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NATIONAL PROCUREMENT – THE ACHILLES HEEL OF THE DEPARTMENT OF NATIONAL DEFENCE VOTE 1 APPROPRIATION

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JCSP 37

Master of Defence Studies

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By Lieutenant-Colonel P.J.W. Saunders

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DEDICATION

Over the years we are occasionally fortunate enough to encounter people who through example and force of will both inspire and instruct us as we move forward in the pursuit of life's goals. My wife is one of these rare souls. I should therefore like to thank and acknowledge Major Valerie Saunders, CD for constantly challenging and encouraging me throughout these past many years of post-secondary study. Lacking her example, support, encouragement and belief in my abilities, this project would never have seen the light of day.

ACKNOWLEDGEMENTS

An undertaking of this nature is seldom, if ever, a solo event. My thoughts, ideas and avenues of investigation throughout this process have been inspired, formed, shaped and indeed challenged by a host of professionals working within the Department of National Defence; all charged with the difficult task of forecasting the financial future of the largest department within the Canadian government. Though the list of contributors is lengthy, I must make specific note of two individuals without whom this project would likely never have been initiated let alone completed. Specifically, I would like to acknowledge Mr Terry Melnyk, head of the Investment Planning team within the Directorate of Defence Force Planning whose guidance and instruction was instrumental in bringing this project to life. I must also note the stellar work of Major (Retired) Jeff Edey who labored on the capital equipment aspects of the investment plan risk analysis. His work ethic and attention to detail was both daunting and at times inspirational.

ABSTRACT

In October 2010, staff members within the Chief of Programme Division at National Defence Headquarters were challenged with the task of quantifying risk to the extant departmental investment plan. One outcome of this challenge was a careful analysis of the national procurement corporate account; its management, constitution and governance as well as the inherent uncertainties that lead inevitably to a higher risk profile for the account, and subsequently for the department as a whole. The risk study considered national procurement under the two broad categories of extant and new / replacement capabilities; analyzing each independently of the other. The outcome of this investigation is a dollar quantification of risk to the departmental Vote 1 appropriation generally and the departmental investment plan specifically, arising from the difference between departmental notional inflation and national procurement-specific inflation for extant demand and cost risk associated with uncertainty related to national procurement estimates in support of new and replacement capabilities.

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LIST OF ACRONYMS

ADM (Fin CS)	Assistant Deputy Minister Finance and Corporate Services
ADM (Mat)	Assistant Deputy Minister Material
B	Billion
BY	Budget Year
CA	Canadian Army
CF	Canadian Forces
CFDS	<i>Canada First Defence Strategy</i>
CPI	Consumer Price Index
C Prog	Chief of Programme
CY	Current Year
DND	Department of National Defence
DSI	Defence Specific Inflation
DSP	Defence Services Programme
FY	Fiscal Year
GDP	Gross Domestic Product
IP	Investment Plan
ISSC	In Service Support Contract
K	Thousand
L1	Level 1
LCMM	Life Cycle Material Manager
M	Million

NPOC	National Procurement Oversight Committee
O&M	Operations and Maintenance
RCAF	Royal Canadian Air Force
RCN	Royal Canadian Navy
RPP	Report on Plans and Priorities
TBS	Treasury Board of Canada Secretariat
WSM	Weapon System Manager

INTRODUCTION

In Budget 2012, tabled by the Government of Canada on 29 March 2012, a little commented-upon section refers to the requirement to continue to restrain the growth in defence spending.¹ Indeed, it has become an article of faith that defence spending is on an ever-increasing tangent requiring careful monitoring lest the institution find itself bereft of the ability to replace its current capabilities let alone prepare for the challenges of tomorrow.² When faced with such a statement, it is both common and natural to reflect upon the cost of equipment acquisition; these items being discrete, obvious and well publicized in the media. This said, the increase in defence spending is also heavily influenced by the ever-increasing amount of departmental appropriation required to both support and operate these acquisitions. A more detailed examination of Budget 2012 as articulated in the Main Estimates shows that the annual

¹ Department of Finance, *Budget 2012 Jobs Growth and Long Term Prosperity*; available from <http://www.budget.gc.ca/2012/plan/toc-tdm-eng.html>; Internet; accessed 22 June 2012, 210.

² In 1982, Ms Rivlin, Director of the CBO reported that, “Real cost growth in the acquisition of weapon systems continues to be large and to present budget and management problems.” Alice M. Rivlin, *Statement of Alice M. Rivlin, Director Congressional Budget Office Before the Committee on Governmental Affairs United States Senate 22 April 1982*; available from <http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/109xx/doc10935/82-cbo-029.pdf>; Internet; accessed 17 September, 2012; 1.

In a 2008 RAND report, it was noted that, “As with many other military weapon systems, military aircraft have experienced long-term, unit cost increases that are greater than the rate of inflation. These increases, largely driven by the desire for greater capabilities, appear likely to persist and could have dire implications for aircraft inventories...” David Arena, et al, *Why has the Cost of Fixed-Wing Aircraft Risen? A Macroscopic Examination of the Trends in U.S. Military Aircraft Costs over the Past Several Decades*; RAND, 2008; available from <http://www.rand.org/pubs/monographs/MG696.html>; Internet; accessed 17 September, 2012; XV.

In a 2010 Article, the Economist referenced Norman Augustine’s 1983 analysis that military aircraft specifically were increasing in price at an exponential rate and specifically noted that, “Nearly three decades on, Mr. Augustine says, “we are right on target. Unfortunately nothing has changed.” These days Raptors go for \$160m apiece (\$350m including the cost of developing the jet), compared with \$50m-60m for the venerable F-16. In the long run, high unit costs must limit numbers. Since 1970 America's fleets of combat aircraft and major warships have shrunk, even as defence spending rose...” “Defence Spending in a Time of Austerity” *The Economist*; 26 Aug 2010.

appropriation for the Department of National Defence (the Department) for the fiscal year 2012-2013 is set at \$19.8 billion.³ Of this initial allocation, the Estimates go on to detail that the Department has plans to spend \$14.06 billion on operating expenses, an expression that covers a variety of activities from aviation fuel to multi-year ship overhauls and salaries.⁴ Part III of the estimates, the Department of National Defence Report on Plans and Priorities, offers a plan to spend approximately \$10.141 billion on overall readiness, a more focused term that speaks to the heart of military capability; that is to say, the ability to generate forces in order to conduct operations in the furtherance of governmental policy and objectives.⁵ By way of comparison, the budget for capital acquisition in this same period stands at \$4.103 billion.⁶

Of note, nowhere in any of the aforementioned documents is there any allusion to or mention of the curious sub-set of the operations and maintenance budget referred to within the Department as national procurement. Given that national procurement as a single account with a fiscal year 12/13 allocation of \$2.716 billion accounts for approximately 13.7% of the overall defence budget and 26.8% of the operating budget, this is interesting indeed.⁷ This is not, however, particularly surprising as national procurement contributes to many of the strategic

³ Treasury Board of Canada Secretariat, *2012-13 Part I and II - Main Estimates*; available from <http://www.tbs-sct.gc.ca/est-pre/20122013/p2-eng.asp>; Internet; accessed 22 June 2012, 245.

⁴ *Ibid.*, 244.

⁵ Treasury Board of Canada Secretariat, *2012-13 Part III - Reports on Plans and Priorities*; available from <http://www.tbs-sct.gc.ca/rpp/2012-2013/index-eng.asp?acr=1974>; Internet; accessed 22 June 2012, 16.

⁶ *Ibid.*, 16. The figure is provided as a representative comparison as to the overall Vote 5 allocation as compared to funds allocated to operations and maintenance.

⁷ Department of National Defence, *Notional Database*, available from http://admfincs.mil.ca/db/nd-bdt_e.asp; DWAN; accessed 21 June 2012.

outcomes detailed in the Report on Plans and Priorities and as such is diluted in terms of reporting. Although it is a single account, national procurement touches all aspects of operations. Given the nature of the departmental reporting structure as mandated by the Treasury Board of Canada Secretariat, however, it does not appear in the reports as a discrete entity.⁸ This should not, however, be taken as being indicative of national procurement's relative or perceived importance within the Department.

To better understand the focus of this paper, it is necessary therefore to define what exactly constitutes national procurement and, of equal import, what does not. In 2004, the Assistant Deputy Minister (Materiel) published a document that outlined the national procurement forecasts for a large cross-section of major users. In this document, national procurement was defined as,

*...part of the Department's Operations and Maintenance (O&M) budget. It deals with the acquisition of material and/or services required to support centrally managed equipment, services and systems already in the DND inventory. This includes the procurement of spare parts, contracting for technical support and maintenance, repair and overhaul, and refit services necessary to keep equipment in-service.*⁹

In addition to those items outlined in the definition above, the national procurement account also funds the acquisition of all departmental ammunition from 9mm rounds to Harpoon missiles. It supports the acquisition of uniforms and tents, field rations and flags. It does not,

⁸ Government departments report by Program Activity Architecture (PAA). Treasury Board of Canada Secretariat, *Policy on Management, Resources and Results Structures*, available from <http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=18218§ion>; Internet; accessed 6 October 2012.

⁹ Department of National Defence, *Long Term Equipment Support Cost Projections*, (ADM (Mat), 2004), 8.

however, enable the acquisition of consumables or those items that are not centrally managed such as computers or office supplies nor does it fund fuel or personnel costs as these are funded from the operating budgets of the various Level Ones or from the military pay account respectively.¹⁰ In practical terms, the departmental capital account (Vote 5 and accrual) is used to acquire ships for the Royal Canadian Navy, aircraft for the Royal Canadian Air Force and field artillery amongst others for the Canadian Army. The operations and maintenance budgets for the Royal Canadian Navy, the Royal Canadian Air Force and the Canadian Army purchase fuel and stores such as rations and fund the conduct of training that enables the vessels to actually operate, the planes to fly and the equipment to go into the field. The national procurement account funds periodic over-hauls of the ships, aircraft and guns as well as the acquisition of spare parts and ammunition. In essence, the investments and activities funded from the national procurement allocation directly support and enable the Canadian Forces in turning people and equipment into operational effects; the *raison d'être* of any military organization.

Given the foregoing, it stands to reason that the Department has a vested interest in ensuring the national procurement supply envelope over time is sufficient to address anticipated demand, as failure to do so risks an inability to meet the expectations of government. Opposing this requirement is the argument that inflation of defence-related investments increases at a rate greater than that of the economy as a whole, suggesting that national procurement funds required

¹⁰ Level One refers to Assistant Deputy Ministers or Environmental Chiefs such as the Commander of the Royal Canadian Air Force.

to maintain a given level of readiness will increase at a rate greater than that of the economy generally and the defence budget specifically resulting in ever more expensive operating costs relative to the notional defence appropriations.¹¹ Additionally, the vagaries inherent in national procurement forecasting beyond the immediate horizon generate uncertainty that, by its very nature, increases risk. The very act of forecasting overall national procurement requirements for the entirety of the Canadian Forces over a period of decades is therefore fraught with uncertainty and as a result, there is considerable risk that the national procurement supply envelope as detailed in the notional data-base will be insufficient to meet demand over time.¹² Moreover, as the Department moves ahead in implementing the *Canada First Defence Strategy* and the specific equipment acquisitions detailed therein, there exists a risk that national procurement forecasts prepared in support of these initiatives understate demand; the inevitable result being an eventual pressure on the Department's overall Vote 1 appropriation for which there is no relief.¹³

¹¹ David Kirkpatrick, "Is Defence Inflation Really as High as Claimed?" available from http://www.rusi.org/go.php?structureID=articles_defence&ref=A490B1EFDE057E; Internet; accessed 15 June 2012.

¹² As is required in order to generate full life-cycle costs required by TBS. Treasury Board of Canada Secretariat, Guide to Investment Planning – Assets and Acquired Services, available from <http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=17660§ion=text#sec>; Internet; accessed 6 October 2012. Though this policy requires a minimum of 5-year life-cycle cost projections, the nature of the investments undertaken by DND such as ships and aircraft demand projections extending into decades in order to ensure full life-cycle costs are accounted for when making submissions to government. The Notional Database is prepared and regularly updated by the Director of Budget within ADM (Fin CS) and outlines in detail the planned allocations by account and by year over time.

¹³ Department of National Defence, *Canada First Defence Strategy*, available from http://www.forces.gc.ca/site/pri/first-premier/June18_0910_CFDS_english_lowres.pdf; Internet; accessed 21 June 2012, 12 (Chart 3). Parliament of Canada; Library of Parliament Research Publications, <http://www.parl.gc.ca/Content/LOP/ResearchPublications/prb0925-e.htm#a5>; Internet; accessed 21 Aug 2012. "Part II, the Main Estimates consists primarily of the items to be included in the appropriation bill and ministry

This paper will examine national procurement in terms of supply versus demand over time. Specifically, it will demonstrate that there is a clear requirement to establish a national procurement contingency reserve that is shaped by two distinct drivers:

1. The difference between departmental notional inflation and national procurement-specific inflation for extant demand; and
2. Cost risk associated with uncertainty related to national procurement estimates in support of new and replacement capabilities.

To this end, this paper will first provide an overview of the national procurement account; its history, constitution and management (supply). It will then examine the basis whereupon national procurement demand estimates were generated in support of the current departmental investment plan for both extant capabilities as well as new and replacement capabilities (demand).¹⁴ Next, it will detail the conduct and outcomes of the risk assessment associated with national procurement within the current investment plan which will, in the end, demonstrate the requirement for and nature of the national procurement contingency reserve required over time to support both the current and future departmental investment plans. As a final contribution, this paper will offer specific recommendations as to potential departmental

summary information. The table of items to be included in the appropriation bill sets out the expenditure votes that committees, and eventually the House of Commons, will vote upon. Each vote is given a number, e.g., 5, 10, 15.

¹⁴ Department of National Defence, *Investment Plan FY 2009/10 - FY 2013/14*. The Departmental Investment Plan prepared in accordance with TBS Policy is, in essence, the operationalization of the CFDS.

options in terms of risk response to the dollar quantification of risk brought forward in the preceding sections.

LITERATURE REVIEW

Given the uniquely Canadian nature of the national procurement account, the literature review for this project focused primarily upon source data as produced by the Government of Canada as well as the Assistant Deputy Minister (Materiel), the Assistant Deputy Minister (Finance and Corporate Services), and the Chief of Programme; all within the Department of National Defence. Specifically, the project accessed and regularly referenced the notional database prepared by the Director of Budget within the Assistant Deputy Minister (Finance and Corporate Services) organization as this provides a base-line view of planned national procurement supply over time. It also referenced the historical archives for the notional database so as to reconstruct the history of the account and better understand its variations over time. The departmental economic model was also referenced on a regular basis in order to have a consistent view as to the departmental inflators used to project national procurement demand into the future. This repository of information was particularly instructive as it allowed for an appreciation of the variations in forecast departmental inflators over time which, in turn, allowed for a better understanding as to the genesis of many of the national procurement demand forecasts used in this analysis.

The Assistant Deputy Minister (Materiel), as the manager of the national procurement account, likewise provided a plethora of data from long-term forecasts as to national procurement demand by major platform to current actual expenditures; this data forming the core of the risk analysis about which this paper is centered.

Since the long-term national procurement forecasts were used to generate the extant departmental investment plan as prepared by Chief of Programme staff and since the national

procurement risk study was conducted so as to assess pressure on this plan, much was also drawn from published and non-published products from the Chief of Programme organization. Of particular note were the published minutes of the meetings of the National Procurement Oversight Committee as these provided the necessary insight into the origin of many of the conventions and standard operating procedures associated with the management of this account.

Additionally, in order to provide context to the analysis of the account, the relevant Budgets, Main Estimates and Reports on Plans and Priorities were all accessed and extracts used so as to bolster the analysis.

In addition to the foregoing, several academic papers and published works were also reviewed and analyzed. Though the field of research is extremely narrow due to the specificity of the account under discussion, Groves' and Fetterly's paper, "An Imperfect Storm: Air Force Operations & Maintenance Cost Trends" was, in reality, the genesis for this study.¹⁵ Their assessment of the current state of national procurement demand forecasting holds true to the present day. Moreover, their proposals as to improvements in this area planted the seeds that resulted in this project. Likewise, Fetterly's paper, "National Procurement: A Critical Defence Vulnerability" provided much of the background of the account origin and development over time.¹⁶

¹⁵ Maj Richard A. Groves and LCol Ross Fetterly, "An Imperfect Storm: Air Force Operations and Maintenance Cost Trends." *Air Force Journal* Vol 1 Issue 1, (Spring 2008).

