

# Why Isn't the Nuclear Option in Play?

Jonathan Cassels | May 2026

## Executive Summary

Canada's submarine replacement program reflects a pragmatic assessment of Canada's strategic priorities, operational requirements, and industrial realities. While nuclear-powered submarines offer superior range, endurance, and Arctic capability, modern diesel-electric submarines equipped with air-independent propulsion can meet Canada's most critical defence needs more effectively and affordably. The paper argues that Canada's primary submarine mission is protecting key maritime approaches and ports, where quieter diesel-electric boats hold advantages. Combined with alliance dynamics, industrial limitations, and urgent procurement timelines, these factors explain why Canada has excluded nuclear submarines from consideration

Canada's submarines are running out of time. Built over 30 years ago for service with the UK's Royal Navy, the four-boat Victoria-class was acquired by Canada in the 1990s and has never quite lived up to its advertised potential.<sup>1</sup> It now needs replacement, and submarine procurement programs can be long and uncertain ordeals.

However, ever since former Prime Minister Justin Trudeau announced that Canada planned to pursue a fleet of up to 12 submarines in July of 2024, Canada's submarine procurement is one project that's actually moved extremely quickly. Requirements were set, industry feedback sought, and the downselection to two potential builders happened in just over a year.<sup>2</sup> By March of 2026, both builders had submitted detailed bids, and Canada is now potentially just weeks away from making its final selection.<sup>3</sup>

Of course, selecting a submarine quickly isn't the same as getting a submarine quickly. The earliest Canada will receive newly built submarines is 2032.<sup>4</sup> However, in a procurement system that has, in recent years, averaged over 15 years for routine procurements — and much longer for projects of this size — just eight years from announcement to initial delivery is an impressive outlier.<sup>5</sup>

The two submarines contending for this contract are the KSS-III-class, built by Hanwha Ocean and already in service with the South Korean Navy, and the Type 212CD-class, being built by TKMS for Germany and Norway.<sup>6</sup> The Government of Canada has stated that, notwithstanding the differences in their capabilities, sizes, and systems, both designs meet the Royal Canadian Navy's needs, and the final decision will be based on other criteria within the competing bids.<sup>7</sup> One thing that both designs have in common is that they're diesel-electric submarines with an integrated air-independent propulsion system — not nuclear powered.

Nuclear-powered submarines have a reputation for being the most advanced and most capable submarines in the world. This reputation isn't entirely unearned; they have real advantages over diesel-electric submarines that are significant for Canada. This raises the question: why isn't the Government of Canada or the CAF at least considering nuclear-powered submarines for the Royal Canadian Navy?

Generally speaking, nuclear submarines' advantages are that they have enormous range without the need to refuel, can operate at higher speeds than conventional submarines and won't reduce their total range when they do, and can stay submerged for months without needing to exchange air with the surface.<sup>8</sup> Discussions of submarines for Canada often centre around the Arctic, and all three of these advantages of nuclear submarines are relevant to maintaining a persistent presence there.

First, it is very difficult to operate diesel-electric submarines in the North because they need to exchange air with the surface to run the diesel generators that recharge their batteries. This is usually, and most safely, done with a snorkel, but sea ice makes this a liability, as snorkels cannot penetrate solid ice sheets and can be damaged in areas with loose ice chunks.<sup>9</sup>

Canada's Arctic also has no facilities capable of supporting submarines, and building such facilities has proven to be an immense challenge.<sup>10</sup> Without support facilities in the North, the distances Canadian submarines need to transit, independent from support, to and from the Arctic can actually be greater than the distance to friendly ports in Asia or Europe — even if they never leave Canadian waters. This makes long range a requirement. While that range is not impossible for diesel-electric submarines, it remains an advantage for nuclear propulsion. Nuclear submarines' higher speeds are also beneficial because they can increase patrol efficiency. More speed means less time transiting to a patrol area and more time on station, potentially allowing fewer nuclear submarines to provide equivalent coverage within the Arctic.

