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Under Pressure: Procurement Options For New Submarines

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UNDER PRESSURE: PROCUREMENT OPTIONS FOR NEW SUBMARINES

AIM

1. In July of 2021, the Department of National Defence (DND) announced the stand-up of the Canadian Patrol Submarine Project (CPSP). This project will acquire new submarines to replace the Royal Canadian Navy's (RCN) four Victoria-class submarines (VCS). This paper will advocate for a foreign-built "military-off-the-shelf" (MOTS) approach to acquisition over a designed-in-Canada or even a built-in-Canada solution.

INTRODUCTION

2. The VCS were originally built for the Royal Navy (RN) as the Upholder-class. When the RN decided to divest their conventional submarine capability to focus on their nuclear-powered fleet, they sold the four completed submarines to Canada. The RCN bought them in 1998 for \$812 million as a stopgap measure.¹ At the time, the RCN's three Oberon-class submarines were over 30 years old and were slated to be decommissioned. A RCN project to build a fleet of nuclear-powered submarines had recently failed, and there was no time left to retool and build conventional submarines before the Oberon-class were retired. Therefore, Canada bought the Upholders, renamed them the Victoria-class, and put them into service to maintain the RCN's proficiency in submarine operations and ensure they continued to hold this strategic capability.

3. Now, that stopgap has been in place for over twenty years with a proper replacement only just announced. The VCS are aging, having been launched between 1986 and 1993,² and they are currently scheduled to be decommissioned in the late 2030s, meaning their hulls will be almost 50 years old.³ The RCN has again found itself at risk of gapping its submarine capability if new submarines are not brought into service within 15 years. DND can pursue one of four options for the CPSP: designed and built-in-Canada, foreign-designed-built-in-Canada, Canadianized MOTS, or pure MOTS. While all options have positive and negative aspects, the delay in launching the CPSP, the risks of the various options, and the feasibility of the options should guide the decision. This paper will demonstrate the importance of maintaining a submarine capability, the benefits of a MOTS solution, and why now is the ideal time to pursue this course of action.

DISCUSSION

4. Submarines provide a unique strategic capability, and project sea power in a way surface vessels are incapable of matching. Submarines are, unquestionably, the best anti-submarine warfare (ASW) platform available. They also provide covert surveillance and intelligence gathering capabilities, and they can be used to insert or retrieve special forces. Finally, because

¹ Pat O'Brien, *Procurement of Canada's Victoria Class Submarines: Report of the Standing Committee on National Defence and Veterans Affairs* (Ottawa: Communications Canada, 2005), 19.

² "Victoria-class Submarines," Canada, last modified May 28, 2021, <https://www.canada.ca/en/navy/corporate/fleet-units/submarines/victoria-class.html>.

³ Canada, "Future Fleet," *Your Navy Today* 5, no. 1 (January 21, 2021). <https://www.canada.ca/en/navy/corporate/navy-news/your-navy-today/volume-5-issue-1.html>.

submarines are so difficult to locate, they impart a far greater deterrence effect and can access littoral areas that may be denied to surface ships and aircraft by Anti-Access/Area Denial (A2/AD) weapons.⁴

5. Canada currently fills its submarine capability with a conventional diesel-electric submarine. Diesel-electric submarines are smaller and quieter than their nuclear-powered counterparts.⁵ They are also far more prevalent in the world. Consequently, the United States Navy (USN), who operate an all-nuclear-powered fleet of submarines, seek opportunities to exercise their ASW capabilities with conventional submarines, meaning the VCS provides a distinct capability to Canada's largest ally.⁶ Additionally, operating submarines entitles Canada to continue to be part of the Water Space Management (WSM) regime.⁷ WSM is used by nations to communicate the operations of their submarines to avoid mutual interference. This classified information is only shared with those with a need-to-know, namely other nations with submarines. Being part of the WSM regime avoids the adage quoted by VAdm (ret) Norman, "you'll always have a submarine in your waters... yours or someone else's."⁸

6. Uncrewed underwater systems are not a viable replacement to their crewed counterparts. Due to the density of water, remotely operated systems are almost always tethered to the operator, meaning they cease to be covert. Autonomous systems allow for covertness, but they are required to be preprogrammed with their tasks and lack the flexibility of having human decision makers embarked. While both remotely operated and autonomous underwater systems could provide the RCN with useful capabilities, they cannot achieve the full spectrum of operations available with a crewed submarine.⁹

7. Retaining submarine capability is critical to Canada's maritime defence, but capital acquisition by the DND is slow. A 2006 report states that capital acquisition in DND can take upwards of 15 years and up to 70% of major capital projects are subject to delays.¹⁰ While this timeline is similar to many of our allies, delays in other nations are primarily during the research and development phase, something Canada rarely engages in.¹¹ Moreover, major shipbuilding projects are some of the most complex procurements conducted by DND. The Canadian Surface Combatant (CSC) project, likely the closest equivalent to CPSP, is currently projected to take over 20 years from its announcement in 2008 to delivery of the first vessel in the early 2030s.¹²

⁴ Jeffrey F. Collins, *Deadline 2036: Assessing the Requirements and Options for Canada's Future Submarine Force* (Macdonald-Laurier Institute, 2021), 15.

