordinal value between 0 to 4, with 0 meaning they had no potential to fill the role, and 4 meaning they had the full

potential. His analysis, which he classified as an initial analysis, determined that a multi-role fighter ranked first in terms of weapons system options to replace the CF-18.<sup>160</sup>

In 2005, eighteen specific force development scenarios were created. This chapter has broken down these new scenarios into specific missions (CAP, AI, SA, SWP, ESC, CAS and air interdiction). Based on Gongora's report and the latest technological advances, this research paper will look at the following weapons systems as potential options to accomplish the stated missions: UAVs, including armed UAVs and Unmanned Combat Aerial Vehicles (UCAV), attack helicopters, and fighter aircraft (air-to-air, air-to-ground, or multi-role). Surface-to-Air Missile (SAM) systems will not be reviewed because they can only fill the AI mission. Also, surface-to-surface missile systems (SSM) and cruise missiles will not be examined based on the low ranking they received in Gongora's report.

## **UAVs**

The *Department of Defense Dictionary*, Joint Publication 1-02, defines a UAV as:

A powered, aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload. Ballistic or semiballistic vehicles, cruise missiles, and artillery projectiles are not considered unmanned aerial vehicles.<sup>161</sup>

Nonlethal payloads carried on UAVs include cameras, sensors, and communication

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<sup>160</sup>Thierry Gongora, *Future Combat Air Operations System: Initial Assessment of Roles and Options* (Ottawa: Department of National Defence, 2003), 1-36.

<sup>161</sup>Laurence R. Newcome, *Unmanned Aviation: A Brief History of Unmanned Aerial Vehicles* (Reston, Virginia: American Institute of Aeronautics and Astronautics, Inc., 2004), 1.

equipment.<sup>162</sup> As stated above, lethal payloads can also be carried on some versions of UAVs, such as the MQ-1 Predator. The MQ-1 Predator is known for its use by the US in targeting Qaed Senyan al-Harithi, also known as Abu Ali, with a Hellfire missile on November 3, 2002 in Yeman.<sup>163</sup> The success of this operation, and other similar operations in Afghanistan and Iraq, opened military eyes to the potential of UAVs beyond just their traditional use as surveillance and reconnaissance platforms.<sup>164</sup>

A distinction is made between UAVs and armed UAVs. Armed UAVs are reconnaissance and surveillance UAVs that have been retrofitted to carry lethal payloads. In other words, they were not built expressly to conduct strike missions. UCAV has come into existence to differentiate UAVs from those that are designed specifically to conduct strike missions. However, there are different interpretations of what makes a UCAV different from armed UAVs. The Loitering Electronic Warfare Killer (LEWK) UAV was designed as a strike aircraft, yet it is not referred to as a UCAV.<sup>165</sup> Hellenic Aerospace Industry views UCAVs as a class of UAVs that are not only designed to carry out air strikes, but are also flown without human controllers on the ground.<sup>166</sup> In other words, they are autonomous in operation. UAVs and armed UAVs are generally easier to

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<sup>162</sup>Hellenic Aerospace Industry, "The Unmanned Technology has a Huge Potential," *NATO's Nations and Partners for Peace* no. 1 (2007): 138; <http://www.proquest.com>; Internet; accessed 23 January 2008.

<sup>163</sup>Abu Ali was a high-level al-Qaeda operative believed to have been involved in the planning of the October 2000 attack on the USS Cole. Mark Hosenball, *et al*, "The Opening Shot," *Newsweek* 140, no. 21 (November 18, 2002): 48; <http://www.ebscohost.com>; Internet; accessed 22 February 2008.

<sup>164</sup>Catherine MacRae Hockmuth, "UAVs – The Next Generation," *Air Force Magazine* 90, no. 2 (February 2007): 70; [journal on-line]; available from <http://www.afa.org/magazine/feb2007/0207UAV.asp>; Internet; accessed 23 January 2008.

<sup>165</sup>Laurence R. Newcome, *Unmanned Aviation: A Brief History of Unmanned Aerial Vehicles*, 2-3.

<sup>166</sup>Hellenic Aerospace Industry, "The Unmanned Technology has a Huge Potential," 138.

transport, support, and operate, but they don't provide as much fire support as a UCAV. A UCAV looks more like a fighter aircraft and requires a lot more support, including proper take-off and landing areas.<sup>167</sup> The cost savings from a UCAV compared to a fighter come from the fact that they will only be used during combat operations, and stored in sealed containers during peaceful situations.<sup>168</sup>

So, although there are similarities between UAVs, armed UAVs and UCAVs, there are also major differences in terms of the effects they can provide or support. Since only armed UAVs or UCAVs can provide lethal payloads, basic UAVs will not be looked at in determination of weapons systems to fulfill the missions. In addition, since there are disagreements over the differences between armed UAVs and UCAVs, this paper will use the terminology of UCAV to imply both.

