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Optimising Future Submarine Sustainment

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Optimising Future Submarine Sustainment

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OPTIMISING FUTURE SUBMARINE SUSTAINMENT

AIM

1. This paper will explore how Canada can position itself optimally to sustain the future Canadian Patrol Submarine (CPS) for maximum availability. It will do this by first, looking at recent Royal Canadian Navy (RCN) submarine sustainment history to provide important context to this challenge. Second, by exploring the sustainment practices associated with the current Victoria Class Submarine (VCS) fleet, it will identify lessons to be taken from it. Third, it will consider aspects of Australia's submarine sustainment program, which is similar in scale and scope and identify strengths that could be mirrored in Canada. Finally, it will take this analysis and provide recommendations on how Canada can develop a successful sustainment program for the future CPS.

INTRODUCTION

2. Submarines play a key role for the RCN in maritime domain awareness now and will into the future. The importance of submarines is spelt out in Strong Secure Engaged (SSE): "they will play an important role in sovereignty operations and continental defence."[1] As Canada embarks on a new project to acquire a future submarine capability, it is important to understand what underpins the difficulties associated with sustaining an effective submarine capability in service – an incredibly complex undertaking. Modern submarines are some of the most technically challenging machines man has invented, have stringent safety standards and operate in a harsh environment. They are an expensive capability and require significant resources and expertise to acquire and sustain.

3. History is littered with examples of nations that have focussed on the acquisition of complex military systems without focussing on how they would sustain it. As a result, often much money and effort are expended, but a disappointing capability results.[2] There is a great risk that this could happen with a future Canadian submarine. As with VCS, sustaining these new submarines, once in service will be challenging. Operating and sustaining the current VCS has been difficult for Canada, with the submarines spending more time in maintenance, than being available for operations due to a multitude of compounding factors.[3] As recently as 2019, despite spending in above $200M that year on sustainment activities, the RCN achieved zero days at sea from a fleet of four boats.[4] It

[1] Canada and Department of National Defence, *Strong Secure Engaged: Canada's Defence Policy*, 2017. p 65.

[2] Randy Starr, "Fixing the Military's Aircraft Sustainment Problem," *Oliver Wyman* (blog), March 1, 2021, https://www.oliverwyman.com/our-expertise/insights/2021/mar/fixing-the-military-aircraft-sustainment-problem.html.

[3] Lee Berthiaume, "Navy Kicks off Long-Anticipated Push to Replace Canada's Beleaguered Submarine Fleet," *CBC News*, July 14, 2021.

[4] Murray Brewster, "Canada's Submarine Fleet Spent 'zero Days' at Sea Last Year: Government Documents," *CBC News*, February 11, 2020.

is critical that as much effort is afforded to the sustainment plan, as to the acquisition of these new submarines.

DISCUSSION

Learning from the Past

4. The capability and prestige submarines provide to nations make them attractive and the number of nations currently either acquiring for the first time or expanding their fleets reinforce this paradigm.[5] Canada has had an on-again, off-again relationship with submarines for over 100 years – at times going decades with none at all.[6] However, since the acquisition of the Oberon Class submarines in the 1960s, which were seen as a successful platform, Canada has maintained a submarine fleet. To help shape what a successful CPS may look like, it is important to understand the factors behind why the current VCS have suffered from limited operational availability. This is critical to avoid those factors being carried forward into the new submarine sustainment program.

