National Defence Défense nationale

Canadian Forces College

Collège des Forces Canadiennes

Lieutenant-Colonel Jason Fox

Defence Spending: To Be Based on Readiness

JCSP 47

Exercise Solo Flight

Disclaimer

Opinions expressed remain those of the author and do not represent Department of National Defence or Canadian Forces policy. This paper may not be used without written permission.

PCEMI 47

Exercice Solo Flight

Avertissement

Les opinons exprimées n'engagent que leurs auteurs et ne reflètent aucunement des politiques du Ministère de la Défense nationale ou des Forces canadiennes. Ce papier ne peut être reproduit sans autorisation écrite.

Canada

CANADIAN FORCES COLLEGE – COLLÈGE DES FORCES CANADIENNES

JCSP 47 – PCEMI 47
2020 – 2022

Exercise Solo Flight – Exercice Solo Flight

Lieutenant-Colonel Jason Fox

Defence Spending: To Be Based on Readiness

DEFENCE SPENDING: TO BE BASED ON READINESS

Introduction

The latest vision for defence is "*Strong* at home, *Secure* in North America, *Engaged* in the world."[1] As part of the defence policy, the federal government is committed to fixing defence spending. Chapter 3 is dedicated to the development of stable, predictable, and realistic funding.[2] Similarly to the *Canada First Defence Strategy* (CFDS) from 2008, both policies have core missions with anticipated levels of concurrent operations. This enables all elements of the Canadian Armed Forces (CAF) to focus on their readiness to achieve its mandate. While both defence policies support accrual accounting for capital investments, the latter policy expands into accrual accounting for estimating the costs of operational and sustainment funding. This approach to estimating uses life-cycle costing to predict defence spending.[3]

Using life-cycle costing as a metric for success is not a new concept. The United States Department of Defence (DoD) have used the approach for decades and after studying nearly 2 decades of data, its military readiness is degraded despite having an ongoing National Defense Strategy to maintain its formerly unchallenged or dominant military advantage.[4] As a direct result, the United States Government Accountability Office (GAO) regularly reports to the congressional Committee on the Department of Defense's *Military Readiness* of ongoing progression.

---

[1] Department of National Defence, *Strong Secure Engaged: Canada's Defence Policy,* (Ottawa: Queen's Press, 2017), 14.

[2] *Ibid*., 43-47.

[3] *Ibid*., 44.

[4]Government Accountability Office Report to Congressional Committees, *Military Readiness: Department of Defense Domain Readiness Varied from Fiscal Year 2017 through Fiscal Year 2019* (Washington, DC: U.S. Government Printing Office, April 2021), 1.

In 2001, Maj M.R. Voith published an article in the Canadian Army Doctrine and Training Bulletin that compared military capability models between Canada and Australia. It established a common model for military readiness; as depicted in **Error! Reference source not found.Error! Reference source not found.**. The article draws a strong linkage between speed, mass and efficiency as being key to generating forces able to rapidly deploy.

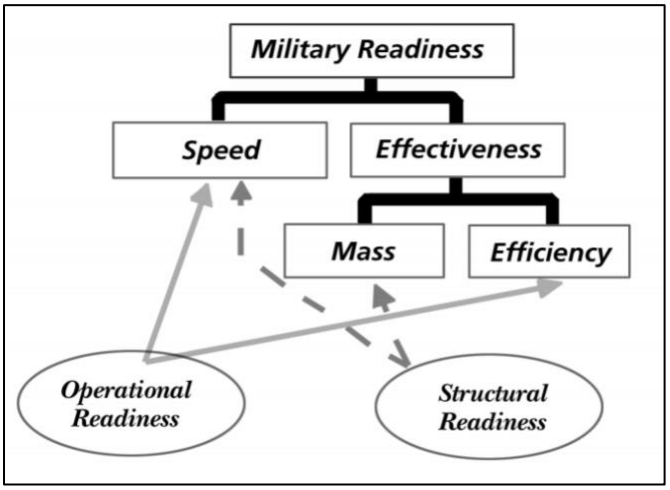

Figure 1: Speed, Mass and Efficiency Relationship to Establish Military Readiness.[5]

