



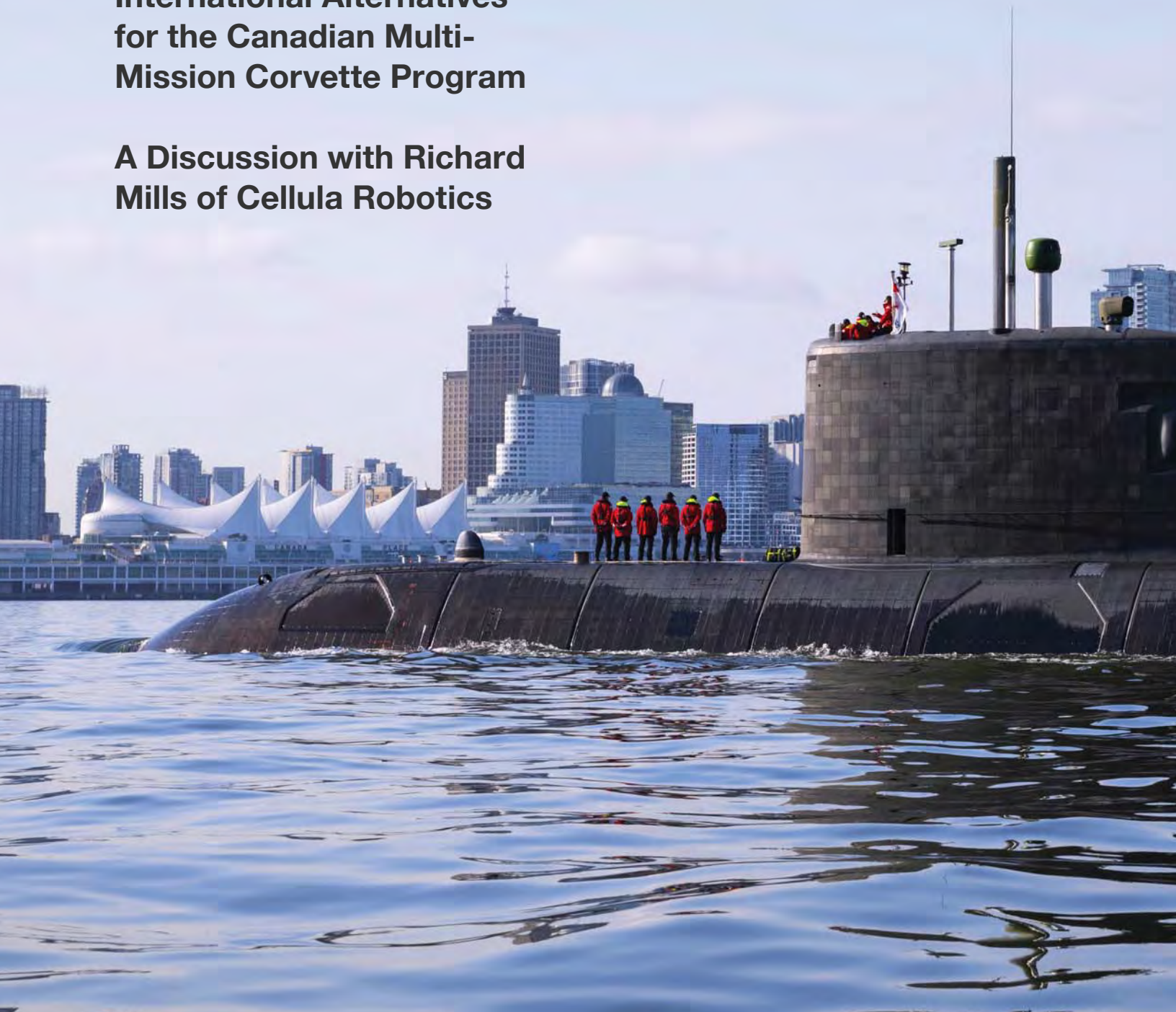
CANADIAN NAVAL REVIEW

VOLUME 21, NUMBER 1 (2025)

**The Royal Canadian Navy
and Corvettes**

**International Alternatives
for the Canadian Multi-
Mission Corvette Program**

**A Discussion with Richard
Mills of Cellula Robotics**



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VOLUME 21, NO. 1 (2025)



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HMCS Corner Brook enters Vancouver on 3 April 2025 as part of its workups prior to operations later in the summer.

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Editorial

Canadian Naval Aviation: A Cautionary Tale

(Note: Editorials represent the opinion of the author, not *CNR*, the Editorial Board or sponsors.)

In March 2025 the government of Canada announced the contract award for the construction of the first batch of *River*-class destroyers for the Royal Canadian Navy (RCN).¹ This followed a news release in 2024 reporting that Canada is launching the process to acquire up to 12 conventionally-powered submarines.² Perhaps it is time to review previous attempts to expand Canadian naval capabilities to see what lessons can be (re)learned from the past.

The procurement of new or enhanced capabilities in any military organization, especially one as politically sensitive as Canada's, is fraught with challenges. In an intriguing article in *Canadian Naval Review* published in 2015, military historian Marc Milner observed that the Canadian navy's "key battleground has always been Ottawa, and it neglects the politics of procurement at its peril."³ While there are any number of cases studies that validate this conclusion, the rise and fall of Canadian naval aviation is a particularly compelling one.

The RCN made three attempts to develop a Canadian naval air service in the 20th century, each linked to a major conflict: the First World War; the Second World War; and the Cold War. All three attempts eventually failed, not because the RCN lost the battle at sea but because they lost the battle in Ottawa.

Canada initially became involved with naval aviation during the First World War when Canadian airmen served with the Royal Navy (RN) and the Royal Naval Air Service (RNAS) and later the Royal Air Force (RAF). These naval air forces operated principally in the Western Approaches to the United Kingdom and so, when long-range German submarines arrived in neutral American ports in late 1916, the UK was not able to support the Canadian navy's East Coast patrol service although the threat to Allied shipping was obvious.

Consequently, in early 1917, Canada requested that the Admiralty provide an officer to assist in establishing a Canadian naval air service and they obliged. This officer promptly prepared a plan for the use of flying boats and balloons to strengthen the patrol service and, just as promptly, the plan was rejected by Cabinet in the interest of economy.⁴

In January 1918, the Admiralty warned that German submarines were likely to arrive in the Western Atlantic during the upcoming shipping season but advised that they could not provide any material support.⁵ As a consequence, Canada established the Royal Canadian Naval Air Service (RCNAS) on 5 September 1918. However, because the RCNAS would not be operational until 1919, the US Navy (USN) was requested to provide aircraft and personnel to operate in Canada until the RCNAS could become combat ready. The USN began anti-submarine patrols in Nova Scotia (from Halifax and North Sydney) in late August 1918 and continued doing so until the



Credit: Shearwater Aviation Museum

The height of the peace-time RCN: HMCS *Bonaventure* and the Canadian Atlantic fleet sail in an exercise in 1968.

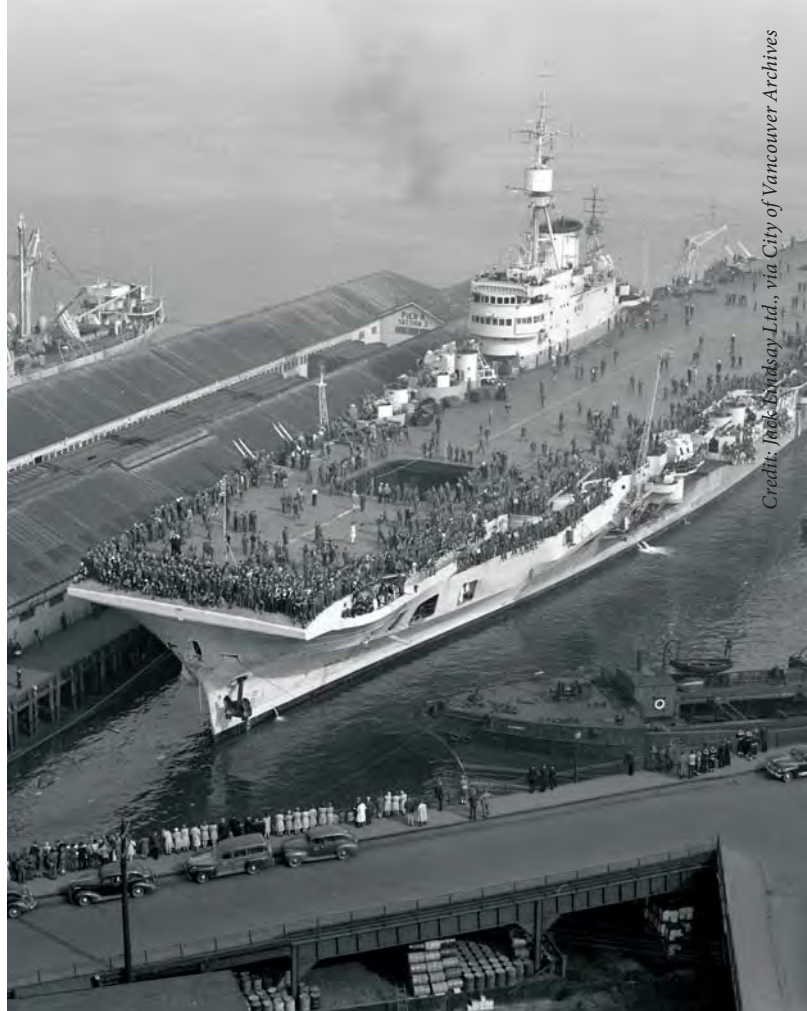
Armistice in November at which time they terminated their operations and returned home.