¹⁶ Ross Fetterly, "National Procurement: A Critical Defence Vulnerability." *Review of Business Research* Vol. 8 no. 2 (March 2008); available from <http://www.freepatentsonline.com/article/Review-Business-Research/182406766.html>; Internet; accessed 13 June 2012.

Notwithstanding the specific focus of this paper upon national procurement, numerous international sources and studies on military sustainment costs were reviewed and at times referenced in order to provide a more comprehensive international overview of trends in this area which provide the necessary contextual element for understanding this account and the likely weaknesses inherent within it. Of particular note were the series of RUSI (Royal United Services Institute for Defence and Security Studies) papers discussing defence specific inflation.¹⁷ These were of specific relevance to this project as the existence or not of an identifiable defence specific inflator was one of the causal elements under investigation as being contributory to the study's results. Further, the work of the American Congressional Budget Office on projected trends in defence spending and the United States Government Accountability Office on trends in operations and maintenance costs and support services contracting, though not directly related to the study of national procurement as defined in Canada, provided the continued sense that this project's findings were indeed consistent with other international studies on the issue of increases in defence spending generally.¹⁸ These latter sources, however, were not used for direct comparisons with Canadian results due to differences

¹⁷ David Kirkpatrick, *Is Defence Inflation Really as High as Claimed?* available from http://www.rusi.org/go.php?structureID=articles_defence&ref=A490B1EFDE057E; Internet; accessed 15 June 2012; Malcolm Chalmer, John Dowdy, David Kirkpatrick, and Dr. Robbin Laird, *Defence Inflation: Reality or Myth*, available from http://www.rusi.org/downloads/assets/Comment_Defence_Inflation_Myth_or_Reality.pdf; Internet; accessed 15 June 2012.

¹⁸ Congressional Budget Office. "The effects of Aging on the Costs of Operating and Maintaining Military Equipment." <http://www.cbo.gov/ftpdocs/29xx/doc2982/AgingCostsO&M.pdf>; Internet; accessed 8 July 2012. United States Government Accountability Office, "Trends in Operation and Maintenance Costs and Support Services Contracting." <http://www.gao.gov/products/GAO-07-631>; Internet; accessed 8 July 2012.

in accounting as well as differences in the constituency of the broad-brush conglomeration of cost-drivers that characterize operations and maintenance expenses.

NATIONAL PROCUREMENT DEFINED

In order to assess risk to the national procurement account and thereby ascertain the nature of the contingency reserve required in order to mitigate this risk, it is necessary to understand the origin of the account, its constitution and governance structure.

National procurement is curious in that it is a uniquely Canadian conglomeration of planned investments that are united primarily through their aggregation under the umbrella of departmental accounting as a single corporate account (C113).¹⁹ Though all nations with militaries procure goods and services focused upon enabling their troops to conduct operations, the programmatic approach to account management which dates to Defence Minister Hellyer's 1964 White Paper on Defence and under which national procurement operates, sets this account apart in terms of its constitution, organization, management and impact upon the entire defence services programme.²⁰ Although national procurement was not specifically noted in Hellyer's White Paper, it is this concept of a programmatic approach to defence resource management that paved the way for central control of this critical account. Though clearly and unambiguously a

¹⁹ Within the Departmental Financial Management System, C113 refers to a Corporate Vote 1 Account. Similarly, C503 is the corporate Vote 5 account used for capital equipment acquisition. Accounts managed by the Level Ones (Chief of the RCAF, RCN, etc) start with L, and so on.

²⁰ Department of National Defence, *White Paper on Defence March 1964*; available from <http://admpol.mil.ca/newsite/downloads/White%20Paper%20on%20Defence%20-%20March%201964.pdf> DWAN; accessed 21 June 2012. Hellyer specifically noted that the government would, "...introduce into the Department of National Defence a management system for planning and controlling major Defence programs at the departmental level." Defence Services Programme is an expression used within DND to refer to the business of defence presented in a programmatic format. It encompasses the governance and operation of all defence expenditures.

sub-set of the departmental operations and maintenance budget, national procurement stands apart in that it is accessed through a single corporate account handled exclusively by the Assistant Deputy Minister (Materiel); the departmental functional organization responsible for all materiel and equipment programs.²¹ This programmatic approach ensures central control of the funds thus allowing for reserved or surplus funds to be directed where there is greatest need in accordance with departmental priorities. In essence, the Commander of the Royal Canadian Navy does not have a national procurement budget any more than the Commander of the Royal Canadian Air Force. Rather, the Assistant Deputy Minister (Materiel) ‘owns’ all of the national procurement funding, and administers it on behalf of the various level one organizations whose equipment it supports.

Supply

In terms of magnitude, the account has grown over time due to inflation as well as the necessity to support an ever-increasing portfolio of operational demands. Figure 1 details national procurement notional supply over time inclusive of in-year adjustments.

²¹ As detailed on their home page, ADM (Mat) is, “...a central service provider and functional authority for all defence materiel and equipment programs. The Group manages equipment through its entire life cycle, beginning with initial concept, moving through procurement, maintenance and support and ending with disposal. The Group is also responsible for defence materiel liaison and coordination with other departments, governments and interdepartmental organizations. ADM (Mat) has functional authority over the following key areas: procurement of goods and services; materiel management; and materiel-related support. ADM (Mat) is the departmental program authority for materiel and is accountable to the Deputy Minister for the full life cycle of materiel, including program management of the Materiel Acquisition and Support (MA&S) process. The products of this process (ships, aircraft, trucks, ammunition, food, clothing, and supplies) contribute to Canada’s defence capability, both at home and abroad. Defence procurement is an instrument to help the CF ensure that it is strategically relevant, operationally responsive, tactically decisive and capable of operating within a dynamic and evolving security spectrum <http://www.materiel.forces.gc.ca/en/index.page>; Internet; accessed 16 Aug 2012.

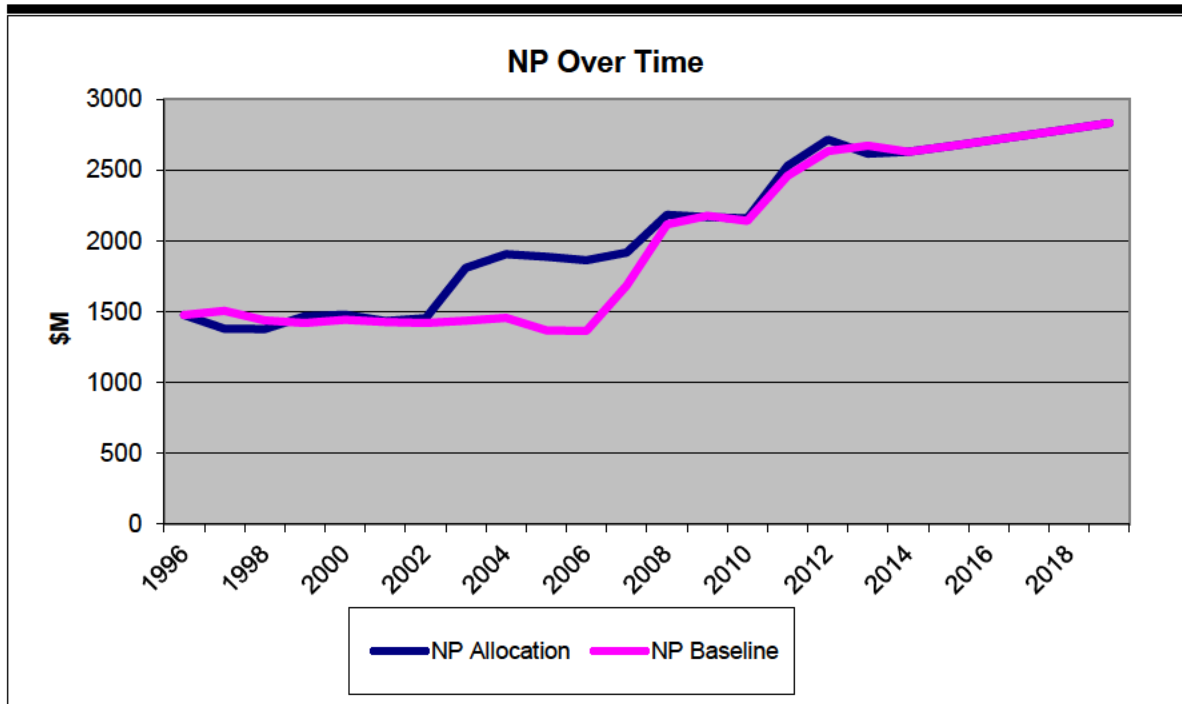


Figure 1: National procurement in absolute terms over time inclusive of in-year adjustments.²²

Within the demand / supply equation, this figure represents national procurement supply including baseline allocations, baseline increases and in-year increases. It is, however, exclusive of investment plan incremental top-ups beyond fiscal year 13/14 as they may or may not be applied to the account subject to the performance of the various large capital projects they support. This concept of investment plan incremental top-ups is addressed in greater detail later within this paper.²³

²² Department of National Defence. *Notional Database*, http://admfincs.mil.ca/db/nd-bdt_e.asp; DWAN; accessed 21 June 2012.

²³ The department's initial IP was prepared in association with the publication of the CFDS. Funds for the IP incremental top-ups arise from additional funding afforded the department from budgets 2005, 2006 and 2008, all focused upon either strengthening the force or improving its sustainability as well as implementing the specific recommendations arising from the CFDS. The IP therefore acts as an overarching method of allocating budgetary

In order to provide for better understanding as to how levels of supply are defined and indeed vary on a year-to-year basis, a detailed explanation of two years within Figure 1 follows. In 2003 the national procurement baseline was \$1,435M.²⁴ There was an in-year adjustment of \$372.5M resulting in a total annual allocation of \$1,808M. For 2004, the account reverted to the previous year's baseline value of \$1,435M and was then inflated, in this case by 1.5%, to result in a new baseline figure for the year of \$1,457M. There was then a baseline reduction of \$533K resulting in a final 2004 baseline figure for national procurement of \$1,456M. This figure was then subjected to an in-year increase of \$449.4M resulting in a total annual allocation to national procurement for 2004 of \$1,906M.²⁵ This process of baseline inflation / deflation coupled with in-year adjustments is repeated each year resulting in the graph at Figure 1. Of note, from 2014 onward, the graph increases in a linear fashion at 1.5% per annum reflective of the fact that no further in-year or baseline adjustments are currently forecast, government-imposed austerity initiatives will by that time have been implemented (Strategic Review, Deficit Reduction Action Plan), previously approved investment plan incremental top-ups will be exhausted and the only

funds against specific demands, be they capital or sustainment. Within the allotment of budgetary funds, an amount was set aside to supplement the national procurement account; the stated objective being to maintain funding of at least 80% of total demand even as new capabilities were brought into service. Of course, these funds are not fenced or reserved in any real sense. Accordingly, they are at constant risk of being harvested in order to address other Vote 1 pressures that might arise. For this reason, they do not enter into any of the calculations throughout the balance of this paper. They are, however referenced several times with a view toward providing a better understanding of the account's inherent complexity.

²⁴ By convention, dollar figures within DND are amplified by letters indicating magnitude. In this case, \$1,435M means one billion, four hundred thirty five million. This could also be written as \$1.435B where the B indicates billions. Similarly, \$1,435K (the K referring to thousands) would indicate one million, four hundred thirty five thousand which could likewise be written as \$1.435M.

²⁵ Department of National Defence. "Notional Database." http://admfincs.mil.ca/db/nd-bdt_e.asp; DWAN; accessed 21 June 2012.

outstanding variable will be the annual 1.5% inflator which is applied by the Department from the overall 2% nominal increase provided by government as an outcome of the *Canada First Defence Strategy*.

On this point, the *Canada First Defence Strategy* noted that,

*...the Government has committed [by way of] Budget 2008 to raise the annual increase in defence funding to 2 percent from the current 1.5 percent starting in fiscal year 2011-12. Over the next 20 years, these increases will expand National Defence's annual budget from approximately \$18 billion in 2008-09, to over \$30 billion in 2027-28.*²⁶

The *Canada First Defence Strategy* also noted that national procurement had historically covered only 70% of demand, the inference being that moving from a 1.5% to a 2% nominal increase would provide for the improvement of this metric.²⁷ As will be discussed later in this paper, however, such metrics are not without fault and a clear understanding of the demand referred to within the *Canada First Defence Strategy* is essential if meaningful conclusions are to be drawn. What can be stated with a degree of certainty is that government acknowledged that the real purchasing power of the Department was decreasing as its nominal increases appeared to be lagging inflation generally. It therefore increased the nominal annual inflator by 0.5% in order to close this gap.²⁸

²⁶ Department of National Defence, *Canada First Defence Strategy*; available from http://www.forces.gc.ca/site/pri/first-premier/June18_0910_CFDS_english_low-res.pdf; Internet; accessed 21 June 2012; 4.

²⁷ *Ibid.*, 18.

²⁸ Of note, the Department of National Defence remains the sole government department to receive this increase in recognition of the general erosion of its purchasing power.

The development of the 2009 departmental investment plan recognized that national procurement was going to need baseline increases above the 1.5% notional inflator in order to adequately service the new capabilities coming on line as a result of commitments made in the *Canada First Defence Strategy* as well as to achieve the increased level of sustainment funding. Accordingly, a funding line was set aside within the plan designed to regularly top up the national procurement account. These funds are confirmed through the annual business planning process and allocated from one to three years into the future. Consequently, although the notional chart forecasts the national procurement envelope as increasing at 1.5% per annum, in reality there are greater increases if the associated initiatives come on-line as forecast or supply falls below 80% of expressed demand. In the alternative, should projects be delayed for whatever reason, the baseline top-ups from the investment plan would likely not be applied; hence their exclusion from Figure 1 beyond the current fiscal year. Table 1 below provides data taken from a presentation to the National Procurement Oversight Committee in June 2010 and shows the potential impact of these investment plan incremental top-ups.

NP Supply	FY 11/12 (\$K)	FY 12/13 (\$K)	FY 13/14 (\$K)
DB NP notional as of 27 May 10	2,255,133	2,322,756	2,239,000
IP incremental	285,036	422,767	538,792
Assumed NP Envelope	2,540,169	2,745,523	2,777,792
Initial Apportionment distr	2,538,511	2,584,768	2,616,436
Reserve left for prioritization	1,658	160,755	161,356

Table 1: National procurement supply including investment plan incremental funding²⁹

Figure 2 compares the baseline inflation applied to the account over time to the gross variance

²⁹ Department of National Defence, *NPOC 01/10*; Presentation, 15 June 2010, Slide 35.

year over year including all in-year adjustments as well as approved investment plan top-ups; the result being periodic baseline increases of greater than 10%.