### **UCAV CAPABILITIES**

UCAVs have been developed primarily to support *land effects* through aerospace means. The United Kingdom is looking at developing an air force Deep and Persistent Offensive Capability (DPOC) by 2018-20 that will consist of a UCAV to replace the Royal Air Force (RAF) Tornado GR4 strike aircraft. Its primary purpose will be “. . . to engage high-value and mobile targets in a threat environment that includes Russian-manufactured double-digit surface-to-air missiles.”<sup>169</sup> The German Air Force Chief, Lt Gen Stieglitz, foresees the German use of UCAVs for the SEAD mission, but he warns

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<sup>167</sup>*Ibid.*, 139.

<sup>168</sup>Thierry Gongora, *Future Combat Air Operations System: Initial Assessment of Roles and Options*, 26.

<sup>169</sup>Douglas Barrie, "Time-Critical Target: U.K. Debates National UCAV Time Scale," *Aviation Week & Space Technology* 166, no. 17 (April 30, 2007): 36; <http://www.ebscohost.com>; Internet; accessed 23 January 2008.



that they will not provide a significant cost savings over the use of fighter aircraft.<sup>170</sup> Shenyang Aircraft Design and Research Institute in China unveiled “Dark Sword” in November 2006 at the Zhuhai Air Show as a concept for a UCAV designed as an air-to-air superiority fighter. However, Western analysts remain sceptical about its proposed role, especially in light of the fact that Western UCAV designs are being optimized for SEAD.<sup>171</sup> L.M.B.C. Campos reports that “Air-to-air combat is likely to be one of the last missions to be assigned to a UAV, given the very dynamic situation and the importance of motion cues and perceptions . . .”<sup>172</sup>

The USAF has bought General Atomics’s upgraded version of the MQ-1 Predator, the MQ-9 Reaper, to provide a more robust UCAV.<sup>173</sup> The Reaper conducted its first US combat strike on October 27, 2007 in Afghanistan using Hellfire missiles, and as of November 19, 2007, had also dropped two GBU-12, 500 pound laser-guided bombs (LGBs).<sup>174</sup> The RAF has purchased three Reapers and is using them in Afghanistan to support the land forces.<sup>175</sup> With the capability to carry a combination of Hellfire

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<sup>170</sup>Rober Wall, "Advancing UAVs: Luftwaffe Wants More than Advanced UCAV," *Aviation Week & Space Technology* 167, no. 20 (November 19, 2007): 36; <http://www.ebscohost.com>; Internet; accessed 23 January 2008.

<sup>171</sup>Peter La Franchi, "Is China's UCAV a Chimera?" *Flight International* 172, no. 5110 (October 23-29, 2007): 25; <http://www.proquest.com>; Internet; accessed 17 January 2008.

<sup>172</sup>L.M.B.C. Campos, *Report 826 – Aircraft Design Integration and Affordability* (Lisbon, Portugal: Advisory Group for Aerospace Research & Development - NATO, 1998), 49.

<sup>173</sup>Department of Defense, *Defense Science Board Study on Unmanned Aerial Vehicles and Uninhabited Combat Aerial Vehicles* (Washington, DC: U.S. Government Printing Office, 2004), 7.

<sup>174</sup>“Reaper, a Grim Addition,” *Aviation Week & Space Technology* 167, no. 20 (November 19, 2007): 18; <http://www.ebscohost.com>; Internet; accessed 22 February 2008.

<sup>175</sup>“RAF to Fly Armed Reapers,” *Aviation Week & Space Technology* 167, no. 20 (November 19, 2007): 18; <http://www.ebscohost.com>; Internet; accessed 22 February 2008.

missiles, GBU-12 500 lb laser guided bombs, and GBU-38 Joint Direct Attack Munitions (JDAMs), the Reaper can provide lethal and precise firepower in a conflict.<sup>176</sup>

### **ADVANTAGES/DISADVANTAGES**

UCAVs provide many advantages. Laurence Newcome provides three unique virtues over manned aircraft. First, shooting down a UCAV does not provide as much of a propaganda ‘win’ to the enemy, and may highlight the enemy position. Second, there is no pilot that can be captured and used as a bargaining chip, and third, UCAVs can remain on-station for extended periods of time.<sup>177</sup> Other advantages include the ability to create an aircraft that does not need to conform to human limitations such as gravitational forces and pilot support systems, thereby reducing weight, complexity, and size.<sup>178</sup>

However, UCAVs have limitations. Since they generally need to be controlled from the ground, they rely heavily on sensors and data link. Losing data link, whether it is temporary or permanent, could lead to the loss of the UCAV without any enemy action. Loss of a surveillance sensor can blind the ground controller, and without a pilot in the aircraft, there is no way of just looking out. A pre-programmed UCAV may not be as susceptible to the loss of data link, but it is also unable to react to changing situations on the ground or in the air.<sup>179</sup> Bandwidth and processing speed will be a major challenge, especially as more and more UAVs and UCAVs are produced. Another major

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<sup>176</sup>Air Force Link, “MQ-9 Reaper Unmanned Aerial Vehicle,” <http://www.af.mil/factsheets/factsheet.asp?fsID=6405>; Internet; accessed 24 March 2008.

<sup>177</sup>Laurence R. Newcome, *Unmanned Aviation: A Brief History of Unmanned Aerial Vehicles*, 135-136.

<sup>178</sup>Hellenic Aerospace Industry, "The Unmanned Technology has a Huge Potential," 139.