The RCNAS was ‘discontinued’ on 5 December 1918 “until such time as the government decides on the details and policy of a permanent Air Service.”⁶ The government eventually decided not to form a Canadian naval air service despite a strong recommendation to do so by Admiral of the Fleet Viscount John Jellicoe in December 1919,⁷ and an equally strong recommendation from the British Air Ministry.⁸

During the Second World War, as in the First World War, Canadians flew with the Royal Navy (RN), this time as members of the Fleet Air Arm (FAA). Once again, the FAA was a British as opposed to a Canadian formation and so the second attempt to develop a Canadian naval air service began during the Battle of the Atlantic when the RCN was confronting German submarines in the broad reaches of the North Atlantic, well beyond the range of the shore-based maritime aircraft of the Royal Canadian Air Force (RCAF).⁹ In order to bolster the effectiveness of the Canadian escort groups, the RCN sought approval to acquire, on loan, two British Escort Carriers (CVEs) with RCN ship’s companies and RN FAA aircrews.¹⁰ The RCAF gave its grudging support to the proposal with the specific proviso that “the matter of further development of an RCN Fleet Air Arm be considered later.”¹¹ However, as revealed in subsequent meetings of the Cabinet War Committee, Prime Minister William Lyon Mackenzie King was deeply suspicious of the intent of the proposal which he felt involved undesirable postwar commitments.¹² Fortunately for those in the RCN who advocated for the establishment of a Canadian naval air service, the proposal to acquire the British CVEs was approved at the next meeting of the Cabinet War Committee on 12 January 1944.¹³

The RCN’s third and final attempt to form a Canadian naval air service came hard on the heels of the decision to man the CVEs. Initially, the RCN sought approval to acquire two Light Fleet Carriers (CVLs) from the UK with Canadian ship’s companies and aircrews in order to participate in the campaign against Japan.¹⁴ As it turned out, however, the two aircraft carriers, HMC Ships *Warrior* and *Magnificent*, were not ready in time for the Pacific campaign. But with an eye to the future, the RCN pressed ahead with plans for their acquisition on loan from the British Admiralty in order to transform the RCN “from what was essentially a coastal defence force into a ‘blue-water’ navy.”¹⁵

On 19 December 1945, the RCN finally received approval to form an “air component in co-operation with the RCAF” within the RCN’s peace-time manning ceiling of 10,000.¹⁶ Of note, at the Cabinet meeting during which the



HMCS *Warrior* in Vancouver in 1947.

air component was approved, it was decided that one of the two aircraft carriers would have to be held in reserve in order to meet the restrictive manning ceiling.¹⁷ The lack of a second carrier would bedevil the Air Branch throughout its existence and, when faced with the decision to replace HMCS *Magnificent* in 1956-1957, the RCN was unable to make the case either for retaining *Magnificent* as a second carrier or for the purchase of a much larger and more capable American *Essex*-class carrier rather than the eventual purchase of HMCS *Bonaventure*, another British CVL.¹⁸

Other difficulties also emerged. The ‘co-operation’ between the RCAF and RCN proved to be illusory and a protracted struggle between the two services began over which service should control and operate shore-based maritime aviation and whether the RCN should continue with naval aviation at all. The issue came to a head in March 1950 when the RCAF launched an all-out campaign against naval aviation that could not be decided at the Chiefs of Staff Committee level and had to be referred to the Defence Minister, Brooke Claxton, for resolution.¹⁹

In a tit-for-tat ploy, the RCN exacted its revenge on the RCAF by arguing strenuously against the proposal to procure the Canadair CL-28 Argus maritime patrol aircraft.²⁰ These existential debates were finally put to rest following a personal letter from the Chief of the Air Staff (Air



A highly-detailed model of HMCS *Bonaventure* in the Canada Aviation and Space Museum in Ottawa, February 2025.

Marshal Roy Slemmon) to the Chief of the Naval Staff (Vice-Admiral Rollo Mainguy) in which Slemmon suggested that cooperation rather than confrontation would be the best policy for both services.²¹

The suggestion took hold and the RCN and RCAF worked to resolve their differences. The RCN eventually became a highly proficient anti-submarine force, centred around *Bonaventure* and its embarked air group with the support of the aircraft of the RCAF's Maritime Air Command.

But a cascading series of events in the mid-1950s through the 1960s would spell the end of the Air Branch. Most importantly, from 1956 to 1961, successive governments reduced the funding available for the RCN by 38% to the detriment of naval aviation programs.²² Next, *Bonaventure's* mid-life refit in 1966-67 was a frustrating exercise which went well over budget and encountered lengthy delays, raising painful questions regarding the utility of operating a sole aircraft carrier. Then, with the introduction of 'Unification' on 1 February 1968, the RCN and its Air Branch lost their voice in Ottawa and finally, in 1970, the decision was made to pay-off *Bonaventure* and, except for maritime helicopter operations from RCN ships, Canada's third attempt to form a Canadian naval air service came to a close.

To conclude, in each of the instances examined above, operational effectiveness mattered little. What did matter was that it became more and more expensive to operate the Air Branch while it became less and less operationally relevant to the policy-makers in Ottawa. In many ways, the RCN Air Branch was much like the RCAF's No. 1 Air Division, an elite air arm that eventually lost political support at the national level for its continued operation.

So, in these turbulent times, when Canada's very sovereignty may be at risk, it is important that the 'battle of Ottawa' be waged not only in the corridors of power but also in public in order to counter the 'sea-blindness' of Canadians. In this regard, we all have a responsibility to step up and share our perspectives on the navy and its relevance to Canada and Canadians. 🇨🇦

John L. Orr

Notes

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2. DND, "Canada Launching Process to Acquire up to 12 Conventionally-powered Submarines," Media Release, 10 July 2024.
3. Marc Milner, "Reflections on Canada, the State, the Nation and the Navy," *Canadian Naval Review*, Vol. 11, No. 2 (2015), p. 20.
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5. Library and Archives Canada (LAC) – Air 1 Vol. 6 272/15/226/123 Pt 1. Extract from Admiralty Operations Committee Minutes 2/3/1918, "Formation of Air Unit for Anti-Submarine Work Overseas (Canadian Coast)."
6. LAC – NSS 63-9-1 – Letter – Minister C.C. Ballantyne to Deputy Minister G.J. Desbarats, 5 December 1918.
7. LAC – Admiral of the Fleet Viscount Jellicoe – Report on Naval Mission to the Dominion of Canada, 31 December 1919, Vol. II Chapter 7, Reel T-1184 – Images 392, 393.
8. Directorate of History and Heritage (DHH) – File C 2481. Vol. 2 "Reports of the Civil Aerial Transport Committee," "Aerial Expansion with Particular Reference to Canada. Air Ministry, April 26 1919."
9. The RCAF was established in 1924 and was engaged in the Battle of the Atlantic in cooperation with the RCN throughout the Second World War.
10. This proposal was presented informally by the British First Sea Lord, Admiral Sir Dudley Pound, at the Quebec Conference of August 1943 to the consternation of Prime Minister Mackenzie King. LAC – Minutes of the War Committee of the Cabinet – September 8, 1943 – Para 15 – Navy; British proposals for further assistance; aircraft carriers – Reel C-4875 – Image 991.
11. LAC – Minutes of the War Committee of the Cabinet – October 21, 1943 – Para 1 "Navy: Acquisition and operation of aircraft carriers" – Reel C-4875 – Image 1297.
12. LAC – Minutes of the War Committee of the Cabinet – January 5, 1944 – Para 20 "Aircraft carriers (C.V.E.s)" – Reel C-4876 – Image 100.
13. LAC – Minutes of the Cabinet War Committee of Cabinet – January 12, 1944 – Para 28 – "Navy: acquisition of aircraft carriers" – Reel C-4876 – Images 1113-11405-115.
14. LAC – Minutes of the Cabinet War Committee of Cabinet – February 14, 1945 – Para 14 "Navy; Loan by United Kingdom of carriers and destroyers; Japanese war" – Reel C-4876 – Images 1425-1426.
15. Michael Whitby "Fouled Deck: The Pursuit of an Augmented Aircraft Carrier Capability for the Royal Canadian Navy, Part 1, 1945-56," *The Canadian Air Force Journal*, Vol. 3, No. 3 (Summer 2010), p. 2.
16. LAC – Cabinet Conclusions – December 19, 1945 – Para 32 "Navy; establishment of air component in co-operation with RCAF."
17. LAC – Cabinet Conclusions – December 19, 1945 – Para 36 "Navy, Army and Air Force; postwar organization and composition."
18. For more, see the two-part article by Michael Whitby "Fouled Deck," *The Canadian Air Force Journal*, Part 1, Vol. 3, No. 3 (Summer 2010), Part 2, Vol. 3, No. 4 (Fall 2010).
19. DHH 73-1223 [Raymont fonds]. Box 152 File 1 "The Formulation of Canadian Defence Policy 1945-1964," p. 83.
20. DHH 73-1223 [Raymont fonds]. Box 56 File 1052 "Maritime Aircraft for SACLANT Area (1953-1958)" – Memorandum – Minister of National Defence to Chairman Chiefs of Staff Committee May 24, 1954 – "Notes on the Britannia Concept."
21. DHH 73-1223 [Raymont fonds]. Box 56 File 1052 "Maritime Aircraft for SACLANT Area (1953-1958)" – Personal Letter – April 6, 1955 – Air Marshal Slemmon to Vice-Admiral Mainguy.
22. Michael Whitby, "Vice-Admiral Harry G. DeWolf: Pragmatic Navalist," in Michael J. Whitby, Richard H. Gimblett and Peter Haydon (eds), *The Admirals: Canada's Senior Naval Leadership in the Twentieth Century* (Toronto: Dundurn Press, 2006), Table 1: Decline in Naval Expenditure 1956-1961, 215e.

The Royal Canadian Navy and Corvettes

Lise Arseneau and Ben Lombardi

As the world finds itself in a highly uncertain international security environment, the Royal Canadian Navy (RCN) is engaged in a recapitalization of its fleet. This is, therefore, an opportune time to investigate additional platform options in relation to the navy's likely domestic and expeditionary requirements. The highest number of warships ever built in Canada was the corvette during the Second World War. But corvettes have not been part of the RCN fleet for more than half a century. While it does not advocate any course of action, understanding why a corvette-like platform might once again find its place in the RCN is the subject of this article.