⁵ Unlike nuclear submarines, which can remain submerged indefinitely, diesel-electrics are required to snort (raise a snorkel above the surface) periodically in order to access air to run the diesel generators and recharge their batteries, this is the primary disadvantage of diesel-electric. Air-Independent Propulsion (AIP) technology is now more mature and can be used to power conventional submarines for periods of 2-4 weeks without a requirement to snort.

⁶ O'Brien, *Procurement of Canada's Victoria Class Submarines*, 19.

⁷ Collins, *Deadline 2036*, 16.

⁸ Collins, *Deadline 2036*, 4.

⁹ The RCN currently employs remotely piloted underwater vehicles for mine-hunting and disposal, route surveys, and bottom inspection.

¹⁰ Canada, *Perspectives on the Capital Equipment Acquisition Process* (National Defence: Chief Review Services, 2006), 1; Collins, *Deadline 2036*, 11.

¹¹ Canada, *Capital Equipment Acquisition*, 1.

¹² "Canadian Surface Combatant," Canada, last modified February 18, 2022, <https://www.canada.ca/en/department-national-defence/services/procurement/canadian-surface-combatant.html>.

Additionally, Canada continues to struggle to spend allotted funding on capital projects. Whereas our allies have estimated approximately 30% of their defence budgets should be spent on capital replacement projects, in fiscal year 2021/22 DND only spent 13.7% of its budget on capital projects.¹³ DND's record of slow procurement requires CPSP to work towards an accelerated timeline to minimize the risk of gapping their crucial submarine capability.

8. Although Canadian ship-building is seeing a resurgence under the National Shipbuilding Strategy (NSS), Canadian industry is not currently up to the task of designing or building a submarine in Canada. Canada has never built submarines domestically; all previous Canadian submarines have been UK or US built.¹⁴ Far more complex than surface ships, submarines are more aptly compared to crewed spaceflight.¹⁵ They operate in extremely hostile environments: subjected to high sea-states while surfaced and extreme pressures at depth, constantly exposed to salt-water which corrodes the hull, and required to remain water-tight while having openings to the sea (for example when releasing weapons or circulating water for cooling.) The ongoing struggles with the VCS In-Service Support Contract (VISSC) provide evidence of Canadian industry's unfamiliarity with submarine work. The VISSC is a multi-billion-dollar contract to perform the deep maintenance periods on the VCS. However, issues with weld quality, incorrect testing procedures, and maintenance periods that have ballooned in length demonstrate the lack of experience with these complex vessels.¹⁶

9. Moreover, Canada's ship-building industry is currently tackling three major ship builds for the Navy and several more for the Canadian Coast Guard, and it is struggling to find skilled workers to complete these projects.¹⁷ Similarly, Canada's Naval Architectural ability attrited significantly in the late 1980s, after the design of the Halifax-class, reviving it will take years.¹⁸ The NSS hopes to mitigate these shortfalls and sustain some of these capabilities into the future by building ships more slowly over a longer period of time, thereby keeping experienced people employed. However, the once-in-a-generation build of a fleet of submarines will not be able to similarly sustain any investment in submarine building expertise. While investing to develop domestic expertise required to build submarines in Canada would be valuable to the long-term

¹³ "Defence Spending," Canada, last modified January 27, 2023, <https://www.canada.ca/en/department-national-defence/corporate/reports-publications/proactive-disclosure/secu-06-october-2022/defence-spending.html>.

¹⁴ Both the US and UK have now transitioned to exclusively building and operating nuclear submarines and neither is an option for CPSP; Collins, *Deadline 2036*, 17-18.

¹⁵ Collins, *Deadline 2036*, 12.

¹⁶ Dean Beeby, "Wonky Welds Keep West Coast Submarines Stuck in Port," *CBC News*, May 17, 2016, <https://www.cbc.ca/news/politics/submarine-welding-repairs-hmcs-chicoutimi-victoria-1.3584592>;

Canadian Press, "Navy Submarine has Long-Term Damage to Ballast Tank from Bungled Test, Report Says," *CBC News*, April 5, 2021, <https://www.cbc.ca/news/canada/navy-submarine-damage-ballast-tank-test-1.5975659>.