5. In the late 1990s, Canada confident in its submarine operating abilities embarked on acquiring the second-hand VCS from the UK, however, underestimated the difficulties it would encounter in sustaining these boats. Before acquiring VCS, Canada developed significant expertise in sustaining the Oberon Class submarines, carried out large upgrades on them and the boats were operationally successful.[7] However, the success enjoyed with the Oberon Class submarines by Canada was due to at least four key points of difference not replicated with the current VCS. It is important to acknowledge how an under appreciation of these differences has contributed to the low availability of VCS. Firstly, the Oberon's were technologically simpler and therefore not as challenging to maintain. The VCS was a step-change with over 67 per cent of auxiliary machinery and 90 per cent of weapons equipment new to the class.[8] Secondly the Oberon's were logistically and technically well supported, with 27 boats built, which were then operated by five countries (including the country that designed and built them, the United Kingdom).[9] Third, only four VCS exist and all are with Canada; the parent Royal Navy retired them shortly after build, later sold them to Canada and then focussed on nuclear submarines only, critically limiting follow-on technical support. Fourth, the Oberon's were all operated and maintained out of Halifax, Nova Scotia by one sustainment

[5] Sam LaGrone, "Top Stories 2021: International Acquisition," *USNI News* (blog), December 31, 2021, https://news.usni.org/2021/12/30/top-stories-2021-international-acquisition.

[6] Haze Gray, "Canadian Navy Ship Timeline 1910 -2006," accessed January 16, 2022, http://www.hazegray.org/navhist/canada/timeline/.

[7] Michael Whitby, "Boomers, Draggers and Black Boxes: The Operational Legacy of Canada's Oberon Class Submarines, 1983-1998.," *The Northern Mariner* 23, no. 4 (October 2013): 32. P. 371.

[8] Canadian Naval History, "Some History of the Upholder-Class Submarines," *Canadian Naval Review* (blog), accessed January 16, 2022, https://www.navalreview.ca/2012/05/some-history-of-the-upholder-class-submarines/.

[9] Seaforces Online, "Oberon Class Attack Submarine SSK - Royal Navy," accessed January 21, 2022, https://www.seaforces.org/marint/Royal-Navy/Submarine/Oberon-class.htm.

organisation.[10] In contrast, the VCS are split over two coasts and maintained by multiple organisations diluting critical expertise and accountabilities. These factors are at the heart of the low VCS availability, they should be acknowledged and must not be repeated for a successful follow on CPS sustainment program.

A Split Fleet

6. The decision to split the small class of four submarines across two coasts limited Canada's ability to grow and develop a critical mass of expertise and has been a considerable impediment in sustaining the VCS effectively. Submarines are unique vessels and while similar to ships in many ways, are far more complex and more akin to aircraft with respect to technical requirements.[11] The technical expertise required to support their sustainment takes time to grow and is specialised – even leading submarine operating nations are challenged by this.[12] This is particularly the case with VCS as Canada is the only country sustaining this orphan platform with limited options to turn to for external deep level technical support.[13] Presently there are three repair facilities across both coasts, with the sustainment program managed from Ottawa - this expertise is spread wide and thin. Canada would benefit greatly from a submarine sustainment centre of excellence by focussing its sustainment efforts within one or more organisations in one primary location.

Governance Structure

7. The governance structure that underpins VCS sustainment has been considerably enhanced since the classes' introduction however it remains sub-optimal. Absent is a robust framework that provides clear lines of accountability and authority that incentivises the entire organisation to 'pull in the same direction' and minimise and optimise the time submarines spend in maintenance and ultimately deliver availability.[14] The Assistant Deputy Minister (Material) (ADM(Mat)) group oversee the material management and certification of the VCS.[15] They are supported by multiple organisations

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[10] Canada, "Canadian Submarine History," Canadian Armed Forces, last modified June 14, 2017, https://www.canada.ca/en/navy/services/history/canadian-submarine-history/canadian-submarine-history.html.

[11] Megan Eckstein, "Navy Taking Hard Look at Sustainment Costs, As New Projection Doubles Expected Long-Term Bill," *USNI News*, January 28, 2021, https://news.usni.org/2021/01/28/navy-taking-hard-look-at-sustainment-costs-as-new-projection-doubles-expected-long-term-bill.