The purpose of any navy is to provide a range of options to a government for the application of national power at sea, up to and including the use of armed force. Moreover, as the international security environment deteriorates in the face of intensifying Great Power competition, much of this competition will likely play out on the world's oceans. It is reasonable to expect, therefore, that there will be a greater demand by governments for naval power than we have witnessed since 1945. Canada holds an ocean estate that is truly enormous and includes the longest coastline in the world. Regardless of current frictions in a bilateral relationship that has been highly beneficial to both Canada and the United States for many decades, geography dictates that so long as it enjoys independent statehood, Canada is inextricably tied to the United States in the defence of North America. Advancing Canada's specific maritime security interests both in home waters and overseas, while ensuring the best possible defence relationship with the United States, are the rationale for a modern, properly sized and combat-effective RCN.

For those same reasons, the future force structure of the RCN, including the necessary number and mix of platforms, should engage the country's leadership far more than it has done in recent memory. Writing in 2004, defence policy analyst Peter Haydon noted that "despite clear evidence that Canada was being well served internationally by its navy, there was a lack of resolve to implement a sensible naval policy to sustain key naval capabilities over the long term."¹ Arguably, that situation persists today. The current fleet recapitalization program attempts to address some of these concerns. It nonetheless fails to match prescribed fleet size with the ambitions laid out in the current defence policy especially given new and emerging international concerns. Moreover, due to other pressing public policy areas (e.g., health and infrastructure), constraints on public expenditure are likely to have a dampening effect on expectations within navy quarters



The *Castle*-class corvette HMCS *Tillsonburg* underway during the Second World War.

(and the Canadian Armed Forces in general) on possible measures to address capability deficits.

Regardless, some issues related to naval force structure will inevitably force themselves at least a little way up the greasy pole. One example is the *Kingston*-class Maritime Coastal Defence Vessels (MCDVs) that the RCN operates, but that are all near the end of their service life. They will need to be paid off long before the current recapitalization program is completed in the late 2040s, leaving a gap in force structure and potentially significant strategic and operational vulnerabilities. While there is no approved replacement program for the MCDVs underway, the naval leadership knows that it must begin to investigate options with a breadth of capabilities to support both domestic and international operations. Among the options that will likely be considered is the procurement of an advanced corvette-like platform.

Such consideration cannot, however, take place in a political vacuum. The second Donald Trump administration has already transformed bilateral trade and, even if the most extreme rhetoric (especially threats to annex Canada) is set aside, its policies nonetheless are threatening to disrupt the two countries' longstanding defence relationship. Expectations from Washington related to NATO's Article 5 could be linked to a greater effort by European allies to increase defence spending and modernize their armed forces.² While sharing a continent with the United States will continue to provide Canada with protection from the most serious overseas threats, demands that Ottawa increase defence expenditure and

Credit: Imperial War
Museum, A27644

contribute more combat-effective military capability will continue. A serious disharmony in Canada-US relations with no assured end-date, the emergence of China and Russia as Great Power threats, and an increasingly unstable global security environment, would seem to warrant a re-examination of guidelines regarding both fleet size and the most appropriate platforms for Canada's navy. This is especially so because advances in technology, sensors and weapons systems offer the possibility that a broader range of platforms than was heretofore considered, including corvettes, might make a highly useful contribution to a medium-sized navy such as the RCN.

What is a Corvette?

Perhaps the reason why Canada is not considering corvettes is due to the lack of consensus as to what exactly a corvette is. The ships were originally conceived as small warships designed to protect shipping. Naval analyst Bernard Brodie argued that the concept of a corvette “was developed by the British in order to provide an escort vessel much more quickly produced and not requiring as large amount of crew as a destroyer.”³ As a response to the emergence of the submarine, countries needed to build and produce warships quickly. Corvettes had a relatively small displacement, and carried only limited armament (i.e., a small deck gun, some anti-aircraft capability and a store of depth charges). During the Second World War, to provide escorts to civilian ships and protect them from submarines, the Royal Navy built 421 such ships, ranging from 500 tonnes displacement to the *Flower*-class, three times that size.⁴

In modern times, a corvette is defined as a small, heavily armed combatant displacing 500 to over 1,250 tonnes with a length from 70 to 100 metres (approximately 230

to 328 feet).⁵ However, that definition is not always applicable. Some navies have classified platforms as corvettes that fall outside those parameters – for example, Norway's *Skjold*-class (250 tonnes), Israel's *Magen*-class (1,900 tonnes) and India's *Kamorta*-class (3,100 tonnes) are all referred to as corvettes. The smaller vessels are more akin in size to a coastal patrol vessel, and the larger are closer to what is often described as a light frigate. So ‘corvette’ seems to apply to a ship (usually) larger than a patrol craft and smaller than a frigate.

The proliferation of such platforms – and, as of January 2024, there were more than 400 warships classified as corvettes in service with 46 navies⁶ – illustrates a general appreciation of their overall utility. Several countries are engaged in the development of new similar-sized platforms. Denmark is designing a corvette-like patrol ship that one official noted “will now have air and surface warfare capabilities and a sensor package that will come closer to the capability of a frigate.”⁷ The United States is developing the Large Unmanned Surface Vehicle (LUSV) that its naval leadership says will be 61 to 91 metres (200 to 300 feet) in length and have full load displacements of approximately 900 to 1,800 tonnes, which would place them in the size of a corvette. The LUSVs are intended to be “low-cost, high endurance, reconfigurable ships with ample capacity for carrying modular payloads.”⁸ Likewise, the Modular and Multi-role Patrol Corvette (MMPC) project, previously called the European Patrol Corvette, a collaborative effort involving Italy, France, Spain, Greece and Norway is currently in the design phase for two new classes of corvettes – a long-range multi-purpose vessel and a full combat multi-purpose vessel that will be “adaptable, interoperable and capable of performing a broad spectrum of missions tailored to the specific need of each navy.”⁹



Painted in its commemorative camouflage pattern, the Maritime Coastal Defence Vessel HMCS *Goose Bay* pulls alongside in St. John's, Newfoundland, on 1 July 2024 for the interment of the Unknown Newfoundland Soldier.

Credit: Corporal Charles Audet



Credit: Courtesy photo via DVIDSHUB Credit: Courtesy photo via DVIDSHUB

The Norwegian 'corvette' HNoMS *Skjold* (P960) underway during BALTOPS 22 in the Baltic Sea, 10 June 2022.

These examples illustrate the value navies place on corvettes as small, but versatile, warships. Advanced technology makes this possible. Modern corvettes can be equipped with advanced sensors and weapons that enable multi-dimensional warfighting (air, surface and sub-surface), as well as self-defence capabilities including stealth design. It is also possible for smaller vessels to be provided with specific mission-focused modules that can be swapped out quickly depending on the tactical requirements and thus providing improved flexibility. As a result, a modern corvette would be far less expensive to build and operate than a frigate, and perhaps easier to crew, without necessarily sacrificing the capability that is provided by a frigate. Their resilience in one-on-one confrontations with larger enemy warships would almost certainly be limited. The presence of corvettes in foreign fleets nonetheless indicates that an assessment has been made that they could make an effective contribution to the success of future operations.

The RCN and Corvettes

Canada's navy had considerable experience operating corvettes in the Second World War (1939-1945). Corvettes were not, however, the RCN's preference. Prior to the outbreak of hostilities in September 1939, Canadian naval planners hoped to acquire destroyers, but British shipyards could not support additional orders from Ottawa, and Canadian shipyards could not build large warships to naval standards. Therefore, the two sides agreed that Canada should focus on building smaller types of warships. These smaller warships – i.e., corvettes – were employed as North Atlantic convey escorts (necessarily involving anti-submarine operations) and in the assault phase of the D-Day operation. By the war's end, 122 corvettes had been built in Canadian shipyards, the highest number of a class of warship ever built in Canada.¹⁰ After 1943, however, corvettes were gradually replaced by frigates. Frigates had greater speed, improved armaments and equipment, nearly twice the endurance of the corvettes, as well as better accommodation (resulting in less physical exhaustion) for the crew.¹¹

Corvettes as a warship class never returned to Canada's post-war navy, although platforms smaller than frigates were included in the navy's force structure (1950 to 1990s), mainly for coastal mine warfare. The *Kingston*-class MCDVs were built between 1995 and 1999 primarily as mine counter-measures platforms, although that capability was significantly reduced due to cost-cutting.¹² The prioritization given to frigates and destroyers in post-Cold War era naval planning was due to the decision of the Jean Chretien government underlying its 1994 Defence White Paper (according to what an unnamed defence official purportedly said) to emphasize "doing its part to ensure global security" and a rejection of the idea of "an investment in forces capable only of constabulary operations."¹³ Given the limited role and capabilities associated with small-sized warships, it seemed cost-effective to pursue a fleet composed of larger ships, especially when in the immediate aftermath of the Cold War, the level of threat was very low.

Despite the focus on large ships in the early post-Cold War years, in many medium-sized navies, Canada's included, an effective maritime armed force has traditionally been understood to require a mix of platforms from destroyers to frigates to corvettes, to even smaller ships such as offshore patrol vessels. This is because no naval platform can respond to demands arising from all threat environments or provide the broad range of options that governments need to respond to threats and challenges. This is particularly so when, as in the case of Canada, the RCN is more than just a contribution to the national deterrent. It must also ensure presence in peace-time in all three of the country's oceans supporting other government departments, such as the Canadian Coast Guard, Fisheries and Oceans Canada and Transport Canada, in maritime surveillance and enforcing Canadian law at sea. Naval planners have no choice, therefore, but to take into consideration a wide scope of potential missions and tasks when determining force structure requirements.