¹⁷ J.L. Granatstein, "That Sinking Feeling – Despite a Huge Investment in Shipbuilding, Canada's Navy isn't Living up to its Historic Reputation," *Legion Canada's Military History Magazine*, February 17, 2023,

<https://legionmagazine.com/en/that-sinking-feeling-despite-a-huge-investment-in-shipbuilding-canadas-navy-isnt-living-up-to-its-historic-reputation/>; David Pugliese, "Irving Recruiting Foreign Workers to Build Royal Canadian Navy's New Warship Fleet," *The Ottawa Citizen*, September 22, 2022, <https://ottawacitizen.com/news/national/defence-watch/irving-recruiting-foreign-workers-to-build-royal-canadian-navys-new-warship-fleet>.

¹⁸ David Rudd, *Military Off-the-shelf: A Discussion on Combat Ship Acquisition* (National Defence: Defence Research and Development Canada, 2014), 13.

interests of both Canadian industry and DND, the timelines required to replace the VCS are too short to make a built-in-Canada submarine viable.

10. MOTS solutions have several advantages. Clearly, there should be schedule and cost savings. A mature design and experienced shipyard will provide economies of scale. However, this assumption needs to be carefully dissected during the procurement process. Building submarines is not equivalent to mass producing consumer products. Delays can have cascading impacts on future vessels and conflicts with the supplying nation may arise over priorities. For example, there are already concerns that the United States (US) has insufficient capacity to supply Australia with nuclear-powered submarines after the AUKUS announcement. Estimates suggest the US Navy requires two new submarines per year, but their shipyards are only averaging 1.3 per year – even before the Australian demand.¹⁹ Regardless, MOTS is a necessary consideration for Canada. Naval vessels are inherently different from other military hardware. They are usually produced in far smaller volumes than aircraft or land vehicles, and there are no prototypes, all vessels launched from the shipyard are expected to enter operations. The integration of a wide variety of systems adds an additional layer of complexity.²⁰ Investing in a mature design, removes much of the risk of this no-fail build criteria and complex integration.

11. A MOTS solution will also help avoid the supply chain issues experienced when operating an orphaned class.²¹ The Oberon-class had 27 submarines operated by nations worldwide, and Canada was able to leverage allies' supply lines and expertise. The four VCS are unique. After the RN cancelled the project, many of the original equipment manufacturers (OEM) closed their doors or retooled to pursue new projects.²² DND has struggled to recreate critical supply chains, often at significant cost, to provide the necessary parts and materiel to maintain the VCS. A MOTS solution would once again leverage a larger fleet to support long-term sustainment of the CPSP.

12. Ideally, a MOTS solution would offer a degree of modularity, allowing a Canadianized MOTS solution. Modular designs are advantageous as they allow substitution of Canada's preferred equipment, and, more importantly, later upgrades as technology advances. However, caution must be exercised when contemplating what Rudd refers to as "a 'MOTS+' or 'MOTS++' designs that "incorporate significant internal or external design changes."²³ Too much customization risks shoehorning in capabilities that cannot be supported by the MOTS design, resulting in increased complexity and design costs. What may seem like a relatively simple change, for example substituting a more powerful sonar system, may have significant follow-on effects. Designers will need to ensure that there is sufficient power available in the electrical system to power it, that the power cables to the sonar are properly rated for the additional current, that there is space for more amplifiers, that the added weight does not negatively impact the centre of gravity of the submarine, that the cooling is increased to account for additional heat, and that the new system is properly integrated with other sonars and the

¹⁹ Mark Watson, "Who Will Build our Nuclear Subs?" *The Australian Financial Review*, (January 14, 2023): 38.

²⁰ Rudd, *Military Off-the-shelf*, 3.

²¹ Michael Byers and Stewart Webb, *That Sinking Feeling: Canada's Submarine Program Springs a Leak* (Ottawa: Canadian Centre for Policy Alternatives, 2013), 15.

²² Collins, *Deadline 2036*, 13.

²³ Rudd, *Military Off-the-shelf*, 4.

Command and Control system. This type of modification was attempted on the VCS torpedo launch system, to accommodate the US-built Mk-48 torpedo instead of the UK Spearfish for which it was built; it delayed the VCS achieving full operational capability by years.²⁴ As naval vessels are a system of systems, requiring a complex design spiral to optimize, deviating from the mature design may offset any advantages of buying MOTS.

13. A pure MOTS solution, and to a lesser extent a Canadianized MOTS solution, will clearly have trade-offs. CPSP is Canada's only opportunity to sustain, improve, or add submarine operational capabilities for a generation. A MOTS solution will necessarily dictate what those capabilities will be, and if the design is particularly mature, some of those capabilities may already be nearing obsolescence. Attempts to avoid these issues by dictating overly restrictive requirements will limit the options available and likely reduce the benefits of MOTS by complicating the design process and eating into the efficiencies created by economies of scale. A foreign built submarine may also limit maintenance support options as the expertise in design and build will not be resident in Canada. Similarly, access to the intellectual property (IP) may limit what maintenance can be conducted in Canada.²⁵ For example, not all IP was sold to Canada upon purchase of the VCS, and some equipment must still be shipped back to the UK for repair and overhaul by the OEM. While these trade-offs are important to understand and mitigate where possible during procurement, they are reasonable considering the advantages of a quicker procurement and avoiding maintaining an orphaned fleet.