In a review article by Johnathan Hill, the North Atlantic Treaty Organization (NATO) definition for military readiness is "the ability [for] military forces to fight and meet the demands of [their] assigned missions."[6] In this case, SSE identified eight core missions.[7] From these core missions, the CAF is expected to simultaneously deploy into

[5] Mike Voith, 'Military Readiness," The Army Doctrine and Training Bulletin, vol. 4, no. 2 (Summer 2001): 44.

[6] Johnathan Hill, "NATO – ready for anything?," NATO Review, 24 January 2019, https://www.nato.int/docu/review/articles/2019/01/24/nato-ready-for-anything/index.html#n2.

[7] Department of National Defence, *Strong Secure Engaged: Canada's Defence Policy,* (Ottawa: Queen's Press, 2017), 82.

nine international peace and stability operations while maintaining forces ready to defend Canada, and meeting commitments to NATO and the North American Aerospace Defense Command (NORAD). Coupling the definition for military readiness and Maj Voith's military capability model, an equation for military readiness is established having the following form:

$$\boldsymbol{Readiness}_{(\boldsymbol{Force},\boldsymbol{Notice\ ToMove})}=(\boldsymbol{Personnel}+\boldsymbol{Materiel})^{\mathbf{Training}}\times\boldsymbol{Sustainment}$$

For this paper, this equation will be referred to as the *Readiness Equation* and it is only being used to establish a relationship between *Personnel, Materiel*, and *Sustainment*. This paper argues that defence spending cannot directly adopt a life-cycle costing approach without incorporating *Readiness* as a metric to achieving mission objectives. This will be demonstrated through the Capital Investment Fund (CIF) preventing the flexibility to define life-cycle costs and the staffing constraints that a true assessment of Personnel demands based on *Materiel* requirements. These two arguments then assessed against the legislative framework which prevents the Minister of National Defence (MND) from applying an unconstrained life-cycle costing approach to defence spending.

Capital Investment Fund Prevent Life-Cycle Costs

From the Canadian Army Doctrine and Training Bulletin, a common model for military readiness identifies the fiscal limitations of shrinking budgets and its impacts on increasing defence costs.[8] After decades, the situation has not changed. Canada

[8] Mike Voith, 'Military Readiness," The Army Doctrine and Training Bulletin, vol. 4, no. 2 (Summer 2001): 47.

remains under pressure from NATO to increase its defence spending to 2% of its Gross Domestic Product (GDP).[9] The challenge arises from demonstrating a predictable and defensible increases to capital investments while maintaining or surpassing the core missions set by the government. The Capital Investment Fund (CIF) is designed to do that for materiel only and can be represented at the cost of materiel within the *Readiness Equation*. This section will explain the financial review of Corporate Submissions within project approval gates defined in the Project Approval Directive (PAD). Then, it will demonstrate how CAF *Personnel* have become an integral factor in defining the capital costs of *Materiel*, as well as, defining the costs for *Sustainment*. This co-dependency is needed life-cycle costing models.

In the first annual update to the Defence Investment Plan, it assessed 333 SSE projects. Approximately 46% of the projects passed through a significant approval gate. The approval process required a financial review of the project against the CIF.[10] The PAD identifies the Chief Financial Officer (CFO) as the functional authority for Financial Management,[11] as such, the Assistant Deputy Minister for Finance is the custodian for the CIF. As a result, 157 projects prepared financial updates which included life-cycle costing estimates. While researching how the review process changed, a Financial Officer for the Capital Investment Management team, confirmation that no changes have been made to the review process with the exception of increasing the scope to include life-cycle costing components declared by project teams.[12]

---

[9] North Atlantic Treaty Organization, "Funding NATO," last modified 1 April 2022, https://www.nato.int/cps/en/natohq/topics_67655.htm.