There are many factors that influence both the decision to acquire a specific type of platform and the design of the



Credit: Mass Communication Specialist 1st Class Tom Tonthat, US Navy

The Indian Navy *Kora*-class corvette *INS Karmuk* (P64) works with Amphibious Transport Dock *USS Anchorage* to conduct a cooperative deployment (CODEP), 12 January 2023.

corvette required to meet the specific needs of a country's navy. For countries that have a requirement to conduct and sustain far distant operations, the corvette's limitations are significant. A retired Australian Rear-Admiral argued that "[b]lue-water navies can comfortably and effectively operate in brown-water areas as the RAN [Royal Australian Navy] has always done, but brown-water ships – including corvettes – will fail quickly in blue-water operations."¹⁴ The MMPC project, for example, is clearly intended to overcome these constraints, but how successful it will be in doing so remains to be seen. In selecting the Type 31 *Inspiration*-class light frigate with a length of 138.7 metres (approximately 455 feet), a beam of 20.36 metres (67 feet) and a displacement of 7,000 tonnes, Britain's Royal Navy (RN) appears to have determined that smaller corvettes would not satisfactorily address its needs, given the country's location and an assessment of the future operating environment as global. Arguably, five Type 31s (reduced from an expected 13 ships) are not enough to address Britain's maritime security requirements, particularly in terms of anti-submarine capability, while the greater affordability of a purpose-built corvette of 3,000 to 4,000 tonnes might have allowed for a larger number of platforms to be built. Indeed, as public acceptance of increased defence expenditure cannot ever be assured, particularly when other priorities might be adversely impacted, the greater affordability of a smaller platform like a corvette could become a significant consideration for naval planners.¹⁵ This is especially so in times of global instability. For, while the quantity versus quality argument is often dismissed as trite, it acquires relevance when fleet size becomes a pressing strategic concern.

Perhaps, however, the most important reason that the RCN might select a corvette to replace the MCDV is one of practicality. While the RCN must obviously be able to conduct and sustain expeditionary operations far from the country's shores, requirements for operations closer to home within Canada's ocean estate continue to exist. A fleet built around only 15 surface combatants (i.e., the *River*-class destroyers) would be hard-pressed to undertake

such a broad array of roles in peace-time, even if one ignores the inefficiencies of deploying large warships for missions normally undertaken by patrol vessels. In wartime, the over-stretch would contribute to operational and strategic failures. In that setting, the RCN might be called upon to sustain an expeditionary mission at the same time as, for example, it is asked to conduct anti-submarine patrols off the country's East and West Coasts. Although the RCN has been adding Arctic and Offshore Patrol Ships (AOPS) to its fleet, this platform is unarmed and is slower than ships designed to take on possible combat roles. Assessing platform requirements for the navy of the future cannot assume that operations will only occur in peace-time settings. Taking account of the added pressures of conflict and what response Canada would be expected to provide is necessary. The addition of smaller, yet capable, corvettes would provide more options, with the potential to amplify the capability of the fleet's larger warships – its destroyers – through flexible mission fits.



Credit: Sonar Technician 1st Class Kevin Frus, US Navy

The Turkish corvette *TCG Burgazada* (F-513) sails next to *USS The Sullivans* (DDG 68) in the Arabian Gulf on 2 December 2022.



An illustration of notional concepts for the Modular and Multi-role Patrol Corvette Project (formerly known as the European Patrol Corvette Project).

In general, were a decision to be made in favour of corvettes, the challenge for the RCN would be to achieve an appropriate balance between the size of the ship and its capabilities. Too small and either seakeeping is reduced or capabilities must be reduced; too large and the advantages associated with small size must be sacrificed. Several countries are trying to pack as much capability as possible into new classes of corvette-sized platforms, hence the re-branding of such ships as light frigates or multi-role combat vessels. However, real constraints for such a platform type do exist. In terms of capacity, range and sustainment, and capability (via both indigenous weapons systems and add-on mission modules), a corvette cannot replace larger, more heavily armed warships. Due to its size, a corvette will lack the redundancies that a warship depends upon; in an expeditionary operation, a corvette can only be a consumer of logistic support, rather than a provider as is the case with larger ships. But corvettes offer other advantages in addition to affordability. With specific reference to the RCN, they would likely have an important force-generation function in the ongoing fleet recapitalization, particularly so since the *River*-class destroyers will not have any training bunks. More quickly built than larger warships, and yet still equipped with modern weapons and sensors, corvettes could be used to train future crews required for the destroyers and support ships that are due to join the fleet in the years and decades to come.

Conclusion

As the international security environment becomes ever more dangerous, and challenges to the current Canada-US defence relationship emerge, the value of the RCN as an instrument of government policy can only grow in importance. Canada's navy will need to be prepared and able to respond to various types of domestic and expeditionary missions in the future, perhaps several simultaneously. A future fleet made up only of major surface combatants, submarines and Arctic patrol vessels will not suffice to provide that capacity. It would seem reasonable to suggest, therefore, that a broader fleet mix to address Canada's maritime security requirements is now needed more than was foreseen in the fleet recapitalization program that was first announced in the *Canada First Defence Policy* (2007), and has been re-affirmed by *Strong, Secure, Engaged* (2017) and *Our North Strong and Free* (2024).

Alongside the planned acquisition of 15 advanced *River*-class destroyers, a smaller warship to replace the *Kings-ton*-class might be a way forward. The RCN has not added a corvette as a new class of warship to its fleet since the Second World War, but modern versions of this type of platform are far more capable than the platforms used in the war. With a reduced unit cost, relative to a frigate or a destroyer, a modern corvette-like vessel can be equipped with advanced weapons and sensors, potentially enhanced

by add-on mission modules. It ought not to be considered a replacement for a destroyer because large platforms capable of full-spectrum operations cannot be eliminated from a 'blue-water navy' without incurring serious strategic and operational risks. But in terms of force generation, coastal patrols, presence operations and conducting operations where lower-level armed engagements with an adversary are considered possible, a corvette might be a highly useful addition to the future RCN fleet. 🇨🇦

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International Alternatives for the Canadian Multi-Mission Corvette Program

Robert Shea



Credit: Puolustusvoimat / The Finnish Defence Forces

A rendering of the Finnish *Pohjanmaa*-class corvette currently in construction.

Since mid-2023, discussions surrounding a new Canadian Multi-Mission Corvette Program, an initiative to replace the rapidly aging and controversial *Kingston*-class Maritime Coastal Defence Vessels (MCDVs), have started to take shape. The *Kingston*-class ships, launched throughout the 1990s as coastal defence and mine-clearing vessels, have proven adaptable, yet their compact design is not well suited for the various tasks they have been assigned in recent years. Their small displacement and blunt bow make for poor seakeeping in rough sea states and their steel construction is out of the ordinary for mine-hunting vessels, which are usually constructed of fiberglass, thus requiring additional degaussing equipment to be installed to reduce the magnetic signature of the ships. While the government and industry officials contemplate what will replace the *Kingston*-class, sailors have started drawing attention to the rapidly deteriorating state of the *Halifax*-class frigates which were also built in the 1990s.¹ With the *River*-class destroyers slated for delivery in the distant 2030s, the Royal Canadian Navy (RCN) again risks a “capability gap” – repeating the planning failures that were illustrated with the retirement of the *Protecteur*-class and *Iroquois*-class ships a decade ago.²

Canada is not alone with regard to renewing its federal fleet. Amongst Canada’s allies several countries have implemented some intriguing shipbuilding programs that mirror capabilities that are required by the RCN. These international programs could represent an opportunity for Canada to think outside the box, collaborate closely with North Atlantic Treaty Organization (NATO) allies, and quickly address both current and future capability gaps within the RCN rather than begin a new domestic

project from scratch. This commentary will briefly examine some of the projects that Canada’s European allies are undertaking in naval construction and how these projects could replace the *Kingston*-class and provide the RCN with a more suitable and capable platform. It is not meant to assess what capabilities a future Canadian ship should have but rather to encourage discussion of options in order to get ships in the water as soon as possible.

The Finnish Connection

Since the Russian invasion of Ukraine in February 2022, NATO has expanded with the addition of previously neutral countries Sweden and Finland. Both countries bring significant military design and research experience, which could benefit the RCN. In 2024, Finland began construction on its first two *Pohjanmaa*-class corvettes, part of that country’s Squadron 2020 Project.³ Squadron 2020 was initiated to replace Finland’s aging *Rauma* missile boats and current 1,500-ton *Pohjanmaa* mine-laying vessels which date back to the 1980s with four multi-use corvettes. These Finnish-designed, ice-class vessels are being built for year-round coastal defence in the harsh Baltic Sea environment. The design also takes low manning requirements into consideration – something the RCN must consider in the future given current recruitment difficulties.⁴ The new 4,200-ton Finnish ships will be the country’s largest naval platforms, and their size will enable them to deploy farther afield, potentially with NATO task groups. In recent years, Canada has deployed the 950-ton *Kingston*-class vessels to Africa, the Caribbean Sea and even to the Baltic – roles for which their original design was never intended. A larger ship such as *Pohjanmaa*-class corvettes would be more capable for these types of patrol and projection missions.

Additionally, Quebec-based shipbuilder Davie has made significant inroads into the Finnish shipbuilding sector by acquiring Helsinki Shipyard in 2023.⁵ This shipyard is known for its icebreaking construction expertise. When Davie began the conversion of MV *Asterix* to provide the RCN with a stop-gap supply capability, the ship's new superstructure was built in Finland and shipped across the Atlantic to Quebec for installation. By leveraging the Canadian-Finnish relationship, Canada could join the *Pohjanmaa* program and adapt the existing design to meet Canadian requirements.

Next-Generation Danish Innovation

On 30 January 2025, Denmark announced a billion-dollar investment into Arctic defence infrastructure around Greenland.⁶ This includes funding to construct three new Arctic-capable frigates.⁷ These Danish frigates could meet the RCN's Arctic force projection requirements and provide an additional deterrent to complement the *Harry DeWolf*-class Arctic and Offshore Patrol Ships (AOPS). While the Danish Arctic frigate concept is still in the planning stages, it is worth noting that Denmark has more experience designing, building and operating Arctic frigates than Canada. The Danish Navy has operated the 3,500-ton *Thetis*-class Arctic light frigates around Greenland since the 1990s, and before that it had the *Hvidbjørnen*-class, which was built in the 1960s. Compared to the 4,700-ton Canadian *Halifax*-class frigates, the *Thetis*-class provides Denmark with a stable purpose-built and adaptable platform for long-range patrols around Greenland, another task which Canada has deployed the *Kingstons* to fulfill during recent iterations of *Operation Nanook*.