The advantages of nuclear submarines are not limited to the Arctic, however. One of the main capabilities submarines offer is the ability to threaten another nation's sea lines of communication — the routes used by its trade and naval vessels. If Canada needed to threaten another nation's sea lines — unless that country was its historic ally, the United States — geography dictates that it would be doing so a long way from Canadian shores. Significant range is therefore a requirement

for Canada to have this capability, and speed also benefits this capability because it makes that threat more immediate. Nuclear submarines are better suited to this task than non-nuclear submarines. A similar logic applies to using submarines to threaten targets on land.

These advantages have historically been well understood within the Royal Canadian Navy and the Government of Canada. The current procurement project is only the third time Canada has sought to acquire new submarines since the first nuclear submarine sailed in 1954.<sup>11</sup> Even though other options were executed in the end, it's notable that in both of the previous submarine procurement projects, the intention was, at least for a time, to acquire nuclear submarines.

In the 1950s, the Royal Canadian Navy selected the US Navy's nuclear-powered Skipjack-class before the government overruled that plan and selected the UK's non-nuclear Oberon-class in 1960 instead.<sup>12</sup> In the 1980s, the government of Brian Mulroney announced that it would replace the Oberon-class with nuclear-powered submarines in its 1987 Defence White Paper, before reversing that decision in 1989 and eventually acquiring the currently serving Victoria-class.<sup>13</sup> Despite the end result, in both cases, the advantages of nuclear submarines featured prominently in discussion and debate.

Nuclear submarines' advantages of speed and range still exist today, and Canadians in and out of government service show awareness of them. While public discourse on military subjects in Canada is often limited, interest in nuclear submarines spiked after the United States, United Kingdom, and Australia announced the AUKUS pact in 2021. This agreement aimed to transfer several American nuclear submarines to Australia in the near term and should eventually result in Australia building its own nuclear submarines domestically. Many Canadians wondered why Canada couldn't be included in this agreement.<sup>14</sup> There has also been a small, but loud, segment of public and academic Canadian defence communities who persist in advocating for nuclear submarines based on these advantages, and professionals within the RCN and government hear those arguments. Nonetheless, there have been no public indications that nuclear submarines were seriously considered by the RCN or the government in this procurement.

Cost is undoubtedly a factor in this decision, but it is not a sufficient explanation on its own. Australia's planned acquisitions under AUKUS give us a good cost benchmark for Canada. That project is expected to cost up to \$368 billion over the first 30 years — an average of \$12 billion annually.<sup>15</sup> This is an enormous sum, which would consume nearly half of the defence budgets Canadians are used to.<sup>16</sup> However, Prime Minister Carney recently committed to increasing Canada's defence spending to 3.5% of GDP by 2035.<sup>17</sup> Based on current GDP figures, that represents \$52.5 billion of additional annual defence spending over 2024 levels. While there will be competing priorities, a \$12 billion annual program is not inconceivable in that context, if it addresses a core need.

Rather than cost, Canada's continued official disinterest in nuclear-powered submarines appears rooted in something Canadian defence discourse isn't used to: decision makers' deeper understanding of strategic and industrial considerations today than in past procurement cycles.

Canada's nuclear submarine ambitions in the 1980s were based on an understanding of the advantages of nuclear submarines but a misunderstanding of strategic priorities. The immediate

catalyst that led to the decision to procure nuclear submarines was when an American Coast Guard icebreaker, USCGC *Polar Sea*, sailed through the Northwest Passage without Canadian permission. The United States claimed the Passage as an international strait, giving it a right to transit. In response to public concern, the Mulroney government quickly made it clear that Canada viewed the waters of its Arctic Archipelago as internal waters — meaning permission was always needed for passage.<sup>18</sup>

This created a quandary for Canada, which didn't have the ability to monitor violations of — much less enforce — these claims. Persistently monitoring the entire Canadian Arctic with ships, satellites, planes, or ground stations was impractical for technical reasons, and other countries would always know when these assets were absent.<sup>19</sup> Submarines would have been an appealing solution, as they could monitor ships without being detected themselves, forcing those ships to always act as if they may be surveilled even if the actual coverage was intermittent.