[10] Department of National Defence, *The Defence Investment Plan 2018: Annual Update 2019*, (Ottawa: 2020), 15-16.

[11] Department of National Defence, *Project Approval Directive (PAD),* (Ottawa: 2019), 283.

[12] Lisa Liang, *TB Policy Directive*, email correspondence with Jason Fox, Chief Financial Management, Director of Capital Investment and Analysis, Ottawa, ON, 7 April 2022.

For each project seeking approval, the Director Cost Analytics (DCA) and Director Cost Estimate Delivery (DCED) works in conjunction with the project team to prepare the Corporate Submission. Their teams reconstruct financial models to review and assess for error or omissions. This approach creates an air gap which prevents an assessment of future forecasted demands found in Defence Resource Management Information System (DRMIS). In an email from JeanMarc Saint-Yves, a senior analyst with the Chief of Programme, future revisions to DRMIS will incorporate a comparative analysis tool. This tool assess forecasted demands against the CIF as a financial assessment metric.[13]

After Corporate Submission is assessed by DCA and DCED teams, the Financial Input Committee (FIC) reviews the submission. The FIC ensures the project remains in line with departmental priorities. During this process, adherence to the CIF remains a significant factor. If the Corporate Submission deviates from the CIF, the project is subjected to a CIF Change Management activity. Funding baselines are assessed against factors, such as human resources and the capability's impact on Program Outcomes.[14] A critical factor becomes the review of Human Resources, specifically the number of *Sustainment* practitioners for the *Materiel* being sought.

With the shift to life-cycle costing, phase gate approvals are expected to see a significant change to costing models. For example, the total costs of CAF operators or sustainment practitioners will directly factor into the longevity of the *Materiel*. While the salary costs of CAF members can be considered a sunk cost, the actual cost becomes

---

[13] JeanMarc Saint-Yves, *TB Policy Directive*, email correspondence with Jason Fox, Chief of Programme, Director Programme Governance and Innovation, Ottawa, ON, 7 April 2022.

[14] Department of National Defence, *Project Approval Directive (PAD),* (Ottawa: 2019), 84-85.

significant when factoring in sustainment options. The design of *Materiel* can lead to *Personnel* requirements that exceed the establishment. Increases in the number of *Personnel* lead to outsourcing of staff which increases the *Sustainment* costs of the *Readiness Equation*.

As a summary, this section reviewed the findings of the first update to the Defence Investment Plan. It created a baseline for spending which include a life-cycle approach to funding against SSE related projects. As a result, *Materiel* is purchased without directly correlating the *Personnel* requirements for the longevity of the *Materiel*. While the government is committed to increasing defence spending to 2% of GDP, the increase does not guarantee the CAF will be able to achieve its eight core missions identified in SSE.

Staffing Constraints Hinder Maintenance Demand Assessments

The world is full of uncertainty. Canada is geographically positioned where major mission components have not changed over decades. However, the tasks to deliver upon strategic goals have changed. For instance, Chapter 6 of SSE highlights 43 new initiatives.[15] These initiatives increase the workload of the CAF. In doing so, SSE increased the Regular Force and Reserve Force by 3,500 members and 1,500 members respectively. [16] Which adjusts the total force posture to 71,500 Regular Force and 30,000 Reserve Force members. When compared to CFDS from 2008, it is only an increase of

[15] Department of National Defence, *Strong Secure Engaged: Canada's Defence Policy*, (Ottawa: Queen's Press, 2017), 65-80.

[16] *Ibid.*, 44.

1,500 Regular Force members and sees no increase in the Reserve Force.[17] As a result, the institution has remained stable over decades. This section will assess the fixed number of resources against an increasing number of tasks.