Denmark also has under-utilized shipyard capacity whereas Canada's largest shipyards have order books filled

into the 2040s. Danish shipyards, which have constructed some of the world's largest container ships and known for their innovative approaches to propulsion and design, still have room in their order books to accommodate any potential Canadian purchase.⁸

Multi-Phased International Construction

The Swedish Navy's *Lulea*-class Corvette Project, led by SAAB, and the Norwegian Navy's *Jan Mayen*-class, led by Norwegian shipbuilder Vard Ship Design, a subsidiary of the Italian shipbuilding and industrial giant Fincantieri, should also be included in the discussion. The SAAB project builds upon Sweden's experience with the *Visby*-class stealth corvettes. The futuristic design of the 670-ton *Visby*-class gives the boats a small radar cross-section while their waterjet propulsion and shallow draft allows for quick deployment through the Baltic's shallow littoral areas. SAAB, a trusted defence contractor with a Canadian subsidiary, is integrating new composite construction materials and an advanced warfare technology suite into a design led by another trusted Canadian defence partner, Babcock.⁹ Like the Finnish program, this Swedish corvette is intended to operate year-round in the Baltic Sea against the backdrop of increasing Russian hybrid warfare.

Norway recently completed the final ship of the *Jan Mayen*-class Offshore Patrol Vessels (OPVs) for its coast guard (which is part of the Norwegian Navy). These vessels are massive at 9,800 tons (compared to the *Harry DeWolf*-class at 6,500 tons) and are designed to replace Norway's Arctic light frigates. While they may be overkill for Canada and would require significant infrastructure upgrades at RCN bases, these ships are designed by Vard, the Norwegian parent company of the Canadian branch of Vard, whose proposed design is considered the front-runner to replace



The Danish *Thetis*-class patrol vessel HDMS *Hvidbjørnen* in Reykjavik, Iceland, in May 2019.

Credit: Timothy Choi



The Norwegian *Jan Mayen*-class patrol ship *KV Bjornoya* near Stavanger in August 2024.

the *Kingston*-class. The *Jan Mayen*-class is ice-strengthened and capable of operating with NH-101 helicopters, which are similar in size to the Canadian Cyclone helicopters. Vard's Canadian *Vigilance*-class proposal would not be built with an ice-classification and the helicopter pad would only be suitable for drone operations.¹⁰

The *Jan Mayen*-class was built in two phases – the initial phase was undertaken in Romania followed by fitting out at Vard's yard in Norway. This two-phased construction method has been successfully employed in Canada before, such as the conversion of *MV Asterix* as noted earlier, and in 2016 when Dutch shipbuilder Damen delivered two unfinished offshore support ships to Irving Shipyards in Halifax for completion and fitting out for eventual service with Atlantic Towing Ltd. working the Hibernia oil drilling development off the coast of Newfoundland. The Australian and Danish governments have used this same multi-phased international ship construction method numerous times to rejuvenate their naval fleets. For example, the Royal Australian Navy's *Canberra*-class Landing Helicopter Dock (LHD) hulls were built in experienced Spanish shipyards while the final fit outs were completed in Australian yards. While Canada debated the Joint Support Ships (JSS), and the project suffered delay after delay, the Dutch *Karel Doorman*-class Joint Support Ship was initially built in Romania then completed in the Netherlands within three years.¹¹

Proven 'Off-the-Shelf' Design

BAE Systems is currently one of the prime contractors working with Irving Shipbuilding on the *River*-class destroyers, a variant of the Type 26 frigate also being built for the Royal Navy and Royal Australian Navy. BAE has a proven capable design within its portfolio that would easily transition into the RCN's fleet, their *River*-class Offshore Patrol Vessel (OPV). Built in two batches, there are now 14 *River*-class hulls operating with four different navies around the world. The BAE OPV *River*-class is roughly twice the displacement of the *Kingston*-class at 1,900 tons but requires a similar crew complement of 40-50 sailors.¹² Canada needs to get replacement hulls launched quickly, and BAE has refined the *River*-class

OPV construction process such that it takes two years from hull lay down to commissioning. For comparison, it took the most recent *Harry DeWolf*-class five years from first steel cut to be commissioned with the navy.

The Royal Navy operates eight of the *River*-class OPVs and deploys them in a similar fashion to Canada's *Kings-ton*-class. Currently, *HMS Tamar* and *HMS Spey* are on long-term deployments to the Asia-Pacific region, while *HMS Forth* is permanently based in the Falkland Islands. Meanwhile, Brazil and Thailand have proven the adaptability of the *River*-class OPV platform by upgrading the weapons and sensory suites.

Canadian Planners Repeating Past Mistakes

Canada has long been plagued by poor procurement performance, particularly when it comes to replacing government fleets. Successive governments – regardless of their political stripe – seem unable to plan ahead and therefore find themselves over-paying for stopgap solutions. Examples include *MV Northumberland* which was obtained



The Thai patrol ship *Krabi* in Sydney Harbour during the Royal Australian Navy International Fleet Review 2013. *Krabi* is a variant of the BAE *River*-class Offshore Patrol Vessel.



A model of a shipyard building the Vard 'Vigilance' corvette design shown at CANSEC 2024.

to serve as an interim solution to replace the former MV *Holiday Island* ferry between Prince Edward Island and Nova Scotia when the existing ferry could no longer do the job,¹³ and MV *Asterix* after the existing support ships were paid off earlier than expected and while the Joint Support Ships are being built.¹⁴

The current leading proposal to replace the *Kingston*-class (note that no official Request for Information (RFI) has been issued) is a consortium of Ontario-based companies, led by Vard Ship Design, with a 'Vigilance-class' Multi-Mission Patrol Vessel. While Vard Canada has successfully provided the government with new ship designs within the National Shipbuilding Strategy portfolio, this consortium is pitching a whole new 'Made in Canada' design to be built at Ontario Shipyards in Hamilton.¹⁵ This shipyard has not built a significant ship since the 1980s with the construction of Coast Guard Ship CCGS *Des Groseilliers*.

The initial teething issues with the *Harry DeWolf*-class and the repeated delays with the Joint Support Ships in Vancouver show that Canada cannot afford to risk an unproven platform and an untested shipbuilder for a program that needs to be completed quickly. Given that the new *River*-class destroyers will not be delivered until the 2030s, if the government does not address the looming degradation of the *Halifax*-class soon, it will once again find itself unable to fulfil international naval obligations and critical deployments. By partnering with experienced programs and shipyards through NATO allies, the government could quickly move to address these coming shortfalls and provide the navy with a capable replacement for the *Kingston*-class.

As noted in the introduction, this commentary is not meant to debate the armament capabilities or sensor suite of any future Canadian corvette. It is intended to expand Canada's thinking, to encourage Canada and the RCN to

look beyond unproven homegrown solutions and to consider the quickest way to get hulls in the water. By integrating further with European NATO partners, we help all parties achieve economies of scale for naval projects, achieve critical knowledge transfer, and create meaningful skilled jobs for everyone involved. ⚓

Notes

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A Discussion with Richard Mills of Cellula Robotics



Credit: Cellula Robotics Ltd.

A Cellula Robotics Autonomous Underwater Vehicle operates just below the surface of unidentified waters.

In March, Ann Griffiths, Editor of *Canadian Naval Review*, exchanged emails with Richard Mills, Chief Commercial Officer of Cellula Robotics Canada. Because of scheduling, Mr. Mills was unable to sit down with *CNR* but answered questions that were posed via email. This is a summary of the discussion.

CNR: Technology is changing rapidly. Thus far, Uncrewed Surface Vessels (USVs) and Aerial Vessels (UAVs) have dominated the technology. How is the technology for Uncrewed Underwater Vessels (UUVs) coming along?

Richard Mills: UUVs and Autonomous Underwater Vessels (AUVs) have been around for longer than most people are probably aware of. The first recognisable UUV was built in 1957 by the University of Washington Applied Physics Lab as part of a US Navy funded project. It was called the Self Propelled Underwater Research Vehicle (SPURV). After that, there was a bit of a hiatus until 1980 when Ifremer, the French oceanographic research institute, launched Epaulard. International Submarine Engineering Ltd. then followed with Canada's first UUV, the Autonomous Remote Controlled Submarine (ARCS). Commercially, there are now about 12 companies globally which build vehicles in volume.

To date, there have been approximately 2,700-3,000 UUVs built. That includes everything from micro-UUVs right through to the Boeing Orca XLUUV. Some of the smallest vehicles are about 50 cm long, weighing in at just 7 kilograms. On the other end of the scale, the Orca is 26 metres long with the optional payload bay. The exact number of AUVs is difficult to accurately identify. The majority of these systems have been smaller, shallow-rated UUVs, but more exquisite, deep-water vehicles are also growing in prominence.

CNR: I understand that sub-surface vessels can be very useful to militaries. For what purposes can they be used?

RM: They are used for geophysical survey, scientific research and exploration, and of course, various defence applications. Most people associate military UUVs with mine countermeasures operations or route clearance, but they are also used for seabed warfare tasks, Intelligent Preparation of the Environment (IPoE) and Rapid Environmental Assessment (REA). The payload sensors and vehicle capabilities are very similar to those required for commercial survey operations. It has been commercial and scientific users that have largely driven the development path for cruising, survey-grade UUVs.

Until very recently, the majority of tasks have been focused on those survey-type missions and data collection. Now the user community is also investigating how AUVs may be able to deliver capability rather than just gather data. For example, a lot of work has been done to develop a surface intelligence, surveillance and reconnaissance (ISR) and electronic intelligence (ELINT) concept of operations using long-range UUVs that can enter an environment covertly, gather data using surface sensors, process and transmit information via secure communications links, and then egress safely.

The advent of larger platforms also allows users to deploy off-platform payload at very long ranges. This opens new opportunities to conduct offensive operations at reach. In essence, as capital programs become more and more expensive, and the risks associated with an ever-changing geopolitical situation, the desire to use uncrewed and autonomous assets means that more uses are being discussed all the time.