Since it would have been extremely difficult to operate diesel-electric submarines of the time in the Arctic — and after getting some outrageously optimistic estimates on the cost of the program and the likely interest of allies in assisting Canada — the government committed itself to acquiring nuclear submarines for this purpose in 1987.<sup>20</sup>

The strategic miscalculation in all of this was one of priorities. In any conflict with a major naval power, the first priority for Canada's submarine force is unlikely to be the Arctic. The protection of shipping in the Gulf of St. Lawrence, the Strait of Juan de Fuca near Vancouver, and the seas around Saint John, Halifax, and Prince Rupert — near all of Canada's largest ports — would almost certainly be a much higher priority.

This prioritization reflects a fundamental concept in military strategy referred to as a “centre of gravity” — which is the “hub of all power and movement, on which everything depends,” according to famed strategist Carl von Clausewitz, and the “point against which all [of a belligerent's] energies should be directed” in order to gain advantage and win in any conflict.<sup>21</sup>

None of Canada's centres of gravity — none of its most vital capital, industrial, resource, population, strategic, or trade centres — are in the Arctic. That is not to say that the Arctic does not have value in several of these areas, but the Arctic is not a hub that Canada relies on for its prosperity, ability to project military power overseas, or existence as a nation.

Canada's major ports, on the other hand, are its centres of gravity — at least when it comes to conducting war on or across the ocean. Canada depends on the sea lines of communication that must start at its ports. Because these sea lines pass through very few chokepoints — and none that are likely to be unfriendly — except at entry points to the Indian Ocean, threatening Canada's use of them can most efficiently be done close to these ports.<sup>22</sup> Hunting vessels, even civilian vessels, on the open ocean is resource intensive. So, Canada should expect them to be a high-priority target for its adversaries.

History reinforces this. During the Second World War, German U-boats operated near all of Canada's major East Coast ports, as well as in the Gulf of St. Lawrence and even into the St.

Lawrence River. A future adversary would likely seek to do the same with modern submarines on both coasts. It's a threat Canadian military plans should take seriously.<sup>23</sup>

Taking the threat of enemy submarines in these areas seriously means prioritizing platforms that can deal with those threats most effectively. The best counter to a submarine is another submarine, and, despite the advantages of nuclear submarines in other areas, diesel-electric submarines have the advantage here. That advantage comes down to noise profiles. Nuclear-powered submarines are always generating noise because they can't shut down their reactors — they're always quiet, but never silent. Diesel-electric submarines, by contrast, can operate on batteries in near silence, giving them an advantage. While this advantage is lost when they must periodically use diesel generators to recharge, this is less of a liability near home, where they can return to port or arrange support from other assets during this time of vulnerability.<sup>24</sup>

Without another solution to the Arctic monitoring issue, perhaps it could be argued that a nuclear submarine that was less capable in providing security near Canadian ports but could be used in the Arctic — as opposed to a diesel-electric submarine that was the best submarine for maintaining security near ports, with very little Arctic utility — would be a reasonable trade-off. But the Arctic issue was primarily one that should have been addressed through diplomatic means, as evidenced by the fact that it eventually was. In 1988, the United States and Canada agreed that American ships would not transit through the Northwest Passage without Canadian permission, even as the United States would not recognize Canada's claim that it was internal waters.<sup>25</sup> With few other countries having the means or interest to sail through the area — the USSR, being the main contender, actually sided with Canada's claims — this effectively settled the matter and allowed Canada to abandon its nuclear submarine plans the following year.