To start, the Chief of Force Development (CFD) is at the center of creating new projects. CFD's mandate is to "[h]armonize, synchronize and integrate the force development activities of the CAF in order to develop the capabilities required to produce strategically relevant, operationally responsive, and tactically decisive military forces."[18] At the Identification Phase of a project, CFD uses Capability Based Planning (CBP) methodologies to define the merits of a project for inclusion into the Defence Services Program (DSP). The assessment is rigorous, however it is only against the information available. At this phase, the selected *Materiel* is unknown, however, the CBP process generates a bottom up assessment for Human Resources required to acquire, operate and sustain a mission capability. The assessment creates several assumptions which are challenged or proven during subsequent project approval gates.

In support of SSE life-cycle costing approach, maintenance becomes a significant factor in determining the sustainment costs. There are two types of maintenance: preventative maintenance and corrective maintenance. Preventative maintenance is scheduled to prevent *Materiel* failure from occurring, where corrective maintenance returns *Materiel* to a serviceable condition after damage.[19] Once the *Materiel* is selected and the maintenance details become known, a maintenance task analysis is performed.

---

[17] Department of National Defence, *Canada First Defence Strategy*, (Ottawa: Queen's Press, 2008), 15.

[18] Department of National Defence, "Capacity and abilities of the Chief of Force Development (CFD)," last modified 25 May 2022, http://intranet.mil.ca/en/organizations/vcds/cfd.page.

[19] Department of National Defence, A-LM-505-019/JS-001, *Life Cycle Materiel Manager Activity Handbook* (Ottawa: DND, Canada, 2002), 5-2-6 to 5-2-7.

This assessment theoretically determines the number of maintainers required to operate and sustain the *Materiel*. Once *Materiel* is delivered, theoretical models are validated against assumptions. Any adjustments to these theoretical maintenance models can lead to significant changes over the life-cycle costs. For example, in a Briefing Note (BN) on the Rationalization of the Armoured Engineer Vehicles, it recommends one-third of the operational fleet being placed in long-term preservation.[20] Within 5 years of delivery, the justification this recommendation is to total amount of preventative and corrective maintenance that exceeds capacity. The maintenance demands amounted to 9,620 hours of work where the unit only has capacity to for 4,491 hours.[21]

This disconnect from theoretical maintenance task estimates and the verified maintenance requirements is becoming more relevant. In a Service Paper prepared by Major John on "The Future of Tank in the Canadian Army", it indicates the culprit of this maintenance mismatch as the theoretical estimates were conducted against the predecessor fleet.[22] These findings were presented at a LOEBEN Steering Committee conference in 2018. The finding identified the maintenance burden on the new fleet is nearly sevenfold of its predecessor.[23] Thankfully this specific example includes materiel that is not specifically identified within the eight CAF core missions highlighted within SSE.[24]

The question remains, is the AEV example an isolated case or does translate to other CAF capability. Unfortunately, the CAF does not have a readiness reporting processes however U.S. GAO reports on its military readiness to the Congressional Committee. From the military

---

[20] Kurt R. Grimsrud, *Briefing Note for the Commander 1 Canadian Mechanized Brigade Group: Armoured Engineer Vehicle (AEV) II Rationalization* (Canadian Forces Base Edmonton) 7 March 2021.

[21] *Ibid.*

[22] Matthew D.C. Johns, "Leopard Without Claws: The future of Tanks in The Canadian Army" (JCSP 45 Service Paper, Canadian Forces College, 2019), 4.

[23] *Ibid.*

[24] Department of National Defence, *Strong Secure Engaged: Canada's Defence Policy,* (Ottawa: Queen's Press, 2017), 17.

readiness report published in 2021, 10 of 19 resources readiness metrics show an increased from Fiscal Year (FY) 2017 to FY 2019. However, only five of 19 mission capability readiness metrics increased within the same time period.[25] This equates to 52.6% of materiel readiness increasing. When viewed in terms of the *Readiness Equation*, this translates to newer *Materiel* or more efficient *Sustainment* of existing materiel. More shocking is only 26.3% of mission capability increased. The report indicated several elements not achieving maintenance targets. While not a direct correlation to CAF capability, it does collaborate with the AEV example in demonstrating that new *Materiel* does not translate to increased readiness. When the establishment is not driven by the staffing demands, *Sustainment* life-cycle costs become difficult to model.