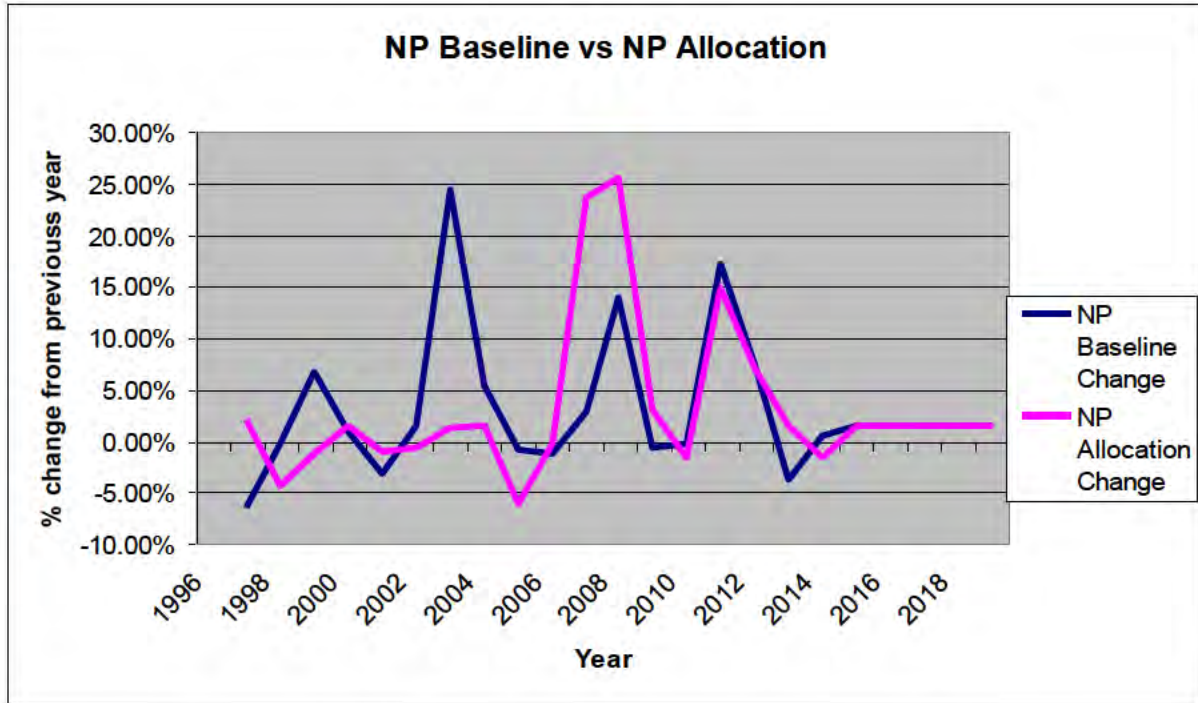


Figure 2: National Procurement baseline versus national procurement allocation

Figure 2 clearly shows that notwithstanding a nominal annual inflator of 1.5%, the account experiences regular baseline adjustments sometimes in excess of 20%.³⁰ Though the reasons and rationale for these variances are many and varied, they serve to highlight the

³⁰ The term baseline in this context is not intended to imply stability but rather continuity. A baseline increase of \$100M in year 1 implies that any percentage increases in year 2 take as their baseline the previous year's supply including the \$100M baseline increase. In contrast, an in-year increase is just that, a one-time infusion of cash that does not change the overall structure of the account. Future percentage increases do not consider in-year increases of previous years.

potential volatility of this account. Needless to say, such volatility breeds uncertainty and exacerbates the challenges inherent in its management.

Demand

On the demand side of the equation, national procurement is equally complex. Demand has been characterized over time by complexity and opacity as managers strive to articulate levels and types of demand against which to compare supply. For instance, the most recent meeting of the National Procurement Oversight Committee noted three different types and levels of demand as follow:

FG Demand: Funding required to maintain CF authorized materiel in the Force-Generator required operationally ready state. May also be described as “Readiness Demand” or “Force Generation Demand”.

Minimum Operational Demand: Funding required to sustain the minimum level of operational readiness to meet CF operational commitments.

Executable Demand: Funding level matching the Division’s capacity to execute (i.e. ability to spend considering HR, PWGSC, industry capacity, etc).³¹

Force generation demand can best be considered as the sum-total of all national procurement funds required to meet a defined level of readiness. Readiness levels in the Canadian Forces reflect the ability of a weapon system to fulfill a mission or series of missions over time. Although weapon systems generally bring to mind visions of equipment, it is in fact the pairing of equipment with qualified and trained operators and sustained over a prescribed

³¹ Department of National Defence, *Final Minutes National Procurement Oversight Committee (NPOC01/12) Held on 2012/04/17*, available from [http://otg-vcd-webs019.ottawa-hull.mil.ca/shared/doc-display.asp?XMLFileName=Published Meetings.xml&committeeid=8&meetingid= 396&versionNumber=8; DWAN](http://otg-vcd-webs019.ottawa-hull.mil.ca/shared/doc-display.asp?XMLFileName=Published%20Meetings.xml&committeeid=8&meetingid=396&versionNumber=8;DWAN); accessed 21 June 2012. In this context, ‘Division’ refers to the Functional grouping under ADM (Mat) responsible for managing national procurement on behalf of the various environments. For example, DGAEPM (Director General Aerospace Equipment Program Management) is the ‘Division’ responsible for the Royal Canadian Air Force. Likewise, DGLEPM is responsible for the Canadian Army and DGMEPM for the Royal Canadian Navy.

period that permit the achievement of a degree of readiness. These readiness levels can be expressed in many ways but are often defined in terms of a unit's preparedness to commence operations. For example, a ship in and of itself cannot deliver an effect regardless of the amount of national procurement funding expended in its support. When, however, that ship is paired with a trained and motivated crew and supplied with the consumables, spare parts and munitions necessary for operational employment and moreover is prepared to engage in operational employment within a specified window of time (1 hour notice to move, 1 day notice to move, etc), a readiness level is achieved. Desired readiness levels, therefore, when taken across the totality of the Canadian Forces' inventory of operational effects, dictate a specified level of support required in terms of national procurement; that is to say, force generation demand.

Minimum operational demand is similar to force generation demand in that it refers to readiness levels as the primary drivers, however this level of demand assumes that there is an acceptable level of readiness below that which defines force generation demand to which the Canadian Forces could reduce and still carry out the six mission sets defined in the *Canada First Defence Strategy*.³² This level of demand is less clear, and discriminating between this and force generation demand is challenging in the extreme.

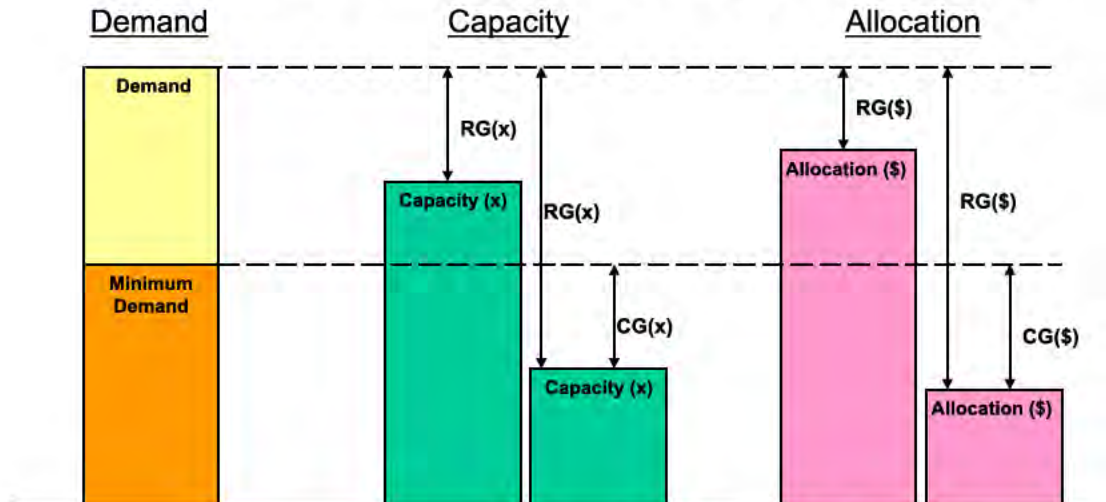
Executable demand departs from the previous two in that it does not consider requirements but rather the ability of the overall procurement system to respond. This takes into

³² Department of National Defence, *Canada First Defence Strategy*, available from http://www.forces.gc.ca/site/pri/first-premier/June18_0910_CFDS_english_lowres.pdf; Internet; accessed 21 June 2012, 10. These six missions include conducting daily domestic and continental operations, including in the Arctic and through NORAD; supporting a major international event in Canada such as the 2010 Olympics; responding to a major terrorist attack; supporting civilian authorities during a crisis in Canada such as a natural disaster; leading and/or conducting a major international operation for an extended period; and deploying forces in response to crises elsewhere in the world for shorter periods.

consideration capacity within Assistant Deputy Minister (Materiel), Public Works and Government Services Canada, Treasury Board of Canada Secretariat as well as the ability of industry to respond and support. Executable demand is, in essence, a sub-set of force generation demand as capacity in excess of this stated level of demand would be better described as excess executable capacity.

By way of illustration, Figure 3, taken from the 17 April 2012 presentation to the National Procurement Oversight Committee, illustrates notionally the interaction between the various types of demand and the resultant gaps when demand falls short or is forecast to fall short of supply.

Readiness Gap and Critical Gap



- The ability to meet the Demand / Minimum Demand can be limited by either the Capacity (x) or the Allocation (\$)
- There is a **Readiness Gap (RG)** when the allocation or ability to execute is lower than the Demand
- There is a **Critical Gap (CG)** when the allocation or ability to execute is lower than the Minimum Demand

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Figure 3: National Procurement Oversight Committee 01/12 demand vs capacity³³

In this Figure, demand is equivalent to force generation demand described previously. It demonstrates in graphical terms that when capacity or supply (in this case referred to as allocation) lags demand, there is a Readiness Gap. Similarly, when capacity or supply lags minimum demand, the resultant condition is referred to as a Critical Gap.

³³ Department of National Defence, *NPOC 01/12*; Presentation, 17 April 2012, Slide 50.

From these definitions and the foregoing discussion, it is clear that comparisons of supply and demand must be carefully investigated to ensure the reader is aware of the type of demand under discussion and, moreover, whether the supply line in question considers only baseline funding, baseline combined with known in-year adjustments or indeed whether forecast investment plan incremental top-ups have been added to the supply picture. Failure to have these parameters clearly outlined will invariably result in faulty analysis.

Much as the notional database projects supply into the future, so too must the Assistant Deputy Minister (Materiel) forecast demand. In addition to known or anticipated changes in demand from a myriad of user-generated factors, this exercise requires an assessment of inflation over time. National procurement demand was, at one time, forecasted through use of the departmental inflators as detailed in the departmental economic model.³⁴ Since 2007, however, a value of 2.2% has been and continues to be used to inflate national procurement demand.³⁵ Concurrently, although the Department was assured of a 2% annual inflator as part of government's stated desire in the *Canada First Defence Strategy* to minimize the reduction in real buying power and provide certainty to defence acquisition and sustainment funding, the

³⁴ Department of National Defence, *DND Economic Model Historical Rates*; available from http://admfincs.mil.ca/db/Publications_e.asp; DWAN; accessed 21 June 2012.

³⁵ The origin of the 2.2% demand inflator can be found in the minutes of NPOC 02/07 where this figure was decided upon as a means of preparing the initial 20 year forecast in support of IP 09; reflective of an assumed level of Defence Specific Inflation. Department of National Defence, *Final Minutes National Procurement Oversight Committee (NPOC 02/07) 2007/11/28*; available from <http://otg-vcd-webs019.ottawa-hull.mil.ca/shared/doc-display.asp?XMLFileName=PublishedMeetings.xml&committeeid=8&meetingid=105&versionNumber=28>. The NPOC is a Level 2 group co-chaired by the Chief of Staff ADM (Mat) and the Chief of Programme. Members are drawn from all departmental Level 1 organizations and include, *inter alia* Deputy Commander Royal Canadian Air Force, Deputy Commander Royal Canadian Navy, and so on. The group meets formally twice yearly with additional ad-hoc gatherings as circumstances warrant.

Department continues to increase the notional accounts over a range of values, the exact inflators varying by account and the balance being reserved at the centre.³⁶ As a result, the Department has created a structural variance between approved national procurement supply and demand inflation. This variance is ameliorated through the application of investment plan incremental top-ups, the objective being to maintain national procurement funding at a level of at least 80% of executable demand.³⁷ In terms of magnitude, consider the current situation whereby supply is increased at 1.5% per annum and demand at 2.2% per annum, a difference of 0.7%. Given a notional national procurement supply figure of \$2.716B for fiscal year 12/13, this factor alone could result in a supply / demand variance of \$19M for fiscal year 12/13, a figure that rises to \$33M in fiscal year 28/29.³⁸ Although admittedly of minimal magnitude relative to the overall account, this 0.7% variance is but one factor. When considered in conjunction with the other factors that will be detailed later in this paper, the cumulative negative effect on the account as a whole becomes apparent.

³⁶ See...Department of Finance, *Budget 2008 Responsible Leadership For Uncertain Times*; available from <http://www.budget.gc.ca/2008/pdf/plan-eng.pdf>; Internet; accessed 21 June 2012, 180. Department of National Defence, *Canada First Defence Strategy*, available from http://www.forces.gc.ca/site/pri/first-premier/June18_0910_CFDS_english_low-res.pdf; Internet; accessed 21 June 2012, 4. Department of National Defence. *Notional Database*, http://admfincs.mil.ca/db/nd-bdt_e.asp; DWAN; accessed 21 June 2012. Within the notional database, national procurement is still inflated at 1.5% per annum as at FY 12/13.

³⁷ The origin of the goal of funding 80% of executable demand is not recorded. It is, however, accepted as the norm and is widely referenced within the department. Department of National Defence, "NPOC 01/10" Presentation, 15 June 2010, Slide 34.

³⁸ $\$2.716B * (0.022-0.015) = \$19.012M$ for FY 12/13. For FY 28/29, the notional supply figure is drawn from Department of National Defence, *Investment Plan National Procurement 20 years Executable Demand, 2008*; ADM (Mat). $\$4.757B * (0.022-0.015) = \$33.299M$

Thus, the national procurement account for extant capabilities is structurally underfunded; the infusions of cash from the investment plan notwithstanding. Further, this situation is potentially exacerbated by the variances between economic inflation and a defence specific inflator; or the, "...assertion that the prices of "defence-specific" goods and services respond to inflationary pressures in a manner not captured by broad national economic measures such as the Gross Domestic Product (GDP) implicit price index or the Consumer Price Index (CPI)."³⁹

Though Solomon highlighted the weaknesses in the argument for the recognition of a defence specific inflator, subsequent work by Kirkpatrick has suggested the existence of a defence specific inflator in the United Kingdom in the order of 3% above the Gross Domestic Product deflator, whereas Chalmers and Dowdy rebut Kirkpatrick's work and ascribe the perceived inflationary pressures to increased operational commitments, ambitious equipment programs and slow real funding growth.⁴⁰ Although debate on this issue continues, what remains is the fact that national procurement demand and supply are inflated at different rates, and there is a very real possibility that the rate of supply inflation still lags assumed inflation for the goods and services procured under the national procurement umbrella. The obvious outcome of such a

³⁹ Binyan Solomon, "Defence Specific Inflation: A Canadian Perspective." *Defence and Peace Economics*, 2003, Vol. 14(1), 19.

⁴⁰ See...Binyan Solomon, "Defence Specific Inflation: A Canadian Perspective." *Defence and Peace Economics*, 2003, Vol. 14(1), 31. David Kirkpatrick, *Is Defence Inflation Really as High as Claimed?* available from http://www.rusi.org/go.php?structureID=articles_defence&ref=A490B1EFDE057E; Internet; accessed 15 June 2012, 71. Malcolm Chalmer, John Dowdy, David Kirkpatrick, and Dr. Robbin Laird, *Defence Inflation: Reality or Myth*, available from http://www.rusi.org/downloads/assets/Comment_Defence_Inflation_Myth_or_Reality.pdf; Internet; accessed 15 June 2012, 15.

structural issue is an inevitable divergence between national procurement demand and supply as well as a reduction in real buying power over time.

From the foregoing, the complexity of the national procurement account and the delicate balance between supply and demand become readily apparent. With this understanding of the overall account structure as a base, the following sections outline the status quo insofar as the derivation of demand forecasts are concerned. Given that risk to the account and by extension, the contingency funds required to mitigate against this risk are directly related to the accuracy of the demand forecasts, the following sections provide a more detailed look at the underpinnings of the demand forecasts and thus provide a ready appreciation of the potential inherent risks.

DERIVATION OF NATIONAL PROCUREMENT DEMAND FORECASTS

This paper does not purport to provide a detailed explanation of the means whereby specific individual national procurement forecasts are generated as this level of technical examination is beyond its scope. Rather, it will examine the two distinct and vastly different overarching approaches used depending upon whether the capability in question is extant or new.

Extant Capabilities

For extant capabilities, or those capabilities already in the Canadian Forces' inventory and in support of which national procurement funds have been drawn for at least one fiscal year, the demand forecasts originate with the life cycle material managers.⁴¹ These procurement specialists within the Assistant Deputy Minister (Materiel) organization use their knowledge of the procurement system, market and procurement environment, the usage history of the capability as well as usage rates proposed by the end-users and weapon system managers to generate national procurement demand forecasts for the coming two to three years. Once short-term forecasts are generated, they are generally inflated at 2.2% per annum in order to provide a 20-year view of national procurement demand. Of note, this inflator applies only to demand. As discussed in the previous section, national procurement supply overall is inflated at differing

⁴¹ This is a distinction drawn by the study principal so as to provide a means of categorizing national procurement demand. In differentiating between new and extant capabilities, the primary issue is one of forecasting future demand based on current knowns and forecast changes to those knowns (current demand, for example) as compared to forecasting demand for an unknown quantity; the new capability. This demarcation line was therefore drawn so as to better differentiate between extant and new.

rates over time with the current plan forecasting an inflation rate to the national procurement notional allocation of 1.5%.

