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INTERNATIONAL COLLABORATION: CANADA'S ONLY AVENUE TO ACQUIRING STATE OF THE ART FIGHTER AIRCRAFT

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ABSTRACT

The cost of high technology weapon systems continues its meteoric rise, outpacing inflation and, year after year, reducing the purchasing power of every defence procurement dollar destined for state of the art fighter aircraft. Nations have several options in the procurement of advanced weapon systems. In an effort to defray spiralling weapon costs as well as enable access to high technology systems from abroad, countries often turn to international collaborative agreements. By sharing costs and risks, they hope to enjoy political, operational and financial benefits such as economies of scale, shared access to new technologies and increased interoperability.

Many observers correctly point out that international collaboration programs often come with increased risk, including cost overruns and delayed deliveries. However, careful analysis reveals that the answer to the question of international collaboration is not cut and dried. The aim of this paper is to demonstrate that despite the risks, in an increasingly globalized economy, collaboration can be the only means that Canada has at its disposal to obtain state of the art fighter aircraft. Due to a number of political, economic and military factors, both Canada and its long-time ally and economic partner the US, stand to mutually benefit from collaborative programs.

LIST OF ABBREVIATIONS

C3I – Command, Control, Communications and Intelligence

CDN – Canadian

CF – Canadian Forces

CFDS – Canada First Defence Strategy

COTS – Commercial-Off-The-Shelf

CRS – Congressional Research Service

DITC – Department of Industry, Trade and Commerce

DND – Department of National Defence

DoD – Department of Defense

DSB – Defense Science Board

EPG – European Participating Governments

EU – European Union

FF – Fighter Force

FMS – Foreign Military Sales

GAO – Government Accountability Office

GD – General Dynamics

ICA – International Commercial Alliance

ITAR – International Traffic in Arms Regulation

JSF – Joint Strike Fighter

MOTS – Military-Off-The-Shelf

MOU – Memorandum of Understanding

MRCA – Multi-Role Combat Aircraft

NATO – North Atlantic Treaty Organization

NFA – New Fighter Aircraft

NORAD – North American Aerospace Defense Command

OT&E – Operational Test and Evaluation

PSFD MOU – Production, Sustainment and Follow-On Development Memorandum of Understanding

PWGSC – Public Works and Government Services Canada

R&D – Research and Development

RCAF – Royal Canadian Air Force

RFP – Request for Proposals

RSI – Rationalization, Standardization and Interoperability

SAM – Surface to Air Missile

UK – United Kingdom

US – United States

USAF – United States Air Force

CHAPTER 1 - INTRODUCTION

According to the Stockholm International Peace Research Institute, global military spending increased every year between 1998 and 2011.[1] At the same time, although in 2011 Canada's defence spending was at its highest (in billions of dollars) since the end of World War II, it was just over half of what it had been in 1990 as a percentage of GDP.[2] With the seemingly ever-increasing costs of advanced weapon systems coupled with progressively tighter national budgetary constraints, the subject of military procurement understandably attracts much attention and controversy in political and military circles, particularly for the member states of the North Atlantic Treaty Organization (NATO). In Canada specifically, when the Department of National Defence (DND) announced on July 16, 2010 that it would acquire 65 F-35 Lightning II Joint Strike Fighters (JSF) at a cost of $9 billion CDN to replace the CF-18, considerable interest and heated debate on the matter quickly ensued.[3] Along with legitimate questions concerning the overall costs associated with Canada's purchase, the debate also involved the fact that the JSF program is an international collaboration between Canada and eight other countries, with the United States (US) as the lead partner nation.[4] Among

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[1] Stockholm International Peace Research Institute. "SIPRI Yearbook 2012," Last accessed 13 March 2013: 8, http://www.sipri.org/yearbook.

[2] The National Post. "Graphic: Financing Canada's Armed Forces," Last accessed 13 March 2013. http://news.nationalpost.com/2012/06/08/graphic-financing-canadas-armed-forces/. Also see Collins, Mark. "Canada's Declining Defence Budget as a Percentage of GDP," *Canadian Defence and Foreign Affairs Institute*, Last accessed 13 March 2013, http://www.cdfai.org/the3dsblog/?p=1197.

[3] National Defence. "Backgrounder: Canada's Next Generation Fighter Capability – The Joint Strike Fighter F-35 Lightning II," Last accessed 12 March 2013, http://www.forces.gc.ca/site/news-nouvelles/news-nouvelles-eng.asp?id=3471.

[4] United States. *Memorandum of Understanding Among the Department of Defence of Australia and the Minister of National Defence of Canada and the Ministry of Defence of Denmark and the Ministry of Defence of the Republic of Italy and the State Secretary of Defence of the Kingdom of the Netherlands and the Ministry of Defence of the Kingdom of Norway and the Undersecretariat for Defense Industries on*

other details of the program, which is still in the testing phase, one topic of particular concern is the overall efficiency of the international program in meeting cost and delivery timeline milestones. Program delays and successive reports of cost overruns have led many to question not only whether the JSF will best suit Canada's future fighter needs, but also whether Canada should even be involved in an international collaboration project of this magnitude and complexity.[5]

The JSF program is not the first international weapons program in which Canada has been involved. On the contrary, particularly with respect to aircraft and especially fighters, since World War II the trend has been for Canada to enter into agreements with international weapons manufacturers. The JSF, however, is the first international collaborative development of this scale in which Canada has been a partner. Moreover, it is known to be the largest weapons procurement program in Canadian history.[6]

There are indeed examples of aircraft being developed and produced domestically in Canada (the Avro CF-100 Canuck for instance). Others, such as the F-86 Sabre, F-104 Starfighter and F-5 Freedom Fighter were produced in Canada under licensed co-production agreements with the US.[7] More recently, the CF-18 Hornet was purchased

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Behalf of the Ministry of National Defense of the Republic of Turkey and the Secretary of State for Defence of the United Kingdom of Great Britain and Northern Ireland and the Secretary of Defense on Behalf of the Department of Defense of the United States of America Concerning the Production, Sustainment, and Follow-On Development of the Joint Strike Fighter (Short Title – JSF PSFD MOU), 12/2009, 4.

[5] Tim Naumetz,, "Feds' reasons for acquiring fighter jets implausible, says Liberal MP," *The Hill Times Online*, March 5, 2013, http://search.proquest.com/pqrl/docview/212115843/13DD2E62D68771C8F95/1?accountid=9867.

[6] John Siebert, "What's Driving the F-35 Procurement?" The Ploughshares Monitor Vol 32 Issue 1, (Spring 2011): 22. http://ehis.ebscohost.com/ehost/detail?vid=5&sid=9a695e2a-3d63-4776-862e-2dd650a0e56d%40sessionmgr13&hid=2&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=poh&AN=65290279.

[7] Randall Wakelam, *Cold War Fighters* (Vancouver: UBC Press, 2011), 79. Also see Anthony Stachiw, *Canadair CF-104 Starfighter*, (St. Catharines: Vanwell Publishing Limited, 2007), 25, and

directly from the US. In general, to date, in the realm of advanced weapons procurement for the Canadian Forces (CF) and the Royal Canadian Air Force (RCAF), the involvement of international partners to at least some extent has been the rule rather than the exception.

There is an abundance of western literature regarding the challenges of military procurement, and in particular those challenges related to international collaboration. Many observers correctly point out that international collaboration programs often come with increased risk, including cost overruns and delayed deliveries[8]. Some claim that the RCAF should replace the CF-18 with an aircraft developed domestically, rather than procuring one internationally.[9] However, as this paper will reveal, careful analysis reveals that the answer to the question of international collaboration is not cut and dried. There are many often conflicting priorities of the Canadian government including budgetary constraints, military requirements, political concerns (both domestic and international), domestic industrial capacity and existing policies of other stake holding government departments. This is particularly true with respect to advanced weapon systems such as fighter aircraft. Thus, in the end, the decision regarding such a complex problem as international collaboration will nearly always demand a compromise be reached. If the Canadian government decides that it requires timely access to state of the art high

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Anthony Stachiw, *Canadair CF-5 Freedom Fighter*, (St. Catharines: Vanwell Publishing Limited, 2003), 14.

[8] United States. Department of Defense. Report of the Defense Science Board Task Force on Joint Advanced Strike Technology (JAST) Program, 19950309 051 (Sep 1994), 49. http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA292094. See also Bill Kincaid, "We Can't Do Collaborative Projects!" *RUSI Defence Systems*, (Summer 2004): 12, http://www.rusi.org/downloads/assets/contentionjuly.pdf.

[9] Canadian Broadcasting Corporation. "Ottawa Accused of Axing Avro Arrow Revival Too Soon," Last accessed 27 April 2013, http://www.cbc.ca/news/politics/story/2012/09/10/avro-arrow-revival-plan.html.

technology fighter aircraft, then the need for some form of international program will be a virtual certainty. The question will be reduced to one of weapon system capability, cost and availability. If the best weapon system to meet Canada's needs is available and affordable, either domestically or on the international market, then Canada can buy it. If it is not, then Canada may very well have to wait for it, settle for something less, or else participate in developing it. International collaboration, while potentially higher risk, might very well be the only way for Canada to acquire the advanced weapon systems that it needs, when they are required.

In detailing why international collaboration has a place in future Canadian defence procurements, this paper will begin in Chapter 2 with an analysis of the rising costs of advanced weapons and airpower in general. It will examine the rationale explaining why Canada and its allies, particularly the US, consider it essential to possess state of the art weapons. The persistent potential threats posed by historical adversaries' recent advancements in technology and military spending will be explored. They will be shown to be the principal reason behind the continued drive for western weapons advancement. While technology has been seen to steadily advance since the Cold War, the gap between allied and potential adversary capabilities has not been constant. Added to this, rising costs, declining budgets and the changing nature of the global defence industry further complicate western nations' efforts to maintain adequate military power in the face of the ever advancing capabilities and proliferation of weapons from countries such as China and Russia.

Chapter 3 will focus on a synopsis of military procurement options in general, citing some examples of each. Emphasizing the consequences of rising unit costs as well

as the lengthening timelines involved in modern weapons programs, some of the relevant advantages and disadvantages of the various options will be presented. A by-product of these increasing costs is longer life cycles for major weapon systems, which also plays into the decisions regarding the utility of international collaboration. Other variables affecting this decision such as interoperability, economies of scale, policy alignment, domestic industrial benefits and technology transfer will likewise be reviewed and compared. Noting that national self-reliance in the realm of the defence industry is a strategic issue, an analysis of the pros and cons of the various alternatives will be included. The chapter will conclude with a look at Canada's participation in the JSF program from the perspective of a "junior" partner in a large international collaboration.

The discussion will then turn in Chapter 4 to revisit the potential procurement options available to Canada, particularly with respect to Canada's Fighter Force (FF) and impacts regarding Canada's allies. It will recommend particular factors which DND and other interested government departments should consider in assessing whether to enter into international collaboration programs. It will suggest potential partner nations with which to investigate possible future collaboration efforts. Finally it will argue that for any future advanced weapons procurement programs, Canada should and will need to work closely with our most important ally, the US. Particularly in the realm of fighter aircraft procurement, international collaboration should be considered as a viable option for Canada to ensure that it is appropriately equipped to meet our obligations as detailed in the Canada First Defence Strategy.

CHAPTER 2 – A PRIMER ON THE RISING COSTS OF AIRPOWER

INTRODUCTION

As stated at this study's outset, defence spending has been on the rise globally during the first decade of the millennium. The events of September 11, 2001 triggered the start of the Global War on Terror, precipitated wars in Afghanistan and Iraq, and signalled a new era in security measures adopted by the west, led by the US. These operations highlighted defence capability shortcomings, and have stretched defence budgets to their limits. Even with the global financial crisis of 2007 – 2008 that placed defence budgets under increased pressure, the costs of weapons continued to rise. In recent years, military hardware costs in Europe were growing at 5 – 10 % annually.[10] The US has experienced similar trends. Norman Augustine presented a most striking elucidation of this trend by observing that if this trend continues, "in the year 2054, the entire defence budget will purchase just one tactical aircraft".[11] These increases are not solely attributable to the post-9/11 world, however. As we will see, there are many forces at play that influence the cost of high technology weapons, in particular for advanced fighter aircraft. It is clear that governments must continue to work to find ways of controlling expenses to ensure that they are able to adequately equip their armed forces. This chapter will examine the reasons behind these rising costs.

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[10] Bastian Giegerich, "Budget Crunch: Implications for European Defence." *Survival*, vol.52 no. 4, (Aug – Sep 2010): 87, http://ehis.ebscohost.com/ehost/detail?vid=3&sid=4318e53d-d0ed-43d7-88b9-cb58301fea33%40sessionmgr110&hid=106&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=a9h&AN=52444974.

[11] Norman Augustine, *Augustine's Laws*, (Reston: American Institute of Aeronautics and Astronautics, Inc., 1997),107.

There is an abundance of literature written regarding government defence expenditures, military procurement issues and the arms race[12]. The chapter will begin by examining some of the principle factors influencing government defence spending. After characterising these basic influences, the discussion will then turn to a brief overview of the current arms industry, including some of the implications of increasing globalization. Finally, it will then examine more closely those forces that continue to drive the costs of high technology aerospace weapons ever higher. In particular, emphasis will focus on the military-political nexus that exists to influence defence inflation, pausing to ponder some of the more disturbing trends.

WHY DO WE NEED TO SPEND SO MUCH?

A nation's military capability requirements must be assessed with respect to the perceived threat, both current and expected. Since the end of the Cold War, however, threat assessment metrics have become more difficult to read.[13] Notwithstanding the overwhelming blow dealt by US airpower in the opening days of the Iraq war in 2003, the wars of the last decade in Afghanistan and Iraq were marked by adversaries posing little significant threat to airpower. Nevertheless, that is not to say that potential conventional threats against allied forces no longer exist. While global political dynamics have changed, both Russia and China continue to develop and export increasingly

[12] Ethan Kapstein, "Capturing Fortress Europe: International Collaboration and the Joint Strike Fighter." *Survival*, vol 46 no. 3 (Autumn 2004): 137-160. See also Baudoin Heuninckx, "A Primer to Collaborative Defence Procurement in Europe: Troubles, Achievements and Prospects," *Public Procurement Law Review*, Vol 17, Issue 3 (2008): 123-145. http://www.unpcdc.org/media/4929/eu%20collaborative%20defense%20procurement.pdf.

[13] Michael Alexander and Timothy Garden, "The Arithmetic of Defence Policy," *International Affairs*, Vol 77 No 3 (2001): 516, http://ehis.ebscohost.com/ehost/detail?vid=4&sid=83383454-ecfe-41f4-91bf-1bc67bbc86d6%40sessionmgr114&hid=106&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=aph&AN=4856462.

sophisticated fighter aircraft and surface-to-air missile (SAM) systems. From an airpower perspective, the threat posed by SAM defences is real and must be addressed. During the NATO bombing campaign in Kosovo in 1999, an estimated 700 SAMs were fired at coalition aircraft.[14] Furthermore, both Russia and China have active development programs of their own fifth generation fighters.[15] Also, China arguably warrants special recognition as an emerging global influence both militarily and economically. The debate is heated over to what extent these indeed constitute real potential threats or if this is more fear mongering on the part of the military industrial complex (or military industrial political complex as the case may be).[16] Further, the debate also revolves around whether the West actually requires such sophisticated weapons to counter those threats, or if that money can be better spent.[17] At any rate it is with these potential threats in mind that the US and its allies continue to pursue high technology aerospace capabilities.[18]

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[14] Rebecca Grant, "Airpower Made it Work," *Airforce Magazine*, (November 1999), 34 http://www.airforce-magazine.com/MagazineArchive/Documents/1999/November%201999/1199airpower.pdf.

[15] Marco Wyss and Alex Wilner, "The Next Generation Fighter Club: How Shifting Markets Will Shape Canada's F-35 Debate," *Canadian Military Journal* Vol 12, No. 2 (Spring 2012): 24, http://www.journal.dnd.ca/vol12/no2/18-wilner-eng.asp.

[16] Barrett Tillman, *What We Need, Extravagance and Shortages in America's Military*, (St. Paul: Zenith Press, 2007), 10.