[12] Megan Eckstein, "Submarine Industrial Base Under Strain as Virginia-Class Parts Wearing Out Early; Implications For Columbia-Class," *USNI News*, April 20, 2021, https://news.usni.org/2021/04/20/submarine-industrial-base-under-strain-as-virginia-class-parts-wearing-out-early-implications-for-columbia-class.

[13] Canada, "Inquiry of Ministry – Victoria Class Submarines," Senate Committee on National Security and Defence (SECD) - State of the Canadian Armed Forces (DND, July 13, 2021), https://www.canada.ca/en/department-national-defence/corporate/reports-publications/proactive-disclosure/secd-state-of-caf-19-april-2021/q-433-victoria-class-submarines.html.

[14] Canada, "Canadian Submarine History," Canadian Armed Forces, last modified June 14, 2017, https://www.canada.ca/en/navy/services/history/canadian-submarine-history/canadian-submarine-history.html.

[15] *ibid.*

that conduct maintenance and provide engineering advice, principally the Fleet Maintenance Facilities (FMF), the in-service support contractor Babcock Canada and other Tier 0 contractors.[16] While these organisations do work for ADM(Mat), they are not working directly for them or the Canadian Submarine Force (CANSUBFOR) and have separate command chains, which it makes it difficult to drive accountability or delivery. A recent positive step was the announcement by the in-service support contractor Babcock Canada of a new 'Team Victoria-Class' which aims to better integrate three of the main supporting sustainment contractors.[17] A similar contractual arrangement that is inclusive of all key stakeholders is the optimum solution for the future CPS sustainment framework.

Accurate Information to Inform Decision Making

8. The current system of submarine data management is not fit for purpose and a tailored solution is required to accurately inform decision making. Presently ADM(Mat) uses a 'one size fits all' data management system for many of its programs known as the Defence Resource Management Information System (DRMIS).[18] The system is broad in scope and is defined in the following manner:

> It is an integrated software tool used to conduct equipment and supply chain management activities such as the ordering of spare parts, tracking of supply commodities, and logging of maintenance work hours. In addition, it tracks financial transactions as well the real property management. The system also provides an integrated business analytics capability.[19]

9. While it can be seen above that the DRMIS software has wide functionality, it does not provide the level of fidelity or useability that submarine sustainment stakeholders require. This is critical as the data contained within it forms much of the objective quality evidence underpinning submarine material certification which needs to be readily accessed and understood. Other complex CAF platforms requiring similar levels of certification such as the CF-18 Hornet do not use DRMIS, but rather a tailored and dedicated material management software package.[20] Australia too, uses a developed-for-purpose submarine material certification tool known as Ship's Information

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[16] David Pugliese, "RCN Strategic Capability: Victoria-Class Submarine Sustainment Top Priority for Royal Canadian Navy," *Esprit de Corps - Canadian Military Magazine*, October 5, 2020, http://espritdecorps.ca/feature/rcn-strategic-capability-victoria-class-submarine-sustainment-top-priority-for-royal-canadian-navy.

[17] Mike Whalley, "Babcock Introduces 'Team Victoria-Class,'" *Babcock* (blog), October 28, 2020, https://babcockcanada.com/team-victoria-class/.

[18] Canada, "Defence Resource Management Information System In-Service Support," Canada - Defence Procurement, March 12, 2015, http://www.forces.gc.ca/en/business-defence-acquisition-guide-2015/joint-and-other-systems-899.page.

[19] Canada, "Defence Resource Management Information System - Defence Capabilities Blueprint," Canada - Defence Investment Plan 2018, May 30, 2018, http://dgpaapp.forces.gc.ca/en/defence-capabilities-blueprint/project-details.asp?id=1912.

[20] The material management system used with CF-18 Hornets known as DMS, as explained by two RCAF engineers to the paper's author.