The threat to critical undersea infrastructure seen in Europe is also driving the development and adoption of UUV technology. Inspecting pipelines, cables, harbours, refineries and so on must be done regularly to achieve a reasonable confidence in detecting anomalies or threats. Again, the hardware is similar to that used in commercial survey, but linear features like cables require long-range capabilities such as the Canadian-developed Envoy AUV.

CNR: There has been a long history of Canadian efforts in this field, much of which has been based in British Columbia. A number of vehicles have been produced and tested in the Arctic in support of the charting effort associated with the Arctic claims (amongst other things). Can UUV systems be operated regularly and effectively in the Arctic, have they been tested in ice edge or under-ice conditions?

RM: Canada has a long history of Arctic exploration using UUVs. In the 1990s, the joint US-Canadian Project Spinnaker was undertaken to lay a fibre-optic cable as a part of a now-declassified Arctic listening system. This spawned Theseus, the world's first XLUUV. Designed and built by International Submarine Engineering (ISE), it measured 10 metres long, 1.5 m diameter and it conducted a 220 kilometre mission to deploy the fibre cable under ice. The size was simply a design consideration due to the bend radius of the fibre cable and the amount of silver-zinc batteries required to achieve the mission.

In the late 2000s and early 2010s, ISE returned to the Arctic as part of Natural Resources Canada's submission under the UN Convention on the Law of the Sea (UNCLOS) Continental Shelf Extension Project. Two Arctic Explorer-class AUVs were built to map areas under ice as far as 88 degrees North.

Surveying, or exploring under ice is perhaps one of the most challenging environments for a UUV. Taking into account the high latitudes, as well as the inability to surface

should something go wrong, then mission success is never quite guaranteed. As part of the UNCLOS work, specialists were brought in from Canada, France, New Zealand and the United Kingdom to assist with modeling success rates. To this day, those missions are exemplars of how to succeed. Many UUVs have been lost in the Arctic and Antarctic and remain in semi-permanent cold storage.

CNR: To what extent are uncrewed sub-surface vessels affecting warfare? We've seen in the Black Sea that relatively cheap uncrewed surface vessels can be effective in countering traditional warships. What about UUVs?

RM: Ukraine is one example where rapid prototyping has changed how wars are fought. Asymmetric capability enables the implementation of different tactics, and UUVs are increasingly being used in offensive operations. Away from Ukraine, the Houthis in Yemen have used simple UUVs to target commercial shipping in the Red Sea in an attempt to close international waters and influence the situation in the Middle East.

The acceptance of attrition – i.e., how acceptable the loss of vessels is – is key to being able either to deploy assets in a contested environment, or to deliver an effector at low financial risk. There are a few ways to achieve that. You can achieve it either through reduced complexity and thereby cost, or build in volume. We are not yet there with volume, and by limiting complexity, we also limit the possibility of positive mission outcomes.

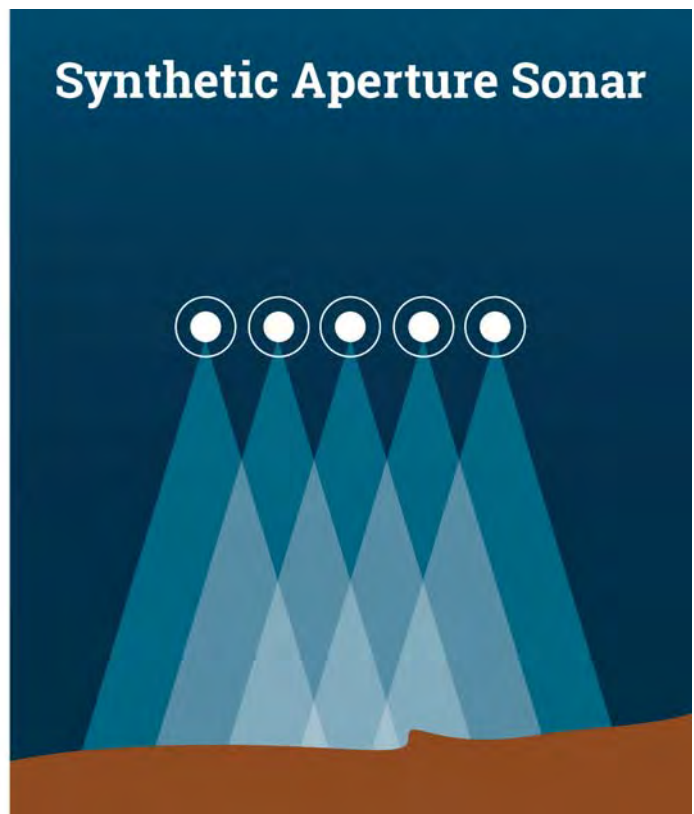
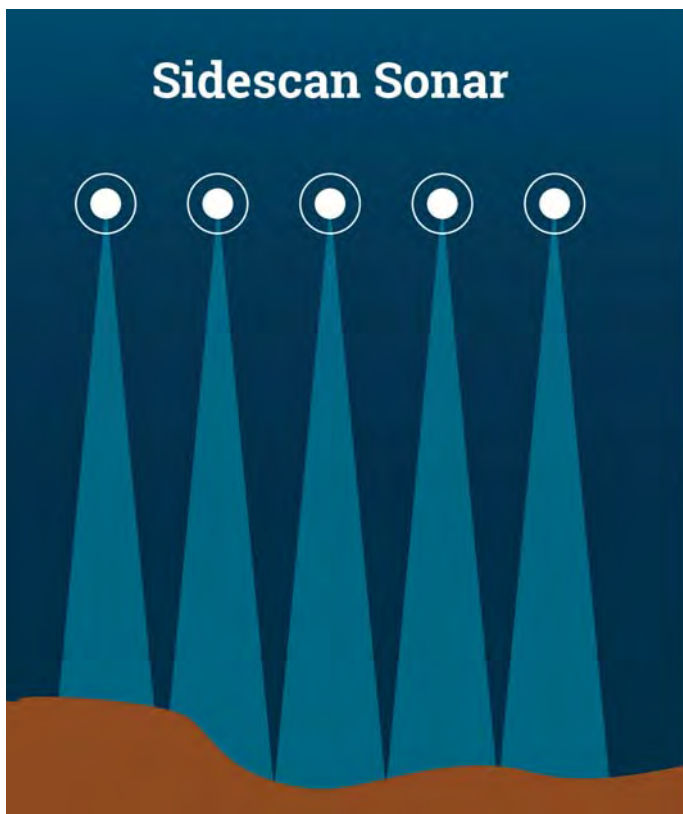
CNR: What is your vision of the place of uncrewed vessels, Artificial Intelligence (AI) and robotics in the maritime domain in the future? Are there any existing or emerging standards for their incorporation in naval operations?

RM: The acceptance of uncrewed systems is growing in all domains, from the wingman concept of UAVs, to large transport-style USVs and also UUVs. One of the driving factors of these systems is interoperability. That means



A photo of the AUV Theseus prior to leaving International Submarine Engineering on its first sea trials in August 1994.

Credit: Bruce Butler, Wikimedia Commons



A simple illustration of the difference between traditional side-scan sonars and modern synthetic aperture sonars which provide higher resolution images.

that standards are becoming essential. Whether those standards are focused on how UxVs¹ operate or how they are integrated with combat management systems, common architecture is here to stay.

The majority of autonomous systems have what is known as a condition-based decision matrix with hierarchical layers of safety applied to them. Basically, that means If This Then That (IfTTT). This is a common approach to navigational, or event-based autonomy and is quite predictable as a result. AI is applied to mission autonomy where adaptive capability requires large volumes of data handling and processing.

A good example of AI in UUVs is mine countermeasures (MCM). In this case, a UUV would carry a high-quality side-looking sonar, such as a Synthetic Aperture Sonar (SAS). Most SAS systems collect real aperture side-scan data in real-time. They then process the return many times, extending the length of the array through software to generate a very high-resolution image of the seabed. These data volumes are enormous, and manual processing takes a very long time.

In-mission SAS data can be analysed on-board the vehicle using Automatic Target Recognition (ATR) algorithms. Some ATR systems use machine learning heuristic algorithms to detect objects of interest and assign a measure of confidence to them. These objects can then be inserted into a revised mission plan on the fly, and the UUV can return to collect photographs of the targets. The result is in-mission detection, classification and identification of mines using AI processing.

CNR: Given Canada's geography – i.e., bordered by vast oceans – what would the navy do with UUVs in Canada's ocean territory. In other words, uncrewed systems have worked well in conflict in maritime areas that are limited in size like the Black Sea, but would they be useful to Canada in the open oceans off its coasts?

RM: Canada's coastline is not only very long, but part of it is also inaccessible for much of the year due to ice coverage. One only has to look at the limits of battery-powered UUVs or the XLUUV concept with a diesel-electric power plant that requires the vehicle to surface regularly to charge the on-board batteries. These can work for some applications, but the distances covered will be relatively small as a result of their limitations.

One thing that is being developed rapidly in Canada is the use of fuel cells to overcome some of the challenges posed by conventionally powered UUVs. Some of this has been driven by Defence Research and Development Canada (DRDC), but also by industry. Using a hydrogen-oxygen fuel cell, operational ranges can be as much as three times that of a battery vehicle for a given volume.

Small UUVs have been used inshore from the East and West Coasts predominantly for MCM and explosive ordnance disposal operations. Larger, ultra-long-range UUVs like Cellula Robotics' fuel-cell-powered Guardian XLAUV enable the Department of National Defence (DND) to consider alternative operations for missions requiring up to 5,000 km ranges, where previously they may have relied on a submarine to be deployed.

CNR: I think that communication with (and among) UUVs has been a challenge to overcome. How possible is it to transmit information from underwater systems, and how confident can we be that it is sufficiently secure for military operations?

RM: Acoustic communications is challenging due to the propagation of energy through sea water, the various layers and frequencies to achieve long distances. For example, sound can travel through multiple paths between a source and receiver, leading to interference patterns, or the attenuation of energy due to scatter particles in the water leading to a low signal-to-noise ratio, making receiving over long distances more challenging. There is no silver bullet or magic solution to solving these challenges, so we, as an industry, are working on what we can do on-vehicle to reduce the data volumes we need to transmit.