[17] *Ibid*., 155.

[18] Samuel Walker, "Interoperability at the Speed of Sound: Canada-United States Aerospace Cooperation…Modernizing the CF-18 Hornet," (Queen's University Kingston (Ontario) Centre for International Relations, 8 Feb 2013), 5, http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA393987. Also see Public Works and Government Services Canada. "Final Industry Engagement Request: Capability, Production and Supportability Information Questionnaire," Last accessed 20 April 2013, http://www.tpsgc-pwgsc.gc.ca/app-acq/stamgp-lamsmp/questevalfin-finquesteval-eng.html.

In addition to military assessments, the threat must be assessed from the political perspective. It is understandable how US defence budgets had significant support during the Cold War, particularly following events at the end of 1979 such as the Soviet invasion of Afghanistan and the Iran hostage crisis.[19] Through the last decade during the Global War on Terror, western defence departments have enjoyed similar public support for their increased expenses.[20] However, after years of massive defence spending, public support for such large expenditures is waning.[21] Nevertheless, US and allied defence planners and the entire military industrial political complex still prepare for the potential next adversaries, and not just to fight the last war. Thus despite public wariness towards spending and deficits, political pressure to advance military capabilities in the face of persistent threats to national security continues.[22]

Enter the next wave in technological advancement: stealth, improved sensor, engine and weapon technologies, enhanced computer, display and data fusion technologies, adaptive aerodynamics, directed energy weapons and hypersonic platforms.[23] These emerging technologies have been in development for years and are being exploited not just in the west, but by emerging powers as well. As we will see, technology is a major factor in the cost of high technology weapon systems. The ongoing

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[19] Lauren Holland, *Weapons Under Fire*, (New York: Garland Publishing, 1997), 41.

[20] John Isaacs, "Defense Spending: No More Blank Checks," *Bulletin of the Atomic Scientists*, Vol. 60 Issue 3, (May/Jun2004): 19.

[21] *Ibid.*

[22] Michael O'Hanlon, *Budgeting for Hard Power*, (Washington: Brookings Institution Press, 2009), 29.

[23]David Kirkpatrick, "The Affordability of Defence Equipment," *RUSI Journal*, 142, 3 (Jun 1997), 61, http://search.proquest.com/pqrl/docview/212115843/13DD2E62D68771C8F95/1?accountid=9867.

arms race leads to new generations of weapons, whose costs continue to follow existing trends.

As framed above, a nation's ability to arm and protect itself is a strategic issue, both militarily and politically. Procurement decisions too are as much political as military; declaring high technology requirements (for example stealth) will come with a higher price tag, and must be carefully considered as to actual necessity. A discussion regarding Canada's specific fighter aircraft requirements (i.e., JSF or something else) is beyond the scope of this paper. However, it is a salient example, as Canada is currently in the market for a replacement fighter for the CF-18 and the debate is a frequent topic in the national news media (not to mention in the halls of Canada's fighter squadrons.) Thus, it is appropriate that the next section will look at how the global arms industry both enables and discourages countries from finding reductions in defence spending, with both military and political ramifications.

CURRENT GLOBAL ARMS INDUSTRY

A prominent theory of the arms industry conceived by Krause and illustrated by Kinsella explains that the global arms industry is now in a "wave" of development that began at the end of World War II.[24] Each wave is characterized by five phases of technological innovation and proliferation. The first phase features a marked technological advance by one or a small group of nations that comprise a first tier. They become the only holders and proliferators of the new technology or capability. In phase two, proliferation of the technology expands rapidly, which in turn leads to increased

[24] David Kinsella, "The Arms Trade," in *The Handbook on the Political Economy of War*, ed. Christopher J. Coyne and Rachel L. Mathers. (Northampton: Edward Elgar, 2011), 221.

demand for domestic production capability by a second tier of nations in phase three. Phase four features second tier nations that are able to produce and export the weapons, thus increasing competition and enabling a third tier to begin relatively limited domestic production and export. In the fifth phase the "military-technological diffusion slows" and the three tier order of weapons exporters is solidified.[25]

For illustrative purposes, suppose Krause's model can be applied to the current advancements in stealth technology. Taking the example of the JSF, phase one had a sole tier one nation, the US.[26] The second tier could comprise those partner nations that receive the aircraft (phase two) and later have access to the technology used in its production (phase three). In parallel, other competing nations are working to develop their own stealth technologies but are not known to be as advanced as the US. Hence with the JSF, the tier two countries stand to become part of the global supply chain for the JSF should further tier three countries sign on to purchase the aircraft if and when this model proceeds to phase four.

This example highlights the process of the globalized arms supply chain. Markowski and Hall explain that there are a number of procurement options open to nations: they can develop weapons domestically, purchase from foreign suppliers, or enter into some sort of cooperative arrangements with other nations to develop and/or produce systems together.[27] (These processes will be examined in greater detail in

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[25] *Ibid*., 222.

[26] Although some other western nations, for example France, claim some "stealth" capabilities, for the purposes of this discussion we will not compare them to the Low Observable technology used in such US aircraft as the F-117 Nighthawk, B-2 Spirit or F-22 Raptor, none of which were exported.

[27] Stefan Markowski and Peter Hall, "Defense Offsets in Australia and New Zealand" in *Arms Trade and Economic Development*. Ed. Jurgen Brauer and J. Paul Dunne, (Milton Park: Routledge, 2004), 276.

Chapter 3). In the case of the JSF example, the tier two nations enter into an international work share arrangement as part of the globalized supply chain. The tier one nation, the US, "buys locally" for the other stealth aircraft in their inventory but is also part of the international arrangement (collaboration) for JSF. These distinctions have important implications for weapons program costs and schedule risks. From the US point of view, the primary purpose of the collaboration is to spread the financial risk of development of the JSF and to ensure a customer base (other reasons will follow in Chapter 3).[28] For the tier two nations, the collaboration enables them to share the cost of development and to have access to the technology. This international collaboration is not a new phenomenon, but as noted by Brauer and Dunne, it is likely to become more common for the "tier two" type nations (such as European Union (EU) member nations) in an effort to reduce procurement costs.[29] Nations not part of the JSF collaboration, but which subsequently purchase the aircraft, could be foreign military sales (FMS) customers, as if they were purchasing any other US aircraft. The most advanced capabilities and price would not necessarily be the same as for the JSF partner nations, and they would also presumably have to wait their turn for aircraft to become available.

Thus, weapons procurement decisions generally amount to a compromise between military capability and cost. Countries must consider these factors when beginning weapons procurement programs as they directly affect what weapons they can procure, when, and at what cost. This has both military and political ramifications. Defence industry globalization affects cost and, as will be seen, has other political implications.

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[28] Kapstein, Capturing Fortress Europe, 149.

[29] Jurgen Brauer and John Paul Dunne. "Arms trade offsets: what do we know?" in *The Handbook on the Political Economy of War*, Ed. Christopher J. Coyne and Rachel L. Mathers, (Northampton: Edward Elgar, 2011), 262.

The following section will now probe in greater detail those forces that continue to push the cost of advanced airpower ever higher.

DEFENCE INFLATION

Commercial computer technology continues to advance at an impressive rate, yet at the same time prices for the latest gadgets do not seem to be increasing. This raises the question, "why is it not the same for high technology military jet fighters?" Lauren Holland states that, "90 percent of advanced weapons systems in the post-World War II period have experienced significant cost overruns, and 85 percent have experienced schedule delays."[30] According to Alexander and Garden, in most European countries the rise in cost of a "unit of defence capability" has outpaced inflation.[31] Thus they make the point that for nations with level spending on defence budgets from one year to the next, defence capabilities are actually on the decline. This phenomenon of unit cost growth outpacing that of defence budgets is called "Military Malthusianism", which as Brauer and Dunne explain, can only be tolerated for so long before the costs "spiral out of control."[32]

They go on to list the options available to nations in this situation: they can cut defence budgets across the board, they can reduce their military commitments and so their weapons requirements, they can spend more money on defence or they can look to options offering increased efficiency, such as international collaboration.[33]

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[30] Holland, Weapons Under Fire, xx.

[31] Michael Alexander and Timothy Garden, Arithmetic, 510.

[32] Brauer and Dunne, Arms Trade Offsets, 261.

[33] *Ibid*.

Another approach, as Caverley and Kapstein suggest, is that in the US, the Pentagon and the defence industry need to stop designing and producing "unnecessarily sophisticated weapons for domestic use" and instead develop "simpler, more cost-effective ones for a global market."[34] As Augustine puts it, "The last 10 percent of performance generates one third of the cost and two-thirds of the problems."[35] While there will always be many opinions regarding how best to cope with the problem of rising costs, it is plain to see that the status quo will not remain tenable for long. As will become evident, the solution will have to incorporate many or all of the above proposed measures, with specific implementation options assessed for appropriateness on a case-by-case basis. There is no "silver bullet" available yet that is acceptable to all stakeholders and can stem the problem of rapidly spiraling weapons costs. That is unless, as Brauer and Dunne suggest, "as unit-costs of weapon systems become unaffordable we might be spending ourselves to peace."[36]

Regarding the need for so called "gold plated" or "unnecessarily sophisticated" versions of weapons systems, the debate in Canada regarding the requirement for JSF is in part centered on this question. Once the Government of Canada announced in the Canada First Defence Strategy (CFDS) in 2008 that it would be buying a "next generation" fighter, depending on how "next generation" is interpreted, the field of

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[34] Jonathan Caverley and Ethan B. Kapstein, "Arms Away," *Foreign Affairs*, Vol 91 Issue 5 (Sep/Oct 2012), 131, http://ehis.ebscohost.com/ehost/detail?vid=4&sid=5ac95542-d24f-49ac-89ec-c58edd8c0f9d%40sessionmgr111&hid=106&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=bth&AN=78859921.

[35] Augustine, Augustine's Laws, 103.

[36] Brauer and Dunne, Arms Trade Offsets, 261.

potential replacement fighters could be narrowed considerably.[37] If by "next generation" it means "fifth generation" (the CF-18 is a fourth generation fighter), that leaves only one option, the JSF. To some, the requirement for fifth generation is in itself "gold plating" the requirement.[38] The only fifth generation aircraft currently in operation is the F-22 Raptor, which is not being exported.[39] As has been previously mentioned, the JSF program is today the world's most advanced weapons development program, and thus comes with a high unit cost price tag. As defence contractors endeavour to implement increasingly sophisticated technologies into new systems, program risks increase as it is that much more difficult to develop complex systems and thus costs swell.

A claimed added benefit of high technology systems is that in addition to increased military effectiveness against adversary systems, fewer platforms are required to accomplish what could previous versions. However, as Kirkpatrick points out, one downside to doing more with fewer high value platforms is that the overall force becomes more vulnerable, similar to having fewer key nodes in a network. When one falls out, the load on the others goes up significantly. As Kirkpatrick illustrates:

> Taken to extremes, this policy would ultimately entrust the air defence of the UK to a 'Starship Enterprise' in synchronous orbit for a century or more. Even if the Starship's phasars were theoretically able to destroy or deter any potential threat to UK from enemy aircraft or missiles, this option would represent an unprecedented concentration of power and risk.[40]

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[37] Siebert, What's Driving the F-35 Procurement? 21. Also see Department of National Defence, "Canada First Defence Strategy," 4, http://www.forces.gc.ca/site/pri/first-premier/index-eng.asp.http://www.forces.gc.ca/site/pri/first-premier/June18_0910_CFDS_english_low-res.pdf.

[38] McKay, Hill Times, http://search.proquest.com/pqrl/docview/212115843/13DD2E62D68771C8F95/1?accountid=9867.

[39] Martin van Creveld, *The Age of Airpower*. (New York: PublicAffairs, 2011), 204

[40] Kirkpatrick, Affordability, 60.

Thus more technologically advanced and less affordable systems not only contribute to rising defence costs, but come with their share of increased operational risk as well.

COMPETITION AND CHANGES ON THE FLY

Another factor driving up the costs of airpower results from diminishing competition in the US military aerospace industry. Rising costs result in fewer major programs. According to Rebecca Grant, fewer aerospace programs means an eventual loss of military aerospace industrial capacity, and thus increasing cost pressure in the supply and demand equation.[41] Kapstein points out that "during the 90s, the number of US major defence contractors competing for Pentagon contracts dropped from six to three."[42] This is in part due to the fact that the stakes are so high for companies bidding on projects with such high unit costs and requirements for development of new technology. As a case in point, McDonnell Douglas was one of the companies that had submitted a bid on the original JSF program, prior to the competition being narrowed down to just Boeing and Lockheed Martin. The company had "invested so heavily in its bid for JSF that it lost its independence and had to accept a merger with Boeing."[43] Not only is the industrial base required for competition, but the corporate knowledge is a vital strategic asset that is difficult to replace once lost.[44]

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[41] Rebecca Grant, "The Vanishing Arsenal of Airpower," Mitchell Institute for Airpower Studies, Mitchell Paper 4 (Oct 2009), 5, http://www.afa.org/mitchell/reports/MP4_Arsenal_1009.pdf.

[42] Kapstein, Fortress 140.

[43] *Ibid*., 146.

[44] Tillman, What We Need, 162.

During the research and development (R&D) of new technologies, hundreds of millions of dollars can be spent in "paper studies" before a prototype is even built.[45] As Holland observes, technology is critical in the development of new weapon system programs.[46] In situations when the demand is high for a condensed timeline from initial R&D through development, production, testing and delivery, project costs and risks can skyrocket. This was the case for the F-22. Although the debate over whether the F-22 was needed at all still continues and may never be settled, even proponents admit that the development and production "could have been handled much better."[47] The use of advancing technologies before they are ready also leads to increased financial risk. Costs ballooned because many new technologies were attempted all at once on a new platform, as opposed to an iterative development approach.[48] To make matters worse, the production run was begun prior to completion of initial operational test and evaluation (contrary to normal US policy), thus making it that much more difficult and expensive to rectify problems discovered during testing.[49] Therefore, unlike in the commercial sector where products go to market when the technology allows (based upon market economics), there are strong military-political influences that affect the demand for new high technology weapons that subsequently drive up costs.

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[45] Ethan Kapstein, "International Collaboration in Armaments Production: A Second-Best Solution," *Political Science Quarterly*, Vol 106 No 4, (1991-92): 668, http://search.proquest.com/docview/208290804/13DD32C733A40024A36/10?accountid=9867.

[46] Holland, Weapons under Fire, 218.

[47] Tillman, What We Need, 163.

[48] *Ibid*., 163.

[49] Holland, Weapons under Fire, 233.

As with hurried technological development, any changes in mission requirements during weapon system development take time and money, and do not always work as planned. According to the US Government Accountability Office (GAO), cost increases averaging 72 percent were experienced for development programs in which requirements changed during program development.[50] In another example, originally contrived during the Nixon years to be a cheap, lightweight fighter, the F-16 was at first designed outside normal United States Air Force (USAF) procurement channels. However, it was subsequently given to the USAF and standard new weapon system development procedures were applied. New missions were added making it now a much more complex multi-role (and therefore more expensive) aircraft.[51]

Having said this, the F-16 did go on to enjoy a long production run, significant exports, and is still a very effective fighter that is in use by many countries around the world to this day. Thus, there is more to assessing the value of a weapon system than only cost. Had the original design been retained, it is questionable whether such a simple fighter would still be considered useful to all of those air forces around the world that employ it today. Hence many factors must be considered when trying to assess the true costs of weapons procurement.

SEARCHING FOR EFFICIENCIES

One option that nations have in order to reduce or at least forestall defence expenses is to consider prolonging service life of aircraft. While quite common, there are

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[50] United States. Government Accountability Office. "GAO-10-382, Joint Strike Fighter: Additional Costs and Delays Risk Not Meeting Warfighter Requirements On Time." Last Accessed 21 April 2013. http://www.gao.gov/assets/310/302161.html. , Also see O'Hanlon, Budgeting 80.

[51] Holland, Weapons under Fire, 105.

risks associated with extending the life cycles of existing weapons. It comes with the added risk that the forces will become obsolete and ineffective unless an upgrade program can be implemented. For example, after identifying shortcomings in its CF-18 fleet in the early 1990s, Canada embarked on a significant upgrade program to increase capabilities and to extend the service life of the aircraft from 2003 to beyond 2017.[52] For an estimated cost of $2.6 billion (CDN), the CF-18 was modernized and the DND was able to postpone having to purchase a replacement fighter.