Management System (SIMS) for its Collins Class submarines. Within this system, as examples: planned maintenance is managed, system changes recorded, and evidence of safety system upkeep is tracked.[21] All of the information required to determine a Collins submarine material certification status can be found in one place and it is readily navigated. A platform as technically complex as the future CPS must come with a dedicated software package tailored to allow comprehensive and accurate material certification activities to occur. In addition, this software package should be utilised as the primary management tool by all stakeholders so that all see the same picture, presently this is not the case due to significant silos.

Maintenance Silos

10. The current VCS sustainment organisation is hampered by distinct silos between the organisations that execute the planned maintenance on the platforms - this introduces large inefficiencies and churn. The various maintenance required to sustain the vessels is carried out by different organisations depending on the level of complexity and periodicity.[22] Like other RCN platforms, VCS have their planned maintenance split over three tiers based on periodicity: first level with ship's staff, second level with the Fleet Maintenance Facilities (DND) and third level with the in-service support contractor Babcock Canada and its supporting contractors.[23] This structure introduces significant technical risk due to the over-arching fact that no one organisation is responsible for executing all of the planned maintenance. This results in each organisation focusing on its responsibilities and any effects on the other supporting agencies introduced by deferrals of maintenance or delays is a secondary consideration. To avoid carrying this model into the future CPS program, Canada would benefit from looking at how Australia restructured its submarine program to overcome similar issues associated with siloed maintenance organisations.

The Australian Experience

11. The Australian Collins Submarine program faced similar challenges to VCS with poor submarine availability over a decade ago. Many of the factors that contributed to that are mirrored in Canada. There are valuable lessons to be taken from how Australia corrected its program that should be applied to the future CPS sustainment program. To address its poorly performing submarines, the Royal Australian Navy (RAN) engaged an international team to conduct a no-holes-barred review of the program and provide corrective recommendations.[24] Their findings became known as the 'Coles Review'. The review was blunt in its assessment, however, the recommendations were embraced,

[21] John Coles, "Study into the Business of Sustaining Australia's Strategic Collins Class Submarine Capability - Progress Report" (Australia, March 2014). A1-15.

[22] "HMCS Corner Brook Case Study," *Babcock Newsroom* (blog), May 9, 2019, https://babcockcanada.com/hmcs-corner-brook/.

[23] "Canada's Submarine Sustainment Program," Defence Industry, *Vanguard* (blog), September 2020, https://vanguardcanada.com/canadas-submarine-sustainment-program/.

[24] Conrad van Coller, "Submarines Give Smith a Sinking Feeling," *Lowy Institute - The Interpreter*, accessed January 21, 2022, https://archive.lowyinstitute.org/the-interpreter/submarines-give-smith-sinking-feeling.

implemented and the program recovered to be now seen as a world standard setter.[25] The key findings included: "unclear requirements, lack of a performance-based ethos, unclear lines of responsibility, poor planning and a lack of a single set of accurate information to inform decision making."[26] A number of these factors have already been discussed however two of these will be looked at in further detail with particular relevance to the CPS sustainment program.

A Performance-Based Ethos

12. A performance-based ethos is essential to ensure all personnel contributing to submarine maintenance execution have an interest in the submarine achieving maximum availability. A performance-based ethos was a challenge in Australia's submarine sustainment program, now corrected through significant changes to contractual arrangements, however, it remains unresolved in Canada.[27] Presently the VCS production workforces executing the work are not incentivised to complete the work in a timely manner – through "neither carrot nor stick."[28] More time spent on task completion, potentially means greater overtime and hence the incentive is to not complete the work expeditiously. The absence of a performance-based ethos is a contributor to the general lack of submarine availability in Canada and must be reset for the future submarine program. This was identified as a significant factor in Australia's struggling sustainment program and the restructuring of the in-service support contract placed much emphasis on shifting to a performance-based model to good effect.[29]

Other Areas for Focus

13. Due to the constraints of this paper, not all factors that contribute to a strong sustainment program could be fully explored. Other areas worthy of further analysis include: First, prioritisation of the sustainment program delivering submarine capability over other factors such as interprovincial competition for jobs or industrial offsets called for by government policy linked to acquisition.[30] Second, submarine sustainment expertise is specialised and takes many years to grow. A successful sustainment program should have a submarine specific workforce across all levels which is presently not the

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[25] Marise Payne, "From Concern to Exemplar - Collins Class Submarine Sustainment," accessed January 22, 2022, https://www.financeminister.gov.au/media-release/2016/10/21/concern-exemplar-collins-class-submarine-sustainment.