Data latency and security are key considerations for military operations, and encryption is only one part of the puzzle. For acoustic transmissions, where we may use low frequencies and very low bandwidths, it is not easy to encrypt such small data volumes. Another challenge is how do we cross the water/air barrier and access high-bandwidth, secure links in contested or congested environments.

One way is to come close to the surface and deploy a mast or buoy that has a limited surface expression. There are other challenges involved in this type of operation, not least ensuring position certainty when operating in blue water. The typical solution is binding the inherent drift of an Inertial Measurement Unit (IMU) with a Doppler

Velocity Log (DVL) tracking the AUV's movement over the sea floor. This is known as 'bottom lock' and provides a reliable method for reducing position error uncertainty. There are emerging technologies that may assist with breaking the water/air barrier, and aid with data transmission. They may enable systems to remain submerged and transmit from depth.

CNR: A variety of commercial enterprises and states are working on using AI in their uncrewed systems. This would enable linking and networking and operating independently/autonomously. What degree of autonomous decision-making capability to enhance mission success does Cellula anticipate developing? Will the systems be able to network autonomous vehicles and their sensors both nationally and with allies?

RM: Interoperability across platforms, technologies and states is the ultimate goal for uncrewed systems. Vehicle-to-vehicle communication systems are being trialed for fleet and swarm operations. With increasing AI processing tools, the ability to hand off targets for further investigation by other UUVs is getting closer. This has been relatively common practice in the aviation world for many years. Previously discussed standards, interfaces and integration with combat management systems are key to succeeding, combined with wide-scale adoption of UxVs in multiple domains. One element on which there is still much to be done is data fusion: how do we get better quality, actionable information from multiple different sensors and platforms.

At Cellula, we are focused on adding capability to our platforms in the form of advanced and adaptive autonomy. Some of that work is in-house and some with partners. We have domestic and international partners for adaptive autonomy, signal processing and more. It is through these collaborations that we can bring such advanced capabilities to bear. It is also through these partnerships that we are exploring the international interoperability of UxVs.

CNR: I would imagine that you have been talking to the Canadian government about contracts. Are Cellula products, or can they be, deployable from existing RCN assets such as Arctic and Offshore Patrol Ships (AOPS)?

RM: Our systems are designed to operate from containerised solutions compatible with the payload bays on the AOPS and *River*-class destroyers. They can also be deployed from shore for the very large, long-range UUVs.

CNR: Could your products be mass produced if required?

RM: Yes.

CNR: Are there any government support programs for Canadian industries like yours? What would you like to see the government do to support this business?



Two AUVs operating in close proximity during Cellula Robotics' Technology Awareness Event in July 2024, West Vancouver.

Credit: Cellula Robotics Ltd.



The Cellula Robotics XLAUV development and trials team after successful sea trials, taken in West Vancouver, summer 2024.

RM: Long-range UUVs are a strategic capability and Canada currently leads the way. Whilst there are mechanisms to assist with research and development funding, we would like to see the government commit to increasing defence spending in line with NATO requirements. This would enable DND to procure UxVs in the volumes required to enhance capability.

CNR: Will tense relations with the United States affect your business development or contracts? If so, how? Is there any reliance on US technology that might be an obstacle?

RM: Our supply chain includes domestic and international vendors. We are always working to achieve surety of supply regardless of origin.

CNR: As I understand it, there are no regulations for the use of underwater vehicles, and we see some commercial enterprises using them for ‘exploration.’ Do you have any concerns about the lack of regulations? Should the International Maritime Organization (IMO) be looking at this?

RM: We are constantly reviewing the regulatory space for UxVs. Last year, our cruising UUVs were awarded Transport Canada Maritime Autonomous Surface Ship Compliance Certificates for safe operations. The sub-surface environment is largely unregulated at present. We anticipate the slow adoption of rules similar to those for uncrewed surface vessels to promote not only sound design, but also best practice in their usage.

CNR: Let’s look into the future. What are your priorities going forward? And what are the biggest challenges yet to be overcome?

RM: As a company, we are working to develop and deliver enhanced capabilities; to change the paradigm for autonomous underwater vehicles for all of our customers across survey, science and security. That means producing common technology platforms capable of adding value in each of those segments and applications. We are also striving to accomplish some very long duration missions with fuel-cell-powered UUVs in the near future to demonstrate safe and reliable operations with an alternative energy source.

CNR: This has been very interesting. Thank you for taking the time to answer my questions. 🇨🇦



A Cellula Robotics Envoy AUV (formerly SOLUS-LR) being retrieved from the water at an unspecified location and date.

Notes

1. The ‘x’ denotes the domain, in this example it indicates the class of robots not specifically air, water or ground.

Making Waves

(Note: These commentaries represent the opinion of the authors, not of CNR, the Editorial Board or sponsors.)

A New Focus on Simulation and Training Jean-Claude Siew¹

One thing that separates an effective workforce – including a military force – from a lacklustre one is training. The better trained personnel are, the better they can do their jobs and react and adapt to situations that arise. Historically technology did not play much of a role in training, it was done by experienced personnel. But with developments in technology, there is a case to be made that training can be effectively done using new technologies like simulations and virtual reality.

New training systems can be used in a variety of circumstances but this commentary will focus on training for the Royal Canadian Navy (RCN). Today the RCN offers a wide range of professional trades for those interested in becoming sailors. These trades provide specialized training, career advancement and the opportunity to serve at sea or ashore. In addition, there is specific training for different ship platforms.

Technology evolution has been extremely important for training. Technology has facilitated access to training without dependency on the actual asset to be trained on, has increased output and has improved training methods. With technologies such as virtual reality (VR) and mixed reality (MR), which are driven by the gaming industry, the rate of evolution is just phenomenal. Virtual reality, augmented reality (AR) and mixed reality are transforming military training. These technologies create realistic, scenario-based environments that improve cognitive readiness, decision-making and stress management, while reducing costs and risks associated with live exercises. However, technology always needs to be seen as a tool to improve training methodology. The most important thing is always to think about training outcomes before thinking about what technology suits best. The trap is to get enamored with a technology and force it into a training system.

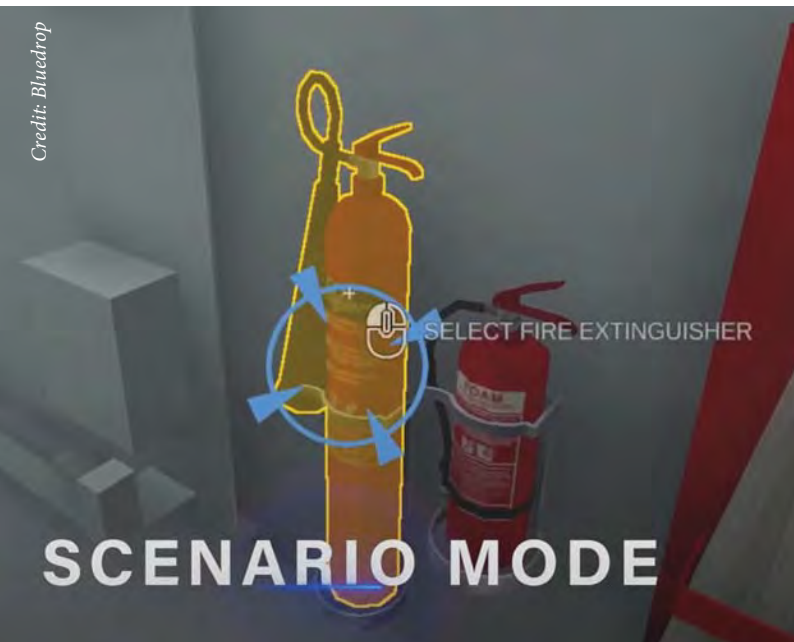
Technologies like virtual and mixed reality and artificial intelligence (AI) need to be put in the same light to leverage their full capabilities properly. For example, these capabilities include a better immersive environment preparing



Through a combination of virtual-reality goggles and physical infrastructure, BlueDROP can provide training for various scenarios such as hoisting from a helicopter as in this image.

personnel for unpredictable, high-stress environments. Where the student is wearing a helmet-mounted display – i.e., VR goggles – that is useful for an improved realistic environment, interactivity and mission rehearsal. AI is very useful in improving productivity, adaptive training and mission scenario creation and thus provides personalized training and specific skills gap reduction. Finally, it is important in a training program to understand how these technologies are used and maintained to make sure that the training program does not become an eclectic assembly of non-sustainable technologies.

Organizations have achieved improved throughput of newly trained personnel using technology by facilitating access, by bringing the training to the student instead of relying on specific locations, by being 'greener' and by being more cost efficient. In addition, simulated environments can provide different ship platforms at a fraction of the cost of an actual full-scale model. That being said, organizations must have a training strategy first, by doing a proper training analysis to identify needs and gaps, and use technology to execute the strategy. The strategy must include infrastructure development to support new technologies, a continuous technology insertion methodology as well as an in-service support program to maintain the training program.



A screenshot from a Bluedrop video demonstrating its virtual training system for the Joint Support Ships shows how users can interact with their environment as part of training scenarios.

One example of a company involved in training and simulation is Bluedrop, located in Halifax, Nova Scotia. Bluedrop has been involved as a Small and Medium Business (SMB) in the National Shipbuilding Strategy (NSS) by contributing to both Irving Shipbuilding and Seaspan Shipyards. The company provided Initial Cadre Training (ICT) for the Arctic and Offshore Patrol Ships (AOPS) and is working on both the courseware and technical publications for the Joint Support Ship (JSS) program and Canadian Coast Guard (CCG) programs. For example, the company has developed a complete virtual ship (Vship) for the JSS that permitted first person ‘know your ship’ training even before the first ship was built. The Vship can be adjusted to add features and be used as an interactive and immersive springboard for continuous and just-in-time training, emergency procedures and maintenance procedures.