<sup>179</sup>Clayton K.S. Chun, *Aerospace Power in the Twenty-First Century – A Basic Primer* (Maxwell Air Force Base, Alabama: Air University Press, 2001), 296.

challenge is that air traffic control facilities have placed domestic airspace restrictions on UAVs and UCAVs that operate in airspace occupied by manned aircraft such as airliners.<sup>180</sup>

There is a role for UCAVs in the future of aerospace power. However, to develop an unmanned weapons system that can conduct operations in a medium to high threat environment requires more technological advances to be made. The risk is that “. . . the capability to perform these additional roles may come at an added cost that no longer makes a UCAV a cheap alternative compared to other options.”<sup>181</sup> In addition, William Scott argues that UCAVs are not always cheaper than manned aircraft when one includes the life-cycle and logistic-tail costs.<sup>182</sup> This is important to highlight because according to the USAF, it cost approximately US\$53.5 million for four MQ-9 Reaper UCAVs and their associated sensors.<sup>183</sup> This would make UCAVs appear relatively cheap.

For the international inter-state control scenarios, UCAVs may be used to conduct SA, air interdiction, and CAS missions when the risk associated with the loss of a pilot is too high. For IW intra-state control scenarios, UCAVs will be much more relevant, as seen in Afghanistan. The only limitations may be the amount of munitions that they may be able to carry, or the willingness of CF officers to authorize CAS with UCAVs when their own soldiers are in close proximity. However, as demonstrated with the MQ-9 Reaper, the amount of weapons a UCAV can carry is quickly increasing. With continued

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<sup>180</sup>Catherine MacRae Hockmuth, “UAVs – The Next Generation,” 73.

<sup>181</sup>Thierry Gongora, *Future Combat Air Operations System: Initial Assessment of Roles and Options*, 25.

<sup>182</sup>William B. Scott, "UAVs/UCAVs Finally Join Air Combat Teams," *Aviation Week & Space Technology* 157, no. 2 (July 8, 2002): 54; <http://www.ebscohost.com>; Internet; accessed 7 January 2008.

use of UCAVs in OIF and OEF, it may not take long before a more concerted effort is made to fully use them in the CAS role.

## UCAV MISSIONS

Therefore, the primary operations that UCAVs will be able to fulfill, with some limitations, are OCA and Counter-Land; specifically SA, SEAD, air interdiction, and CAS. Since Canada's Air Force does not plan on having the capability to conduct SEAD, this mission will not be explored further. Currently the speed, technology, and air traffic control restrictions associated with UCAVs does not make them operationally suitable for CAP, AI, SWP, and ESC missions. This is not to say that they will not be suitable in the future, but based on current trends and investments, it is not envisaged to occur before the retirement of the CF-18.

## ATTACK HELICOPTERS

The anti-tank helicopter is reaching a level of sophistication rivalling that of combat airplanes. It has demonstrated high kill ratios against tanks, and proven very effective for night flying during the Gulf War. The increasing number of armed forces procuring combat helicopters testifies to the growing appreciation of its effectiveness.<sup>184</sup>

Attack helicopters are designed to provide support to land forces.<sup>185</sup> The CF CH-146 Griffon is not an attack helicopter, but 1 Wing did develop a concept paper to promote the arming of the Griffon for armed reconnaissance and anti-armour strike capability in 2002.<sup>186</sup> Attack helicopters came about from the Vietnam conflict and have

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<sup>183</sup>Air Force Link, "MQ-9 Reaper Unmanned Aerial Vehicle."

<sup>184</sup>L.M.B.C. Campos, *Report 826 – Aircraft Design Integration and Affordability*, 46.

<sup>185</sup>*Ibid.*, 28.

<sup>186</sup>Dr. Thierry Gongora, *Aerial Armed Reconnaissance and Fire Support: The Potential and Implications of the Attack Helicopter for the CF* (Ottawa: Department of National Defence, 2006), iii.

been used in many conflicts since that time.<sup>187</sup> During Operation Desert Storm in 1991, US AH-1 Cobra and AH-64 Apache helicopters played an important role in supporting both air and land attacks. Prior to the first air strikes against Iraq, Apache helicopters “punched an 80-mile-wide hole in Iraqi air defenses that allowed USAF F-117s, F-111s, and other coalition fighter-bombers to appear undetected in the skies over Baghdad.”<sup>188</sup> The AH-1 Cobras played a pivotal part during the four-day ground offensive at the end of the war by destroying at least 97 tanks, 104 armoured personnel carriers, and 16 bunkers.<sup>189</sup> During Operation Iraqi Freedom in 2003, these same helicopters conducted deep strike missions and supported the land forces with CAS.<sup>190</sup>

### **ATTACK HELICOPTER CAPABILITIES**

During Desert Storm, OIF, and OEF, attack helicopters were used to primarily conduct CAS, but also did some SA and air interdiction missions. Attack helicopters have also been used in the ESC mission for protection of other transport or utility helicopters. Dr Thierry Gongora’s 2006 study of attack helicopters for the CF clearly showed that attack helicopters could support *land effects*, both to land forces and Special Operations Forces (SOF). He also pointed out their ability to conduct DCA operations against slow and low aircraft.<sup>191</sup> Although attack helicopters could support some aspects

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<sup>187</sup>Michael J. Taylor, *Close Air Support – Armed Helicopters & Ground Attack Aircraft* (London: Greenhill Books, 1996), 5.