[26] John Coles, "Study into the Business of Sustaining Australia's Strategic Collins Class Submarine Capability" (Australia, November 2012). p 8.

[27] Andrew Davies, "Sub Par Management: The Coles Review and the Collins Class," *The Strategist*, December 12, 2012, https://www.aspistrategist.org.au/sub-par-management-the-coles-review-and-the-collins-class/.

[28] A comment made to the paper's author by a middle-manager within the VCS sustainment framework. This reflected a theme that came up on multiple occasions.

[29] "ASC to Support Australian Navy's Collins-Class Submarines," *Naval Technology* (blog), July 4, 2012, https://www.naval-technology.com/news/newsasc-support-australian-navys-collins-class-submarines/.

[30] Craig Stone, "Defence Procurement Offsets and Their Economic Value in Canada," *CDA Institute*, accessed January 21, 2022, https://cdainstitute.ca/defence-procurement-offsets-and-their-economic-value-in-canada/.

case.[31] Finally, submarines require unique infrastructure to facilitate maintenance such as ship lifts and battery charging. Whilst Canada has much of this presently, there is considerable scope for upgrade and improvement.[32]

CONCLUSION

14. The Canadian Patrol Submarine program will be one of the most significant military projects in Canada's history, therefore it is critical that any lessons that can be taken from current submarine sustainment are identified. It is also important to acknowledge that the recommendations identified within this paper are not exhaustive and that a comprehensive assessment of past and contemporary submarine sustainment practices contribute to the sustainment planning for the CPS.

15. Sustainment of complex military systems is difficult and the planning for sustainment too often comes second to acquisition. It is essential that current sustainment expertise and capability is carried forward, while at the same time embedded impediments are identified, corrected and new opportunities grasped. The level of focus and effort applied to acquisition must equally be expended on the sustainment planning for the future Canadian Patrol Submarine to ensure the promise of this new capability is fully realised to the benefit of Canada.

RECOMMENDATIONS

16. The following recommendations are provided for consideration as part of an optimised future Canadian Patrol Submarine sustainment model:

a. Acquisition of an orphan class of submarines should be avoided where possible. Sustaining a future submarine in conjunction with allied navies will be a significant enabler.

b. Comprehensive analysis should be conducted as to the risks and benefits of splitting the basing of submarines on both coasts. The focus should be on developing submarine capability through availability - by basing in one location.

c. A robust and comprehensive governance structure with clear lines of authority, accountability and that is incentivised for optimised availability should be incorporated as part of the sustainment model from the outset.

[31] FMF Cape Breton, "Fleet Maintenance Facilities Strategic Capability Brief" (Canada, September 13, 2016).

[32] Canada, "Dry-dock Leak Repairs at HMC Dockyard, Canadian Forces Base Esquimalt," Impact Assessment Agency of Canada, December 10, 2019, https://iaac-aeic.gc.ca/050/evaluations/proj/80367.

d. A developed-for-purpose data management package to facilitate maintenance planning and material certification should be incorporated across the sustainment program from acquisition.

e. Create one integrated sustainment organisation with the aim to develop a centre of submarine sustainment excellence with a submarine specific workforce.

f. Underpin the sustainment framework with performance-based incentives to ensure unity of effort with a focus on submarine availability.

g. Invest in submarine specific infrastructure to facilitate the prompt and efficient conduct of maintenance.

h. Prioritise the sustainment of submarines to deliver capability over other second-order priorities wherever possible.

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