There are other options available to nations to increase efficiency and reduce costs. Policy tools such as "…private finance initiatives, technology demonstrator programmes, procurement of commercial-off-the-shelf (COTS), contractor logistic support, improved training and information technology, and others…" can help to stem unit cost growth, but cannot be expected to stop the growth trend entirely.[53] Many of these alternatives are being employed not only by nations, but by the increasingly globalized defence industry as well.

Another way that nations use to control costs is to work together. The JSF program is designed to enable partner countries to access such sophisticated weapons at an acceptable cost, which is precisely the logic explained by Brauer and Dunne in forming an international collaboration to answer the problem of military Malthusianism. One of the basic principles behind collaboration is to allow for longer productions runs, thus allowing for lower unit costs resulting from economies of scale.

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[52] Office of the Auditor General of Canada, Report of the Auditor General of Canada to the House of Commons, Chapter 3 National Defence – Upgrading the CF-18 Fighter Aircraft (Nov 2004), 2, http://www.oag-bvg.gc.ca/internet/English/parl_oag_200411_03_e_14907.html.

[53] Kirkpatrick, Affordability, 61.

There are, however, downsides to collaboration, from military, political and financial risk perspectives. While the Memorandum of Understanding (MOU) for the JSF refers to a process for dealing with any changes to the design of the aircraft put forth by a participant nation, it is evident that both production timelines and cost could be affected should this process be exercised.[54] This situation has indeed occurred in other major aircraft collaboration programs, for example the Eurofighter Typhoon. According to Ethan Kapstein, that program had several changes to aircraft orders from participant nations, which subsequently impacted program costs.[55] Similarly, in the example of the French-UK collaboration on the Jaguar fighter/attack aircraft, some French officials claimed that their share alone of the collaborative costs of development actually exceeded the total development cost of the arguably more advanced Dassault Mirage F1-C, which was borne entirely by them.[56]

The number of nations involved in the collaboration also can exacerbate difficulties. While more partners should mean larger numbers and thus lower costs, it also drives up complexity in the contracts and means it is that much more difficult to obtain a consensus.[57] This in turn could affect costs and delivery timelines as well as overall project risk.

Whether pursued by nations individually or collaboratively, in order to stretch defence budgets as far as possible, governments will have to look for any means available

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[54] JSF PSFD MOU, 28.

[55] Kapstein, Fortress Europe 152.

[56] John Birkler, Mark Lorell, and Michael Rich, "Formulating Strategies for International Collaboration in Developing and Producing Defense Systems."(*RAND Issue Paper*, 1997), 1, http://www.rand.org/content/dam/rand/pubs/issue_papers/2006/IP161.pdf.

[57] Holland, Weapons under Fire, 122.

of trimming expenses. The subject of collaboration itself will be examined much more closely in Chapter 3.

POLITICAL FACTORS

When discussing defence spending and the costs of weapons procurement, there is an array of political issues that become important depending on the point of view of a particular stakeholder. The list of stakeholders obviously grows when international collaborative partnerships are formed.

While partner nations in a collaboration all wish to minimize procurement costs, they still must contend with the political issue of domestic defence industrial capability. Seen as a strategic issue, countries wish to preserve this capability, but due to the nature of collaborations, the work is generally shared among partners in proportion to their contributions to the projects. Additionally, not all partners possess adequate defence industrial capacity for all aspects of development or production of high technology weapons. This is where the contract negotiations can become complicated. More than just getting together to "purchase in bulk", the partners each want as much of the work (i.e., jobs) as possible in their own constituencies.

Another related political factor arises when countries purchase weapons systems from foreign suppliers, even if they are not involved in collaborative development or production of the system (i.e., FMS). There can be significant political pressure to spend the associated large sums of money at home rather than abroad. However, this is not necessarily possible if the country lacks the means to produce the weapons domestically.

As an incentive to attract foreign buyers, weapons producers have implemented the practice of offsets. In general terms, offsets are agreements between purchaser and

vendor in which the vendor agrees to invest a percentage (perhaps even 100%) of the total procurement cost back in the economy of the purchaser.[58] This investment back in the purchasing nation can be in the form of the set-up of production facilities in that country (with the added benefit of technology transfers required to enable production). It also could be in the form of reciprocal investment in another sector of the purchaser's economy.

Offsets themselves are a controversial topic. From the perspective of the purchasing nations, these offsets can be very attractive. They might, however, be less so from the perspective of the vendor (e.g. the US) for a number of reasons, including the fact that they are seen as "economically inefficient and trade distorting".[59] In part this is because there are additional costs required in implementing the terms of the offsets as well as in oversight and monitoring, which are generally borne by the purchaser. In the purchasing nation, however, this can be an easier sell politically. This is due to the difficulty in assessing the value of the expenditure when more jobs are being created at home, even if the weapons cost more than they would have without the offsets. Add to this the benefits of technology transfer (again difficult to valuate) and the picture becomes even more complicated.[60]

Brauer and Dunne have found that in general offsets do not lower weapons acquisition costs, and they increase the complexity of the entire procurement process.[61] Nevertheless, they also recognize that they have an inherent attractiveness and thus are

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[58] Brauer & Dunne, Handbook, 244.

[59] *Ibid*., 263

[60] *Ibid*., 259

[61] *Ibid*.

unlikely to disappear.[62] Even in the JSF program, in which traditional offset arrangements are excluded, Markowski and Hall note that, "in practice, *de facto* reciprocal trade is likely to emerge [emphasis in the original]."[63] In the big picture, the desires of countries to retain domestic defence industrial capability work to limit the achievement of potential efficiencies and lower costs possible through collaboration.

There are several other political factors influencing the cost of high technology weapons procurement. Some suggest that one of the main reasons for the rising cost of weapons is plain old fashioned greed on the part of the military industrial complex, enabled by a lack of democratic transparency and civilian oversight.[64] This lack of public involvement could be for a number of reasons, including that the issues are too complex, the process is too closed to the public or they just lack interest. At any rate, the large sums of money and number of stakeholders involved, coupled with the political nature of defence policy, all work to increase the complexity of the arguments. It is difficult to please everyone.

Part of the sway held by the military industrial political complex is in the push by politicians to secure work in their respective constituencies. Tillman notes that for the F-22, "contractors and sub-contractors are found in forty-six states, plus Puerto Rico, and by one reckoning in 88 percent of all congressional districts."[65] It was originally envisaged in the 1980s as a replacement for the extremely capable F-15 to counter the growing perceived threat posed by increasingly advanced adversary weapons such as

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[62] *Ibid*., 263.

[63] Markowski and Hall, Defense offsets, 279.

[64] Holland, Weapons under Fire, 220.

[65] Tillman, What We Need, 163.

Flanker and Russian SAMs.[66] However, to many it represents an unacceptably high price tag considering the number of other defence priorities which it bumped, or the likelihood that it will ever be used in combat.[67] Nevertheless, despite the claims that it costs too much and is not required, there is significant political support because of its impact on the US defence industry.

CONCLUSION

This chapter has outlined some of the basic principles as to why western governments are experiencing spiraling costs of high technology weapons. Defence spending is driven by political agendas and military capability requirements to meet perceived current and future threats. As technology advances, so too do the costs of producing high technology weapon systems rapidly so as to be prepared for threats seen as increasingly sophisticated. Delays in development reduce the purchasing power of the previous year's dollars. As unit costs continue to rise, the number of major defence contractors has declined which affects competition. In a globalized arms industry, the influences upon procurement are progressively more political.

To combat spiralling costs, nations have various options available in their search for efficiencies in the procurement process. One option seen to be most viable and efficient is international collaboration between partner nations. Collaboration enables economies of scale to reduce unit costs, as well as giving partner nations access to new technologies. Collaboration is also affected by a number of factors including political

[66] O'Hanlon, Budgeting, 82.

[67] Tillman, What We Need, 169.

influences related to constituency work share agreements and domestic industrial capacity, offsets, and the fact that defense contractors need to turn a profit.

The fact remains that high technology costs money. As militaries insist on having increasingly sophisticated weapons, the costs will continue to rise and governments will need to look for clever ways of reducing costs. In the next chapter, the discussion will turn to a more detailed look at the procurement options outlined above. Canadian and international examples will be used to provide context to the discussion, such that in Chapter 4 the relative benefits of each for Canada can be probed and to show that collaboration must indeed remain a part of Canada's major weapons procurement strategy.

CHAPTER 3 – MILITARY PROCUREMENT OPTIONS

INTRODUCTION

The previous chapter demonstrated that globalization of the weapons industry is following similar trends to those seen in the commercial sector. Technologies are rapidly advancing, and major firms worldwide are consolidating while looking to lower costs by finding compatible offshore suppliers. In a 2002 RAND study, Lorell and Lowell noted that in general increased defence industry globalization can be expected to lower costs while increasing quality, productivity and innovation.[68] Additionally, benefits of increased globalization include interoperability and commonality of equipment, as well as reducing the technology gap between participant nations.[69] Increased international collaboration is tied directly to this globalization, and as will be shown, can be a means to achieving these potential benefits and to countering the aforementioned defence inflation.

Obviously, increased defence industry globalization has political and policy implications for the defence procurement options available to western nations. As a matter of strategic importance, nations tend to treat their domestic defence industrial capacity as something to be protected and nurtured. With strictly private enterprise, governments will generally mostly allow free market forces to dictate whether an industry thrives or otherwise, leaving it to engage globally (including allowing foreign ownership) as required. For industries deemed vital to the national interest, however, governments may impose regulations in line with wider political objectives. In Canada, for example, industries such as the oil and gas sector are regulated to ensure that

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[68] M. Lorell, et al., *Going Global? U.S. Government Policy and the Defense Aerospace Industry*, (Santa Monica: RAND, 2002), xvi

[69] *Ibid*., 73.

significant foreign investment results in a "net benefit" to the country.[70] Similarly, governments will regulate defence industries in order to ensure continued access to satisfy defence requirements.[71] Thus, increasing globalization means that governments have additional political and economic influences affecting major defence procurement decisions.

Moreover, as purchases of high technology weapon systems constitute some of the largest expenditures a government will make, there is strong political pressure to spend that money domestically rather than sending it abroad. Hence, increasing globalization further affects those options available to governments endeavouring to spend their money domestically. However, as was shown in the previous chapter with offsets, defence procurement collaboration can allow governments the opportunity to satisfy those political objectives if employed properly.

Having established in the previous chapter the basic reasons behind the ever-increasing costs of advanced weapon systems, this chapter will turn to a closer examination of the primary procurement options currently available to governments. The specific terminology pertaining to defence procurement options varies slightly among consulted references. However, as previously mentioned, in general the alternatives consist of purchasing locally, purchasing from foreign sources, or entering into some form of procurement or production arrangement with one or more foreign entities (i.e., collaboration). These options will be explored in greater detail in the following sections,

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[70] Aaron Wherry, "Harper Government Approves CNOOC and Petronas Deals", Maclean's, http://www2.macleans.ca/2012/12/07/harper-government-approves-cnooc-and-petronas-deals/, 7 Dec 2012. See also Industry Canada, "An Overview of the Investment Canada Act", Last accessed 1 Apr 2013, http://www.ic.gc.ca/eic/site/ica-lic.nsf/eng/h_lk00007.html.

[71] Jacques Gansler, "Collaboration, Internationalization, and Security," in *Global Arms Production: Policy Dilemmas for the 1990s*. Ed. Ethan Kapstein, (Lanham: University Press of America, 1992), 42.

along with the potential benefits and drawbacks of each. Examples of each will also be presented, culminating in a more detailed look at the collaboration involved in the JSF project. Finally, through these examples it will be shown that international collaboration is a significant and increasingly important mode of defence procurement, and, despite the difficulties, it remains an option with many potential benefits for the Canadian government.

TERMINOLOGY

To enable a discussion of arms procurement it is first necessary to reconcile the terminology in use. As stated above, procurement options available to governments differ primarily with respect to from where, or whom, weapon systems are being purchased. Brauer and Dunne explain that the two logical extremes are to either produce everything domestically, or to purchase "off-the-shelf" from abroad.[72] Taken one step further, between these two extremes lays the option to collaborate with a range of foreign entities in the development and/or production of weapon systems, on a continuum of collaboration. Those foreign entities include both corporations and governments. As noted in the previous discussion of offsets, purchasing "military-off-the-shelf" (MOTS) from abroad as a cross-border business relationship actually itself typically involves at least some amount of partnership or cooperation.

The various procurement terms in use can readily be resolved using the notion of the continuum of collaboration. Regarding purchasing from abroad or through international collaborative arrangements, Lorell and Lowell have identified multiple types of activities: direct foreign sales, Foreign Military Sales (FMS), licensed co-

[72] Brauer & Dunne, Arms Trade, 1.

production, FMS with co-production, partnership co-production, and development collaboration.[73] At this point in the discussion, it is useful to group direct foreign sales and FMS as variations of "purchase from abroad", with the remaining options grouped as variations of "international collaborative arrangements."[74] In another example using somewhat different terminology, Heuninckx generalizes these cross-border arrangements as reciprocal trade, cooperative production or coproduction, and co-development.[75] As will be shown, each of these arrangements has "different characteristics and consequences in terms of harmonization of requirements, integrations of the defence industry and technology transfer."[76] Though the terms may differ, again in essence reciprocal trade refers to foreign purchase with offsets, and fits along with coproduction and co-development on the continuum of international collaboration.

Finally, the distinction between cooperative production (co-production) and collaborative development is also important. As will be seen, collaborative development implies a much deeper and more complex arrangement between partner nations than does co-production. Nevertheless, for the purposes of this discussion both co-production and co-development are forms of international collaboration, but discrimination between the two will be necessary in the analysis that follows.

For ease of discussion the continuum of international collaboration described above essentially begins at one end with purchase from abroad while incorporating some

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[73] Lorell, et al., Going Global, 26.

[74] As stated above however, all of these options essentially fall on the continuum of collaborative arrangements. Only direct foreign sales without any sort of offsets or other government arrangements could really escape being defined as being "collaborative".

[75] Heuninckx, Primer, 4.

[76] *Ibid.*

form of cooperation such as offsets. The other end of the continuum is marked by a full collaboration on weapon system development and production between two or more partner nations or entities. The multitude of possible combinations of partner cooperation and collaboration sit within that range. This concept is illustrated at figure 1.

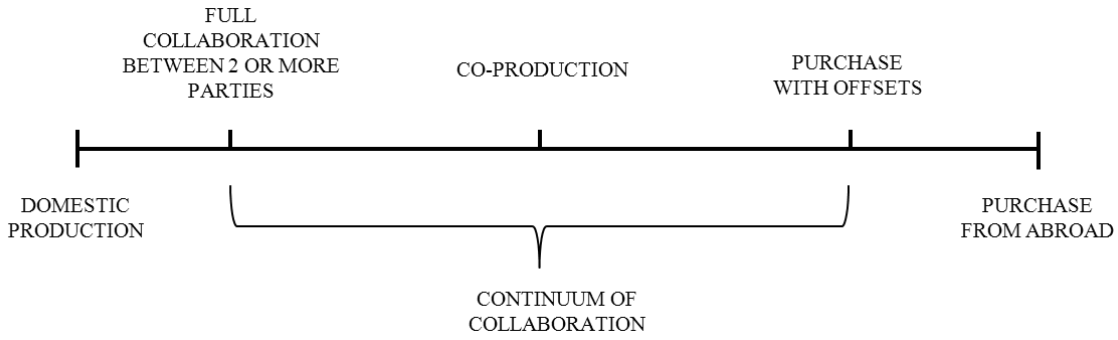

Figure 1. Range of Procurement Options

Having clarified the terminology to be used throughout the discussion of procurement, the analysis will next turn to highlight some significant issues impacting all of the alternatives.