New and Replacement Capabilities

For new capabilities and those replacing extant capabilities such as the Canadian Patrol Frigates and the CF-18 fighters, it was clear at the time of investment plan 2009 development that the projects were not yet sufficiently mature to have refined national procurement estimates. Consequently, as reported at National Procurement Oversight Committee 02/08, a decision was taken to base demand in support of operations and maintenance (national procurement being a sub-set of operations and maintenance) on a 1:1 ratio basis relative to the accrual profiles for a given capability of which 60% would be apportioned to national procurement and 40% to operations and maintenance.⁴² In the end, however, and in almost all cases, 100% of this resultant demand figure was assigned to national procurement; operations and maintenance being handled separately. Unfortunately, the written record does not provide specifics as to the rationale behind this decision; if indeed a formal decision was made in this regard. Additional operations and maintenance funding for new and replacement capabilities was, however, relegated to a separate funding line within investment plan 2009.⁴³

⁴² Department of National Defence, *Final Minutes National Procurement Oversight Committee (NPOC 02/08) Held on 2008/06/20*; available from <http://otg-vcd-webs019.ottawa-hull.mil.ca/shared/doc-display.asp?XMLFileName=Published Meetings.xml&committeeid=8&meetingid=153&versionNumber=15>; DWAN; accessed 21 June 2012.

⁴³ Department of National Defence, *Long Range Planning Tool*; C Prog 2009. Of note, the specific methodology used to calculate the funding lines associated with additional O&M for new and replacement capabilities is not recorded. Discussions with those who generated the funding lines provide the only insight into the origin of these values.

For example, the replacement for the Aurora aircraft, the Canadian Multi-mission Aircraft, has planned accrual payments of \$80M per annum (non-inflating) over its expected life.⁴⁴ It's proposed national procurement demand is just short of this at \$71.4M per annum, inflating at 2.2% per year which, within the bounds of investment plan 2009 (which covers a twenty year span from fiscal year 08/09 to fiscal year 28/29) average just over \$80M per annum.⁴⁵ Similarly, the unmanned aerial vehicle project, dubbed JUSTAS, has proposed accrual payments of \$53.2M per year (non-inflating) and a proposed national procurement requirement that commences at \$54M per year and then inflates at the standard 2.2% thereafter.⁴⁶ In both cases, it is apparent that the national procurement demand associated with the capability under discussion was derived through use of the simplistic 1:1 ratio analysis and the totality of the resultant figure being applied to national procurement.

In their 2008 paper on air force operations and maintenance cost trends, Groves and Fetterley noted that actual ratios for extant capabilities varied from this simplistic approach and suggested that as a minimum, a range of ratios might be more appropriate such as "... 1:1.5 – 1:3.0 for complex weapons platforms (aircraft, ships with large amounts of embedded software), 1:1 – 1:2 for land combat (direct, indirect fire) systems and 1:0.5 – 1:1.0 for land non-combat

⁴⁴ Non-inflating refers to the fact that accrual payments made by the Department to Government are not subject to inflation. Once agreed to, they remain constant until the liability is discharged.

⁴⁵ Department of National Defence, Investment Plan National Procurement 20 years Executable Demand; 2008; ADM (Mat).

⁴⁶ Department of National Defence, *Long Range Planning Tool*; C Prog 2009. Department of National Defence, Investment Plan National Procurement 20 years Executable Demand, 2008; ADM (Mat).

vehicles.”⁴⁷ This approach has merit, and indeed draws from ratios observed with extant equipment of similar complexity and usage. This method of national procurement forecasting is not, however, without its weaknesses. The development of the ratios themselves draws upon a comparison of national procurement usage for a representative capability with its capital cost. This approach risks suffering from comparison bias in that it assumes that a replacement capability will be used in similar fashion to the one it replaces or the capability used as a basis for comparison. This is not always the case. Replacement platforms are generally delivered with enhanced basic capabilities inherent to the design that inevitably draws them into other usage areas than their predecessors. Though time will tell the tale, it is highly unlikely that the CH148 Cyclone, for example, will be used in exactly the same manner and fashion as the CH124 Sea King it replaces. To do so would be to waste a tremendous amount of operational capability and moreover does not reflect the likelihood that the platforms’ roles will change over time. By way of example, the Sea Kings traditionally prosecute sub-surface contacts using dipping sonar. With the advent of the Canadian Patrol Frigates with the towed array sonar and with the EH 101 on the horizon as the contracted replacement for the Sea King, a decision was taken to convert four aircraft from active to passive acoustics so as to better integrate with the new ships and better prepare crews for the next aircraft which would possess both active and passive acoustic

⁴⁷Maj Richard A. Groves, and LCol Ross Fetterly, “An Imperfect Storm: Air Force Operations and Maintenance Cost Trends” *Air force Journal* Vol. 1 Issue 1, (Spring 2008), 24. Weapon System /Platform FY06-07 Actual Ratio of Annual Amortization Expense to Annual national procurement Spending:

CP140 Aurora	1: 3.02	CH148 Griffon.....	1: 0.78
CF188 Hornet.....	1: 1.09	CH149 Cormorant.....	1: 1.8
CC130 Hercules (E/H Models).....	1: 3.43		

capabilities.⁴⁸ Although seemingly a simple change, this generated a shift in national procurement patterns due to the new requirement to purchase sonobuoys in support of the passive sonar system. The Sea King is indeed a maritime helicopter with the unique ability to take off from and recover upon small decks at sea. The Cyclone will do likewise. It is not, however, inconceivable and one might suggest it is even likely, that given the sensor suite inherent to the Cyclone, it will find itself pressed into service in overland roles as well. Accordingly, the use of a ratio derived from Sea King sustainment over time would inject a degree of error into the analysis. Though this can be buffered through the use of bracketed or a range of ratios as suggested by Groves and Fetterley, this factor must be recognized and accounted for if ratio analysis is to be improved from its current overly simplistic status.

A second weakness of the flat-ratio approach is that the historic ratios that gave rise to those proposed for new and replacement capabilities are exaggerated through longevity. The C130 Hercules aircraft exhibited a 1: 3.43 ratio of amortization expense to national procurement support expended in 2006.⁴⁹ To draw from this a conclusion that 1:3 is appropriate for this type of air vehicle misses the point that this level of support is driven by the age of the airframes and consequently the relatively low acquisition cost as compared to support costs of the day. By way of comparison, the replacement for the C130, the C130J of which Canada has just completed taking delivery, has an accrual amortization rate of \$94.4M per annum (non-

⁴⁸ RCAF Historical Workshop 2012. http://www.seaking50.ca/RCAF_Historical_Workshop/Entries/2012/8/3_Report_on_18th_RCAF_Historical_Works_hop19-20_June_2012.html; Internet; accessed 28 Sep 2012.

⁴⁹ Maj Richard A. Groves, and LCol Ross Fetterly, "An Imperfect Storm: Air Force Operations and Maintenance Cost Trends" *Air force Journal* Vol. 1 Issue 1, (Spring 2008), 24.

inflating).⁵⁰ It's most recent revised national procurement forecast (which encompasses a full in-service support contract) suggests an annual national procurement demand of \$165M inflating at 2.2%, a ratio of 1:1.75; within the range proposed by Groves and Fetterley, but short of the mark suggested by its predecessor.⁵¹ Of course, were Canada to keep the C130J as long as its predecessor, as history suggests will likely be the case, it is indeed possible that a similar analysis conducted upon the C130J's retirement would find that the ratio had risen from 1:1.75 to 1:3, or even higher. This is not, however, of significance when attempting to derive ratios for current planning. The ratio approach when used in conjunction with the requirement to provide life-cycle costs over the 20-year span of an investment plan looks forward and proposes to relate support costs to acquisition costs bounded by the span of the investment plan itself.

Suffice to say, it is clear that national procurement management suffers from a lack of rigour in demand forecasting; a fact noted by Groves and Fetterley in 2008 and this has yet to be sufficiently ameliorated.⁵² Though changes to the ratio approach such as those suggested by Groves and Fetterley have the potential to improve the current situation, the weaknesses inherent in ratio analysis as noted above require that this issue be revisited as future editions of the departmental investment plan are drafted and submitted to government for consideration.

⁵⁰ Department of National Defence, *Long Range Planning Tool*; C Prog 2009.

⁵¹ Department of National Defence, 20 years National Procurement Demand (in BY) for IP 12; ADM (Mat).

⁵² Maj Richard A. Groves and LCol Ross Fetterly, "An Imperfect Storm: Air Force Operations and Maintenance Cost Trends." *Air force Journal* Vol. 1 Issue 1, (Spring 2008).

This is not to say that efforts are not underway to better refine demand estimates. Pall and Van Bavel's work on ammunition forecasting relative to readiness levels is but one example.⁵³ In this study, a group of readiness levels was considered in terms of training required to achieve them and the persistence of this training. From this, training ammunition requirements were calculated; the results being compared to actual requests and usage logs. It was clear that training ammunition requests, which translate into national procurement demand, were generally over-stated based upon the agreed-upon readiness levels used to base-line the study. Likewise, there have been numerous studies over time focused upon national procurement forecasting for specific capabilities; the impetus for these studies being driven by the replacement / life-extend debate that inevitably occurs as assets age.⁵⁴

With this basic understanding of the systemic weaknesses in the derivation of national procurement demand forecasts as well as the overall issue of national procurement supply, it is possible to consider the risk assessment conducted on the national procurement account as a whole; the results of which define the risk mitigation strategy in the form of a national procurement contingency reserve.

⁵³ Raman Pall and Gregory van Bavel, *Towards a Determination of Readiness-based Ammunition Allocations*; DRDC CORA TR 2010-283 December 2010.

⁵⁴ A. Sokri, *An Economic Evaluation for CP-140 Aircraft Replacement*; DRDC CORA TM 2009-027 July 2009; Paul Desmier, *The Optimal Time to Upgrade or Replace the Light Armoured Vehicle (Lav III) Fleet*; DRDC CORA TM 2010-101 June 2010; Edward G. Keating, and Matthew Dixon. *Investigating Optimal Replacement of Aging Air Force Systems*; RAND 2003; available from http://www.rand.org/pubs/monograph_reports/MR1763.html; Internet; accessed 8 July 2012.

RISK ASSESSMENT

In October 2010, the Chief of Programme division undertook an overall risk assessment of the extant investment plan (2009), the results of which were intended to inform and thereby shape the development of its next iteration. Specifically, the stated work plan required the development of a dollar quantification of risk by year for the period from fiscal year 11/12 through to and including fiscal year 31/32 across the four pillars upon which both the *Canada First Defence Strategy* and investment plan 2009 were built.⁵⁵ Although the work was completed and its results central to this paper, only those methods and results stemming from examination of the readiness and equipment pillars are described in any detail as the other two pillars had little bearing on the specific issue of national procurement risk as defined within the study itself.⁵⁶

This study was not initiated solely out of idle curiosity. Concerns repeated in successive meetings of the National Procurement Oversight Committee and specifically articulated in the graphical representations of future funding shortfalls as depicted in Figure 4 coupled with the outcomes of the Chief of Review Services' 2003 assessment of national procurement

⁵⁵ The CFDS refers to four pillars upon which military capability is built, Personnel, Equipment, Readiness and Infrastructure. Department of National Defence, *Canada First Defence Strategy*; available from http://www.forces.gc.ca/site/pri/first-premier/June18_0910_CFDS_english_low-res.pdf; Internet; accessed 21 Jun 2012, 12 (Chart 3).

⁵⁶ It should be noted that there are indeed links between national procurement and the personnel pillar as the ability to execute the national procurement program are directly linked to the procurement professionals within ADM (Mat) charged with implementation of the plan. Though systemic capacity can and will affect execution and thereby overall readiness, this aspect of the equation is reserved for separate investigation and comment at a later date.

management led to the belief bordering upon certainty that the national procurement account was under-funded in future years; notwithstanding the fact that, as previously noted, previous budgets had provided additional funds for this account.⁵⁷ The obvious questions resulting from this belief, therefore, concerned by how much and with what degree of certainty could the future national procurement demand envelope exceed anticipated supply.

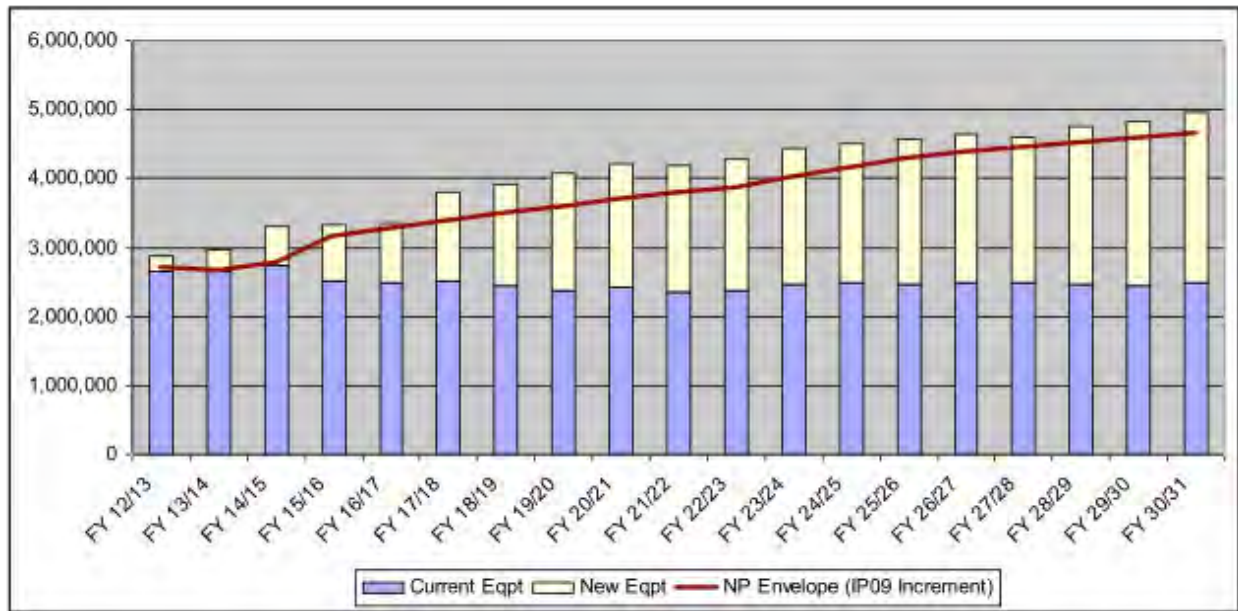


Figure 4: National procurement forecast demand vs supply⁵⁸

⁵⁷ Department of National Defence, *Final Minutes National Procurement Oversight Committee (NPOC 03 October, 2006) Held on 2006/10/03*; available from <http://otg-vcd-webs019.ottawa-hull.mil.ca/shared/doc-display.asp?XMLFileName=PublishedMeetings.xml&committeeid=8&meetingid=78&versionNumber=14>; DWAN; accessed 21 June 2012. At NPOC 03 Oct 2006, the Chair, "...emphasized that due to chronic under-funding we are continuing to rust out our fleets." Department of National Defence, Chief Review Services, *National Procurement: Assessment Study*; September 2003; available from <http://crs-csex.mil.ca/reports-rapports/pdf/2003/p0538-eng.pdf>; DWAN; accessed 21 June 2012. A similar forecast on p 38 of this report demonstrated the belief and understanding in 2002 that national procurement demand was likely to continue to outstrip supply as far forward as FY 15/16.

⁵⁸ Department of National Defence, *Final Minutes National Procurement Oversight Committee (NPOC 02/11) Held on 2011/10/24*; available from <http://otg-vcd-webs019.ottawa-hull.mil.ca/shared/doc->
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Given the study was seeking to understand and quantify risk relative to information as it was understood when investment plan 2009 was developed, it took as its base-line the national procurement demand schedule produced by the Assistant Deputy Minister (Materiel) in support of investment plan 2009 development.⁵⁹ From this, the study considered the certainty surrounding the estimates associated with new and replacement capabilities as well as the difference between the 1.5% annual inflator applied to the national procurement account and an assessment of national procurement-specific inflation; or the degree of inflation unique to the national procurement account.