14. As with any government procurement project of this size, support from political leadership will be important. The destroyer replacement project, which eventually became the CSC project, changed course several times as different political parties took office. Each change saw significant set backs to the project timelines.²⁶ More recently, a government-led decision to increase the number of Arctic Off-shore Patrol vessels (AOPS) has further delayed the CSC because the AOPS and CSC are being constructed by the same shipyard.²⁷ Major procurement projects are often used by governments to further their policy goals, including regional benefits, social equity, and environmental sustainability.²⁸ Unfortunately, a MOTS solution is unlikely to present any benefits in these areas. Therefore, the political aspect of this procurement will need to be carefully managed. Making a decision early and executing it swiftly is the only option to avoid a capability gap. Because of the "path dependencies and very large sunk costs" involved in naval vessel procurement, changing course will be harmful to both cost and schedule considerations.²⁹

15. Clear doctrine, particularly at the strategic level, articulating the importance of submarines and the requirements to replace the VCS in the near-term is a first step. Leadmark 2050 touches on these requirements, but it should be updated to better reflect the urgency of this

²⁴ Byers and Webb, *That Sinking Feeling*, 16.

²⁵ Byers and Webb, *That Sinking Feeling*, 16.

²⁶ Andrea Migone, Alexander Howlett, and Michael Howlett, "(Mis)aligning politicians and Admirals: The Problems of Long-term Procurement in the Canadian Surface Combatant Project 1994-2021," *Canadian Public Administration* 65, no. 1 (2022): 31.

²⁷ Migone, Howlett, and Howlett, "(Mis)aligning politicians and Admirals," 31.

²⁸ Migone, Howlett, and Howlett, "(Mis)aligning politicians and Admirals," 32.

²⁹ Migone, Howlett, and Howlett, "(Mis)aligning politicians and Admirals," 34.

requirement.³⁰ More importantly, the National Defence Policy needs to match.³¹ Failure to align DND strategy with political policy is partially to blame for the conflicts over the destroyer replacement project as well as the prioritization of AOPS over CSC.³²

16. Fortunately, from a geo-political standpoint, now may be an ideal time for DND to shape the political conversation in favour of investing in this strategic capability. Russia's invasion of Ukraine is reminding Canadians that peer or near-peer conflict remains possible, a sentiment that had faded in the years following the end of the Cold War. Ukraine serves to underscore the importance of maintaining conventional warfare capabilities, including Canada's participation in and contributions to NATO. Equally, Canada's recently released Indo-Pacific Strategy highlights China's growing military capability and divergence from the Rules Based International Order.³³ In particular, China's weaponizing of the South China Sea provides them an A2/AD capability that will be most effectively countered by covert forces, including submarines. Additionally, modern Air-Independent Propulsion (AIP) capable submarines allow for longer periods fully submerged without requirement to snorkel, meaning new submarines could also have greater influence in Canada's arctic, a growing concern as the arctic becomes more accessible. Finally, purchasing MOTS submarines operated by another, or several other, nations provides a unique opportunity to solidify defence partnerships.

CONCLUSION

17. Submarine procurement is a long, complex, and expensive project. There are measurable advantages to designing and building submarines in Canada or curating a detailed list of Canadianized requirements for a MOTS+ submarine. However, given the age of the VCS and the delayed announcement of the CPSP to replace them, pursuing a solution that is not a mature MOTS design will see the submarine capability gapped for Canada. Given the rising tensions world-wide, this gap could have serious implications for Canada's defence and security.

RECOMMENDATION

18. ADM(Mat) and the RCN should focus the CPSP efforts on identifying and procuring a MOTS submarine that can replace the VCS prior to their decommissioning in the late 2030's. To avoid the pitfalls experienced by other major capital procurements, doctrine must be aligned with National Defence Policy, and the benefits of the MOTS solution must be imparted to political leadership and the Canadian public. Failure to achieve a united way forward on a MOTS solution will result in the failure of the CPSP and, more critically, gapping the submarine capability in Canada, which could have significant strategic consequences.

³⁰ Canada, *Canada in a New Maritime World: Leadmark 2050* (National Defence: Royal Canadian Navy, 2016), 39-40.

³¹ Migone, Howlett, and Howlett, "(Mis)aligning politicians and Admirals," 37.

³² Migone, Howlett, and Howlett, "(Mis)aligning politicians and Admirals," 44.

³³ Canada, *Canada's Indo-Pacific Strategy*, (Ottawa: Global Affairs Canada, 2022), 7.

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