<sup>188</sup>Stanley S. McGowen, *Helicopters – An Illustrated History of their Impact* (Santa Barbara, California: ABC-CLIO, 2005), 209.

<sup>189</sup>*Ibid.*, 206.

<sup>190</sup>*Ibid.*, 207, 212-213.

<sup>191</sup>Dr. Thierry Gongora, *Aerial Armed Reconnaissance and Fire Support: The Potential and Implications of the Attack Helicopter for the CF*, 34-38.

of CAP and AI, they are limited in speed and altitude to meet some of the current and emerging threats such as hijacked airliners, Russian Bear bombers, or cruise missiles. Therefore, it is argued that their main focus will be on conducting CAS, with a limited ability to conduct air interdiction, or SA missions.

In a medium to high threat environment, attack helicopters would be more susceptible to small arms and ground defences than a higher altitude platform. This was clearly witnessed during OIF when 31 Apache helicopters attempted to conduct a deep strike mission against armoured columns of the Iraqi Republican Guard. The Iraqis set up a 'helicopter trap' and hit all of the 31 helicopters with small arms and rocket propelled grenades (RPGs), leading to the loss of one aircraft.<sup>192</sup> Although the remaining 30 helicopters were able to return to their base, it clearly showed their susceptibility to small arms fire. This incident led to the argument by General Merrill McPeak, the former chief of staff of the USAF, that attack helicopters should be restricted to direct support of land forces and should not be used for deep strike missions. Instead he advocated the use of fighter aircraft with stand-off precision weapons for deep strike missions.<sup>193</sup> Although it is not surprising to see a disagreement over whether it should be an army asset or an air force asset that conducts air interdiction missions, it does question the ability of attack helicopters to conduct deep strike air interdiction missions in a medium to high threat environment.

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<sup>192</sup>Stanley S. McGowen, *Helicopters – An Illustrated History of their Impact*, 212-213.

<sup>193</sup>Anthony H. Cordesman, *The Iraq War – Strategy, Tactics, and Military Lessons* (Westport, Connecticut: Praeger Publishers, 2003), 323.

## **ATTACK HELICOPTER MISSIONS**

Therefore, based on the capabilities of attack helicopters, it is assessed that they would contribute greatly to the CAS mission, especially in conflicts where enemy surface-to-air defences were limited to small arms, and lower generation handheld surface-to-air missile systems. They could also be used with minor limitations for air interdiction missions in both inter- and intra-state conflicts, although a more robust IADS would restrict their range into enemy territory. Since most attack helicopters don't carry bombs, it is assessed that SA would only be completed with major limitations. In addition, they would only be capable of conducting the ESC, CAP, and AI missions for low and slow aircraft. They would not be suited for the SWP mission.

## **FIGHTER AIRCRAFT**

At the USAF Association's annual Air & Space Conference in the fall of 2007, General Ronald E. Keys, then commander of Air Combat Command, noted that today's GWOT was being fought with 30 year old F-15s and F-16s, and not the newer F-22 or F-35 fighter aircrafts. Gen T. Moseley, USAF Chief of Staff, went on to say that the argument should not be about the type of aircraft, but rather the right tools.<sup>194</sup> Although tools can be added to platforms, thereby modifying them for specific missions, there are still certain platforms that perform better than others. Dedicated bomber aircraft like the B-52 and B-1 are best suited for long range strike missions, but have been used for CAS and air interdiction missions in Afghanistan.<sup>195</sup> Dedicated air-to-air fighter aircraft such

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<sup>194</sup>Adam J. Hebert, Executive Editor, "The Future Is On the Line," 28.

<sup>195</sup>Thierry Gongora, *Future Combat Air Operations System: Initial Assessment of Roles and Options*, 29.

as the F-15C are superb at conducting CAP, AI, SWP, and ESC missions as witnessed during Desert Storm in 1991. However, the requirement for single purpose fighter aircraft is becoming more difficult to justify. Yes, Canada needs an air-to-air weapons system to intercept airliners and Russian Bears, but is that all that Canadians want this weapons system to do? The question is important because the cost of dedicated air-to-air fighters is often the same as it is for multi-role fighters. The USAF F-22 Raptor was built to be a dedicated air-to-air fighter, but was eventually modified to provide a ground attack capability due to its enormous cost of over US\$100 million per aircraft.<sup>196</sup> The Joint Strike Fighter (JSF) which is being built as an “affordable” multi-role fighter is now projected to cost up to US\$80-100 million per aircraft.<sup>197</sup> The enormous cost of new fighters has made aircraft upgrades the preferred option for many countries, “. . . as long as such upgrades retain operational usefulness, and allow an extension of service life.”<sup>198</sup> The primary reason for the increased cost of fighter aircraft is related to production costs associated with incorporating the newest technologies such as stealth and supersonic cruise capabilities, and the reduced numbers being purchased.<sup>199</sup>

Dedicated air-to-ground fighter aircraft such as the A-10 achieved remarkable success during Operation Desert Storm and OIF. In fact, the US is looking at a potential Service Life Extension Program to keep them flying until 2025, to then be replaced by

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<sup>196</sup>L.M.B.C. Campos, *Report 826 – Aircraft Design Integration and Affordability*, 1.