The study was also conducted under the assumption that potential reductions in overall force readiness resulting from insufficient national procurement funding could be treated as a financial problem vice one of capability. In order to reduce the number of variables, it was necessary to fix one component of the equation. In this instance, it was assumed that national procurement demand was a true and reasonable expression of funds required to achieve a desired effect and that variances would be addressed in financial terms. In simple terms, the study assumed that readiness levels as expressed by the national procurement users through their demand forecasts were static and that the only variable under consideration would be the funds

[display.asp?XMLFileName=PublishedMeetings.xml&committeeid=8&meetingid=396&versionNumber=8;](#)
DWAN; accessed 21 June 2012, Slide 76.

⁵⁹ Each year, ADM (Mat) prepares a forecast of national procurement demand by major user group in preparation for the Fall NPOC meetings. These forecasts generally look 10 years into the future. The forecasts prepared in 2008 and 2011 also supported development of the departmental Investment Plans. Accordingly, the forecasts prepared in these years looked 20 years into the future. Likewise, future iterations of this demand forecast will continue to look 20 years into the future so as to provide a basis for year-to-year comparison and thus facilitate ongoing study and analysis.

required to achieve them. Financial resources were therefore chosen as the primary variable as they demonstrate not only funds required but also a dollar-quantification of the problem. This, of course, poses a degree of risk in terms of attempting to define and/or quantify risk to readiness in financial terms. It is understood that a lack of national procurement funds can and will have a demonstrable impact on readiness levels; however one chooses to define them. Readiness speaks to the heart of military capability. It defines the ability and preparedness of forces to execute tasks and conduct operations at the behest of government. Though this analysis could have considered readiness as the primary variable, this would have required excessive subjective assessment in terms of readiness levels as well as imprecise results in terms of the effect of readiness reductions on overall investment plan risk. Since the investment plan is, in effect, a financial document, a decision was taken to express risk in like terms so as to better assess calculated risk against known supply. More specifically, a starting assumption of this study is that the stated extant readiness levels are directly linked to the ability of the Canadian Forces to operationalize the *Canada First Defence Strategy*. It stands to reason, therefore, to consider these as static and assess the financial risks inherent in achieving them. If, over time, the Department chooses to reduce readiness and/or amend the *Canada First Defence Strategy* resulting in altered or reduced readiness requirements, it stands to reason that the financial risk to the investment plan arising from national procurement demand will likewise diminish. This study therefore considers the financial risk based on the status quo in terms of readiness levels.

Extant Capabilities

Considering national procurement that is associated with extant capabilities, three data sources were examined to determine the trend in forecast stability over time. That is to say, given a basket of demand drivers or capabilities with national procurement demand forecasts for

a given future date, the study investigated the degree to which the forecasts themselves were adjusted over time and how these forecasts have fared when compared with actual expenditures. To accomplish this, national procurement demand forecasts for fiscal year 11/12 for a specific and consistent group of national procurement users from 2004, 2008 and 2011 were examined.⁶⁰ These were then compared against actual expenditures for fiscal year 11/12.⁶¹ In all cases the forecasts were presented in budget years according to the economic model of the day.⁶² The specific results of this examination are detailed in Table 2. The rationale in choosing these specific demand drivers was three-fold. First, they represent major draws on the national procurement account.⁶³ Second, they were consistent in their reporting over the eight years under examination. That is to say, it was possible to track the demand drivers as they did not suffer name changes or obvious variations in attribution over time. Third, the drivers represented a cross-section of major national procurement users from all three elements of the Canadian Forces. Accordingly, their selection was assessed by the study principal to be a representative and substantive picture of the national procurement account as a whole.

⁶⁰ Department of National Defence, *Long Term Equipment Support Cost Projections*; ADM (Mat) 2004; Department of National Defence, *Investment Plan National Procurement 20 years Executable Demand, 2008*; ADM (Mat). Department of National Defence, *20 years National Procurement Demand (in BY) for IP 12*; ADM (Mat).

⁶¹ ADM (Mat) expenditure report 2012-05-28.

⁶² Department of National Defence, *Costing Handbook*; available from http://admfincs.mil.ca/costinghb/intro_e.asp; DWAN; accessed 21 June 2012, Glossary. Budget Year Dollars - Costs in budget year dollars reflect the purchasing power of the dollar in the year the cost is incurred. Sometimes referred to as future dollars. Economic Models are prepared by ADM (Fin CS) on an annual basis and provide a consistent baseline for departmental forecasting in terms of inflators to be used for specific classes of goods.

⁶³ Collectively these drivers consumed approximately 53% of the FY 11/12 national procurement budget of \$2.529B (after adjustments). Department of National Defence, *Notional Database*; available from http://admfincs.mil.ca/db/nd-bdt_e.asp; DWAN; accessed 21 June 2012.

National procurement demand forecasts from 2004, 2008 and 2011 for fiscal year 11/12 vs actual fiscal year 11/12 national procurement expenditures				
For FY 2011/2012 in \$M BY	2004	2008	2011	Actual ⁶⁴ 11/12
Halifax Class Warship	136.0	224.4	267.0	⁶⁵ 267.0
Iroquois Class Warship	72.7	54.6	70.5	45.5
Minor Warships	37.5	33.7	30.0	36.0
AORs (Supply Ships)	17.6	48.9	39.0	31.8
Victoria Class Submarines	72.3	203.9	288.2	242.7
Buffalo Search and Rescue Aircraft	7.9 ⁶⁶	16.7	23.1	12.9
Hercules Transport Aircraft	139.2	108.5	92.0	86.0
F-18 Fighter Aircraft	203.0	188.0	169.6	127.6

⁶⁴ Exclusive of national procurement funds expended under the Support to Deployed Operations Account (SDOA). This account provides additional funds to support *inter alia* national procurement driven specifically by participation in operations. Operations in Afghanistan, therefore, play little part if any in this analysis. Where Afghanistan does become a factor is in the constant pressure to increase readiness to deploy that is not directly and specifically linked to a deployment and therefore not funded from the SDOA. This is, in fact one of the factors cited by Chalmers and Dowdy in their paper refuting the concept of defence specific inflation.

⁶⁵ Lacking a final expenditure for this fleet less the betterments that are still being funded from this account, this value was amended to reflect the 2011 estimate less the forecast expenditure on betterments as these were not specifically referenced in the long term equipment cost projections from 2004.

⁶⁶ The long-term equipment support projections from 2004 only projected national procurement for the Buffalo to FY 9/10. In previous years, the inflationary factor used for the Buffalo was 1.55%. This factor was successively applied to the FY 9/10 value to generate assumed projected values through to FY 11/12.

Sea King Helicopter	49.7 ⁶⁷	52.7	68.8	65.0
Griffon Helicopter	28.7	40.0	45.7	65.7
Cormorant Helicopter	40.4	88.8	84.9	112.4
Aurora Long Range Patrol Aircraft	102.2	114.1 ⁶⁸	153.9	91.0
Heavy Logistics vehicle Wheeled	10.3	13.3	18.2	9.6
Light Armoured Vehicle III	96.8	60.9	90.8	83.6
Heavy Armour	9.9	10.2	8.9	35.4
Totals	1024.2	1258.7	1450.6	1312.2
% Change over previous estimate		22.9%	15.2%	
% Change over 2004 estimate			41.6%	28.12%

Table 2: National procurement demand forecasts from 2004, 2008 and 2011 for fiscal year 11/12 vs actual fiscal year 11/12 national procurement expenditures

This simple treatment of estimates made over time brings several issues to the fore that bear examination. Most obviously it demonstrates the danger inherent in making generalizations from single data-points. Specifically, in reviewing this chart it is evident that national procurement demand for fiscal year 11/12 in support of the Halifax Class Frigates made in 2004 grossly understated the actual expenditures in that fiscal year even after factoring out expenditures made in support of betterments to the Halifax Class ships as these were not referenced in the initial long term support projection. Similarly, estimates for the F-18 fighter

⁶⁷ The long term equipment support projections from 2004 only projected national procurement for the Sea King Helicopter to FY 08/09. In the previous period, the estimate had reduced demand by 0.566% relative to FY 07/08. This percentage reduction was successively applied to the FY 08/09 value to derive an assumed FY 11/12 demand for the Sea King helicopter.

⁶⁸ This value represents the national procurement forecast for both the Aurora and the betterments included under the AIMP program as these were both referenced in the 2004 long term equipment support projections.

aircraft over-stated demand. Considered independently, these estimates risk painting an erroneous picture of the state of national procurement forecasting. Taken together, however, as an aggregate basket of goods, it is possible to elicit a series of trends which do provide a sense of how well the department has fared in forecasting national procurement demand. Specifically, it is apparent that, taken as a group, national procurement demand was under-stated by 28.12% over the eight years from when the first forecast was offered in 2004 until fiscal year 11/12 when the expenditures were actually made; an average of 3.5% per year recurring. It should be noted that this shortfall is in spite of the estimates having been inflated in accordance with the economic models of the day. Of greater interest, however, are the underlying factors that collectively contribute to this situation.

Variations in the Inflationary Factors

As previously noted, Life Cycle Material Managers rely upon the published economic models in order to generate forecasts expressed in budget year dollars. In this instance, the economic model for 2011, 2008 and the associated published historic rates for national procurement inflation are of specific interest and are depicted in Table 3.⁶⁹

⁶⁹ See...Department of National Defence, *Economic Model 2011-12 - A Price Trend Forecast*; available from http://admfincs.mil.ca/db/pubs/model2011-12/intro_e.asp; DWAN; accessed 21 June 2012. Department of National Defence, *Economic Model 2008-09 - A Price Trend Forecast*; available from http://admfincs.mil.ca/db/pubs/model2008-9/intro_e.asp; DWAN; accessed 21 June 2012. Department of National Defence, *DND Economic Model Historical Rates*; available from http://admfincs.mil.ca/db/Publications_e.asp; DWAN; accessed 21 June 2012.

FY	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16
Historic EM	2.5	2.6	2.2	2.5	2.1	1.5	1.3					
2008				2.5	2.2	1.8	2.0	2.1	2.0	2.1		
2011								1.8	1.7	2.1	2.1	2.1

Table 3: Economic model inflators for national procurement

Notwithstanding the economic model of the day, national procurement demand is now inflated at 2.2% per annum.⁷⁰ Consequently, forecasts for fiscal year 11/12 made in 2004 and inflated according to the economic model will have a variance from those made in 2008 and/or 2011 when a 2.2% inflator was accepted as the standard.

By way of example, the F-18 fighter forecast for fiscal year 11/12 made in 2004 was \$203.0M. Using the deflators as detailed in the various economic models as shown in Table 3, the 2004 net present value of this figure would have been \$175.53M.⁷¹ Converting this value once again to budget year figures using the historical inflators up to fiscal year 07/08 when the 2.2% inflator was adopted as a standard and the 2.2% inflator thereafter yields a projection of \$205.8M for fiscal year 11/12, a shortfall of \$2.8M and a variance of 1.4% overall.⁷²

⁷⁰ Department of National Defence, *Final Minutes National Procurement Oversight Committee (NPOC 02/08) Held on 2008/06/20*; available from <http://otg-vcd-webs019.ottawa-hull.mil.ca/shared/doc-display.asp?XMLFileName=PublishedMeetings.xml&committeeid=8&meetingid=153&versionNumber=15>; DWAN; accessed 21 June 2012.

⁷¹ The 2004 Net Present Value of \$203M can be determined through successive division by the yearly inflation rate as expressed in the departmental economic model as follows:
 $\$203M/1.013/1.015/1.021/1.025/1.022/1.026/1.025 = \$175.53M$

⁷² Similar to the process used to determine the Net Present Value of a figure, the reverse approach is used to determine the BY future value of a current figure as follows:
 $\$175.53M*1.025*1.026*1.022*1.022*1.022*1.022*1.022 = \$205.82M$

From this estimate, the variance imposed through use of differing inflators over time is evident. Though not large in terms of the overall basket of goods or indeed the size of the account, this factor nonetheless has had and will continue to have a modest impact on the accuracy of future forecasts. To place this into context, this aspect of the study looked at the basket of national procurement users over the eight years from fiscal year 03/04 to fiscal year 11/12. If this were expanded to all national procurement demand, it would represent an understatement in demand of \$37.8M for fiscal year 12/13 alone.⁷³ As for the rest of the contributing factors, this factor in and of itself is of relatively low significance. When, however, it is added to the cumulative effect of the other factors detailed in this study, the additive impact is significant as will be shown when the factors are combined at the end of this section.

Variations in Fleet Size

When national procurement demand is generated, it considers the current demand for a given capability; this demand being influenced by usage rate, fleet size, as well as any known changes in terms of in-service support arrangements. In 2004, the demand forecast assumed a continued expenditure on the Iroquois class fleet into fiscal year 12/13.⁷⁴ In 2008, the demand forecast suggested the likelihood an additional vessel would be retired by fiscal year 12/13.⁷⁵ In

⁷³ $\$2.7B * 0.014 = \$37.8M$

⁷⁴ Department of National Defence, *Long Term Equipment Support Cost Projections*; ADM (Mat) 2004, 14.

⁷⁵ Department of National Defence, *Investment Plan National Procurement 20 years Executable Demand, 2008*; ADM (Mat).

2011, the forecast reflected the apparent decision taken to retain all three of the vessels in class.⁷⁶

Though the minutes of the meeting do not provide a comprehensive view of the processes or discussions behind the decision to keep or retire one of these vessels, nor are the reasons specifically germane, it was in all likelihood driven by a myriad of factors including but not limited to fleet composition requirements, crew training, crew availability, and the political dimension wherein the retiring of a ship is tantamount to the closure of a base; something that is not taken lightly. Accordingly, national procurement forecasts fluctuated as the decision-making process matured over time regarding these large users. Therefore, an unforecast variation in fleet size will have an impact on national procurement demand, especially in those cases where the fleet in question is a more significant user of national procurement funds. A decision to retire one of the Victoria Class submarines, for example, could reduce national procurement expenditure in support of this fleet by as much as \$75M per year; a figure that is approximately 2.7% of the 12/13 notional supply for the entire national procurement account. Although this assumes a lack of fixed costs associated with the Victoria Class overall, the figure serves to show the impact of retaining or shedding individual platforms within a fleet. The fact remains that this analysis is better served through consideration of the overall basket of goods vice focusing on individual components thereof.

⁷⁶ Department of National Defence, *20 years National Procurement Demand (in BY) for IP 12*; ADM (Mat).

Change in Estimated Life Expectancy

National procurement forecasts take into consideration when an asset is likely or planned to be retired. National procurement therefore generally exhibits a tapering off over time as classes of assets are retired in a staggered fashion; this stagger often being driven by the rate at which replacements are brought into service. In 2004, for example, the demand forecast for the Sea King helicopter extended only as far as fiscal year 08/09 based on the assumption that the aircraft would be replaced by 2008.⁷⁷ The 2011 forecast reflected the necessity of an extended life for this fleet and demonstrated an expected tapering off in national procurement demand commencing in fiscal year 12/13 and the 2011 forecast continues to predict a tapering off commencing in fiscal year 12/13, but from a higher start-point of \$61.2M vice the \$52.7M forecast in 2008.⁷⁸ This factor has a two-fold effect. On the one hand, national procurement forecasts will vary simply as a result of a decision to retain a fleet in service longer than initially forecast. There is, however, the additional challenge of maintaining ever-aging platforms. There is a degree of debate as to whether the rate of operations and maintenance cost increase accelerates as platforms age. The United States Congressional Budget Office disputed the concept in its 2001 report on the subject, whereas Maybury points out the challenge in drawing Canadian-specific conclusions from United States Air Force and United States Navy studies due

⁷⁷ Department of National Defence, *Long Term Equipment Support Cost Projections*; ADM (Mat) 2004, 48.

⁷⁸ Department of National Defence, *Investment Plan National Procurement 20 years Executable Demand, 2008*; ADM (Mat). Department of National Defence, *20 years national procurement Demand (in BY) for IP 12*; ADM (Mat).

to variables such as variances in accounting practices.⁷⁹ Sokri's study of Aurora replacement optimization which considered operations and maintenance as a whole (including national procurement) was categorical in stating that the longer a fleet remains in-service, the greater will be its operations and maintenance costs and Fetterley in reference to maintaining the Sea King fleet, offered that, "...their age adds a significant expense."⁸⁰ Of course, these studies all consider operations and maintenance writ large vice the specific sub-set that is national procurement. Accordingly, a more specific examination is required in order to ascertain the specific impact of this factor on the accuracy of national procurement estimates.