FACTORS IMPACTING PROCUREMENT OPTIONS

To build upon the discussion of the previous chapter, defence industry globalization presents many potential advantages while at the same time posing some inherent risks. As Lorell and Lowell observe, working with one firm can increasingly result in de facto involvement in business of firms from other countries due to existing ties between those companies.[77] Large corporations with global business interests can be involved with a multitude of different companies and governments internationally. Indeed, according to the US Defense Science Board (DSB), in most high technology

[77] Lorell, et al., Going Global, 187.

industries including the aerospace sector, "international commercial alliances (ICAs) are the norm rather than the exception."[78] As well, the growth of multinational corporations can involve the merging, acquisition or sale of smaller companies around the globe. This in turn has security implications, particularly those associated with proliferation or acquisition of sensitive advanced technologies by hostile nations or organizations. Taken further, this can lead both to the compromising of key domestic defense capabilities and technologies, and increased dependence upon foreign suppliers and foreign control over domestic industry.[79]

Collaborating nations must take direct steps to address concerns over compromise of sensitive technologies. As Mitchell explains in regard to coalition cooperation, "building both strategic and professional trust is a timeless challenge."[80] The same goes for the importance of trust among collaborating nations sharing sensitive military technologies. Issues surrounding technology transfer are typically one of the more difficult obstacles in negotiating international collaborative agreements.[81] Nations closely regulate the export of such technologies to ensure control over proliferation and to safeguard domestic capabilities.

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[78] United States. Department of Defense. *Report of the Defense Science Board Task Force on International Armaments Cooperation*. 19961031 035 (Aug 1996), C-1, http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA316860.

[79] Lorell, et al., Going Global, xvii.

[80] Paul Mitchell, "Networks in the Coalition Environment." *Adelphi Papers*, Vol 46 Issue 385 (2006), 69, http://www.tandfonline.com/doi/pdf/10.1080/05679320601176218.

[81] Kapstein, Capturing Fortress Europe, 152.

In North America, for example, the Canadian government has implemented the Controlled Goods Program.[82] For Canada's primary ally and trading partner, the US, arms exports are controlled under the Arms Export Control Act and the International Traffic in Arms Regulations (ITAR).[83] Together, Canada and the US have enjoyed a particularly open trading relationship for decades, including within the defence industry. However, despite this close relationship, proliferation control is still of vital importance. For example, in 1999 Canada had its ITAR exemption suspended after it was "found that Canadian firms had exported sensitive technology to Iran and China."[84] Although the trade relationship did eventually improve again during the subsequent year as Canada tightened its own controls, the control of proliferation continues to be of paramount importance at the strategic level.[85]

Another issue impacting national defence procurement is that the bureaucratic processes themselves can be generalized as rather complicated and having many inherent difficulties. While each nation will have its own particular set of circumstances and constraints governing how defence procurement is conducted, all are affected to some extent by the generalities of market economics and globalization, as well as domestic and international political, legislative and practical considerations. For example, Williams asserts that a lack of accountability and delays in Canadian defence procurement result

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[82] Public Works and Government Services Canada. "Canada's Implementation of the New International Traffic in Arms Regulations (ITAR) Dual National Rule." Last accessed 13 April 2013. http://ssi-iss.tpsgc-pwgsc.gc.ca/dmc-cgd/publications/presentations/presentation-2012-09-eng.html.

[83] United States. Departement of State. "International Traffic in Arms Regulations." Last accessed 13 April 2013. http://pmddtc.state.gov/regulations_laws/itar_official.html.

[84] Lorell, et al., Going Global, 125.

[85] Kenneth Epps, "US Imposes Improvements to Canadian Export Controls," *The Ploughshares Monitor*, Spring 2002 Volume 23 Issue 1, Last accessed 13 April 2013, http://ploughshares.ca/pl_publications/us-imposes-improvements-to-canadian-export-controls/.

from overlapping responsibilities shared between the Department of National Defence (DND) and Public Works and Government Services Canada (PWGSC).[86] Or of a more practical nature in the US, O'Hanlon notes the not insignificant problems plaguing the defence procurement process caused by declining levels of experience and high turnover among US Department of Defense (DoD) contracting and acquisition professionals.[87] Although each country has its own realities in which it must operate, in general national defence procurement policies and procedures are subject to a variety of pressures that have a tendency to complicate the process and induce delays. And as we have already seen, delays cost money.

Having established a suitable lexicon necessary to proceed with an analysis of the procurement options, the next sections will more closely examine each. From this examination it will become clear that Canadian defence procurement of high technology weapon systems such as fighter aircraft will most certainly be dependent upon international collaboration as the only viable option.

DOMESTIC PRODUCTION

The first of the three primary procurement options available to nations is to develop weapon systems domestically. Domestic production of high technology weapon systems requires sufficient financial, industrial, technological and political means. Given adequate resources, domestic production should theoretically provide governments with the maximum possible authority over program development decisions and subsequent reliability of supply. For these reasons, as Kapstein suggests, a nation possessing

[86] Alan Williams, *Reinventing Canadian Defence Procurement*, (Kingston: Breakout Educational Network, 2006), 71.

[87] O'Hanlon, Budgeting 81.

adequate resources will tend to prefer domestic production over the other two options.[88] However, the availability of adequate resources is no trivial matter.

As detailed in the previous chapter, rising unit costs of high technology weapon systems result from ever increasing research and development (R&D) and production costs. Thus, it follows that with each new generation of weapon system the resource requirements continue to rise, thereby increasing the difficulty for defence firms and individual nations to produce such systems on their own.

In addition to the financial costs, the requirements for adequate industrial capacity and access to technology tend to be greater for the development of increasingly sophisticated systems. Again, more advanced weapon systems are apt to require more advanced technology and production techniques, not to mention appropriate experience and expertise, further straining the ability of individual nations to execute such programs on their own. Of course, should the lack of access to required technology prove unacceptable, the only real option available to nations is to somehow procure it internationally. This implies a need for at least some sort of collaboration.

In the high technology arena of fighter aircraft, there is a relatively short list of countries that currently have domestic development programs. According to Wyss and Wilner, those countries are China, France, India, Japan, Russia, Sweden, Pakistan and the US.[89] Additionally, the UK, Germany, Italy and Spain have formed a multinational consortium to produce the Eurofighter Typhoon (this collaboration will be discussed

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[88] Ethan Kapstein, "International Collaboration in Armaments Production: A Second-Best Solution," *Political Science Quarterly*, Vol 106 No 4, (1991-92), 659, http://search.proquest.com/docview/208290804/13DD32C733A40024A36/10?accountid=9867.

[89] Wyss and Wilner, The Next Generation Fighter Club, 22

later).[90] Although a nation's ability to develop fighter aircraft domestically is desirable and a symbol of national prestige, it still requires that enough units can be sold to lower costs to an acceptable level. Wyss and Wilner note that as of spring 2012, Sweden and the Eurofighter consortium in particular had experienced great difficulties in penetrating the export market.[91] Thus, if adequate sales are not secured in advance, the financial risk to nations producing fighter aircraft is particularly high. This risk in turn limits the number of countries with the capacity and resources to attempt such a program.

Canada too has a history of domestic fighter development. Canada's only indigenously developed and produced jet fighter, the Avro CF-100 Canuck, had its first test flight in January of 1950.[92] Between 1950 and 1958, 692 CF-100s were produced, and the aircraft remained in service with the RCAF until 1981.[93] Unfortunately, Canadian efforts to export the aircraft were hindered by US concerns over foreign export and technology transfer related to the fire control system, which was from a US company.[94] The only foreign exports of the aircraft were 53 to Belgium through the Mutual Aid program, and not until 1957.[95] The CF-100 example illustrates how even domestic programs can involve components from foreign suppliers, with resulting implications for technology proliferation.

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[90] *Ibid.*

[91] *Ibid.*

[92] Wakelam, Cold War Fighters, 79.

[93] Royal Canadian Air Force. "Avro CF-100 Canuck." Last accessed 14 April 2013. http://www.rcaf-arc.forces.gc.ca/v2/equip/hst/canuck-eng.asp.

[94]Wakelam, Cold War Fighters, 133.

[95] *Ibid.,* 136.

Another example of Canadian domestic fighter development was the Avro CF-105 Arrow. Designed as a state of the art supersonic interceptor, the program was terminated in 1959 during development before the aircraft had entered the production phase.[96] Controversy over the true reason for the cancellation persists to this day. Isinger writes that the primary reason for cancellation of the programme was escalating costs.[97] Campagna, on the other hand, contends that the real explanation for the cancellation was due to political concerns between Canada and the US.[98] Whatever the reason, the Avro Arrow never made it into production and some 14,000 workers in the Canadian aviation industry were put out of work.[99]

Today Canada continues to have a vibrant domestic aerospace industry, which the Canadian government has identified as one of the country's Key Industrial Capabilities.[100] Canadian companies have already secured contracts as part of the JSF collaboration.[101] Furthermore, Canada has other domestic defence production programs, such as the Canadian Munitions Supply Program and the National Shipbuilding and Procurement Strategy.[102] However these programs, while important to Canada's defence

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[96] Palmiro Campagna, *Storms of Controversy*, (Toronto: Stoddart, 1997), 138.

[97] Russell Isinger, "The Avro Canada CF-105 Arrow Programme: Decisions and Determinants" (master's thesis, University of Saskatchewan, 1997), 122.

[98] Campagna, Storms, 211.

[99] *Ibid*., 139.

[100] Public Works and Government Services Canada, "Canada First: Leveraging Defence Procurement Through Key Industrial Capabilities." *Report of the Special Adviser to the Minister of Public Works and Government Services.* (Feb 2013), 17, http://www.tpsgc-pwgsc.gc.ca/app-acq/stamgp-lamsmp/eam-lmp-eng.html.

[101] Industry Canada. "Canadian Industrial Participation in the F-35 Joint Strike Fighter Program." Last accessed 21 April 2013, http://www.ic.gc.ca/eic/site/ad-ad.nsf/eng/ad03962.html.

[102] Public Works and Government Services Canada. "Canada First: Leveraging Defence Procurement Through Key Industrial Capabilities." *Report of the Special Adviser to the Minister of Public*.

capability, industry and economy, are not on their own currently sufficient to enable Canada to domestically develop and produce state of the art fighter aircraft.

Although domestic production might theoretically be a nation's preferred method of weapon system procurement, as systems become more advanced, fewer countries are able to embark on such programs on their own. Costs of domestic production can be shared if the country is able to sell copies of the weapon system to other nations. On the other hand, this is not always possible or even desirable. For example, while the US decided not to export its F-22 Raptor for security reasons, this decision also meant it had to bear the development cost entirely on its own.[103] Hence domestic production of state of the art fighter aircraft is still desirable and possible only for an ever-shortening list of nations with the required resources. However, as will be seen in the next sections, it is not always the most practical or politically acceptable choice. Particularly for smaller nations, some form of collaboration is a virtual certainty as well as a necessity.

FOREIGN PURCHASE

Another of the procurement alternatives available to governments is to purchase from abroad, often as military-off-the-shelf. Certainly, at least from a political perspective, import from abroad is the least desired option.[104] Whereas domestic production rewards the purchasing nation with maximum control and autonomy over system development (and the prestige that goes with it), with foreign purchase a nation

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Works and Government Services. (Feb 2013), 18, 20, http://www.tpsgc-pwgsc.gc.ca/app-acq/stamgp-lamsmp/eam-lmp-eng.html.

[103] Reuters, "Senate Panel Seeks to End F-22 Export Ban," Last accessed 21 April 2013, http://www.reuters.com/article/2009/09/10/us-arms-usa-congress-idUSTRE5896JU20090910.

[104] Kapstein, Second Best, 660.

can only procure what is available on the market. However, as the reality is that only very few countries currently have domestic fighter aircraft development programs, the remaining countries are forced to look beyond their borders to satisfy their fighter aircraft requirements.[105]

Despite (or perhaps because of) a globalized economy, acquisition programs can have more stakeholders than might initially be intuitively obvious. Governments often enter into contracts to purchase weapon systems directly from foreign companies. However, international trade in high technology weapon systems such as fighter aircraft typically entails involvement of the vendor company's host nation government. This is due to a number of reasons, but mainly because of concerns over technology proliferation as well as the inevitable economic implications that such large purchases have for both the selling and purchasing nations.

For example, in the US, the government oversees all agreements related to proliferation of weapons technologies. As previously noted, the US controls weapons exports under the ITARs. In particular, in addition to the more complex collaborative arrangements that will be discussed in the next section, the US exports arms either as direct foreign sales or Foreign Military Sales (FMS). FMS applies to purchases of systems (or subsystems) from US manufacturers that are in use by the US military.[106] Differing from direct foreign sales, FMS agreements are effected with the US government acting as an agent for the purchasing nation and dealing directly with the

[105] As mentioned in the previous section, even MOTS purchase from abroad often includes some sort of reciprocal agreement or offsets due to the large sums involved. Thus most foreign imports of advanced weapon systems involve cooperation or collaboration at some level.

[106] Lorell, et al., Going Global, 99.

vendor company.[107] By their nature, FMS sales are more cumbersome than direct foreign sales due to the need for US government involvement. However, in addition to helping the US government control proliferation and technology transfer, FMS sales contribute to rationalization, standardization and interoperability (RSI) of equipment purchased by foreign nations with that in use by US armed services.[108] Furthermore, the FMS program can also facilitate exports of US equipment through the provision of financial assistance in the form of loans to purchasing countries.[109]

There are a number of other factors that influence the appeal and benefits of foreign purchase arrangements. The actual geographic proximity of the vendor nation affects the ease with which deliveries of the equipment are taken, as well as the potential reliability of supply. In addition to geographic location, general political alignment between purchasing and vendor governments will significantly impact both the initial agreement as well as potential follow-on arrangements for support or eventual upgrades.

MOTS purchases have both advantages and disadvantages. As purchase of MOTS systems generally implies that the system is already in use, this may have positive implications for interoperability and should reduce overall program risk. The downside however, as Boyd observes, is that buying MOTS implies buying already dated technology, or in other words obsolescence.[110] MOTS imports may not necessarily provide "state of the art".

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[107] *Ibid.*, 27.

[108] Kapstein, Second Best, 661.

[109] Kapstein, Fortress 147.

[110] Frank L Boyd, Jr. "The Politics of Canadian Defence Procurement: The New Fighter Aircraft Decision," *Canada's Defence Industrial Base.(Kingston (Ont.), Ronald P. Frye*, 1988), 142.

Obsolescence and political implications notwithstanding, purchasing MOTS from abroad can be the least expensive option.[111] However, as the purchasing nation does not control the development of the weapon system, the actual suitability of the purchased system may not be exactly as desired. For example, a given fighter aircraft may come at an acceptable price but may lack certain desired capabilities that need to be added later (at increased expense) or else risk compromising operational effectiveness. It may also come with unneeded capabilities that are already built into the package, needlessly increasing costs.[112]

Finally, purchase from abroad implies that the defence industrial base of the vendor nation is being exercised and not that of the purchasing nation. Thus even with offset agreements in place, the potential political ramifications of foreign weapons imports can be severe.

It is valuable at this point to examine more closely the significant role that the US arms industry plays in the global context. According to the Stockholm International Peace Research Institute, in 2010 the US was the world's biggest arms exporter with 30% of the global share.[113] In that same year the US also had seven of the ten largest arms producing companies in the world, and 44 of top 100.[114] In particular in the aerospace industry, seven of the top ten performing aerospace and defence companies of 2012 were

[111] Kapstein, Second Best, 660.

[112] Boyd, New Fighter Aircraft, 14.2.

[113] SIPRI Yearbook 2012, 13.

[114] *Ibid*., 11.

from the US.[115] Thus while perhaps stating the obvious, Canada's close proximity, trade relationship, industrial base integration and status as a close ally with the US means that Canada stands to benefit from procurement cooperation with the US, arguably across the continuum of cooperation and collaboration.