Today, with receding ice sheets and more industrialization around the world, more countries may have both the means and interest in using the Northwest Passage for passage. However, Canada has made real progress in having its claims recognized internationally, while new technologies provide options other than nuclear submarines for monitoring the area. Cheaper satellites and modern over-the-horizon radars are two such technologies.<sup>26,27</sup> A third is the air-independent propulsion (AIP) systems found on many modern diesel-electric submarines — including the two Canada is considering.<sup>28,29</sup>

AIP systems began being used on naval submarines in the 1990s, not long after the Victoria-class was completed without them. They come in a number of varieties, but their commonality is that they give diesel-electric submarines the ability to generate electricity for extended periods of time without relying on their diesel generators and without exchanging air at the surface — sometimes extending the time a diesel-electric submarine can remain fully submerged from a few days to several weeks.<sup>30</sup>

This largely addresses the main barrier to diesel-electric submarines operating in the Arctic: the need to frequently snorkel. With the ability to remain submerged for weeks, they can confidently enter ice-covered areas and return to ice-free ones when required. The technology does not quite make them the equal of nuclear submarines in every respect — their sustained speed while using AIP is limited, for example.<sup>31</sup> However, since noise considerations force even nuclear submarines to primarily operate at low speeds, with the option to sprint at higher ones in emergency, and diesel-

electric submarines with AIP can mimic this behaviour by idling to charge their batteries and sprint by drawing them down, this is less of a tactical difference than it may appear.

AIP systems do have the disadvantage that they can't be regenerated at sea.<sup>32</sup> A ship with 21 days of AIP when it leaves port only has those 21 days to use on that deployment. Once that time is used up, they'll need to rely on more frequent charging cycles until they return to port. However, even at the reduced speeds AIP is limited to, 21 days is enough for a submarine to patrol from the most southerly winter extent of the Arctic ice sheet to the most northern point of Canadian territory and back. This will rarely, if ever, be done, since the ability of nuclear submarines to harm Canada from these locations is limited, and nothing else is likely to be present. But just having the option accomplishes many of Canada's goals, as other nations need to guard against the possibility.

More commonly, when deployed to the Arctic, Canadian AIP submarines will be used along the shipping channels that open in the Arctic during the winter, monitoring traffic and, in conflict, hunting belligerent submarines that are actually a threat to that shipping. Their under-ice capability will mostly be used to transit from one area of open water to another or deprive nuclear submarines of the safety they might otherwise find under ice near these shipping channels. These are the highest-priority activities in the Arctic.

Submarines with these systems are also capable of other roles. The presence of diesel-electric U-boats on Canada's East Coast during the Second World War shows that threatening shipping on the far sides of oceans has long been within diesel-electric submarines' capabilities. AIP systems just make them more survivable when far from home. Diesel-electric submarines may not be able to independently threaten shipping as persistently as nuclear submarines, but that can be addressed by accessing nearby friendly ports, and Canada is unlikely to be intercepting shipping except in support of allies. Similar logic applies to the option to attack high-value land targets with submarines.

We shouldn't lose sight, however, of the fact that operating in the Arctic, disrupting shipping, or attacking land targets are all secondary considerations for Canada's submarine fleet. The ability AIP systems give diesel-electric submarines to go for weeks without recharging after leaving port amplifies their advantage over nuclear submarines when operating near Canadian ports — their most important mission. Combined, the increased advantage of diesel-electric submarines with AIP systems over nuclear submarines in Canada's most critical area of need, and their ability to perform a wide range of secondary tasks, eliminates most of the strategic arguments that could be made for Canada to acquire nuclear submarines in the present day.

The nail in the coffin today for a Canadian acquisition of nuclear-powered submarines, however, remains what it was in the 1980s: Canada has no option that will allow it to acquire them. Not on the necessary timelines.

Among Canada's three allies who operated nuclear submarines in the 1980s, the UK and France were, at best, lukewarm to the idea of Canada acquiring them, while the United States was outright hostile.