<sup>197</sup>Cameron Stewart, “Pentagon to Push Sale of Fighter,” n.p.

<sup>198</sup>L.M.B.C. Campos, *Report 826 – Aircraft Design Integration and Affordability*, 1.

<sup>199</sup>*Ibid.*, 1.



the JSF.<sup>200</sup> Aircraft that are designed to fulfill specific missions are obviously going to be very capable in their primary role. The F-117 stealth fighter is excellent for conducting stealth precision strikes, and the A-10 is ideally suited for CAS. However as stated, the cost of fighter aircraft is increasing, and defence budgets are under strain to purchase enough capabilities to meet all their missions. Although multi-role fighters are often a compromise between the best air-to-air fighter and the best air-to-ground fighter, in the past few decades they have performed exceptionally well, as seen with the F-16 and F-18.

### **FIGHTER AIRCRAFT MISSIONS**

Since the intent of this paper is not to list specific fighter aircraft, the capability of air-to-ground fighters, air-to-air fighters, and multi-role fighters will be based on their generic attributes. In other words, it will be assumed that each fighter type will be fully capable of carrying out the missions normally associated with that type of platform. Therefore, it is argued that an air-to-ground fighter (i.e. A-10 or Harrier type aircraft) is fully capable of conducting the CAS, air interdiction, and SA missions, but unable to conduct the CAP, AI, ESC, and SWP missions. An air-to-air fighter (i.e. F-15C type aircraft) is fully capable of conducting CAP, AI, ESC, and SWP missions, but unable to conduct CAS, air interdiction, and SA missions. Finally, the multi-role fighter (i.e. F-16 or F-18 type aircraft) is assessed to be capable of conducting all seven identified missions, although with some minor limitations when compared to a single-role fighter.

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<sup>200</sup>Christopher Bolkcom and Kenneth Katzman, *Military Aviation: Issues and Options for Combating Terrorism and Counterinsurgency* (Washington, DC: Congressional Research Service, 2006), CRS-23/24.

## RANKING WEAPONS SYSTEM CAPABILITIES

Table 4.1 provides a summary of the analysis between UCAVs, attack helicopters, and fighter aircraft. To quantify the analysis, an approach very similar to Gongora's report was used. Each weapons system was assigned an ordinal value between '0' and '3' based on its capability to fulfill each mission. '0' was assigned if the weapons system was unable to perform the mission, '1' if it could partially perform the mission with major limitations (i.e. attack helicopter doing ESC, CAP or AI in an inter-state scenario), '2' if it could fulfill the mission but with minor limitations (i.e. a multi-role fighter doing all the missions), and '3' if it could conduct the mission without limitations (i.e. an air-to-air fighter doing CAP).

**Table 4.1 – Weapons System Capability Assessment**

Effects		Derived Missions	Capability (0-Unable, 1-Partial, 2-Capable w/minor limits, 3-Complete)				
			UCAVs	Attack Helicopters	Fighters		
					A/A	A/G	Multi
Domestic and Continental Control		CAP	0	1	3	0	2
		AI	0	1	3	0	2
		<b>Totals</b>	<b>0</b>	<b>2</b>	<b>6</b>	<b>0</b>	<b>4</b>
International Control	Inter-state	CAP	0	1	3	0	2
		AI	0	1	3	0	2
		SA	2	1	0	3	2
		SWP	0	0	3	0	2
		ESC	0	1	3	0	2
		CAS	2	3	0	3	2
		Air Interdiction	2	2	0	3	2
		<b>Totals</b>	<b>6</b>	<b>9</b>	<b>12</b>	<b>9</b>	<b>14</b>
	Intra-state	CAS	2	3	0	3	2
		Air Interdiction	2	2	0	3	2
		<b>Totals</b>	<b>4</b>	<b>5</b>	<b>0</b>	<b>6</b>	<b>4</b>
<b>Grand Totals</b>			<b>10</b>	<b>16</b>	<b>18</b>	<b>15</b>	<b>22</b>

## DEDUCTIONS

Table 4.1 was specifically divided to highlight the differences between capability requirements for domestic and continental control scenarios, as compared to international control scenarios. What should be obvious from this chart is that a fighter aircraft is

required to provide aerospace control for the domestic and continental control scenarios. Based on the specific missions associated with these scenarios, an air-to-air fighter aircraft would be the best weapons system, but a multi-role fighter aircraft would also be suitable with minor limitations.

When it comes to international control, the choices become more varied. In the case of international control for an intra-state conflict, aerospace operations against surface forces can be conducted by UCAVs, attack helicopters, and air-to-ground or multi-role fighters.

For the international inter-state control scenarios, a multi-role fighter is the leader, but this is based on it fulfilling all the missions. As previously stated, a small air force cannot be expected to fill all seven missions in a particular conflict. If the Canadian government wanted to focus its efforts in a conflict towards aerospace operations against surface forces, then an air-to-ground fighter aircraft would be the best option with UCAVs, attack helicopters, and multi-role fighters scoring almost equally for second place. If the focus was on aerospace control, then an air-to-air fighter aircraft would be the clear leader, with a multi-role fighter as the only other suitable option.