An excellent example of a foreign purchase program is Canada's current fighter, the CF-18, which was purchased from the US. Under the New Fighter Aircraft (NFA) Program established in 1977, the CF-18 was selected from a list of five finalist candidate companies including the European consortium Panavia, and the American companies Northrop, Grumman, General Dynamics and McDonnell Douglas.[116] Selection criteria included evaluation of military capability, price, program risk and industrial benefit proposals from each of the entries. The selection process, however, was not without its difficulties.[117] The inclusion of offsets in this acquisition program means that it can be described as a form of cooperative agreement, at one end of the continuum of collaboration. In the end, the competition was reduced to a short list of the McDonnell Douglas F-18 and the General Dynamics F-16. Boyd notes that the twin-engine F-18 was preferred to the single-engine F-16 from the perspectives of military effectiveness, attrition considerations and economic advantage. However despite these advantages, the final decision was complicated by the political factors associated with proposed industrial benefit packages (offsets) that had regional implications.[118]

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[115] Price Waterhouse Coopers, "Aviation Week Top Performing Companies," Last accessed 12 April 2013, http://www.pwc.com/us/en/industrial-products/aerospace-defense/aviation-week-top-performing-companies.jhtml.

[116] Boyd New Fighter Aircraft, 146.

[117] Ibid., 147.

[118] Ibid., 148.

These political complications were compounded because the requirements pertaining to offsets had not been clearly delineated in the Request for Proposals (RFP).[119] This had implications for the companies in their formulation of proposed offset arrangements. In addition to the CF, other stakeholders such as the Department of Industry, Trade and Commerce (DITC) held political influence over the NFA purchase decision. According to Boyd, Canada had "no strategic economic vision to guide DITC" in the contractual negotiation of offsets, and DITC had "no mandate to use the NFA procurement as an instrument in the pursuit of an industrial strategy" for Canada.[120] Ultimately, after much public controversy and political clamor, the offset arrangements of the two finalists were resolved in time so that the decision could be made based upon military merit rather than political constituency fighting over offsets, which was almost the case.

In the end, according to Markowski and Hall, the imposition of local industry participation in the Canadian F-18 acquisition added approximately 11% to the program cost.[121] However, with a real requirement for a fighter aircraft and the unsavory reality of having to spend billions of dollars abroad, the inclusion of offsets contributed to settling the matter politically. With no domestic fighter development program of its own, a relatively wide selection of potential western fighters from which to choose, and no viable proposals for international collaboration in the development of a new fighter, Canada had little choice but to purchase from abroad. In any event, the additional

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[119] Ibid., 145.

[120] Ibid.

[121] Stefan Markowski and Peter Hall, "Defence Procurement and Industry Development: Some Lessons from Australia," In *Claxton Papers, Studies in Defence Procurement*, Ed. Ugurhan G. Berkok, (School of Policy Studies, Queen's University, Kingston 2006), 69.

expense incurred from offsets must be weighed against the wider political imperatives associated with such large expenditures and the resulting implications for domestic industry.

Lack of clear policy and strategy pertaining to the relationship between military acquisition and offsets, as well as those other political concerns just discussed, cannot be expected to yield the best results for any of the stakeholders. Indeed, as noted by the US Defense Science Board (DSB), difficulties arise when details are not specific enough at outset of program development and contracting.[122] To achieve maximum benefits militarily, economically and politically, adequate coordination is required between government stakeholder departments to formulate a coherent policy and strategy.

Whether direct foreign sales or FMS, MOTS acquisitions are actually simpler for both vendor and purchaser than are the more complex collaborative arrangements to be discussed in the next section. From the perspective of the US as an exporter, FMS is generally preferable to the more complex forms of collaboration.[123] In addition to the economic benefits, FMS enables the US to export advanced weapon systems to allied partners, enjoying the economic benefits and contributing to alliance interoperability while maintaining control over technology proliferation. However, from the perspective of a smaller nation such as Canada, foreign purchase may not always be the best choice. Without a viable domestic fighter aircraft development capability, the reality is that the decision will need to be made on a case-by-case basis when the time arrives to make such an expensive acquisition. Should a suitable and affordable option not be available when

[122] DSB, TF International Armaments, D2.

[123] Kapstein, Fortress 147.

required, a more complex form of international collaboration could be required. This will be discussed in the next section.

FURTHER ALONG THE CONTINUUM OF COLLABORATION

As previously explained, in the range of defence procurement options available to governments, between domestic development and production and purchase from abroad, lies the continuum of international collaboration. In the preceding sections it was demonstrated that few countries today possess domestic fighter aircraft development programs. It was also shown that at the opposite end of the spectrum, purchase from abroad can be an economical option, but it comes with some distinct drawbacks and risks. Thus, for most countries that wish to have any amount of influence over fighter aircraft development and desire state of the art technology but are unable to go it alone, the solution lies in international collaboration.

Modern international weapon system collaboration began in Europe during the 1950s, when the major NATO countries (France, Germany and the UK) could no longer individually afford domestic high technology weapons programs.[124] In the years since, these programs have continued, mainly as ad hoc efforts between governments, demonstrating "both the political will and the technological capability to develop high-tech weapons systems jointly", although with a mixed record of success.[125] Trends show

[124] Lorell, Mark and Lowell, Julia. "Pros and Cons of International Weapons Procurement Collaboration," (RAND Corp. 1995), 10, http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA299337.

[125] Burkard Schmitt, *Chaillot Papers no.59: European Armaments Cooperation Core Documents*, (Paris: Institute for Security Studies, 2003), 7.

that today, collaboration among EU and non-EU nations alike is increasing.[126] In the US since the end of the Cold War, the Pentagon has supported increased US collaboration efforts in order to bolster the health of the US defence industry.[127]

There are a number of reasons for this increasing international collaboration. With national defence as the "ultimate attribute of state sovereignty", nations are politically motivated to retain at least some indigenous defence industrial capability, if possible and affordable. [128] For many countries, collaboration can be the means by which they are able to realize those political and military advantages resulting from retaining at least a portion of their defence industrial base. Furthermore, countries use international collaboration to acquire capital and technology from abroad.[129] Thus Kapstein acknowledges that while perhaps not as attractive as domestic production, collaboration can aptly be described as the "second best" solution for most countries in regard to high technology weapon acquisitions.[130]

International collaboration has grown exponentially in the commercial sector, even though the record for government-led collaborative arrangements has been less than stellar.[131] The US DSB has closely examined the trends in International Commercial Alliances (ICAs) in order to apply their lessons to the defence industrial sector. It has

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[126] Lorell, et al., Going Global, xxii.

[127] Kapstein, Fortress Europe, 153.

[128] Pieter-Jan Parrein, "Some Ideas for European Defence Cooperation from the Case Study of the Belgian-Dutch Navy Cooperation," (*Royal High Institute for Defence, Centre for Security and Defence Studies*, Focus Paper 25 Dec 2010), 11, http://web.rma.ac.be/rhid2/website/media/Files/Focus%20Paper/FP25.pdf.

[129] Kapstein, Second Best, 657.

[130] Ibid.

[131] DSB, TF International Armaments, C1.

identified a number of factors that are applicable to international defence collaboration. This list includes: increased global market access, economies of scale, increasing R&D costs, reduced production life cycles, dual-use (military – civilian) of advanced technologies, technology sharing, reduction of costs, political influence and cooperation, standardization and sharing of risk.[132] The relative pros and cons of collaboration differ based upon the perspective of the participant nation; that is, the US will have a very different perspective on some of the factors than would an EU member of NATO or a small nation like Canada. Nevertheless, the factors are generally applicable to all potential participating nations, and successes in the commercial sector should highlight potential areas where advantage can be realized in defence acquisition. From the perspective of potential participant nations, it can be extremely difficult for governments to resolve the many often conflicting and competing interests of the various stakeholders in a major defence acquisition. Procurement through international collaborative arrangements can offer governments the flexibility to address and prioritize the many rival interests, to ultimately find the most politically acceptable solution. Seen through this lens, it can be argued that by enabling states to maintain domestic defence industrial capabilities, collaboration is essentially a form of protectionism.[133] Furthermore, confronted with the massive defence industrial capability of the US, EU nations have strong incentives to collaborate as a means of balancing the market rather than become

[132] Ibid.

[133] Kapstein, Second Best, 658.

beholden to US manufacturers.[134] At any rate, however, for most countries collaboration can be an easier sell domestically than either of the alternatives.

Despite the potential benefits promised by collaboration, such programs have historically proven difficult to execute.[135] There are a number of opponents, such as Kinkaid, who contend that at least as far as NATO is concerned, the success of government-led procurement collaboration programs has been negligible.[136] Lord Garden contends that longer production times and delays common to collaborative efforts, when coupled with defence inflation, end up hurting large procurement programs by increasing pressure on partners to scale back or alter their requirements.[137] However, despite these observations, proponents maintain that collaboration holds the promise of increased efficiency and economic advantage. For example, while the DSB concedes that despite examples of program inefficiency in the past, these are likely the result of failures to adequately structure programs to achieve success. [138] These past "execution errors" do not diminish the potential increased savings theoretically possible from collaboration. Some potential ways of improving the likelihood of success in collaborative programs will be discussed later in this section.

Once the decision has been made to proceed with a collaborative program, however, the real work begins. Opponents of collaboration such as Kinkaid as well as

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[134] Bastian Giegerich, "Budget Crunch: Implications for European Defence," Survival, vol.52 no. 4, (Aug – Sep 2010): 93, http://ehis.ebscohost.com/ehost/detail?vid=3&sid=4318e53d-d0ed-43d7-88b9-cb58301fea33%40sessionmgr110&hid=106&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=a9h&AN=52444974.

[135] Kapstein, Fortress, 152.

[136] Kincaid, Collaboration, 12.

[137] Lord Garden, "We Need Capability Integration – Not Equipment Collaboration," *RUSI Defence Systems*, (Summer 2004), 14. http://www.rusi.org/downloads/assets/contentionjuly.pdf.

[138] DSB, TF International Armaments, 4.

proponents including Heuninckx agree that one of the factors impeding collaborative agreements is the difficulty in harmonizing capability requirements among partner nations.[139] This is due to "delays in setting up the program arrangement, harmonizing the differing requirements and delivery schedules of the participating States, slow and inefficient decision-making", as well as "accommodating differing national procurement procedures, and agreeing work allocation among the industry of the participating States".[140] Thus it is crucial that in order for a collaborative program to meet its objectives, a significant effort will be required by all partners at the earliest stages of the program to achieve consensus, to correctly and transparently identify program priorities and objectives, and to bargain in good faith.

Collaboration has other implications for participating governments. It creates increased political pressure from partners to follow through with the program, which can serve to increase the likelihood that the effort will be seen through to completion.[141] Also, as Cox points out, once large sums of money have been spent on a program it can become difficult domestically for politicians to recommend program cancellation.[142] On the other hand, depending on the nature of the collaboration, program risk can increase for other partner nations should one partner not live up to its commitments, or decide to withdraw from the program prematurely after all. For example, prior to purchasing the CF-18,

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[139] Kincaid, Collaboration, 12.

[140] Baudouin Heuninckx, "A Primer to Collaborative Defence Procurement in Europe: Troubles, Achievements and Prospects," Public Procurement Law Review, Vol 17, Issue 3 (2008): 3032, http://www.unpcdc.org/media/4929/eu%20collaborative%20defense%20procurement.pdf.

[141] Heuninckx, Primer, 3.

[142] Antonia Cox, "More Bang for the Buck: How we can get better value from the defence budget," *Centre for Policy Studies*, (Jan 2009), 25, http://www.cps.org.uk/files/reports/original/111104155223-morebangforthebuck2.pdf.

Canada was initially part of a NATO program to develop a new multi-role combat aircraft (MRCA).[143] Canada withdrew after allies proposed an initial monetary investment for feasibility studies and prototype development. However, despite Canada's withdrawal, the MRCA program continued on to form a European consortium that eventually developed and built the Panavia Tornado. This highlights the requirement for trust among partners, as well as adequate care and effort in the formulation of the agreement at its earliest stages. Canada's withdrawal early in the program prior to committing financially would have minimized any adverse effects for the other members of the program.

Another of the intended benefits of collaboration is interoperability. As Cox observes, disproportionate operational and technological advances by the US have exacerbated the problems experienced by allied nations in trying to remain interoperable, by continuing to set new standards for equipment.[144] Procurement collaboration aims to address this through development and/or production of common platforms and equipment.[145]

According to Kapstein, interoperability can actually mean four different things:

> …complementarity (country X provides the navy for an operation, country Y the air force); commonality (X and Y operate identical platforms); interchangeability (X can substitute its F-16s for Y's Rafales); and compatibility (X's air-based radars can communicate with Y's ground-based radars).[146]

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[143] Boyd, New Fighter Aircraft, 140.

[144] Cox, More Bang, 8.

[145] Giegerich, Budget Crunch 89.

[146] Kapstein, Fortress Europe, 144.

As a requirement for interoperability, however, Kapstein notes that commonality has been overstated, since allies still have other different command, control, communications and intelligence (C3I) and weapon systems outside of the common platforms.[147] Birkler, Lorell and Rich expand upon this by pointing out that collaboration also does not guarantee standardization or interoperability if individual partners choose national variants during weapon system development and production.[148]

Nevertheless, despite these observations, collaboration through procurement of common systems will still serve to enhance interoperability as long as the partner nations clearly define it as one of the program objectives. Though one collaborative program cannot solve all problems with interoperability, it certainly can contribute to the solution.

Another factor to be examined affecting collaboration pertains to security implications related to technology transfer. While important to all allied nations, from the point of view of the US the issue of safeguarding of shared technology is even more crucial.[149] As the lead nation in the majority of the collaborations in which it is involved and as the world's leading arms exporter, the US has the most to lose in terms of both competitive advantage from an economic standpoint and in maintaining the technology gap in terms of military advantage. Thus, it stands to reason that US policies regarding technology transfer will be an overriding consideration for all collaborations in which it is a partner, while those same policies have significant impact on the ability of all other partner nations to access state of the art technologies that originate in the US.

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[147] Kapstein, Fortress Europe, 144.

[148] Birkler, Lorell and Rich, Strategies, 1.

[149] Kapstein, Fortress, 153.

One more factor of note pertaining to collaboration is in regard to desired foreign policy objectives of partner nations. While it was stated earlier that collaboration can enhance political influence and cooperation among partners, once again there will be differences in priority between prospective partners. For those nations not possessing domestic fighter development programs, the economic issues of program and unit cost, political issues related to weapon system and technology access, as well as interoperability will be of primary concern. However, for the US, while controlling costs and technology access are factors, interoperability and political cohesion may in fact be just as important. Indeed, as the US already benefits from relatively large economies of scale in its own domestic market and it is generally acknowledged as the world's technology leader, it could be argued that it has more to lose than to gain.[150] Historically, the US has generally favored FMS (even with offsets) or co-production arrangements to full developmental collaboration.[151] However, in its Task Force Report on International Armaments Cooperation, the DSB noted that collaboration should be viewed, "first and foremost, as an important means of attaining US geopolitical and military objectives."[152] It goes on to state that potential economic and industrial benefits are essentially secondary. This point will be revisited later in the discussion of the JSF program.

The DSB drew a number of lessons that pertain to the US DOD's interests, but that also apply in general to all nations endeavoring to partner in collaborative arrangements. Primary among these was that large-scale programs at the margin of

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[150] United States, Department of Defense, Report of the Defense Science Board Task Force on Joint Advanced Strike Technology (JAST) Program, 19950309 051 (Sep 1994), 48, http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA292094.

[151] *Ibid*.

[152] DSB, TF International Armaments, i.

meeting required return on investments are less likely to succeed than are smaller-scale programs.[153] Smaller programs are more easily implemented, and can serve to build working relationships among partners enabling subsequent larger scale programs in the future. Next, programs need to be carefully defined and structured at the outset. "Lack of specificity with regard to crucial details before the program was started" contributed to a pattern of previous failures.[154] Sufficient detail regarding objectives and industrial issues is crucial to enable achievement of consensus among partners. Furthermore, the DSB observed that increasing the number of program participants will correspondingly increase program risk and complexity, particularly due to difficulties in harmonizing requirements and achieving consensus.[155] Bilateral programs have a relatively higher chance of success, and can be expanded upon to include more partners as the program matures. These lessons apply to all collaborative programs in general, and can serve as guidelines to aid countries in achieving the maximum potential benefits of the various forms of collaboration.

Having examined some of the broader issues surrounding collaboration in general, the discussion will now turn to a more detailed look at two major points along the continuum of collaboration: co-production and collaborative development.