America's hostility had three basic causes. First, it was clear that Canada's desire for nuclear-powered submarines was in response to US actions — treating the US as a potentially hostile nation — and it's natural that they wouldn't want to provide their own foil. The US also believed that Arctic waters held modest strategic importance and worried that Canadian investment in nuclear submarines would impact the force that it could afford to sustain in the more strategically important European theatre. Finally, while the Northwest Passage was not of huge strategic importance as an international strait at the time, other international straits held and hold enormous strategic importance, and the precedent of one international strait becoming internal waters could open the door to other straits being similarly reclassified.<sup>33</sup>

The UK's and France's lukewarm attitudes were a result both of their disbelief that Canada would follow through, and of the concerns of the United States. The UK, in particular, operated its nuclear submarine program in close cooperation with the United States and couldn't export its submarines or expertise without American approval.<sup>34,35</sup>

America's disapproval was less of a binding constraint — but still a factor for consideration — for France. However, their submarines of the time were significantly inferior in capability and not truly suitable to Arctic operations in any case.<sup>36</sup>

This lack of an enthusiastic partner posed a major challenge to Canadian ambitions. Nuclear submarine technology has only truly been developed independently once — by the United States. All other operators were assisted in their acquisition either through espionage (USSR), open cooperation (UK and China), secret cooperation (France), or a lease arrangement (India). It is an extremely difficult technology to develop.

Despite this, for a time, Canada did consider developing its own nuclear submarine. One novel proposal was for a submarine that operated off of batteries, like a conventional submarine, but had a low-power SLOWPOKE-2 nuclear reactor onboard to recharge those batteries during periods of low activity without surfacing. It wouldn't be able to operate continuously at full power like other nuclear submarines, but it also wouldn't need to surface to charge its batteries like a conventional submarine.<sup>37</sup> This may have been the kernel of a good idea — it's very similar in concept to how modern air-independent propulsion systems work — and can be lauded for realistically acknowledging some of Canada's technical limitations, but it still wasn't very realistic.

Canada not only had no experience building *nuclear* submarines, but it had no experience building *any* sort of submarine, not since it had assembled a few for the UK during the First World War.<sup>38</sup> Modern submarines rely on a number of highly specialized systems — such as acoustic sensors and noise suppression systems — that are immense engineering challenges that Canada would need to overcome on its own. Even with a less ambitious reactor concept, it could take decades and multiple iterations before a submarine that satisfied Canadian needs could be built domestically. As a point of comparison, France commissioned its first nuclear submarine in 1971. But their designs were consistently viewed as being behind their contemporaries until their fourth blank-sheet design — the Suffren-class — entered service in 2020.<sup>39</sup> That 50-year timespan is a realistic expectation for a newcomer to develop competitive nuclear submarines.

In the end, this would always have made it impossible for Canada to acquire nuclear submarines in the 1980s. No other operator of nuclear submarines wanted to give — and was capable of giving — Canada the assistance required. And developing the capability independently over decades did not meet Canada’s needs. Similar dynamics apply to Canada’s position with its allies today, with time pressure being created by the fact that Canada needs a replacement in service by the time the Victoria-class will be retired in 2035, and there being no potential partner with both the willingness and capability to help.<sup>40</sup>

Initially, this might seem too dismissive of recent developments. After all, the UK and the United States are both working with Australia to meet its nuclear ambitions through AUKUS — with the first submarines expected to be in service in the early 2030s.<sup>41</sup> Canada is a similar-sized nation to Australia, with similar (or even closer) relationships with the UK and the United States. This could suggest that Canada might pursue a similar arrangement and timeline. However, this concept falls apart on closer examination.

The logic behind AUKUS is built on Australia’s location. It is not just an agreement for the United States and the UK to sell nuclear submarines to Australia in the near term and help Australia build its own nuclear submarines in the long term. It also includes the right to base their own nuclear submarines in Australia — with Australia bearing the cost.<sup>42</sup>

Australia is much closer to where the United States and the UK want to deploy their submarines in the Indo-Pacific than their own shores are. Basing their submarines in Australia reduces transit time, allowing their submarines to sustain similar “on-station” time even if they are operating fewer of them. Both the United States and the UK have severe limits on their capacity to build nuclear submarines, arguably not even having sufficient capacity for their own needs.<sup>43,44</sup> It’s only through the fact that this basing agreement reduces the number of submarines they need to operate that any of their submarines are freed up for sale to Australia.