Overall, a multi-role fighter would provide the Canadian government the flexibility to task its Air Force to do any of the seven missions identified. As a minimum, an air-to-air fighter or multi-role fighter is required to achieve aerospace control for the domestic and continental control scenarios. The weapons system options for the international control scenarios broaden to include attack helicopters and UCAVs, with the former providing a slight advantage over the latter.

## DOMESTIC AND CONTINENTAL CONTROL – SOLUTION

CF-18s represent our only tool for controlling Canada's airspace, protecting our cities from an airborne threat, [and] fulfilling our obligation to help protect North American airspace under the NORAD agreement . . .<sup>201</sup>

As stated by SCONSAD in 2006, the only effective weapons system that provides aerospace control, a derivative of *aerospace effects*, for domestic and continental control is a fighter aircraft. Based on the analysis above, the only weapons system that can continue to provide aerospace control from 2017 to the foreseeable future is another fighter aircraft. Attack helicopters are too slow and altitude restricted to meet the current and emerging airborne threats to Canada and North America. Although there is great interest in UCAVs, they are not technologically capable of conducting air intercepts of fast aircraft such as airliners and Russian bombers, nor are they expected to be over the next ten to fifteen years.

The identified deficiency of *aerospace effects* requires a weapons system that is capable of conducting CAP and AI missions against threats that vary from low and slow movers such as drug runners, to low and fast objects such as cruise missiles, to fast and high threats such as hijacked airliners. Either an air-to-air fighter or a multi-role fighter will meet these challenges. The other weapons systems, UCAVs and attack helicopters, will not.

## INTERNATIONAL INTER-STATE CONTROL – SOLUTION

An effective strike mission requires success in each of a sequence of operations: penetration of hostile airspace, survival of enemy defences, target identification and assignment, firing of accurate weapons, successful remote or autonomous delivery, and safe escape

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<sup>201</sup>Standing Senate Committee on National Security and Defence, *The Government's No. 1 Job – Securing the Military Options It Needs to Protect Canadians*, 151.

and return. Much more is involved than just the design of a strike aircraft, its weapons and mission systems.<sup>202</sup>

For the international inter-state control scenarios, a multi-role fighter emerges as the best weapons system to conduct all the associated missions found in Figure 4.3. However, if the Canadian government's focus restricts aerospace weapons systems to operations against surface forces, then UCAVs, attack helicopters, and fighter aircraft can all support the SA, CAS, and air interdiction missions. Although OEF and OIF started out as conventional warfare, both have turned into IW. The need for air-to-air combat did not really exist in these conflicts. That would support the argument to focus on weapons systems that can do the SA, CAS, and air interdiction missions only. However, as asserted in Chapter 2, these are not the only types of conflicts expected over the next forty years.

UCAVs, such as the MQ-9 Reaper, provide excellent capabilities in a low and possibly medium threat environment. However, besides some design efficiencies such as size, it is not ideally suited to survive in scenarios involving sophisticated IADS. To add these capabilities requires an increase in size, thereby impacting cost, stealth, and manoeuvrability. As witnessed during OIF, attack helicopters such as the Apache are also susceptible to enemy ground defences, which could restrict their employment to strikes within close proximity of coalition ground forces vice deep into enemy territory.

Fighter aircraft are designed with self-protection equipment to allow them to operate in a more sophisticated threat environment. Based on their proven performance during Desert Storm and Allied Force, it is argued that fighter aircraft are the best

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<sup>202</sup>L.M.B.C. Campos, *Report 826 – Aircraft Design Integration and Affordability*, 4.

weapons system for the international inter-state control scenarios involving a more robust and sophisticated threat environment. A multi-role fighter would give the Canadian government more flexibility for mission assignment in these scenarios than a single-role fighter. A multi-role fighter is therefore the recommended weapons system for these scenarios.

### **INTERNATIONAL INTRA-STATE CONTROL – SOLUTION**

Although the two IW scenarios analyzed by CFD have not identified a deficiency in aerospace operations against surface forces, it was asserted that the four remaining IW COIN scenarios would highlight some requirements for this support to *land effects*. As mentioned in Chapter 2, the USAF is evolving its capability to support COIN operations in an IW environment. UCAVs, attack helicopters, and fighter aircraft could all support the two missions associated with these scenarios - CAS and air interdiction. An air-to-ground fighter or an attack helicopter would likely be the best weapons systems based on Table 4.1. However, the cost associated with introducing a new capability such as an attack helicopter include: personnel availability, training, dedicated support infrastructure, and added logistics and support staffs. A single fighter aircraft now costs up to US\$100 million, while 16 AH-64D Apache helicopters costs around US\$800 million.<sup>203</sup> Instead of purchasing attack helicopters for these specific scenarios, it is recommended that the multi-role fighters purchased for the international inter-state scenarios be used. Conflicts in the recent past have included both conventional and

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<sup>203</sup>The planned sale of 16 Apaches to Kuwait was valued at US\$800 million, to include the weapons, spares and support services. Jane's, "Boeing AH-64 Apache," [http://www.janes.com/defence/air\\_forces/news/jawa/jawa001013\\_1\\_n.shtml](http://www.janes.com/defence/air_forces/news/jawa/jawa001013_1_n.shtml); Internet; accessed 24 March 2008.

irregular warfare; however, it is unlikely that Canada would agree to support two separate international inter- and intra-state scenarios concurrently. Therefore, using the multi-role fighters identified for the international inter-state scenarios would not necessitate additional purchases and/or training. Thus, if CFD identifies an aerospace weapons system deficiency for the remaining four IW scenarios, it is recommended that the multi-role fighters purchased for the international inter-state scenarios be used.