CO-PRODUCTION AGREEMENTS

More complex than foreign purchase with offsets or other reciprocal arrangements, co-production is still much less involved and carries less risk than full

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[153] *Ibid*., D2.
[154] *Ibid.*

[155] *Ibid.*

collaborative development. Also, it offers different benefits to both the selling and purchasing partners.

In the US, co-production is generally referred to as licensed or FMS.[156] Licensed co-production typically does not involve systems or components in use by US forces, whereas FMS does and is as detailed previously in this chapter. In general, co-production is a means by which a purchasing nation can produce either components or complete aircraft domestically, enabling the purchasing nation to benefit from supporting its own defence industrial base as a form of offset. Also in setting up domestic production lines for the program, the purchasing nation has the potential to gain from whatever technology transfer is required in order to establish the necessary production capability. Although typically not as economical as foreign purchase, co-production can be more desirable to purchasing nations because of the industrial benefits and associated political advantages. These advantages can be difficult to assess, however, as comparison of procurement costs with economic and political gains due to industrial benefits becomes very controversial and complex.

More and more, vendor company business objectives tend to account for the economic and industrial objectives of prospective customers in considering arrangements for offsets or co-production.[157] This is because there are additional advantages for the vendor as well. In the case of the US, co-production agreements enable the vendor to access foreign markets while the US government maintains control over technology transfers. In general, the decision to export production is "driven by economic

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[156] Lorell, et al., Going Global, 27.

[157] Robert H. Trice, "International Cooperation in Military Aircraft Programs," *The DISAM Journal*, (Winter 1989/90): 73, http://www.disam.dsca.mil/pubs/INDEXES/Vol%2012-2/Trice.pdf.

considerations", as increased sales mean longer production runs, enabling benefits of economies of scale as more units are produced.[158]

Also from the US perspective, co-production has advantages over full collaboration. While co-production eventually leads to more technology transfer out of the US than would direct sales, it is still relatively limited as most R&D is typically "completed before the coproduction arrangement is agreed"[159] Licensed and FMS co-production arrangements are far simpler to set up and manage than collaborative development, and do not compromise US technological advantage to the same degree.[160]

As one of the primary reasons behind increasing production lines through co-production agreements, the potential advantages to be realized from economies of scale are significant. For example, Heuninckx observed that an increase in the production run of 1% results in a total cost increase of only 0.86%.[161] Taken further, he states that "if two States procure collaboratively the same quantity of military equipment, the production cost per unit would fall by 9%".[162] Realization of those savings, however, is not a given. In cases where more than one country partners with a vendor nation, the political complications related to share of industrial benefits becomes a factor.

As Hartley explains, the principle of juste retour describes a nation's entitlement to offsets in the form of work share in direct proportion to that nation's share of the total

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[158] Kapstein, Fortress Europe, 141.

[159] Heuninckx, Prospects, 5.

[160] Birkler, Lorell and Rich, Strategies, 3.

[161] Heuninckx Prospects, 20.

[162] *Ibid*.

order.[163] This works to limit potential gains from economies of scale where two or more nations enter into a co-production agreement but insist upon work share arrangements based upon juste retour rather than purely economic considerations. Maintaining domestic production lines and other duplication of effort conspire to reduce potential cost savings, and are one of the political obstacles in international collaboration.[164] Unfortunately, for this reason co-production among multiple partners typically ends up costing more than MOTS.[165]

Probably the best known example of co-production is the 1975 "deal of the century" between the US company General Dynamics (GD) and the governments of Holland, Belgium, Denmark and Norway to co-produce the F-16.[166] Cited as a success by both the DSB and GD, this program combined a USAF order for 650 aircraft with the European Participating Governments' (EPG) order for another 348 units.[167] Benefits to the EPG countries included "enhanced national security and NATO interoperability", as well as "a return of approximately $7 billion (then-year dollars) to their respective economies since the program began."[168] Moreover, the co-production arrangement "has

[163] Keith Hartley, "Offsets and the Joint Strike Fighter in the UK and the Netherlands" in *Arms Trade and Economic Development*. Ed. Jurgen Brauer and J. Paul Dunne, (Milton Park: Routledge, 2004), 134

[164] Heuninckx, Prospects, 21.

[165] *Ibid*.

[166] Kapstein, Second Best, 665.

[167] Trice, International Cooperation, 71.

[168] *Ibid*., 70.

permitted the EPG countries to purchase additional F-16s and retain production lines, employment, and R&D capabilities."[169]

According to Lorell and Lowell, the collaboration increased the USAF unit cost for the F-16 by approximately 5%. This was because the economies of scale did not completely offset the increased program costs incurred by the USAF for managing the collaborative program.[170] They do add, however, that these extra costs were probably offset by R&D recoupment charges paid to the US Government.[171] Furthermore, the larger production run of 998 aircraft enabled GD to accept associated program risks to "meet quality, cost, and delivery schedule requirements".[172] Also, according to Trice, "foreign companies bidding for subcontracts must be fully cost-competitive" with other GD suppliers.[173] If they are not, the purchasing nation may elect to pay "coproduction premiums" to its domestic supplier, who is only paid competitive prices by GD.[174] Thus, while not necessarily the least expensive means of acquiring the F-16, the associated political and economic benefits arguably justified the program.

Other examples of co-production and licensed production programs deemed successful by the DSB include the F-4, F-5, and F-15.[175] Additionally, West Germany

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[169] *Ibid*., 71.

[170] Lorell, Mark and Lowell, Julia. "Pros and Cons of International Weapons Procurement Collaboration." (RAND Corp. 1995), 20, http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA299337.

[171] *Ibid*.

[172] Trice, International Cooperation, 71.

[173] *Ibid*., 72.

[174] *Ibid*.

[175] DSB TF International Armaments, D1.

and Canada both had licensed co-production arrangements with the US to produce the F-104 Starfighter during the 1960s.[176] In the West German example, the deal enabled the country to achieve "the capacity to manufacture (but not to develop) high performance aircraft at the same level as the French and British industries".[177]

Probably the best example of licensed co-production in Canada was for the North American F-86 in the 1950s.[178] Produced under license by Canadair for both domestic use as well as export to the US and other NATO countries, more than 1000 units were completed for NATO allies by early 1954.[179] Notably, the Canadian F-86 program was at its zenith during the same period as the domestic CF-100 program, making the 1950s the greatest period of domestic fighter production in Canada's history.

Having now progressed in this discussion from domestic production with offsets through the increasingly complicated arrangements of co-production, the next section will now turn to arguably the most complex end of the continuum of collaboration, that is, collaborative development.

COLLABORATIVE DEVELOPMENT

International collaborative development enables countries to engage in the design and production of state of the art weapon systems when they otherwise might not have the resources or capability to do so themselves. It is the most complex type of arrangement to implement and manage on the continuum of collaboration, arguably even

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[176] Lorell and Lowell, Pros and Cons, 4.

[177] Kapstein, Ethan. "Introduction: Explaining Arms Collaboration," in *Global Arms Production: Policy Dilemmas for the 1990s*. Ed. Ethan Kapstein, (Lanham: University Press of America, 1992), 7.

[178] Wakelam, Cold War Fighters, 67.

[179] *Ibid*., 141.

more complex than purely domestic production. This is due to the requirement to negotiate with partner nations all of the contentious issues such as harmonization of requirements, delivery schedules, work share, technology sharing and access agreements, and more. As previously described, the potential benefits of collaborative development are economic, operational and political.[180]

Collaborative development arrangements imply a commitment among partners not only to develop, but also to proceed with production and procurement.[181] Collaborative development arrangements are typically rather intricate and require significant effort to put in place. Many experts agree that complexity, time required to achieve consensus and program risk all increase with increasing numbers of partners.[182] However, as net potential gains of lower unit costs resulting from longer production runs increase the pressure to have more partners, it is imperative that program objectives are clearly defined and partners chosen carefully in order to maximize probability of program success.[183]

As stated above, the success of a collaborative program typically depends upon achieving unit cost targets in order to assure program affordability. Therefore, in order to secure adequate production runs, Trice recommends that partners commit to at least a minimum purchase sufficient to ensure that the program achieves "critical mass".[184] As

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[180] Lorell and Lowell, Pros and Cons, 7.

[181] Kapstein, Second Best, 660.

[182] DSB TF International Armaments, D1. Also see Heuninckx, Efficient Defense Procurement, 3027.

[183] Heuninckx Prospects, 6.

[184] Trice, International Cooperation, 75.

R&D and subsequent production timelines can be longer than the term lengths of politicians in prospective partner nations, the relative political stability of partner governments becomes important.[185] Also along these lines, it is preferable that the program receive balanced domestic prioritization among the various partner nations in order to ensure long term program funding and reduce program risk for the other partners.[186] Again, trust and transparency is required among partners to enable program success.

The primary concerns associated with collaborative development programs are cost overruns, schedule delays, overall program risk and security. In the following section these concerns will be examined more closely. From this examination it will be seen that despite the dubious success record of many international collaborative development programs, this procurement option nevertheless may be the only realistic way for Canada to procure the most advanced fighter aircraft.

DEVELOPMENT COSTS

Building upon the subject of rising defence costs as addressed in the previous chapter, this section will consider those costs that are of particular concern to collaborative development programs.

R&D costs are generally applicable to all weapon systems incorporating new or advanced technologies, but have been increasing in relative terms over time. According to Gansler, weapon system R&D costs grew from approximately five percent in the

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[185] Alistair Edgar, "The Politics of Defence Co-Production: The MRCA – Tornado," (master's thesis, University of British Columbia, Oct 1985), 16, https://circle.ubc.ca/handle/2429/25384?show=full.

[186] Trice, International Cooperation, 75.

1950s to more than 50 percent by the 1970s.[187] By comparison, R&D costs in the commercial sector average in the two to 10 percent range.[188] As NATO's R&D costs continued to mount during the Cold War, sharing the financial risks through collaborative development was seen as a possible solution.[189]

Nevertheless, not all experts agree regarding the amount of savings possible through development collaboration. According to Lorell and Lowell, there is little empirical evidence available detailing the actual cost savings realized from collaboration as compared to domestic production.[190] However more recently, Heuninckx observed that although overall R&D costs for a collaborative program may be higher than for a comparative domestic program, the share borne by each partner is typically only about 75% of what they would pay for a domestic program.[191]

Regarding overall costs of collaborative development programs, Lorell and Lowell also noted that "failure to save costs appears to occur primarily because few collaborative programs achieve a rational division of work, economic specialization, or the elimination of R&D redundancy".[192] This is consistent with Heuninckx's conclusion that inefficiencies in the early stages of program arrangement and particular individual national desires during program negotiation work to counter the potential cost savings of

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[187] Jacques Gansler, *Affording Defense* (Cambridge, MA: MIT Press, 1989), 215.

[188] Ibid.

[189] Kapstein Second Best, 668.

[190] Lorell and Lowell, Pros and Cons, 14.

[191] Heuninckx, Prospects, 20.

[192] Lorell and Lowell, Pros and Cons, 14.

collaborative development.[193] Still, past failures to achieve success do not detract from the potential for future successes; the lessons do, however, need to be appreciated.

Other factors leading to cost inefficiencies during program negotiation result from work share arrangements and harmonization of requirements. Heuninckx reports that dogged adherence to the principle of juste retour over economic priorities has in some examples been calculated to double a collaborative program's initial forecast cost.[194] Also, partner nations often experience difficulties in harmonizing system requirements such that the resulting system becomes more complex in order to meet the needs of all partners, affecting costs and timelines.

It is very difficult to weigh the political costs of collaborative development against the financial costs. Not all ventures will succeed, yet once a nation has committed to a collaboration program and money has been spent, the political costs could be too great to enable backing out.[195] As Kinkaid and others have suggested, one way to improve financial performance would be to allow industry to take the lead on collaborative programs in order to maximize efficiencies and minimize cost overruns.[196] While this could potentially lead to financial savings, the associated political costs would also need to be addressed. Secondly, the financial cost associated with a collaborative program could be secondary to that nation's wider foreign policy objectives, depending on the partner.[197] Again, this points to the importance of clearly establishing program

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[193] Heuninckx, Efficient Defense Procurement, 3042.

[194] Heuninckx, Prospects, 18.

[195] Kapstein, Fortress Europe, 146.

[196] Kincaid, We Can't Do Collaborative Projects!, 12.

[197] Birkler, Lorell and Rich, Strategies, 1.

objectives and priorities. Furthermore, assessment of the relative success of a given program must be in light of those declared objectives.

Finally, costs are directly affected by schedule delays. Garden observed that particularly with defence inflation, delays in program implementation inevitably have financial consequences as defence fixed budgets lose purchasing power each year. Of note, however, cost increases due to schedule delays are a problem for domestic programs as well as international collaborative development. Similarly, adequate care and attention to detail at the earliest stages of program design and implementation will increase chances of success, international or otherwise. At any rate, these facts do not diminish the reality that international collaboration is still the only realistic way that Canada can participate in advanced fighter development. With that in mind, the next factor to be considered is that of schedule delays.

SCHEDULE AND COMPLEXITY

Program timelines are correlated to program complexity. Program complexity is a matter of both the technical aspects and those related to the collaborative program arrangement itself.[198] Kapstein notes that collaboration "inevitably resulted in a suboptimal division of labour, a more complicated set of programme requirements and a more complex management structure".[199] These issues would tend to introduce complications sufficient to reduce the program's likelihood of success.[200]

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[198] Heuninckx, Prospects, 15.

[199] Kapstein, Fortress Europe, 141.

[200] *Ibid*.

However, Heuninckx points out that in general, delays experienced after program launch are more likely due to technical complexity than the collaboration itself.[201] Greater numbers of partners result in increased program complexity, and thus inflated risk and potential for delays.[202] Procedural differences and the various political pressures to which partner national bureaucracies are subject all serve to complicate achieving consensus.[203] Garden observed that collaborative programs can only "move at the speed of the slowest partner".[204] The DSB noted that "complexity and cost rise exponentially with the number of partners involved in the design of a program."[205] Thus, it recommends that programs are more easily implemented with fewer participant nations; bilateral is best, with additional partners added around that initial core over time.[206] Therefore, improvements made to the process of establishing the agreements at the earliest stages of the program, including careful selection of partners, would likely do more to reduce schedule delays than would focusing on streamlining programme management itself.[207]

As with cost, schedule delays are also caused by the resulting extra complexity when partners fail to harmonize requirements.[208] Detractors of collaborative development note that efforts to satisfy too many partners or fill too many requirements with one

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[201] Heuninckx, Prospects, 15.

[202] Trice, International Cooperation, 75.

[203] Kincaid, We Can't Do Collaborative Projects!, 12.

[204] Lord Garden, We Need Capability Integration, 14.

[205]DSB TF International Armaments, D1.

[206] *Ibid*., D2.

[207] Heuninckx ,Prospects, 32.

[208] Giegerich, Budget Crunch, 95.

platform can slow down the process. This in turn drives up costs, and may reduce the effectiveness of the weapon system in any or all of the multiple missions for which it is designed.[209] Once again, the problem is apparently created at the earliest stages of the program. Weapon system design will always be a compromise, and should be expected. Should partners fail to come to an agreement, however, the resulting choice will be between one relatively expensive platform that can perform several duties acceptably, or multiple platforms that are less expensive but also offer less flexibility. In this situation, where different national variants are produced because one platform does not meet the requirements of all partners, program cost, complexity and timelines are all increased.[210] This scenario also has implications for subsequent upgrades or improvements to follow, when national variants might no longer be compatible. Thus, the DSB recommends that establishing "cost as an independent variable (affordability), meeting coalition military capability needs, and assuring interoperability" as program objectives should compel partner nations to stay within budgets and on time.[211] Again, this emphasizes the importance of carefully aligning requirements at the program's outset.

Another argument against collaborative development is that it "necessarily involves 'incomplete contracts' that are constantly being re-negotiated" thus extending costs, timelines and overall program risk.[212] Indeed, if partners make changes that result in increased requirements or specifications in mid-program, then delays will most certainly be incurred. For example, partners in the Eurofighter Typhoon program have

[209] Kapstein, Fortress Europe, 140.

[210] Heuninckx, Prospects, 13.