In summary, this section identified 43 new initiatives from SSE to be managed by a workforce that remained nearly equal to the force composition in 2008. The section describes various types of maintenance and how the maintenance is estimated and verified through the project approval process. It highlighted the AEV maintenance task assumptions proving to be false after delivery. The incorrect assessment led to a struggling maintenance regime. The example is compared U.S GAO Readiness Report and finds similarities against the entire Department of Defense readiness profile. As a result, the overall constraint in *Personnel* prevents appropriate the life-cycle costing models to *Sustainment* in the Readiness Equation. This constraint limits readiness and flexibility to achieve mission mandates.

---

[25] Government Accountability Office Report to Congressional Committees, *Military Readiness: Department of Defense Domain Readiness Varied from Fiscal Year 2017 through Fiscal Year 2019* (Washington, DC: U.S. Government Printing Office, April 2021), 13.

Framework Prevents Life-Cycle Costing

The Defence Policy plans addresses defence funding through a procurement model that adopts a life-cycle costing approach. The approach is applied to the procurement process of new equipment as well as operating and maintenance budgets to existing equipment.[26] In an article from Ross Fetterly on defence business planning, it indicates that "[t]he management of defence resources is about transforming them into military capabilities in a relevant manner and in accordance with government policy."[27] The article further highlights several key factors that drive resource demands. These factors create a multi institutional perspective which have divergent goals and objectives.[28] While this is true for policies, the policies are formed from the legal framework of government. Without having a universal driver, such as readiness, the abrupt change to incorporate a life-cycle costing approach to defense spending is constrained by the legislative framework. A *Readiness Equation* can act as a fundamental model for life-cycle costing. This section will explore the legal framework of the National Defence Act (NDA) to which the Department of National Defence (DND) and the CAF are founded. It will explore the associated interfaces, such as Governor in Council and Treasury Board to demonstrate how life-cycle costing approach cannot be applied in isolation to fix defense spending.

---

[26] Department of National Defence, *Strong Secure Engaged: Canada's Defence Policy,* (Ottawa: Queen's Press, 2017), 45.

[27] Ross Fetterly, Canada Global Affairs Institute, Defence Business Planning in Canada, Calgary, AB October 2018, 1.

[28] *Ibid.*, 4-5.

First, the NDA establishes the Treasury Board to define the rates and conditions of salaries for CAF members.[29] While a pay and benefit increase may feel insignificant within the greater context of defence spending, it demonstrates an uncontrolled factor that remains outside the control of the MND. For example, a lump sum annual increases of 1.25% announced in 2019 which paid 4 consecutive years of retro-payments.[30] This amounted to a lump sum payment of 6.34%. Since *Personnel* make up nearly 37% of the defence budget,[31] this resulted in a single payment of half a billion dollars in a single year.

Second, the Governor in Council is the legal entity empowered to establish to total numbers of officers and non-commissioned members in the CAF.[32] This might lead to a predictable costing model for the total cost of the CAF, with the exception of the above noted injects. While this is true, it does not translate to stable funding models in terms of *Materiel* and *Sustainment* costs. The example of the AEV lacking maintainers is an example where the life-cycle costing is restricted. In this particular example one-third of the vehicle fleet is recommended for long-term preservation.[33] The justification being a constrained number of CAF members which generated unsustainable costing models. This places the CAF's ability to deploy on its assigned missions in question.

---

[29] Department of Justice, "National Defence Act, Part 2 - The Canadian Forces, Section 35 (1)," last amended 1 August 2019, 29.