Canada does not have this leverage. The naval bases in Canada that could host US submarines are within a few hundred kilometres of the US bases those submarines are already homeported at. The UK could also use those US bases if it needed an increased presence close to Canada for any reason. Nothing Canada can do reduces the number of submarines the United States or the UK require.

Australia is also expected to contribute significantly to the design process of a new AUKUS-class of submarine, which will be the UK’s next nuclear submarine and will serve as the design that’s eventually built in Australia. Australia can contribute to this because it gained significant experience building, and later upgrading, its current class of submarines — the Collins-class — in the 1990s and early 2000s. The Collins-class incorporated some truly world-beating innovations and sustained a capable submarine industry. Canada, as an operator of submarines that were originally designed and built in the UK, can’t provide a similar contribution.<sup>45</sup>

It’s also a fact that the reasons Canada couldn’t rely on the US or the UK to develop a nuclear submarine capability in the 1980s haven’t disappeared. At best, America still views the acquisition of nuclear submarines by Canada as a project that will drain resources from areas they’d prefer us

to invest in. At worst, they still view it as a hostile action targeted directly at their interests. The UK is too integrated in the US program to support Canada independently.

Finally, even if the UK and US were convinced to help Canada acquire nuclear submarines, the timing is impossible. AUKUS was created in 2021.<sup>46</sup> Even if Canada could proceed on the same timeline, starting now would likely push receipt of the first submarine past the 2035 deadline. And proceeding on the same timeline is treating America's and the UK's capacities to assist other countries as if they're infinite. In reality, a similar timeline could only be achieved if AUKUS was abandoned and Canada effectively took Australia's place in a similar agreement. Otherwise, American and UK capacity to assist Canada won't exist until after much of what AUKUS promises has been delivered — well into the 2040s. And that's just too long for Canada to wait.

That leaves France as a potential partner. However, while France's nuclear submarines are no longer significantly handicapped compared to those of the United States or the United Kingdom, its ability to help Canada meet its timelines is no stronger.

France's capacity for building nuclear submarines domestically is limited and appears entirely utilized for its own purposes well past 2035. If Canada were to pay for it, new capacity could plausibly be built. But that's a decade-long project itself, and with the typical construction time of a nuclear submarine in France of over 9 years, that also pushes the first delivery well into the 2040s.<sup>47,48</sup>

One might consider the possibility of France helping Canada build nuclear submarines at home. However, that has even longer timelines. Brazil is currently pursuing the domestic construction of a nuclear submarine with France's assistance. That submarine was ordered in 2008 and is currently expected to launch in 2037 — a 29-year delivery timeline. Far too long for Canada to consider that route for its next generation of submarines.<sup>49</sup>

In the end, Canada's decision not to pursue nuclear submarines is not the result of a single constraint but the convergence of several. Canada's highest priority missions for submarines, the *raison d'être* of its fleet, are best served by diesel-electric submarines with integrated air-independent propulsion systems — exactly what it is pursuing. The technologies that once made nuclear propulsion uniquely suited to Arctic operations are no longer the only way to operate in that environment. And while nuclear submarines still offer advantages in range, speed, and endurance, those advantages are most relevant when operating independently far from home, while Canada is only likely to act in those places with allies. Set against this is the reality that there is no viable path to acquiring nuclear submarines on the timelines Canada requires, whether through allies or domestic development.

This leaves Canada with a clear choice. Rather than pursuing the most capable submarine in abstract terms, Canada is pursuing the most appropriate one for its real-world purposes — aligned with its geography, its alliances, and its strategic priorities. Nuclear submarines remain powerful and, in some respects, unmatched tools. But they are tools designed for a different set of problems than the ones Canada faces. The absence of a nuclear option in Canada's current procurement is not an oversight. It is the result of a clear-eyed assessment of what Canada needs its submarine force to do and what it can realistically deliver.



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## Notes

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