[211] DSB TF International Armaments, 4.

[212] Kapstein, Fortress Europe, 153.

frequently made changes to orders, with subsequent effects on program costs.[213] Indeed, critics assert that cost overruns and schedule delays with the Typhoon program were a "waste of public money on an appalling scale".[214] According to Keohane, these contributed to first deliveries of Typhoon being ten years late and over budget.[215]

However, this phenomenon is not peculiar to international collaborative arrangements. With any program, domestic or international, changes to specifications in mid-stream will affect timelines. This is supported by Heuninckx's contention that delays for collaboration are only marginally longer than for domestic programs.[216]

Having examined more closely the cost, complexity and schedule slippage concerns of collaborative development, the discussion will now turn to overall expectation for success of these programs.

PROBABILITY OF SUCCESS

In order to measure success, a clear understanding of the criteria against which success is measured must first be established. That is, the objectives and priorities of a program must be clearly defined at the outset in order to determine whether the program is meeting timeline milestones, cost targets, or any other performance objectives defined at the outset. It has been established that collaborative development comes with distinct risks. These risks regarding achievement of program objectives are complicated by the fact that multiple international partners will potentially have nuanced differences in

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[213] *Ibid*., 152.

[214] Cox, More Bang, 6.

[215] Daniel Keohane, "Why Collaborate in Europe?" *RUSI Defence Systems*, (Summer 2004), 15. http://www.rusi.org/downloads/assets/contentionjuly.pdf.

[216] Heuninckx, Prospects, 15.

national objectives. Hence again it is of critical importance that the metrics against which success will be measured are specified at the beginning of the program. Having stated this, however, if all partners are transparent in their declarations, realistic in their expectations and bargain in good faith, there is no reason that the advantages of collaborative development programs cannot be maximized.

In general, smaller partner countries stand to realize larger potential gains as the benefits of economies of scale and access to technology are relatively greater when compared to their own domestic programs. Notwithstanding, in order to achieve financial objectives, for example, they may need to compromise on political objectives. For instance, structuring collaborative programs to achieve economic success might require giving up the requirement to establish production lines in their own domestic defence industries. This reduction in duplication could help to achieve cost targets, although it might require expenditure of significant political capital to get there. As Cox points out, rigid focus on the political aspects of sharing industrial benefits and expertise at the expense of pure economic considerations will always work to counter the potential gains of collaboration.[217]

Likewise from the perspective of the US, economic reasons might be relatively less important than the political factors. For example, the US would not be in the same position politically to scale back production lines or reduce accessibility to supply for an important acquisition such as new fighters, as compared to a smaller partner with no domestic fighter program such as Canada. Indeed, the DSB Task Force on International Armaments Cooperation has observed that for the US, the potential geopolitical

[217] Cox, More Bang, 9.

advantages of collaboration are perhaps more important even than the potential cost savings.[218]

When partners become beholden to one another, the risks can increase. One partner can delay the entire project, at the expense of all others. Whether delays are due to technical issues or political ones, joint ventures are all exposed to this type of risk at some level. Uncertainty related to the development of advanced technologies adds to this risk. However once again, domestic development of advanced technologies is also exposed to similar risks, and lacks the added benefit of technology access from partner nations. Once more, this highlights the importance of trust and of carefully formulating contractual details.

For better or worse, collaboration can also entice engaged defence industries in other potential partner nations to buy into a program and lobby their governments to become involved. The resulting increased demand and political influence potentially stands to increase the likelihood that it will succeed.[219]

Having established that collaborative programs are generally exposed to similar risks as are domestic programs, with resulting similar impact upon probability of program success, the discussion will now look at the security factors particular to collaborative development.

[218] DSB TF International Armaments, i.

[219] Kapstein, Fortress Europe, 138.

SECURITY

The remaining factors relating to collaborative development center on technology transfer and the associated security issues. In addition to the discussion surrounding ITARS and technology transfer earlier in this chapter, the potential security implications related to collaborative development are somewhat more involved.

For example, in sharing access to technology among partners, agreements regarding proliferation and technology transfer may need to be more closely controlled, as R&D is now being funded by and executed between partner countries rather than domestically by one country alone (for example the US). Kapstein observes that technology transfer benefits to the US from abroad generally pale in comparison to the amount of technology exported by the US.[220] Although this concern is prominent within the US, the DOD has still recommended changes to security policy to increase opportunities for competition among defence companies with the ultimate goal of improving US forces' access to affordable and effective weapon systems.[221]

Related to the issue of technology transfer, Kapstein notes that increased collaboration could lead to subsequent eventual increased proliferation, followed by stronger competition as partners who gain from transferred technology use it to bolster their own industries.[222] In the long run, from the US perspective successful collaboration can also result in reduced relative advantage in domestic technology and industrial competitive position. From the Canadian perspective, it is possible that any increased competition for the US might help to control prices. As it stands, as the US looks to

[220] *Ibid*., 145.

[221] Lorell, et al., Going Global, 132.

[222] Kapstein, Fortress Europe, 154.

access global markets and share some of the risk of developing state of the art fighter aircraft, this is increasingly becoming the only means that Canada can use to participate in advanced fighter development and production.

JSF

An excellent example of international collaborative development is the JSF program. According to the US Congressional Research Service (CRS), it "is DOD's largest international cooperative program".[223] It is also the Pentagon's first collaborative effort of this magnitude and complexity.[224] And it is not without its critics. In Canada, the US and other partner nations, questions range from whether such a program can possibly meet its lofty development targets as a collaborative program, to whether such an expensive program is even necessary at all.[225] Even the DSB initially concluded that making the JSF program a collaborative effort would "complicate the program to the point of reducing the probability of success."[226] Again, as discussed in Chapter 2, the question of whether Canada should participate in the JSF program is beyond the scope of this discussion. However, as Canada is currently a partner, it is a useful model to highlight the potential benefits and drawbacks of Canadian involvement in international

[223] Jeremiah Gertler, "F-35 Joint Strike Fighter (JSF) Program," Congressional Research Service, 7-5700 RL30563 (Feb 16 2012), 13, http://www.fas.org/sgp/crs/weapons/RL30563.pdf.

[224] Kapstein, Fortress Europe, 137.

[225] Kathleen Miller, Tony Capaccio and Danielle Ivory, "Flawed F-35 Fighter Too Big to Kill as Lockheed Hooks 45 States," *Bloomberg*, Last accessed 19 April 2013, http://www.bloomberg.com/news/2013-02-22/flawed-f-35-fighter-too-big-to-kill-as-lockheed-hooks-45-states.html.

[226] DSB, TF JAST, 50.

collaborative programs.[227] In the following paragraphs, each of the theoretical benefits and drawbacks of collaborative development will be considered in regard to Canada's involvement in the JSF program.

In the previous sections, the benefits of collaborative programs were generally provided as economic, operational and political. Looking at the operational aspect first, the primary benefit of Canada's participation in the program is that, assuming Canada has a stated requirement to acquire a state of the art 5th generation fighter, it is Canada's only means of achieving this in the foreseeable future. Canada does not possess the means to develop a comparable aircraft on its own, and there are no others available on the market. Furthermore, with eight other partners in the program with operational commonality as one of the stated program aims, interoperability with some of Canada's main allies is advanced.

From an economic standpoint, Canada is able to share the development costs with program partners, although there is no other alternative in this case as the JSF is the only 5th generation fighter available. Again according to the CRS, from the US perspective the reason that the JSF program was established as a collaboration was to help defray development and production costs, as well as to "prime the pump" for export sales of the aircraft.[228] However, if an analysis with respect to other potential options were to be made, the outright program costs would need to be compared while trying to normalize

[227] Public Works and Government Services Canada. "Joint Strike Fighter Program," Last accessed 21 April 2013, http://www.tpsgc-pwgsc.gc.ca/app-acq/stamgp-lamsmp/combat-strike-eng.html.

[228] Gertler, CRS F-35 Program, 14.

the many complicating factors such as military capability, long term costs, and so forth.[229]

From both the economic and political standpoints, the question of offsets rises to the fore. The Canadian government has stated that as of December 2012, Canada had contributed $284.6 million CDN to the JSF program. Should Canada proceed with the purchase, the Government states that acquisition costs will be $9 billion CDN, with an estimated total program cost over 42 years of $42.8 billion CDN.[230] Admittedly, there are no explicit guarantees of work share for Canada.[231] However, according to Industry Canada, as of July 2012 Canadian companies had secured $438 million USD in industrial contracts related to the program, with an estimated $9.7 billion USD in potential opportunities until 2051.[232] While the relative merit of these figures is as much political as economic, the Canadian Government does point to these industrial benefits as a positive aspect of the JSF program for Canada.[233]

Kapstein has noted that problems have arisen regarding awarding of work share among JSF partners.[234] From the point of view of the US, more work was going abroad

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[229]The range of factors for comparing such advanced weapon systems is beyond the scope of this discussion.

[230] Department of National Defence. "Next Generation Fighter Capability Annual Update," Last accessed 20 April 2013, http://www.forces.gc.ca/site/reports-rapports/ngfc-cng/index-eng.asp.

[231] Justin Massie, "Bandwagoning for Status: Canada's need of the F-35," *Canadian Foreign Policy Journal* Vol.17, No. 3 (Sept 2011), 252, http://www.tandfonline.com/doi/pdf/10.1080/11926422.2011.638197.

[232] Industry Canada, "Canadian Industrial Participation in the F-35 Joint Strike Fighter Program," Last accessed 21 April 2013, http://www.ic.gc.ca/eic/site/ad-ad.nsf/eng/ad03962.html.

[233] Defense Industry Daily, "Canada Preparing to Replace its CF-18 Hornets," (Mar 4, 2013), http://www.defenseindustrydaily.com/canada-preparing-to-replace-its-cf-18-hornets-05739/.

[234] Kapstein, Fortress Europe, 142.

than was proportional to partner countries' relative investments.[235] The CRS report noted British complaints over insufficient technology sharing in the program as well.[236] While these issues have the potential to become significant if not managed correctly, the fact remains that industrial benefits are a central feature of the JSF program and as such are actively managed among the partners. This is a potential pitfall of all collaborative programs and once again requires trust and transparency among the partners.

Finally also as a political benefit, as seven of the eight other partners are NATO allies and the eighth is Australia, Canada's involvement in the program arguably would contribute to alliance cohesion with many of Canada's most important allies. Granted, some discontent among partners regarding influence over development has already surfaced, along with the aforementioned work share concerns.[237] Still, working together to identify common requirements, share in tactical and operational development and support for their mutual defence industries involved with the JSF should only serve to strengthen alliances among the partners.

Next the discussion will turn to look at the primary criticisms of collaborative development programs for the JSF; that is, cost overruns, schedule delays, program risk and security issues.

Cost overruns are one of the two main criticisms of the JSF program to date. In Canada, aside from the question as to whether RCAF needs the JSF at all, the issue of

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[235] *Ibid*., 151.

[236] Gertler, CRS F-35 Program, 17.

[237] Anton Bezglasnyy and Douglas Allan Ross, "Strategically superfluous, unacceptably overpriced: The case against Canada's F-35A Lightning II acquisition," *Canadian Foreign Policy Journal* Vol.17, No. 3 (Sept 2011):,244, http://www.tandfonline.com/doi/pdf/10.1080/11926422.2011.638192.

increasing program cost has received significant news coverage.[238] According to Williams, as of 2006, JSF unit costs were expected to be between $45 million USD and $65 million USD, depending on which version is bought.[239] According to the Public Works and Government Services Canada (PWGSC) F-35 Secretariat:

> Increases in unit recurring flyaway cost from $75 million U.S. dollars from Selected Acquisition Report 2009 (which was used to support the cost estimate developed in 2010) and the $87.4 million U.S. dollar used for this 2012 Life-Cycle Cost Estimate are largely a result of delays in aircraft production rates, increased labour costs, and costs resulting from design improvements identified during testing.[240]

Thus in the span of six years the projected unit cost has risen by between approximately $20 million and $40 million dollars, depending on which variant is priced. In the US, the JSF program has been officially described as "behind schedule and over budget".[241] The US DOD announced in March 2010 that unit costs had grown between 57% and 89% of the original program baseline, "exceeding the limits specified in the Nunn-McCurdy cost containment law" and requiring the US Secretary of Defense to present a plan to correct the problem as well as "certify that the program is essential to

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[238] Canadian Broadcasting Corporation. "F-35's exorbitant cost clouds its future," Last accessed 20 April 2013, http://www.cbc.ca/news/canada/story/2012/04/02/f-f35-cost-concerns.html.
See also CTV News, "Military kept parliament in dark over F-35 costs: auditor," Last accessed 21 April 2013, http://www.ctvnews.ca/military-kept-parliament-in-dark-over-f-35-costs-auditor-1.791536,
also Kathleen Miller, Tony Capaccio and Danielle Ivory, "Flawed F-35 Fighter Too Big to Kill as Lockheed Hooks 45 States," Bloomberg, Last accessed 22 April 2013, http://www.bloomberg.com/news/2013-02-22/flawed-f-35-fighter-too-big-to-kill-as-lockheed-hooks-45-states.html.

[239] Williams, Reinventing Canadian Defence Procurement, 52.

[240] Department of National Defence, "Next Generation Fighter Capability Annual Update," Last accessed 20 April 2013, http://www.forces.gc.ca/site/reports-rapports/ngfc-cng/index-eng.asp.

[241] Gertler, CRS F-35 Program, 19.

national security before it can continue."[242] Thus, concerns over cost overruns are valid. Whether escalating costs are due to the collaborative nature of the project, or due to difficulties in developing the associated new technologies, remains to be verified.

The other major concern with collaborative development, schedule delays, was also mentioned in the excerpt from the PWGSC website above. The CRS F-35 report states that the JSF only accomplished 16 of 168 planned operational test and evaluation (OT&E) flights for FY09, and "characterized the test plan as having substantial schedule risk."[243] Again, the JSF program has experienced significant schedule delays, however, according to the US Government Accountability Office (GAO), delays seem to be attributed to difficulties in testing, development and manufacture rather than due to the collaborative nature of the project.[244] This is in line with Heuninckx's observations regarding delays previously mentioned.

Another concern with collaborative projects regards probability of success. Once again these concerns have already been confirmed to be valid in the paragraphs above. Additionally, the JSF program is exposed to risk from concurrency, that is, beginning the production phase before testing is completed.[245] But for the same reasons as with cost overruns and delays, the program risk and probability of success do not appear to be impacted by the collaborative nature of the program. Kapstein noted that "JSF is the first cutting-edge weapons platform procured by the Pentagon that relies on significant foreign

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[242] *Ibid*., 20.

[243] *Ibid*., 21.

[244] United States. Government Accountability Office. "GAO-10-382, Joint Strike Fighter: Additional Costs and Delays Risk Not Meeting Warfighter Requirements On Time," Last Accessed 22 April 2013, http://www.gao.gov/assets/310/302161.html. Also see Gertler, CRS F-35 Program, 21.

[245] Gertler, CRS F-35 Program, 7.

participation in every aspect of the programme, including financing, design and project management."[246] It is also true that costs are susceptible to upward pressures if partners withdraw from the program.[247] According to Vucetic, "virtually every partner (or "co-developer") nation has expressed concerns about various dimensions of the JSF program, with some stopping their purchase contract processes altogether."[248] However, the US has extreme interest in achieving program success with the JSF. As Wyss and Wilner point out, "Washington has placed all its hopes for the future equipment of its armed forces on the F-35, which is the only manned fighter currently under development in the US."[249] Thus while there is no guarantee that the program will be ultimately successful, its collaborative nature may in fact increase the likelihood that it is seen through to the end because of political and military imperatives.

Finally, the last concern regarding collaborative programs to be examined is in regard to security. As the JSF is a US-led program, it is governed by standard US security policies such as ITARs. Additionally, the program has its own stringent security requirements to which all partners must adhere. Disclosure and control of information as well as security are all detailed in the Memorandum of Understanding Concerning the Production, Sustainment and Follow-On Development of the Joint Strike Fighter (JSF PSFD MOU).[250] Another factor is security of supply. As the JSF program is expected to

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[246] Kapstein Fortress Europe, 143.