Table 4 shows the planned yearly flying rate for 5 current aircraft fleets in the Canadian Forces' inventory compared against the planned national procurement expenditures over time. The national procurement forecasts are expressed in current year dollars for fiscal year 04/05 so as to remove inflation from the analysis and better identify the thought processes of the forecasters with reference to the likelihood of variances in support costs specifically as a result of asset age as opposed to overall general inflationary factors. Additionally, based on the degree of projection used in the source document (6 years into the future) the planned flying rates for fiscal year 04/05 through to fiscal year 09/10 were drawn directly from the published projection.

⁷⁹ See...Congressional Budget Office, *The effects of Aging on the Costs of Operating and Maintaining Military Equipment*; available from <http://www.cbo.gov/ftpdocs/29xx/doc2982/AgingCostsO&M.pdf>; Internet; accessed 8 July 2012, Summary. David Maybury, *Economic Forecasting with Optimal Replacement for the CP-140 Fleet Under the Aurora Incremental Modernization Program*; DRDC CORA TM 2009-023 June 2009, 1.

⁸⁰ See...A. Sokri, *An Economic Evaluation for CP-140 Aircraft Replacement*; DRDC CORA TM 2009-027 July 2009. LCol Ross Fetterley, "The Cost of Peacekeeping: Canada" *The Economics of Peace and Security Journal*, Vol. 1, No. 2 (2006); available from http://www.epsjournal.org.uk/pdfs/eps_v1n2_fetterly.pdf; Internet; accessed 30 June 2012.

The forecast flying rate for fiscal year 09/10 was then used for fiscal years 10/11 and 11/12 as planners in 2003 and 2004 would likely have been privy to flying intentions for the following 6 years but would not necessarily have had flying rate forecasts beyond that point.

All \$ in Current Year (CY)	CH146	CF188	CC130	CP 140	CH 124	Average \$NP/HR
FY 04/05 Planned YFR ⁸¹	27525	16500	15500	10000	9800	
Planned NP (\$K) ⁸²	23738	215495	112653	90522	66864	
NPS/HR	862	13060	7268	9052	6823	7413.1
FY 05/06 Planned YFR	31175	14000	15475	9500	9100	
Planned NP (\$K)	23913	196354	114059	82013	74660	
NPS/HR	767	14025	7371	8633	8204	7800.0
FY 06/07 Planned YFR	31675	14100	17100	9500	8100	
Planned NP (\$K)	23444	180659	107217	85343	51190	
NPS/HR	740	12813	6270	8983	6320	7025.2
FY 07/08 Planned YFR	31675	14800	15500	6500	7600	
Planned NP (\$K)	23326	162155	115650	102993	46167	
04/05 NPS/HR	736	10956	7461	15845	6075	8214.8
FY 08/09 Planned YFR	29175	14800	13000	8000	7600	
Planned NP (\$K)	23513	163781	111834	88176	44961	
NPS/HR	806	11066	8603	11022	5916	7482.6
FY 09/10 Planned YFR	29175	15000	13000	6500	8300	
Planned NP (\$K)	23822	166402	96702	109285	44046	
NPS/HR	817	11093	7439	16813	5307	8293.7
FY 10/11 Planned YFR	29175	15000	13000	6500	8300	
Planned NP (\$K)	24165	169398	123210	110223	43235	
NPS/HR	828	11293	9478	16957	5209	8753.1
FY 11/12 Planned YFR	29175	15000	13000	6500	8300	
Planned NP (\$K)	24279	171776	117735	86445	42064	
NPS/HR	832	11452	9057	13299	5068	7941.6

Table 4: National procurement forecast per planned hour of flight

Collating this data into a programmatic view of the five platforms yields a slight upward trend in forecast national procurement required per flight hour planned as depicted in Figure 5.

⁸¹ Department of National Defence. "YFR Planned-Actual 98-99 to 16-17." Chief of the Air Staff.

⁸² Department of National Defence. "Long Term Equipment Support Cost Projections." ADM(Mat); 2004.

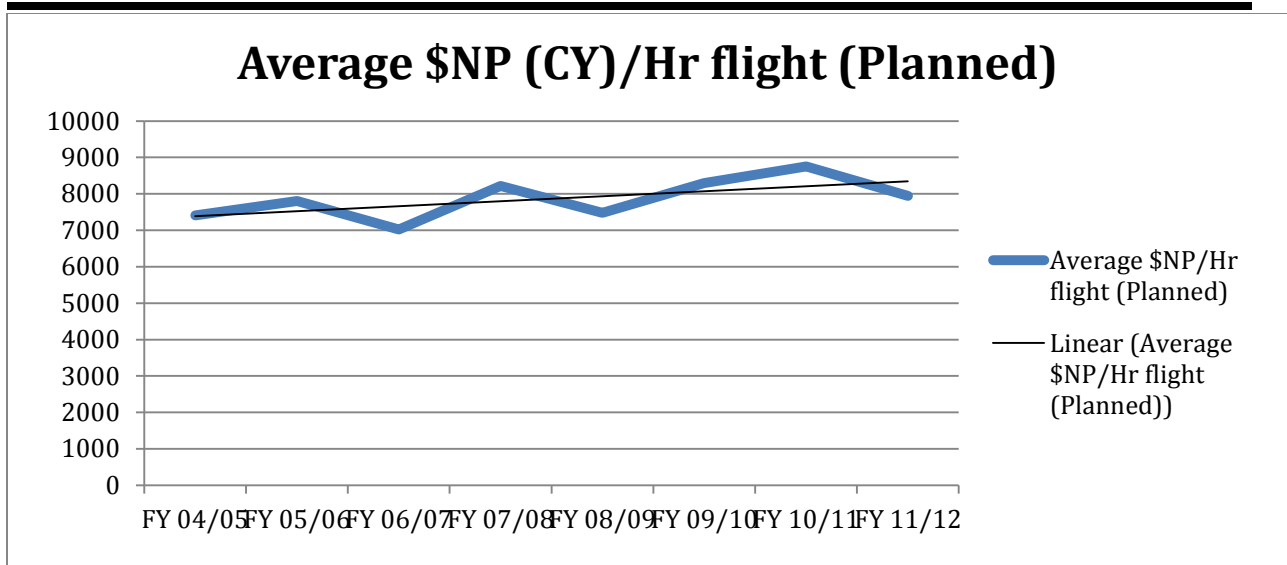


Figure 5: Forecast average national procurement demand per planned flight hour

From these results, it is apparent that planners in fiscal year 03/04 were of the opinion that there would be a modest increase in national procurement support required per hour of flight resulting from the increasing age of the airframes. The question, then, is whether their belief was, in fact, warranted.

Considering actual expenditures per actual hours flown, Table 5 offers a slightly different view. In this table, the actual expenditures were deflated to FY 04/05 using the same deflators as per Table 4 so as to remove the inflationary factor from the actual expenditures and thereby and provide a better basis for comparison.

All \$ in Current Year (CY) 04/05	CH146	CF188	CC130	CP 140	CH 124	Average \$NP/HR
FY 04/05 YFR Flown ⁸³	26511	13365	15622	9623	5254	
Actual NP (\$K) ⁸⁴	25382	206333	96120	83274	56863	
Actual NP\$/HR Flown	957	15438	6153	8654	10823	8405.0
FY 05/06 YFR Flown	28011	13581	15586	9097	6276	
Actual NP (\$K)	22998	205702	97701	85062	53073	
Actual NP\$/HR Flown	821	15146	6268	9351	8456	8008.6
FY 06/07 YFR Flown	27110	12859	16226	8692	6757	
Actual NP (\$K)	27864	173278	80482	81100	46131	
Actual NP\$/HR Flown	1028	13475	4960	9330	6827	7124.1
FY 07/08 YFR Flown	27538	12923	14685	6628	7548	
Actual NP (\$K)	29060	158832	94067	75868	48936	
Actual NP\$/HR Flown	1055	12291	6406	11447	6483	7536.3
FY 08/09 YFR Flown	25843	13671	14458	5982	7435	
Actual NP (\$K)	39396	138476	72000	84544	58497	
Actual NP\$/HR Flown	1524	10129	4980	14133	7868	7726.9
FY 09/10 YFR Flown	26394	13388	14107	5443	7874	
Actual NP (\$K)	47460	121912	74057	75926	53953	
Actual NP\$/HR Flown	1798	9106	5250	13949	6852	7391.0
FY 10/11 YFR Flown	24188	12529	11136	5575	5585	
Actual NP (\$K)	50067	99653	69731	69563	45758	
Actual NP\$/HR Flown	2070	7954	6262	12478	8193	7391.2

Table 5: Actual national procurement expended per hour flown

As shown in Figure 6, when inflation is removed from the equation the 5 Royal Canadian Air Force fleets under consideration actually experienced a slight reduction in national procurement dollars per flying hour of approximately \$800 or an average decrease of 10% over 7 years. These results suggest that, for the Air Force at least, advancing fleet age has not had the expected negative impact on national procurement expenditure per hour of flight.

⁸³ Department of National Defence. "YFR Planned-Actual 98-99 to 16-17." Chief of the Air Staff.

⁸⁴ Department of National Defence. "Report by WS Jan 2012." ADM (Mat).

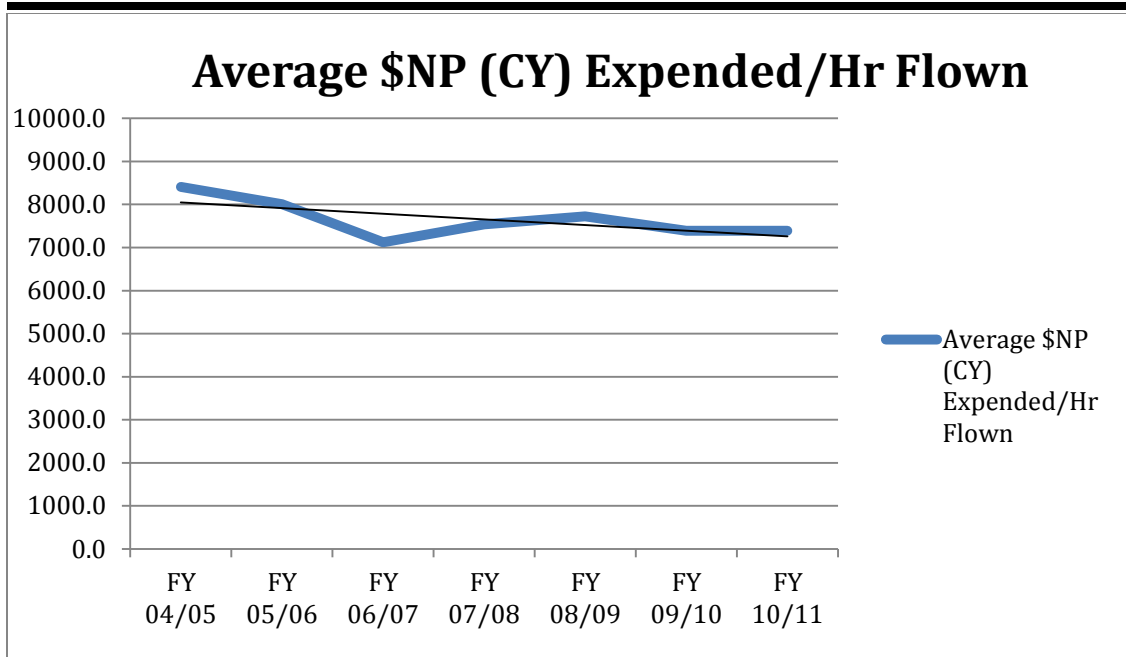


Figure 6: Actual national procurement expended per hour flow (CY)

When inflation is then reintroduced to the figures from Table 5, the rate of expenditure per unit of time becomes relatively flat as shown in Figure 7; reinforcing the fact that age alone is not the significant driver when increases in life expectancy are encountered.

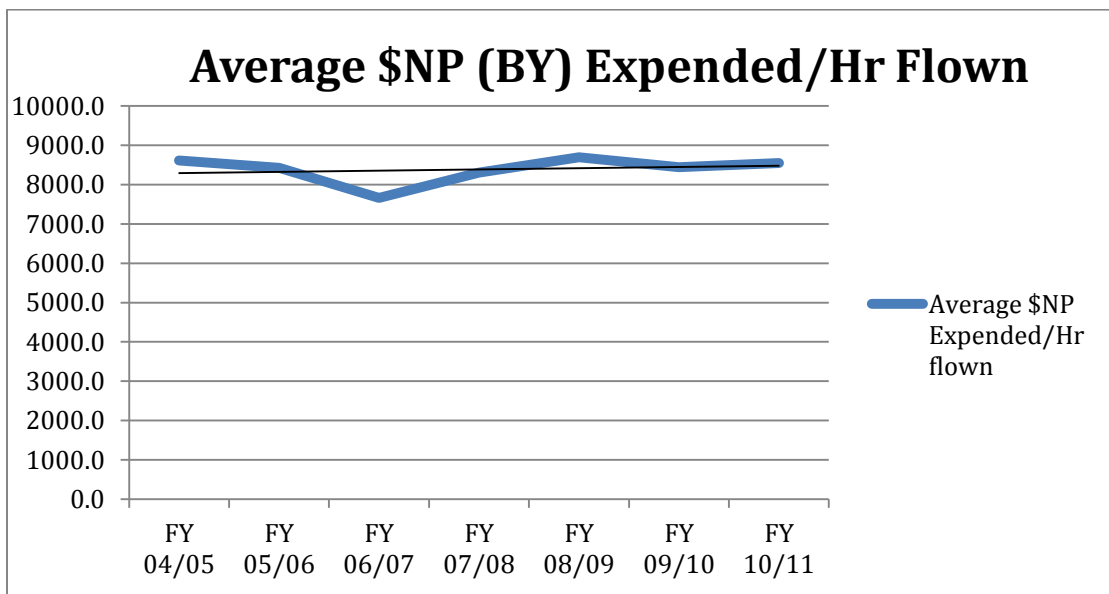


Figure 7: Actual national procurement expended per hour flow (BY)

Another way of considering this issue, however, is national procurement expended per platform. In his paper on optimizing the LAV III replacement, Desmier prepared Table 6 which shows a striking increase in expenditure per platform over time.⁸⁵

Table 2: LAV III National Procurement Costs

Year	Number of Vehicles	BY NP Costs (dollars)	NP Costs per Vehicle (dollars)
01/02	269	1,475,000	5,483
02/03	455	4,037,800	8,874
03/04	500	18,015,135	36,030
04/05	529	18,160,736	34,330
05/06	536	36,883,105	68,812
06/07	567	53,851,492	94,976
07/08	640	50,096,934	78,276
08/09	649	73,313,019	112,963
09/10	649	79,754,250 ^a	122,888

a. Includes \$67,997,434 from C113 current to 06 March 2010, plus an estimated \$6,000,000 (9%) to cover periods 12–15 in year 2010.

Table 6: Actual national procurement expenditure per vehicle

What is not shown, however, as it was not germane to the study that produced this result as it was focused upon optimizing fleet replacement, is whether the usage rate per vehicle changed over time and how this might contribute to the argument as to whether there is a material change in national procurement expenditures as platforms age per unit of output (hours flown in the case of the Air Force). In the case of the LAV III, it would be challenging to envision a scenario wherein the dramatic increase in national procurement usage could be

⁸⁵ Paul Desmier, *The Optimal Time to Upgrade or Replace the Light Armoured Vehicle (Lav III) Fleet*; DRDC CORA TM 2010-101 June 2010, 9.

contributed primarily to age as the study considers only 9 years. It is far more likely that the usage rate corresponding to the vehicles being used in conflict in Afghanistan over this period played a greater role in the dramatic increase shown above.

From the foregoing analysis, it is assessed that the primary impact on the overall national procurement program of extending an asset's age is simply the unforecast addition of national procurement demand for a specific fleet arising from the mere fact of its continued usage. This, however, is not inconsequential. If one considers the Iroquois class of ships with a fiscal year 11/12 expenditure of approximately \$45M, every year this fleet is extended beyond that planned for in preparation for investment plan 2009 adds \$45M in unforecast pressure to the account. Though this is a small increase given the size of the account (1.7% for fiscal year 12/13), when one considers the number of fleets serviced by the account, it is easily understood that this factor alone could have a significant impact on its ability to service demand.