[30] Department of National Defence, "Your Pay and Allowance Increase," last modified 10 September 2019, http://www.forces.gc.ca/en/caf-community-benefits/know-your-benefits-articles/pay-raise.page.

[31] Department of National Defence, "March 2020 - Defence Budget," last modified 30 September 2021, https://www.canada.ca/en/department-national-defence/corporate/reports-publications/transition-materials/defence-101/2020/03/defence-101/defence-budget.html.

[32] Department of Justice, "National Defence Act, Part 2 - The Canadian Forces, Section 15 (2) and Section 15 (4)," last amended 1 August 2019, 12.

[33] Kurt R. Grimsrud, *Briefing Note for the Commander 1 Canadian Mechanized Brigade Group: Armoured Engineer Vehicle (AEV) II Rationalization* (Canadian Forces Base Edmonton) 7 March 2021.

Third, there is an absence of any description of material procurement from the NDA. This forces the department to engage with a third party for the procurement of goods and services. For example, Public Services and Procurement Canada (PSPC) establishes a Contracting Authority to ensure that contract solicitations have competitive submissions. Innovation, Science and Economic Development Canada (ISEDC) is made up of eighteen federal departments and agencies. Their goal is to build a knowledge-based economy in Canada and advance the government's jobs and growth in areas of specific interest.[34] While these stakeholder departments and agencies bring value to the federal government, it creates conflicting requirements. When coupled with the Treasury Board secretariat for funding, the Policy on the Planning and Management of Investments is used to enable government departments to plan and manage the acquisition of *Materiel*. Deputy Heads have the responsibility to "enable effective life-cycle management".[35] As noted above, a Deputy Head within the CAF is unable to contract without support for Other Government Departments (OGDs). In addition, the Deputy Head does not have the authority to increase or decrease the organization based on the needs of the *Materiel*. As a result, the legal framework that defines the department's existence, forces engagement amongst OGDs. This leads to conflicting requirements which may or may not enable effective life-cycle costing for *Materiel.*

In summary, this section defines the legal framework stemming from the NDA. This framework separates responsibilities for establishing life-cycle cost estimate into multiple government departments and agencies. While the policies support a life-cycle

---

[34] Industry Canada, "Innovation, Science and Economic Development Portfolio," last modified 5 November 2021, https://www.ic.gc.ca/eic/site/icgc.nsf/eng/h_00022.html.

[35] Treasury Board Secretariat, "Policy on the Planning and Management of Investments," Treasury Board, last modified 30 June 2021, 4.1.2.4, https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=32593.

approach to defence spending, it separates key variable that are needed to establish those models. This creates a condition that encourages conflicting requirements in an effort to have a collaborative approach to life-cycle costing. In fact, it creates uncertainty or friction that prevents the establishment of life-cycle costing models. The use of a *Readiness* approach to life-cycle costing would enable a consolidated metric for conflicting requirements. This would streamline the various government departments and agencies in generating a life-cycle costing models to defence spending.

Conclusion

DND has prioritized its efforts to fix its defence funding models. Unfortunately, the approach of adding a sustainment costs to an acquisition process leaves room for improvement. Establishing a defence spending model without using a concept of *Readiness* creates constraints that prevents predictable life-cycle cost models and leads to uncertainty in achieving mission objectives. In the first section, the CIF demonstrates a costing focus for new *Materiel* and omits the interdependency between the *Materiel* and its' *Personnel* requirements to establish *Sustainment* costs. The following section identified a constraint on the number of *Personnel* within the CAF. The constraint becomes a significant issue when *Sustainment* demands for *Materiel* exceed *Personnel* available. As a result, it creates the conditions where the life-cycle costs become unpredictable and it leads to significant reductions in *Readiness*. These reductions directly affect the CAF's ability to deploy on mandated missions. The final section reviews the legal framework in which DND/CAF operates. The NDA sets the legal conditions for the operation of the department. It also removes key elements for life-

cycle costing away from the department. Specifically, TBS establishes salaries, the Governor in Council defines a limit on the number of CAF members. These legal conditions prevent DND and the CAF from controlling the conditions for life-cycle costing. The unconstrained approach to life-cycle cost modeling prevents the ability to fix defence spending.