[247] Defense Industry Daily, "Canada Preparing to Replace its CF-18 Hornets," (Mar 4, 2013), http://www.defenseindustrydaily.com/canada-preparing-to-replace-its-cf-18-hornets-05739/.

[248] Vucetic, Srdjan, "Canada and the F-35: What's at stake?" *Canadian Foreign Policy Journal* Vol.17, No. 3 (Sept 2011), 202, http://www.tandfonline.com/doi/pdf/10.1080/11926422.2011.638199.

[249] Wyss and Wilner, The Next Generation Fighter Club, 21.

[250] JSF PSFD MOU, 52, 64, 67.

run until mid-century, security of follow-on supply for spares must also be addressed.[251] However, from the perspective of a junior partner like Canada, security issues are of greater concern to the US, which is providing the majority of technology to the program. Security of supply is explicitly stated as one of the program objectives in the JSF MOU, and so is actively managed.[252] Hence, with the exception of the increased security requirements which Canada must uphold as a partner, security is not a detractor from the collaborative nature of the program as far as Canada is concerned.

Thus the merits for Canada as part of an international collaborative effort such as the JSF program are many. Although the associated costs and risks are not insignificant, this type of program is the only realistic way for Canada to play a part in the development of a state of the art fighter aircraft. The debate over whether Canada requires the JSF at all is valid and is not addressed here. However from the standpoint of Canada's participation in an international collaborative development program, avoidance of the risks would mean that Canada would have to wait until the JSF were offered for FMS, or wait for the next 5th generation fighter to become available. The timing and other potential negative aspects of a decision to wait would have to be weighed against the risks of participation in the largest collaborative weapons development program in history of the world's most advanced fighter aircraft.

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[251] Levent Ozedmir, "Analyzing the Multi-national Cooperative Acquisition Aspect of the Joint Strike Fighter (JSF) Program," MBA Professional Report, US Naval Postgraduate School, Dec 2009, 66, http://calhoun.nps.edu/public/bitstream/handle/10945/10415/09Dec%255FOzdemir%255FMBA.pdf?sequence=1.

[252] JSF PSFD MOU, 13.

CONCLUSION

This chapter has detailed the procurement options available to western governments, and how they are evolving with increasing defence industry globalization. In addition to the military necessity of procuring suitable weapon systems, governments are invariably exposed to a host of other considerations, both financial and political. In fact, as the examples have shown, the military and financial considerations have political implications in their own right. Issues such as interoperability affect military effectiveness, but are also related to alliance cohesion. Similarly, financial benefits of offsets to the purchasing nation have political implications both domestically and internationally. As can be expected with any expenditure of such vast amounts from the public purse, the list of stakeholders is long and varied. Whether a nation pursues domestic development programs, purchases directly from abroad or enters into some more complex arrangement along the continuum of collaboration, the effects of increasing defence industry globalization apparently impact all of the alternatives.

This chapter has also shown how international collaboration is increasingly common, to at least some extent, in a globalized economy. While collaborative arrangements involve some amount of inherent risks based merely on the involvement of multiple partner nations, they can also yield the potential benefits associated with globalization. For many nations, international collaboration is the best means to access new technologies and reduce costs while reaping the political benefits of partnership in an alliance. For those nations without the means of developing high technology fighter aircraft on their own, collaboration is generally their only way of acquiring state of the art weapons.

Finally, this chapter examined the JSF program as a multinational collaborative development, along with some of the implications for Canada. Without wading into the treacherous waters of assessing whether the JSF is appropriate for Canada, partnering in the collaboration is surely Canada's quickest route to acquisition of a state of the art fifth generation fighter.

Chapter 4 will assess some of the implications for Canada with regard to international collaboration, as well as recommending some potential related aspects of collaboration that might be appropriate for future Canadian fighter aircraft acquisition programs.

CHAPTER 4 – IMPLICATIONS FOR CANADA

INTRODUCTION

Thus far this paper has examined the major reasons for rising costs of high technology fighter aircraft, and subsequently followed with an analysis of procurement options with a focus on international collaboration. From that analysis, it was shown that international collaboration is potentially the only means for many countries to access and acquire state of the art fighter aircraft. Based upon that analysis, this chapter will summarize those factors as they apply to Canada, in order to elaborate the specific reasons that the Canadian government should consider collaboration in future major acquisition programs. Finally, it will include recommendations for related topics worthy of further research.

COLLABORATION FOR CANADA: THE PRIME FACTORS

Having established that domestic development is not currently an option for Canada, the question of access to technology alone is probably the single most important argument for Canadian participation in collaborative programs. If a suitable fighter is available on the international market at an appropriate price, Canada may purchase it. If MOTS options are not suitable due to military capability, cost, delivery timelines, interoperability or desired industrial benefits, then collaboration could be the most appropriate choice.

Financial considerations are paramount to all countries. Obviously program cost is a major factor. However, as has been demonstrated, collaboration on its own does not necessarily equate to exorbitant costs. Deliberate care and transparency at the earliest

stages of program definition and negotiation can reduce the risk of runaway costs, particularly by establishing cost as an independent variable as recommended by the DSB.[253] Continued emphasis on efficient program management is also important in controlling costs.

Using the same reasoning as detailed above, schedule risks for collaborative programs are not necessarily greater than for domestic programs. Delays are common while searching for consensus among partners at the earliest stages of a program. However, they can be mitigated in the same way as with cost protections, and through careful selection of collaborative partners. Certainly collaboration holds the promise of potential savings due to economies of scale and access to partners' industrial capacity and other resources. Thus Canada should not avoid collaborative programs on the basis of cost or timescales alone. The question would have to be addressed on a case-by-case basis.

The other side of the delay risk coin is timing of availability. Acquiring MOTS of existing, proven systems may be acceptable if those systems are still relatively advanced and effective in comparison to expected adversary capabilities. However, acquisition of an older, "proven system" while in a period of widespread technological advancement (such as with 5th generation fighters) may only serve to ensure that that new big purchase is rendered obsolete or unsupported even sooner. A little short term gain may result in even greater long term pain.

The potential benefit versus risk question becomes clear in light of Canada's unique relationship with its neighbour and primary ally, the US. From the perspectives of access to technology, political alignment, and Canada's integration into the North

[253] DSB TF International Armaments, 4.

American industrial base, collaboration with the US stands apart from collaboration with Canada's other allies. Interoperability with the US is paramount for Canada, as RCAF fighter doctrine is intended to conform primarily to that of the US.[254] Furthermore, in addition to interoperability, the US has a direct interest in seeing Canada improve its military capabilities for expeditionary operations, and as a partner in North American Aerospace Defense Command (NORAD).[255] For these reasons, Canada and the US have even greater incentives for mutual collaboration than with other allies. Certainly the potential benefits of collaboration exist with the rest of NATO. However, geopolitical considerations especially favour Canadian cooperation with the US.[256]

Collaborative programs, whether full development, co-production or with some other type of offsets, offer the potential to benefit the Canadian defence industrial base more than would a straight MOTS purchase. For geopolitical reasons, the strategic importance of Canada maintaining its strong defence industrial base arguably differs as compared to other countries such as the UK.[257] Nonetheless, collaborative programs can enable the Canadian government to support Canada's domestic aerospace industry as an identified Key Industrial Capability.

As was seen with the CF-18 procurement example, however, large acquisition programs have implications not only for the CF and DND, but also for other Canadian

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[254] Canada. Royal Canadian Air Force. "B-GA-400-000/FP-000, Canadian Forces Aerospace Doctrine." 2 Canadian Air Division, December, 2010, 10.

[255] Dwight Mason, "Canadian Defence Priorities: What Might the United States Like to See?" *Center for Strategic and International Studies (CSIS), Policy Papers on the Americas* Volume XV, Study 1 (March 2004), 4, http://dspace.cigilibrary.org/jspui/handle/123456789/959.

[256] Similarly, a case could be made that collaboration among European NATO countries would be easier than for collaboration with Canada.

[257] Berkok, Ugurhan. "Studies in Defence Procurement." School of Policy Studies, Queen's University, Kingston (2006), 5, http://www.queensu.ca/cidp/publications/claxtonpapers/Claxton7.pdf.

government departments such as PWGSC and Industry Canada. Also, the defence procurement process in Canada has already been described as suffering from inefficiencies. Decisions regarding Canadian participation in collaborative programs also would impact multiple stakeholders. Unfortunately, conflicting interests among those stakeholders are exacerbated because, as Stone has observed, Canada lacks a coherent defence industrial policy.[258] Furthermore, according to the Canadian Association of Defence and Security Industries:

> Canada penalizes itself as few other nations do, delaying essential military materials, adding non-value-added costs to itself and to industry, and inhibiting its industrial champions from winning business at home and abroad. The time has come to break down the barriers impeding efficient execution of defence procurements: the status quo is no longer an option.[259]

Hence Canada stands to gain from participation in collaborative programs. However, as Stone recommends, in order to maximize this potential it behooves the Canadian government to first adopt a rational industrial policy.[260] While decisions regarding collaboration would still need to be made on a case-by-case basis, a sound industrial policy would minimize potential delays and political impediments. This policy should address the concerns of all government departments that have a stake in large purchases.

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[258] Craig Stone, "Canada Needs a Defence Industrial Policy." *International Journal*, 63, (2007-2008), 342, http://www.heinonline.org/HOL/Page?handle=hein.journals/intj63&id=357&collection=journals&index=journals/intj.

[259] Canadian Association of Defence and Security Industries. "Canada's Defence Industry: A Vital Partner Supporting Canada's Economic and National Interests," (Dec 2009), vi, https://www.defenceandsecurity.ca/UserFiles/File/IE/Military_Procurement_Main_Report_March_09_2010.pdf.

[260] Stone, Canada Needs a Defence Industrial Policy, 356.

RECOMMENDED FOR FUTURE STUDY

While this paper examined weapons procurement programs in detail with explicit focus on international collaborative programs, there are many avenues left to investigate in the study of defence procurement collaboration. It is suggested that further research be conducted in the realm of collaboration on other weapon systems in addition to fighter aircraft, such as naval ships. Further, the potential efficiencies possible through collaboration on maintenance, integrated logistics support, common fleet management, and operational test and evaluation (OT&E) should also be explored.

CONCLUSION

Upon deciding that the RCAF has a legitimate need for a state of the art fighter, the next issue of importance is the availability of an appropriate system at an acceptable cost. Without a current indigenous fighter development program, and based upon the experiences of those few Western countries that do, the level of financial commitment and risk for Canada to begin a domestic program are arguably prohibitive. Thus purchase from abroad or entering into an international collaborative agreement are the only options. Should a suitable MOTS option be available for delivery in the time required, then the MOTS alternative is likely the most economical and easiest choice. However, should military requirements dictate that the available MOTS options are not suitable, then the only remaining avenue is to collaborate with other nations to develop what is required. Canada enjoys a unique position within NATO and North America, with a strong aerospace industry that is integrated within the larger North American industrial base. Thanks to close economic, political and military ties with the US, Canada stands to derive maximum benefit from potential collaborations with the US as the world's leading

arms exporter and only superpower. Thus collaborative programs with the US stand to yield the greatest benefits and maximum chance of success for Canada. Having options is a good thing.

High technology development programs all come with considerable financial and timeline risks. However, not all delays are induced during development. Even prior to starting development, delays are common during the procurement decision phase within government. Regardless, whenever induced, delays negatively impact the purchasing power of funds set aside for procurement programs. Thus Canada stands to get more for its acquisition dollars by creating more efficiency at the earliest stages of the procurement process, and by clearly detailing its objectives and requirements as early as possible. Achievement of consensus among stakeholders will be further facilitated if Canada explicitly defines a defence industrial policy. Coherent government policy in this area would serve to reduce risks, improve efficiency in the procurement process, and enable Canada to derive maximum potential benefit should it choose to pursue international collaborative programs for high technology weapon systems.

CHAPTER 5 - CONCLUSION

The cost of high technology weapon systems continues its meteoric rise, outpacing inflation and, year after year, reducing the purchasing power of every defence procurement dollar destined for state of the art fighter aircraft. The reasons for this "Military Malthusianism" are many. Continuous technological advances push some military capabilities ever higher, while others drop off due to strained budgets. While the West has enjoyed a marked technological advantage since World War II, this advantage has not remained constant. Globalization, including of the defence industry, has meant that potential adversaries are also increasing their military capabilities. Thus Western governments continue to push for more advanced weapon systems, which results in spiralling costs.

Furthermore, development of advanced technology demands considerable expertise and money. Often, development programs run into problems that cause delays. Because of defence inflation, delays generally result in higher unit costs. Rising costs further reduce the number of defence companies with the ability to play in the advanced weapon system game, which in effect reduces competition and thus increases upward cost pressure. And so as costs rise, the factors affecting defence procurement become increasingly political.

Nations have several options in procuring advanced weapon systems such as fighter aircraft. They can develop them domestically, purchase from abroad, or can cooperate with allied partner nations to develop and/or produce these systems together. Due to the enormous costs and financial risks, few countries possess the means to engage in domestic fighter aircraft development programs. In an effort to defray spiralling

weapon costs as well as enable access to high technology systems from abroad, countries often turn to international collaborative agreements. By sharing costs and risks, they hope to enjoy political, operational and financial benefits such as economies of scale, shared access to new technologies and increased interoperability. Thus for those nations with a requirement for state of the art fighters but without the ability to develop them at home, the option of international collaboration becomes a "second best solution."[261]

International collaborative agreements are subject to a number of political influences such as differences over program objectives, work share agreements and security concerns, all which have the potential to reduce the gains achievable from the collaboration. However, this paper has demonstrated that these risks are in fact manageable. By carefully selecting partner nations, explicitly and transparently detailing program objectives at the outset, and bargaining in good faith, international collaboration can in fact enable partner nations to achieve their objectives at an acceptable cost. Successful collaborations also benefit from the political advantages of increased alliance cohesion and mutual support to partner nations' defence industrial bases. Thus despite the risks, in an increasingly globalized economy, collaboration can be the only means that Canada has at its disposal to obtain state of the art fighter aircraft.

As an example of international collaboration, this paper examined the JSF program. There are indeed many risks associated with being the largest collaborative program in history with eight partner nations working to push technology further in the development of a 5th generation fighter. However, it was shown that the JSF would have suffered many of the same risks were it a US-only domestic program. Collaboration does come with some risk. Nonetheless, as the only means for the seven non-US partners to

[261] Kapstein, Second Best, 657.

access 5th generation fighter technology, those risks are relatively minor. Although the question of whether the JSF is the appropriate fighter to replace Canada's aging CF-18 is valid and not addressed here, the fact is that such a collaborative program is the only avenue that Canada has to acquire a state of the art fighter.

Having established that international collaborative programs can indeed be engineered to maximize success, this paper concluded with a closer look at the implications of collaboration for Canada. In particular, it was shown that due to its close political, economic and military ties to the US, Canada stands to benefit the most from collaborative partnerships with the US. Benefitting from decades of political and military cooperation in the defence of North America through NORAD and its integration within the North American industrial base, both Canada and the US would mutually benefit from collaborative partnerships.

While beyond the scope of this paper, further study is recommended with regard to international collaborative programs focussing on maintenance, integrated logistics support, common fleet management, and OT&E. Furthermore, expanding the research to include other advanced weapon systems as naval ships is also recommended.

Despite the fact that international collaboration has been shown to be a viable option for Canada's defence procurement requirements, that is not to say that it is the best way every time. When the decision is taken that Canada requires a new high technology weapon system, all of the options should be examined on a case-by-case basis. Whether procuring a fighter aircraft or some other weapon system, it is vital that the requirements and program objectives are clearly and explicitly stated at the earliest stages of the acquisition program in order to ensure transparency, identify stakeholders and achieve

consensus as quickly as possible. Based on those stated requirements, a suitable MOTS option may be available. Indeed, MOTS acquisitions are generally the simplest and most cost-effective. Further options to reduce costs, such as IRBs or other economic offsets are a form of collaboration that can make an agreement more acceptable politically. However, if the right system is not available on the international market when it is required and at an acceptable cost, then international collaboration may indeed be the only means that Canada has of meeting those obligations as detailed in the Canada First Defence Strategy.

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