There is, however, one additional factor that does mitigate against this pressure. Within the demand forecasts, life cycle material managers also specify anticipated national procurement demand in support of new and replacement capabilities; their introduction being driven by the schedules associated with the capital equipment accounts.⁸⁶ Accordingly, if a platform is extended beyond that forecast in the initial demand forecast and there is a replacement capability

⁸⁶ The various projects that make up the DND capital equipment account; whether V5 or accrually funded, have specified timetables as defined by the various project managers. By convention, most capital projects include funds to acquire an initial two years worth of spares as part of the overall project. This then means that generally, national procurement demand will not commence nor is it forecast to commence until 24 months after a project achieves Initial Operational Capability (IOC). In general terms, then, national procurement lags capital by two years.

likewise forecast, the funds budgeted in support of the new capability offer an offset against the extension of the extant capability.

By way of example, Table 7 compares the demand forecasts for the CH124 Sea King and its replacement, the CH148 Cyclone from both 2009 and 2011. From these forecasts, it is evident that the funds demanded and subsequently budgeted in support of the CH148 have, in fact, facilitated the extension of the CH124 with no adverse effect on the rest of the account. Specifically, in 2009 the fiscal year 10/11 forecast demand in support of the Sea King was \$51,611K. The actual expenditure that year was \$52,919K. However, there was also a forecast demand in support of the CH148 Cyclone in the order of \$22,852K. In short, the failure of the CH148 to draw national procurement funds as forecast buffered the expenditure on the Sea King in excess of the forecast. Looking ahead, the 2011 demand forecast in Table 7 shows the expected demand trend with the Sea King tailing off by fiscal year 16/17 whilst the Cyclone ramps up commencing fiscal year 12/13. As was the case in fiscal year 10/11, should the Sea King have to be extended beyond fiscal year 16/17 due to delays in the Cyclone program, demand in support of the Cyclone will serve as a buffer.

As a point of clarification, these demand forecasts are just that; demand documents. They do not necessarily reflect actual funding. Notwithstanding long term forecasts, life cycle material managers prepare detailed annual forecasts that outline demand by capability expected to be in service in the coming year. The long-term demand forecasts then, essentially define the shape of the overall national procurement demand envelope within which the Assistant Deputy Minister (Materiel) prioritizes actual demand on a year-by-year basis.

2009 Demand forecast	FY	FY	FY	FY	FY	FY	FY
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\$K	09/10	10/11	11/12	12/13	13/14	14/15	15/16
Ch124	50,403	51,611	52,746	42,699	32,728	16,724	0
CH 148	0	22,852	61,020	73,798	97,370	103,033	111,229
2011 Demand forecast \$K	FY 12/13	FY 13/14	FY 14/15	FY 15/16	FY 16/17	FY 17/18	FY 18/19
Ch124	62,445	39,694	23,553	14,091	0	0	0
CH 148	54,400	82,578	78,915	102,316	107,865	120,774	165,009

Table 7: CH124 Sea King and CH 148 Cyclone national procurement demand forecasts

Novelty

Both the Cormorant helicopter and the Victoria class submarines experienced inordinate increases in national procurement demand from that forecast in 2004 in the order of 278% and 336% respectively. In both cases, the platforms were relatively new to the Canadian inventory and their true support costs much greater than the rather optimistic figures brought forward in 2004. In both cases one could reasonably offer a number of reasons and rationales as to the drivers behind these variances. In the case of the Cormorant, the Department was relatively new to the concept of in-service support contracts and, in any event, the aircraft was plagued with much publicized issues in securing spare parts. The national procurement forecast for the Victoria class submarines, on the other hand, evolved as the true nature of the work required was revealed over time. Regardless of the specific issues with a given platform, it is abundantly clear that new national procurement demand drivers will engender uncertainty as a result of their novelty.

Though one could argue that these capabilities should be included under the “new and replacement” category, both were in the Canadian Forces’ inventory and drawing national

procurement dollars for several years prior to the baseline for the risk study; the 2008 national procurement demand document. This differs from the new and replacement capabilities where national procurement demand is forecast for capabilities not yet within the Canadian Forces' inventory and for which, in many cases, usage rates and details of in-service support contracts have yet to be finalized. Moving them to the new and replacement category would reduce the overall percentage shortfall in terms of national procurement forecasting for extant capabilities and likewise increase the size of the contingency reserve derived from new and replacement capabilities. This said, since the analysis of extant capabilities considers shortfalls in terms of forecasting arising from a number of factors and since both these capabilities had been in the Canadian Forces inventory for several years prior to the estimates being made, their categorization as extant capabilities is consistent with the overall approach taken throughout the study. Accordingly, they are included and analyzed as extant capabilities.

Readiness Levels

Since national procurement facilitates the translation of personnel and platforms into operational capability and operational capability is described through readiness levels across the force, it is axiomatic that changes in promulgated readiness levels will engender changes in the amount of national procurement funds required.⁸⁷ It is also necessary to understand that the

⁸⁷ Of note, this is not to say that there is a directly proportional relationship between national procurement demand and readiness levels. Much of the national procurement demand is driven by "fixed costs." That is to say, the department has committed to certain minimum levels of spending regardless of usage rates. This phenomenon is most prevalent in the RCAF where long-term maintenance contracts are the norm. Thus, though there is a relationship between readiness levels and national procurement demand, there is a certain minimum level of expenditure that is required regardless of the stated readiness level of the day.

regular national procurement account supports ongoing training to prescribed readiness levels.⁸⁸

Readiness levels are under regular review and scrutiny as commanders at all levels strive to match training to mission requirements. It is therefore understandable that long-term forecasts are generally made using the readiness levels of the day as a baseline; this baseline demand then being inflated according to a prescribed model. Pall and Van Bavel's work on deriving readiness-based ammunition requirements provides a graphic exemplar of the effect of defined and commonly understood readiness levels on national procurement demand resulting from ammunition requirements.⁸⁹ In the study which sought to calculate ammunition requirements based on stated readiness levels, the clear linkage between training required to achieve a prescribed level of readiness in order to carry out military tasks and the amount of ammunition required was central to the analysis.

Readiness levels also drive the defence activity rate. Fetterley and Essaddam described this as the, "number of kilometres driven by vehicles, sailing days for ships and aircraft hours flown."⁹⁰ Though their paper considered operations and maintenance costs writ large as opposed

⁸⁸ National procurement funds required in support of specific operations are funded separately from the Support to Deployed Operations Account (SDOA). The SDOA account funds, among other things, national procurement in support of deployed operations. In essence, the national procurement corporate account supports readiness across the board whereas the SDOA account supplements the various corporate accounts reflective of the incremental costs associated with the actual conduct of unforecast operations. Throughout this paper, values shown are exclusive of SDOA.

⁸⁹ Raman Pall and Gregory van Bavel, *Towards a Determination of Readiness-based Ammunition Allocations* DRDC CORA TR 2010-283 December 2010.

⁹⁰ Ross Fetterley, and Naceur Essaddam, "An Examination of Defence Operations and Maintenance Costs in Canada," *Review of Business Research*, 2008; http://findarticles.com/p/articles/mi_6776/is_2_8/ai_n28552117/?tag=content;coll1; Internet; accessed 16 December 2010.

to the specific sub-set that is national procurement, the directly proportional relationship between asset usage and the funds required to maintain it is intuitive.

From the foregoing, it is apparent that national procurement demand forecasts for existing users have understated demand by approximately 3.5% per annum recurring once adjusted for inflation. Though the reasons and rationales for this vary according to the capability under examination, when taken as a whole and analyzed as a program vice as discrete demand drivers, it is evident that national procurement demand forecasts in support of extant capabilities have understated the actual requirement. If the factors that conspire to create this divergence as described in previous sections are collectively referred to as national procurement specific inflation, then the variance between national procurement specific inflation and current departmental inflators quantifies the financial challenge inherent in forecasting and managing national procurement expenditures in support of extant capabilities over the life of the investment plan. When one considers an investment plan that must look at least 20 years into the future, this could, if taken to the extreme, suggest a 70% variance between forecast demand and actual demand by the end of the cycle.⁹¹

As has been the theme throughout this analysis, attempting to dissect national procurement spending by fleet over time in order to attribute percentages of variance by driver would be of little utility. Considering the Sea King fleet once again; over the past twenty years the fleet has reduced in numbers, it's life has been extended, its activity rates have been adjusted through (for example) fleet participation in Operation Apollo as well as through preparation for

⁹¹ 3.5% per annum over 20 years results in a potential annual shortfall of 70% at the end of the period.

the induction of the CH148 Cyclone, several of the fleet have been modified and re-roled and there have been variances in national procurement inflators over this self-same period of time. One would be hard pressed to specify with any degree of exactitude the resultant outcome of each of these drivers individually as they were, in several cases, experienced concurrently. What can be determined is the overall resultant impact of the collective effect of these drivers on this extant fleet with an understanding that in spite of due diligence exercised in preparing estimates, many of these drivers cannot be forecast with any degree of certainty; a fact that favours the development of a contingency reserve as a mitigating measure.

Regardless whether the observed phenomenon of variances between forecasts and actual expenditures are due to actual defence-specific inflation as defined or an accumulation of other factors as described by Chalmers and Solomon, or indeed the inter-relationships between the various causal factors detailed within this section, the fact of its existence remains and lacking remedies to its specific causes, steps must be taken to buffer against the difference between national procurement specific inflation and increases to national procurement supply as defined by the Assistant Deputy Minister (Finance and Corporate Services) and as articulated in the notional data-base. As shown in the study to date, this amounts to 3.5% per annum. In practical terms, and using the 2008 demand estimate that provided the basis for the investment plan, this would equate to an increase in national procurement funding or the development of a contingency reserve over the balance of the current investment plan for extant capabilities as detailed in Table 8.

	FY 12/13- 16/17	FY 17/18 - 21/22	FY 22/23 - 26/27	FY 27/28 - 31/32
Average annual pressure arising from extant capabilities	\$298M ⁹²	\$892M	\$1,437M	\$2,105M

Table 8: Increase in national procurement funding requirements for extant capabilities

These figures represent the dollar-quantification of the immediate problem set. Naturally, when taken to the extreme end of the demand forecast, the results of a 70% understatement in demand (3.5% annually for 20 years) generates a potential annual contingency requirement of over \$2.1B in the last period (fiscal year 27/28 to fiscal year 31/32). Obviously, substantive changes to the account structure, fleet sizes and compositions and/or readiness levels could reduce or indeed increase the variance between forecast demand and eventual expenditure. However, based on estimate performance over the past eight years using a representative sampling of national procurement demand drivers, the results shown are entirely plausible. Accordingly, the primary recourse is to acknowledge the existence of national procurement specific inflation and buffer the national procurement account against it through the application of a series of risk responses, in which the reservation of contingency funds must play a prominent role.

⁹² Figures derived from the Department of National Defence, "Investment Plan National Procurement 20 years Executable Demand," 2008. Figures as presented in the ADM (Mat) submission were adjusted to remove the contribution of new and replacement capabilities detailed in Table 8. Contingency factors of 10.5%, 28%, 45.5% and 63% (these figures being derived from the successive application of 3.5% per annum; then averaged over the period in question) were then applied to the five- year groupings of adjusted demand; the total being averaged over the five years under consideration resulting in an average yearly contingency value for the period.

New and Replacement Capabilities

National procurement demand forecasts for new and replacement capabilities were treated separately due to the increased uncertainty surrounding the forecasts themselves, the unique method used in their formulation and the inherent uncertainty surrounding the actual acquisitions.

The focus of this aspect of the analysis revolved around the demand forecasts themselves and the self-assessed certainty of their originators. Specifically, in late 2010 the various life cycle material managers were requested to provide a level of confidence to their national procurement forecasts as part of the 2011 national procurement demand roll-up specifically to facilitate this analysis. In order to standardize responses, they were provided with the following categories and asked to apply them to their demand forecasts in five-year blocks (one uncertainty assessment for years 1-5, a different assessment for years 6-10 and so on for the full 20 years). In order to ensure common comprehension and execution of the task, standardized terminology drawn from the Costing Handbook was used.⁹³ Uncertainty categories were defined as follows:

1. Substantive - a highly detailed estimate. The actual price of the contract will prove to be within a band of values less than 15% of the substantive number (+/- <15%) because of the research and supporting documentation;
2. Indicative – a developed estimate supported by standardized costs and research. The actual price of the contract will be within +/- 25% of an indicative number; and
3. Rough Order Magnitude (ROM)- a preliminary estimate based upon personal

⁹³ Department of National Defence, *Costing Handbook*; available from http://admfincs.mil.ca/costinghb/intro_e.asp; DWAN; accessed 21 June 2012.

intuition. Generally, the actual price of a contract will be within +/- 40% of the ROM number however, large variability can exist.⁹⁴

Unsurprisingly, most forecasts beyond the upcoming five-year window were assigned the ROM level of confidence. Since work on extant capabilities as detailed in the previous section demonstrated that demand has been generally under-stated over the past eight years and lacking any fundamental changes to national procurement estimation for which these capabilities relied heavily on simplistic ratio derivation, risk premiums were assigned to the demand forecasts according to the following regime:

1. Substantive (S) +0-10%;
2. Indicative (I) +10-25%; and
3. Rough Order of Magnitude (ROM) +25-40%.

This risk assessment was then assigned to the list of new and replacement capabilities detailed in Table 9 and a series of expected values derived. These expected values were then compared to demand as expressed in the 2008 national procurement demand forecast submitted in support of investment plan 2009; the differential between this value and the expected value being the assessed risk to the extant investment plan stemming from the introduction of these new capabilities and therefore the gross value to be addressed through contingency.

⁹⁴ Department of National Defence, *Costing Handbook*; available from http://admfincs.mil.ca/costinghb/intro_e.asp; DWAN; accessed 21 June 2012; 5-2. These definitions are modifications of those detailed in the ADM (Fin CS) Costing Handbook. Modifications were made to better align the definition specifically to the national procurement demand assessment.

\$M	Risk Assessment	FY 12/13-16/17	Risk Assessment	FY 17/18-21/22	Risk Assessment	FY 22/23-26/27	Risk Assessment	FY 27/28-31/32
FWSAR	N/A	0	R	230	R	317	R	354
N. Utility Aircraft	R	-7	R	-108	R	-138	R	-163
Tutor Replacement	N/A	0	R	43	R	189	R	310
NGFC	N/A	0	R	768	R	623	R	694
MHP	R	118	S	-7	R	253	R	195
JUSTAS	R	-225	R	243	R	661	R	737
MHLH	R	312	R	301	R	250	R	188
CMA	N/A	0	R	569	R	634	R	707
JSS	N/A	-77	R	-104	R	-95	R	125
Victoria Replacement	N/A	0	N/A	-127	R	-1,226	R	-888
Sub Modernization	N/A	0	N/A	0	R	-23	R	-15
CSC	N/A	0	R	-801	R	895	R	496
AOPS	R	1	R	73	R	216	R	473
CCV	I	242	R	370	R	666	R	743
TAPV	I	48	R	100	R	344	R	384
Totals		412		1,550		3,566		4,340
Avg Annual Pressure		82		310		713		868

Table 9: Risk premiums for new and replacement capabilities in \$M

The notional database projects the national procurement account to be \$3.3B in fiscal year 27/28 (exclusive of planned investment plan incremental top-us). The risk premium for

new and replacement capabilities, which includes all the major substantive users demands a 26% addition to the national procurement account in the latter years whereas it only suggests a premium of 3.5% in fiscal year 12/13. This variance is heavily influenced by the fact that many of these new and replacement capabilities do not commence drawing national procurement dollars until the second or third period under examination.