### **WEAPONS SYSTEM DERIVED**

By breaking down the deficiencies noted in Chapter 3's force development scenarios, two aerospace operations were identified: aerospace control and aerospace operations against surface forces. These two operations were divided into their doctrinal missions. The missions were then analyzed based on the domestic and continental control, and international inter- and intra-state control scenarios to determine their feasibility. Based on the analysis, two missions were identified for domestic and continental control scenarios: CAP and AI. Two missions were also identified for the international intra-state control scenarios: CAS and air interdiction. The most demanding scenario involved international inter-state control, whereby seven missions were derived: CAP, AI, SA, SWP, ESC, CAS and air interdiction.

Based on recent technological advances and a report by Thierry Gongora for DND, three weapons systems were compared: UCAVs, attack helicopters, and fighter aircraft. In terms of technological advances and evolving capabilities, UCAVs, which include armed UAVs, appear to offer many advantages over traditional fighter aircraft. Their loiter time capability, coupled with their added benefit of not risking pilots' lives or being restricted in design to conform to human limitations, make UCAVs very popular.

However, their heavy reliance on data-link and sensors, in addition to their size, speed, and air traffic control restrictions prevent them from currently performing all the missions of a fighter aircraft. Attack helicopters have performed extremely well in conflicts such as Desert Storm, OIF, and OEF and provide great support to land forces, their primary purpose. Nevertheless, their speed and altitude limitations do not make them fully capable of conducting aerospace control against some of the current and emerging threats, such as airliners, Russian Bears, and cruise missiles. Fighter aircraft are available as single role variants, air-to-air and air-to-ground, or multi-role variants. In general, single role fighter variants are more capable in achieving their specific missions; however, multi-role variants such as the F-16, F-18, and JSF are proving to be just as capable in fulfilling all the missions. The dilemma comes with the large sticker value for a fighter aircraft.

The analysis in this chapter recommended an air-to-air or multi-role fighter aircraft to provide aerospace control for the domestic and continental control scenarios. For the international inter-state control scenarios, a multi-role fighter aircraft was recommended since it was the only weapons system analyzed that could effectively conduct all the missions. Finally, it was asserted that the multi-role fighters identified for the international inter-state control scenarios be used for the intra-state scenarios, if a need is highlighted by CFD.

Since the newest fighters being produced such as the F-18E/F, F-22, JSF, Eurofighter, Rafale, and Grippen are all multi-role fighters, and since the cost of single-role fighters are often the same as multi-role fighters, it makes logical sense to purchase a multi-role fighter. The training and weapons cost could be greater for a multi-role



aircraft, however this would be less than the cost associated with a mixed fleet of fighter aircraft.

## CONCLUSION

The key to a capabilities approach . . . is not to be wed to specific platforms, but rather to focus on the ‘effects’ that a platform produces, and to seek the most efficient and economical ways to produce those effects.

What is important is not a ‘one-for-one’ platform replacement program. Rather, a capability development program is effective if it fully appreciates the desired effect, considers the various means available to achieve it, and acquires this effect in conformity with the wider defence picture.<sup>204</sup>

### CAN CANADA AFFORD FIGHTER AIRCRAFT?

With the Conservative Government’s 2006 increase to DND’s budget and their 2008 announcement of an increase to DND’s inflation factor starting in 2011-2012, DND is now able to upgrade or purchase new equipment. This increased budget, combined with the introduction of accrual accounting and the inclusion of life-cycle support costs for contract awards, now provides DND with enough money and flexibility to purchase a replacement for the CF-18.

### WHAT ARE THE FUTURE THREATS?

Although the future impact of globalization is not clear, the social, political, and economic interconnection it creates will manifest interdependence such that events that occur in one country will impact another, for better or for worse. Economic deterrence in a global market may work for some states, but its impact on poorer countries such as those found in the global South may be less effective, creating an increased risk of more failed states. In addition, globalization has empowered non-state actors and terrorists, thereby creating new threats.

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<sup>204</sup>Christopher Ankersen, “Capabilities and Capacities,” 15.

Beyond 2020, China, India, and Russia have the potential to be global powers, and all these countries are in the process of building technologically advanced militaries. The threats posed by North Korea and Iran continue to cause much concern for the US. Beyond 2020, it is conceivable that conventional threats from emerging global powers may provoke confrontations that cannot be resolved through globalization.