BIBLIOGRAPHY

Canada. Department of National Defence. A-LM-505-019/JS-001, *Life Cycle Materiel Manager Activity Handbook*. Ottawa: DND Canada, 2002.

Canada. Department of National Defence. *Canada Fist Defence Strategy*. Ottawa: Queen's Press, 2008.

Canada. Department of National Defence. "Capacity and abilities of the Chief of Force Development (CFD)." Last modified 25 May 2022. http://intranet.mil.ca/en/organizations/vcds/cfd.page.

Canada. Department of National Defence. "March 2020 - Defence Budget," last modified 30 September 2021. https://www.canada.ca/en/department-national-defence/corporate/reports-publications/transition-materials/defence-101/2020/03/defence-101/defence-budget.html.

Canada. Department of Justice. "National Defence Act." Last amended 1 August 2019.

Canada. Department of National Defence. *Project Approval Directive (PAD).* Ottawa: 2019.

Canada. Department of National Defence. *Strong Secure Engaged: Canada's Defence Policy*. Ottawa: Queen's Press, 2017.

Canada. Department of National Defence. *The Defence Investment Plan 2018: Annual Update 2019.* Ottawa: 2020.

Canada. Department of National Defence. "Your Pay and Allowance Increase." Last modified 10 September 2019. http://www.forces.gc.ca/en/caf-community-benefits/know-your-benefits-articles/pay-raise.page

Canada. Industry Canada, "Innovation, Science and Economic Development Portfolio," last modified 5 November 2021, https://www.ic.gc.ca/eic/site/icgc.nsf/eng/h_00022.html.

Canada. Treasury Board Secretariat. “Policy on the Planning and Management of Investments.” Treasury Board, Last modified 30 June 2021. https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=32593.

Grimsrud, Kurt R. *Briefing Note for the Commander 1 Canadian Mechanized Brigade Group: Armoured Engineer Vehicle (AEV) II Rationalization.* Canadian Forces Base Edmonton, 7 March 2021.

Hill, Johnathan. “NATO – ready for anything?” NATO Review. 24 January 2019. https://www.nato.int/docu/review/articles/2019/01/24/nato-ready-for-anything/index.html#n2.

Institute for Defense & Business, “What is Military Readiness?,” last accessed 10 April 2022. https://www.idb.org/what-is-military-readiness/#:~:text=Military%20readiness%20is%20the%20military%27s,fulfill%20assigned%20missions%20and%20tasks.

Johns, Matthew D.C. “Leopard Without Claws: The future of Tanks in The Canadian Army.” JCSP 45 Service Paper, Canadian Forces College, 2019.

Lisa Liang, *TB Policy Directive*. Email correspondence with Jason Fox and JeanMarc Stait-Yves. Chief Financial Management, Director of Capital Investment and Analysis. (Ottawa, ON) 7 April 2022.

North Atlantic Treaty Organization. “Funding NATO.” Last modified 1 April 2022. https://www.nato.int/cps/en/natohq/topics_67655.htm.

Saint-Yves, JeanMarc. *TB Policy Directive*, email correspondence with Jason Fox and Lisa Liang, Chief of Programme, Director Programme Governance and Innovation. (Ottawa, ON) 7 April 2022.

Unites States. Government Accountability Office Report to Congressional Committees. Military Readiness: Department of Defense Domain Readiness Varied from Fiscal Year 2017 through Fiscal Year 2019. Washington, DC: U.S. Government Printing Office, April 2021.

Voith, Mike R. "Military Readiness." The Army Doctrine and Training Bulletin, vol. 4, no. 2 (Summer 2001): 41–48.