To better understand the analysis underlying these results, a specific example follows. The Maritime Helicopter Program estimated demand over a period of 20 years in support of investment plan 2009 (D_1). This demand, along with all the others was combined to generate an overall demand profile against which supply was applied. In 2011, a new demand table was produced (D_2) reflecting refined costing, projections and time-lines; all of which affect national procurement demand. The estimate certainty (E_1) was established by the life cycle material managers and applied to the 2011 projection to generate potential High and Low values (V_H and V_L) or, in simpler terms, a range within which the actual value is more likely to be found. This range was compared to D_1 to derive High and Low pressures against the investment plan from which an average value was finally derived. This same methodology was applied to all new and replacement capabilities. In certain cases where the D_2 forecast was less than D_1 due to refined costing or (as was more often the case) a delay in project execution, this methodology resulted in negative pressures or, in other words, surplus national procurement funds for a given period which mitigate against overages associated with other capabilities for that self-same period. As noted in Table 9, the Maritime Helicopter Program example over the first period of five years yields a potential pressure of \$118.5M. This is calculated as follows:

For fiscal year 12/13-16/17

$$D_1 = \$446.45M$$

$$D_2 = \$426.07M$$

$$E_1 = R = 25\% - 40\%$$

$$V_L = D_2 * 1.25 = \$533.38M$$

$$V_H = D_2 * 1.40 = \$596.5M$$

$$\text{Low Pressure} = V_L - D_1 = \$86.93M$$

$$\text{High Pressure} = V_H - D_1 = \$150.05M$$

Average Pressure = $(V_H + V_L)/2 = \$118.5M$ = the average likely pressure on the 2009 investment plan over the period of fiscal year 12/13 to fiscal year 16/17 resulting from the CH148 Cyclone.

As was the case with the extant capabilities in the previous section, the uncertainty associated with individual capabilities arises from a variety of sources as follows.

In-Service Support Contract Factor

Though one might reasonably offer that in-service support contracts reduce uncertainty, and therefore risk in national procurement demand estimation, their performance to date belies this assertion. The CH149 Cormorant, the C-130J Hercules and the C-17 Globemaster are the three most recent acquisitions of the Department in support of the Royal Canadian Air Force. All three are supported through these types of all-inclusive contracts. As shown in Table 10, there is often a strong disparity between planned spending under an in-service support contract and reality.

National procurement demand by fiscal year from three separate estimates						
\$K	Year of Estimate	FY 11/12	FY 12/13	FY 13/14	FY 14/15	FY 15/16
CH149 Cormorant						
	2004	40,412	41,314	N/R	N/R	N/R
	2008	88,770	90,723	92,718	94,758	107,111
	2011	84,873	85,743	87,629	94,759	107,110
C-130J Hercules						
	2004	N/R	N/R	N/R	N/R	N/R
	2008				34,563	110,529
	2011				130,469	133,262
C-17 Globe-Master						
	2004	N/R	N/R	N/R	N/R	N/R
	2008	20,000	56,210	62,669	74,772	60,002
	2011	45,425	50,223	48,078	52,410	57,314

Table 10: National procurement estimates over time in support of the CH149, the C-130J and the C-17

In the case of the Cormorant, the platform entered service in early 2001.⁹⁵

Notwithstanding possession of the aircraft for several years and an in-service support contract in place, the 2004 estimates understated those that followed in 2008 and 2011 by over 100%.

Though it appears this platform has achieved more of a steady-state with the 2008 and 2011

⁹⁵ Department of National Defence, *Long Term Equipment Support Cost Projections ADM (Mat) 2004*; 50.

estimates being comparable, it is apparent that planners' assumptions regarding the cost and nature of the in-service support contract in 2004 clearly missed several important factors that have since come to the fore.

In the case of the C130J, there was no forecast in 2004. Further, the gross increase in the fiscal year 14/15 forecast can be attributed in large part to the aircraft arriving earlier than originally forecast and therefore ramping up to full national procurement demand in advance of the 2008 plan. Notwithstanding these factors, there is a 20.6% variance in demand between the 2008 and 2011 forecasts. Given the platforms began arriving in 2011, this can be attributed in part to the reality of the in-service support contract as opposed to the underlying assumptions from 2008.

The C17 Globemaster likewise was not reported in the 2004 forecast, however it shows a different behaviour from the other two platforms under discussion in that the 2011 forecast is generally less than that of 2008. In short, though the implementation of in-service support contracts is the preferred contracting method within the Department of National Defence, the fact that national procurement estimates are often made well in advance of the definition of the in-service support contract can result in estimates that are greatly at odds with the agreement eventually signed; hence the increase in the uncertainty factor for those capabilities anticipated to be subject to one of these contracts.

Off the Shelf Factor

Referring once again to Table 10, there is a related yet distinct factor that bears mention. The C17 was purchased as an off-the-shelf capability. It wasn't modified or "Canadianized" in any way. Moreover it was not a developmental weapon system. Consequently, the project staff

had available to them considerable information regarding sustainment costs from a variety of international users. Although the actual usage rate of the aircraft will vary from fleet to fleet, this factor permitted considerably more certainty in NP estimates than would otherwise have been the case. Compare this circumstance with that of the CH148 Cyclone or the much anticipated replacements for the Halifax Class Frigates. Both are examples of developmental or unique designs for which support cost histories do not exist. Likewise, though the Cormorant is a variant of the EH101 helicopter that is flown by numerous customers around the world, it was significantly modified to meet the Canadian requirements for a Search and Rescue platform. Accordingly, the historical sustainment costs were of lesser value than they would have been had the platform been purchased off the shelf as was the case with the C17.

Simplistic Ratios

As noted previously, initial national procurement demand for new and replacement capabilities in support of investment plan 2009 was derived through simplistic ratio analysis. In many if not all cases, this resulted in a high degree of uncertainty associated with the estimate that, of necessity, generated risk to the investment plan. Life cycle material managers are cognizant of the lack of rigour that went into the development of national procurement estimates. Though the phrase, “better than nothing” is often bandied about, for those capabilities yet to be clearly defined let alone acquired, the genesis of the national procurement estimates by its very nature leads to gross uncertainty. This issue was, in fact, the core argument of Groves’ and

Fetterly's paper, "An Imperfect Storm: Air Force Operations and Maintenance Cost Trends," and their concerns remain as true today as they were when originally penned in 2008.⁹⁶

Slippage

Part of the overall risk assessment addressed the performance of the capital account as well. Specifically, the capital account manager selected a group of 50 projects all in excess of \$100M conducted within the past 10 years.⁹⁷ The focus of the analysis was to determine the behaviour of this group of projects in terms of accuracy and stability in both cost and schedule forecasts. Though this paper will not go into detail as to the methodology involved in this aspect of the study, the results are germane to any discussion of national procurement. Specifically, they determined that, on average, projects slipped or were delayed seven years from their initial schedule estimates. This is relevant as the estimates of national procurement demand for new and replacement capabilities must also forecast when the national procurement demand will commence; information that is provided by the various project staffs. Obviously, a demand profile that is dependent upon the accuracy of project schedules risks overstating demand in the near term as projects generally achieve their set milestones and thus begin drawing national procurement later than originally anticipated. Moreover, as large national procurement users slip later over time, they generate a sharp jump in demand as opposed to the gradual increase that resulted from the deliberate planning process used in generating the extant investment plan.

⁹⁶ Maj Richard A. Groves, and LCol Ross Fetterly, "An Imperfect Storm: Air Force Operations and Maintenance Cost Trends." *Air force Journal* Vol. 1 Issue 1, (Spring 2008).

⁹⁷ This specific aspect of the overall risk study was completed by Maj (Retired) Jeff Edey with the kind support of Ivan Taylor and Leonard Kerzner from the Defence Economics Team within DND.

That is to say, the investment plan specified not only what would be acquired, but also when various capabilities would likely be introduced into service. This stagger in capital acquisition had a related stagger in associated national procurement demand and was consistent with variations in the planned national procurement supply envelope. When capabilities anticipated for induction earlier in the plan are delayed, they stack up with those planned to be introduced later in the program. This stacking remains and generates a pressure until such a time as the latter projects are likewise delayed or the overall program is rebalanced through the issuance of a new investment plan; a process that occurs every three years.

Immaturity of the Project

In the end, project analysts and life cycle material managers reference the immaturity of many of the projects more than any other factor in terms of estimate uncertainty. From Table 9, it can be seen that of the 15 capabilities listed for which Treasury Board of Canada policy requires long-term sustainment estimates, 12 have yet to be defined. That is to say, project staffs have generated sustainment estimates without knowing the actual nature of the platform being supported. This immaturity in many of the major capital projects results in projects resorting to the simplistic ratio analysis previously discussed so as to provide something; although the numbers provided are, without exception, classified as ROM estimates. To highlight this issue, consider the national procurement estimates for the Canadian Surface Combatant (replacing the Canadian Patrol Frigates and the Iroquois-class destroyers). Though the primary shipyards in support of the National Ship Procurement Strategy have been identified, the project is still in the definition stage; yet the project staff prepared national procurement demand estimates at least as far back as 2008 without a clear idea as to the final design of the vessel class and only the most

rudimentary acquisition costs. Needless to say, the lack of detailed information upon which to accurately assess national procurement requirements must without question raise the uncertainty level to that of ROM; and though the analysis capped uncertainty figures at the ROM level (it being the highest level of uncertainty defined in the Costing Handbook), there were numerous suggestions from project analysts that the uncertainty factor should actually be higher.

From this aspect of the analysis, therefore, it is readily apparent that the national procurement estimates for new and replacement capabilities are rife with uncertainty; the principal reasons being outlined above. This therefore provides strong evidence in support of the thesis that a contingency reserve in support of national procurement should be established; assuming, of course, that the envisioned levels of readiness that would drive the national procurement demand remain at or near where they currently reside.

Referring once again to Table 9, the analysis suggests that contingency reserves arising from uncertainty associated with national procurement estimates for new and replacement capabilities range from an average of \$82M per annum in fiscal year 12/13 through fiscal year 16/17 to a maximum of \$868 per annum over the period of fiscal year 27/28 through fiscal year 31/32.

CONTINGENCY REQUIREMENTS

This paper has to this point considered contingency requirements for extant capabilities separately from those required in support of new and replacement capabilities. Bringing the two together suggests an annual contingency requirement as outlined in Table 11.

	FY 12/13- 16/17	FY 17/18 - 21/22	FY 22/23 - 26/27	FY 27/28 - 31/32
Average annual pressure arising from extant capabilities	\$298M	\$892M	\$1,437M	\$2,105
Average annual pressure arising from new and replacement capabilities	\$82M	\$310M	\$713M	\$868M
Overall annual contingency requirements	\$380M	\$1,202M	\$2,150M	\$2,973M

Table 11: Total contingency required in support of national procurement

These figures represent the overall magnitude of the national procurement contingency reserve that would be required to fully address the account pressures outlined in the preceding pages.

The stated objective of this paper was to demonstrate that there is a clear requirement to establish a national procurement contingency reserve that is shaped by two distinct drivers:

1. The difference between departmental notional inflation and national procurement specific inflation for extant demand; and
2. Cost risk associated with uncertainty related to national procurement estimates in support of new and replacement capabilities.

From the preceding analysis, the argument in favour of establishing a contingency reserve is compelling. The remaining variable, however, is whether the department will choose to address the described risk solely on a financial basis or whether it will choose to employ other strategies at its disposal to address the identified and quantified risk. Having quantified the problem in terms of dollars, the following section will offer a few additional avenues open to the Department to manage this risk.

RISK MANAGEMENT

It is acknowledged that this study presents a risk-based view of pressures that could arise over time; the result being a requirement to expand national procurement supply or reduce readiness to accommodate a fixed national procurement envelope. As with all risk assessments, the results are not absolute but rather present a view of what could happen over time based on past history and the current ways and means of national procurement estimation. Accordingly, the response to identified risk can likewise be measured in terms of avoidance, transference, acceptance and finally mitigation through the allocation of departmental funds to a national procurement contingency reserve. These risk responses are outlined in the following paragraphs.

Avoidance

Risk avoidance in this context speaks to the possibility of improving departmental approaches to national procurement estimation both for extant as well as new and replacement capabilities. Though work is underway in this area as evidenced by Pall and Van Bavel, and the suggestions brought forward by Groves and Fetterley in terms of refining the ratio approach to national procurement forecasting, the results of this analysis clearly demonstrate the need for more refined methods of national procurement estimation so as to reduce uncertainty and thereby reduce risk.⁹⁸

⁹⁸ See...Raman Pall and Gregory van Bavel, *Towards a Determination of Readiness-based Ammunition Allocations*; DRDC CORA TR 2010-283 December 2010. Maj Richard A. Groves, and LCol Ross Fetterly, "An Imperfect Storm: Air Force Operations and Maintenance Cost Trends." *Air force Journal* Vol. 1 Issue 1, (Spring 2008).

Transference

Risk transference could be accomplished through capping the national procurement account, thus transferring the remaining financial risk to operational readiness. Although, as previously discussed, this study was conducted under the assumption that readiness levels would remain unchanged in order to better quantify the financial risk to the department, the possibility remains that the financial risk will be too great and transference will be seen as a means of reducing financial risk as well as funds required for mitigation. The results of this approach are challenging to calculate and are, in any event, beyond the scope of this paper. The issue is brought forward solely as an acknowledgement that having developed a dollar-quantification of the extant risk, transference to operational readiness remains a valid response. Arguably, this has been the departmental financial risk reduction methodology of choice for some time; a fact that resulted in the previously noted desire by government to increase sustainment funding.

Mitigation

Mitigation can appear in many forms. In this case, the proposed means of mitigation seeks to apply financial resources to the problem in the form of a reserve; the focus of this paper. It is acknowledged, however, that departmental resources might not permit addressing all remaining risk in this way and thus the true amount of financial mitigation might well be less than the figures suggested in this paper. One could, for example, consider a sliding scale approach whereby risk remaining after avoidance and transference strategies have been exhausted is fully or nearly fully addressed through financial mitigation in the near term whereas remaining risk in the medium and long term is only partially addressed through financial

mitigation, the balance being accepted and monitored so as to determine the effect of avoidance and transference measures on the overall risk.

Acceptance

Risk acceptance therefore suggests that departmental managers consider the contingency requirements suggested by this study and determine how much the Department simply wishes to accept based on historical spending trends, over-planning limitations, the amount of risk to be transferred through reduced readiness and the pragmatic reality of departmental financial flexibility.

In the end, barring an inordinately high risk-appetite, the department has little choice but to bolster the national procurement account through the establishment of a contingency reserve. This paper has identified the starting point for this work. What remains is a sober assessment of required readiness levels and risk-appetite so as to refine these figures into an actionable way ahead.

CONCLUSION

National procurement has been described as, "...a critical defence vulnerability."⁹⁹ And indeed this paper has provided additional proof as to the precarious nature of this account and its direct impact on operational readiness. Although consolidated under one corporate account, national procurement forecasting is clearly divided along the lines of extant versus new and replacement capabilities. Demand forecasts in support of extant capabilities have historically understated demand by approximately 3.5% annually. Similarly, the uncertainty and therefore the risk associated with forecasting national procurement demand for new and replacement capabilities is quantifiable and must be addressed. In total, the combination of understated demand and uncertainty conspire to create a dollar-quantification of national procurement risk that ranges from a yearly average of \$380M in the immediate future to \$2,973M in the long term. These sobering figures arise from a number of factors, principal amongst which is the lack of sophisticated models that would enable more accurate estimates and the immaturity of the projects for which estimates are being prepared. The simplistic ratios used in support of new and replacement capabilities engender tremendous uncertainty that by its very nature must be addressed. In the end, this paper has quantified the risk arising from understated and uncertain national procurement forecasts and presented the results in financial terms. Specifically, it has outlined the size of a contingency reserve that is required to mitigate the risk generated through

⁹⁹ Ross Fetterly, "National Procurement: A Critical Defence Vulnerability." *Review of Business Research* March 2008 Vol. 8 no. 2; <http://www.freepatentsonline.com/article/Review-Business-Research/182406766.html>; Internet; accessed 13 June 2012.

the various factors outlined throughout. It does, however, recognize that the Department possesses other tools such as transference, avoidance and acceptance; all of which could be used to varying degrees in order to reduce the mitigation and therefore the contingency required to address the identified risk.

National procurement is not a topic that is well known or understood outside the Department. This said, given its fundamental role in enabling operational effect, the risks inherent in its structure, the size of the account relative to the department's overall budget and especially its discretionary operations and maintenance budget, it is clear that its days of obscurity must end. Though risk mitigation through development of a contingency reserve is admittedly but one means of addressing the risk inherent in this account, the development of such a reserve as part of the next iteration of the departmental investment plan is essential for the long-term sustainability of the Canadian Forces as they are structured today.

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