The surprise, uncertainty, complexity, and global risks experienced in today's security environment will continue to manifest themselves beyond 2017, justifying the need for a robust and capable military. Future threats will fight using either IW or conventional warfare, or potentially a combination of both. Therefore, military forces, including airpower, will need to be equipped and trained for these environments.

#### **WHAT DEFICIENCIES EXIST WITH THE RETIREMENT OF THE CF-18?**

By using the 2005 modified CBP process on the eighteen classified FD scenarios, the CM team has identified several military capability shortfalls. The shortfalls relevant to this paper included: inability to provide *aerospace effects* for domestic and continental control, and inability to provide *aerospace effects* and aerospace support to *land effects* for the international inter-state control scenarios. The two primary aerospace operations derived from this were: aerospace control, and aerospace operations against surface forces. These two aerospace operations were further broken down into missions. Two missions were identified for the domestic and continental control scenarios: CAP and AI. The most robust mission requirements derived from the international inter-state control scenarios (conventional warfare) and included: CAP, AI, SA, SWP, ESC, CAS, and air interdiction. Two missions were also identified for the international intra-state control scenarios, however it was recognized that this deficiency has yet to be highlighted.

Ultimately, a weapons system or a combination of weapons systems is needed to accomplish these missions when the CF-18 retires.

### **WHAT WEAPONS SYSTEMS CAN FILL THESE DEFICIENCIES?**

An air-to-air fighter aircraft or a multi-role fighter aircraft were the only viable solutions for the domestic and continental control scenarios. For the international inter-state control scenarios, a multi-role fighter was the only weapons system capable of conducting all seven missions. Although some weapons systems may be better suited for aerospace operations against surface forces (CAS and air interdiction), a multi-role fighter aircraft gives the GOC more flexibility in mission assignment. In addition, the newest fighter aircraft being produced are multi-role fighters, and they are being designed with major technological advances that lend themselves to fulfilling the CAS and air interdiction missions. Finally, it was asserted that the multi-role fighter aircraft identified for the international inter-state control scenarios be used for the intra-state scenarios, if a need is highlighted by CFD.

### **HOW MANY DOES CANADA NEED?**

Technology has revolutionized the relationship between quantity and effects. This is an advantage for small air forces. A small number of platforms, enabled by skilled personnel in a sophisticated system, can now achieve effects disproportionate to numbers.<sup>205</sup>

Although Canada's former Chief of the Air Staff is correct in his assertion, technology has also dramatically increased the purchase cost of military equipment. In addition, even though technology allows fewer platforms to achieve greater effects, there are still a minimum number required to achieve the stated missions. DND's renewed

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<sup>205</sup>LGen Steve Lucas, "The Future of Air Power for Small Air Forces: Perspectives from Canada."

budget allows for the purchase of new weapons systems, but there continues to be cost challenges when it comes to total numbers. The number of platforms purchased must take into account major fleet upgrades halfway through their 30 or 40 year lifespan. Although a new weapons system fleet would initially be expected to have a higher percentage of MR platforms, this number will drastically reduce during major upgrades. Canada has a commitment of up to 36 fighter aircraft for NORAD and six for international operations requiring a MSTF. Based on the analysis in Chapter 3, Canada's fleet of 79 CF-18s does not even provide enough MR aircraft to fulfill the NORAD commitment. It is asserted that the option of reducing MR aircraft commitments to either NORAD or MSTF would be a short-sighted solution to justifying a smaller fleet size. Therefore, 100 new multi-role fighters will need to be purchased to provide enough MR aircraft to fulfill Canada's commitment to NORAD and international operations.

### **THE FINAL ANSWER**

By 2012 or 2013 initial approval will be required from the GOC for the purchase of a new weapons system to replace the CF-18. A fighter aircraft is the clear solution for the domestic and continental control scenario deficiencies. A fighter aircraft has also been presented as the best weapons system for the international inter- and intra-state control scenarios. Therefore, it is asserted that to meet the Conservative Government's CFDS, DND must purchase at least 100 multi-role fighter aircraft to replace the CF-18s. The primary justification will be for control of Canadian airspace, with a secondary requirement for aerospace support to ground forces. 100 multi-role fighters is the minimum needed to meet Canada's NORAD and MSTF MR fighter aircraft commitments.

## **WHERE TO NEXT?**

The purchase of at least 100 multi-role fighter aircraft will be an enormous, but required, capability investment to meet future threats in the first half of the 21<sup>st</sup> century. What must now be determined are which versions to buy. Although this paper touched on some possible fighters that exist, no specific multi-role fighter aircraft was recommended. This must be the next step, and it must be completed over the next three to four years. Based on the arguments in this research paper, it is recommended that the derived missions be used as a foundation for assessing capabilities. As a minimum, the multi-role fighter aircraft will need to be capable of accomplishing these missions against the enemy threat found in the eighteen classified FD scenarios. With increased costs for fifth generation fighter aircraft, a detailed analysis will need to be done to see which multi-role fighter meets these missions, and is the most affordable to allow for the purchase of at least 100. A further analysis will also need to be done on the last four IW COIN scenarios to see if an aerospace weapons system is needed to support land forces. If so, then the multi-role fighter will need to be suited to support these specific missions as well.

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