The extent of the Canadian Surface Combatant (CSC) program is still somewhat blurry. While it is the role of the government to ensure that the intent of policies like the Industrial and Technological Benefits (ITB) Policy is enforced to support the industrial base, on the CSC program, the tendency is still to leave it to the goodwill of larger primes to decide what remaining workshare is left to SMBs. It is a daily fight for SMBs to remind larger primes that building Canadian capability and a strong industrial base should be an imperative and this means building a diverse and self-sustaining industrial capability. While the ITB Policy has helped provide a better collaborative environment, the CSC program has been slow to show progress from a SMB value-added, capability-building perspective.

In the uncertain global environment of 2025, Canadian companies focusing on training may be necessary to provide services and products and continued investment in innovative training. Unfortunately, with few opportunities in Canada, it is also clear that exporting innovations and capabilities internationally will be key for success. 🇨🇦

Notes

1. Jean-Claude Siew is Executive Vice-President Technology and Simulation at Bluedrop Training & Simulation Inc., Halifax.

A 21st Century RCN Structure

Major (Ret'd) Les Mader¹

The continuing rise of authoritarian world leaders and the opening up of the Arctic due to climate change have radically altered Canada’s geo-strategic situation. It must now pursue a ‘dual-track’ strategy of possessing both an expeditionary capability for its ‘distant defence’ and a separate coastal (Arctic) sovereignty protection capability. With this situation in mind, I suggested previously a structure for the Royal Canadian Navy (RCN) based on: *River*-class destroyers (DDGHs); Arctic and Offshore Patrol Ships (AOPS); supply ships (AORs); counter-mine vessels; conventional attack submarines (SSKs); and possibly Arctic amphibious vessels.²

However, I now think that this structure must be radically reworked, as Canada’s world has been completely flipped on its head with Donald Trump’s second election as President of the United States. For the first time since the 19th century, Ottawa faces a foreign government the stated goal of which is Canada’s destruction and annexation. I doubt that this imperial impulse will disappear within at least the next 12 years (three American presidential mandates), as the United States finds itself in the trap of earlier great powers. As Paul Kennedy phrases it, “[g]reat powers in relative decline instinctively respond by spending more on ‘security’ and thereby divert potential resources from ‘investment’ and compound their long-term dilemma.”³ I have always believed that this means these governments invest in the tangible symbols of power rather than investing in the strengths – human, economic and governmental – that underpin that power. In this context, the acquisition of the greatest imperial prize – Canada – will be a temptation that the United States will be very hard-pressed to resist. Such a situation requires Canada to make a paradigm shift in its national defence strategy. This commentary will suggest a new strategic approach and the RCN’s place in it.

It seems to me that the United States has three obvious ways to use its military power to undermine Canada without launching a full-blown invasion. These are: threaten/



conduct blockade operations off the Atlantic and Pacific coasts to cripple the Canadian economy by destroying seaborne international trade; targeted operations to seize/control parts of the Canadian Arctic to obtain their resources and to control shipping routes; and *coup de main* operations in southern Canada to take advantage of/provoke political weakness.

In order to counter such threats, and given Canada's geo-strategic situation and inferior strength, I believe that it must adopt a strategy of total national defence, such as neutral Sweden had, but without the neutrality. The Canadian Armed Forces (CAF) should consist of a high-tech, regular component able to meet Canada's alliance and expeditionary commitments, and a heavily reserve component focused on making any invasion/occupation very costly, exhausting and ultimately unsuccessful. These forces would avoid head-to-head, high-tech, conventional battles. Instead, the regular component would act as 'tripwires' to force the Americans to cross the psychological barrier and start shooting and then the entire CAF would very quickly transition to asymmetric warfare.

The dissuasive benefits of such a strategy, if publicly articulated and supported with ample resources, could very well allow Canadians to live in peace. One has but to remember that Nazi Germany stayed out of Sweden and Switzerland in World War II to understand the strategy's potential.

The RCN's future force structure must change to support this new strategy. I believe that all of the previously listed ship types are still required, although their relative importance and roles will evolve. This is because I do not believe that Canada can ignore the longstanding 'distant defence' mission; there are still a great many hostile states outside of North America which wish to destroy the rules-based order that has benefited Canada so much. Thus, Canada will still have to be prepared to act in concert with like-minded states to defend the democratic world order. This mission will require DDGHs, AORs and SSKs that Canada can commit to allied/coalition operations.

The Canadian naval mission that must undergo massive changes is that of coastal defence. Canada now needs to think about how to defend international trade against blockades and to respond to incursions into the Arctic.

I believe that operations off Canada's three coasts should be based on the concept of tripwires supported by a massively renewed SSK fleet that forces hostile ships to worry about their own survival. The psychological barrier of actually opening fire on the tripwire forces may be sufficient to maintain a cold peace until our previously friendly, bi-national relationship reappears, especially if our submarines are lurking undetected to exact revenge for any attacks on the tripwires.

I envision the tripwires off Canada's West and East Coasts as being primarily open-ocean, minimally crewed missile craft (which I will call corvettes). These could be reinforced by DDGHs, AOPS and counter-mine vessels. The primary role of the tripwires would be to protect merchant ships from interference by blockading warships, while carrying out routine coastal, fishery and anti-submarine protection tasks. Both coasts would require SSKs on station as deterrents.

In the Arctic, the tripwires would be a mixture of heavily armed, ice-capable surface combatants (DDGH(Arctic)), AOPS and possibly amphibious ships that would allow Canada to contain/confront an intruder on land, if required. The supporting SSKs would have to be under-ice capable (thus SSK(A)). Given Canada's geography, the Arctic protection vessels should be based on the Atlantic coast.



Credit: Canadian Naval Review

A bow-on view of a model of the Type 212CD submarine displayed at CANSEC 2024 shows off the design's unique diamond shape. It is one of the expected contenders for Canada's replacement submarine program.

In order to ensure operational flexibility, all submarines must be of the SSK(A) configuration. These vessels would be the RCN's key asymmetric warfare assets and, thus, its new capital ships.

Therefore, the RCN would not require 15 *River*-class DDGHs. It would only need a certain quantity for the expeditionary, alliance and tripwire roles. The rest of the navy's funding and efforts should be invested in SSK(A)s, developing the new DDGH(A)s and corvettes, and renewing and/or upgrading the other ship types discussed. The procurement/upgrading of these types would be made easier by the funds freed up by cancelling up to nine *River*-class DDGHs.

Table 1 illustrates a possible force structure that meets the described requirements; it also provides amplifying remarks about the ship types.

This new strategy would require the RCN to diversify its procurement away from American equipment and software. This would reduce dependency on a hostile state

that could hamstring the CAF by withholding parts and ammunition and possibly embedding dormant viruses in the software of computer-based systems.

Some will probably argue that the above strategy is an over-reaction to Trump's musings about annexation and that Canada should just relax. I believe that such insouciance would be the very embodiment of an 'ostrichian attitude.'

There are also likely some who will find the suggestion that SSK(A)s should be the RCN's capital ships – relegating all other vessels to various supporting roles – off-putting and contrary to Canadian naval traditions and previous force structure concepts. I would argue that having the world's premier navy as a potential adversary means that Canada must shatter its past ways of doing things. Emphasizing *River*-class DDGHs as the navy's primary warships would put Canada into the situation during a crisis of either having to sail them far away to where they can be safely interned or undertaking short, bloody, conventional naval

Table 1. Possible Future RCN Force Structure

SHIP TYPE	QUANTITY	DISTRIBUTION PACIFIC / ATLANTIC	REMARKS
River-class DDGH	6	4 / 2	<ul style="list-style-type: none"> Expeditionary missions Coastal tripwires Anti-submarine capability
Corvette	10	5 / 5	<ul style="list-style-type: none"> Primary coastal tripwires Expeditionary missions Minimal crew Heavily armed with anti-air and anti-ship missiles
AOR	2	1 / 1	<ul style="list-style-type: none"> Support expeditionary and coastal missions
Mine warfare	8	4 / 4	<ul style="list-style-type: none"> Coastal missions including tripwire
DDGH(Arctic)	4	0 / 4	<ul style="list-style-type: none"> Primary Arctic tripwires Expeditionary missions Coastal tripwires Anti-submarine capability
AOPS	6	2 / 4	<ul style="list-style-type: none"> Arctic/coastal tripwires Improved armament Limited amphibious use Arctic mine-hunting 'mother ship'? Expeditionary missions
Arctic Amphibious Ships (if AOPS inadequate)	4	0 / 4	<ul style="list-style-type: none"> Allow Arctic ground presence operations
SSK(Arctic)	16	6 / 10	<ul style="list-style-type: none"> Deterrence component Coastal and expeditionary missions



Credit: Royal Canadian Navy

A rendering of the River-class destroyer posted by the RCN in June 2024.

battles that see the destruction of the RCN fleet and the likely deaths of hundreds of Canadian sailors.

We must do better than these options. Therefore, I feel that we must pursue a naval strategy of asymmetric warfare that allows Canada to force the Americans to have to worry about the safety of *their* extraordinarily expensive vessels. Making SSK(A)s Canada's new capital ships would accomplish this goal.

The world's geo-strategic reality is currently experiencing a previously inconceivable change of its basic underpinnings. Given the imperial impulses displayed by the Trump administration, Canada is particularly affected by this new environment. Thus, it must undertake a radical and expensive paradigm shift of its defence strategy and armed forces. This commentary has suggested a new strategy and an evolved naval force structure that supports it. It is my hope that it encourages further, urgent discussions about how the CAF and the RCN can adapt to the world we actually face, rather than the one we expected and wanted. ⚓

Notes

1. The author would like to thank Guy Lavoie for his editorial advice.
2. Major (Ret'd) Les Mader, "Future RCN Structure: A Modest Proposal," *Canadian Naval Review*, Vol. 17, No. 3 (2022), pp. 22 and 23.
3. Paul Kennedy, *The Rise and Fall of the Great Powers: Economic Change and Military Conflict From 1500 to 2000* (London, UK: Unwin Hyman, 1988), p. xxiii.

The Sea Cadet Program: A Strategic Imperative for Canada's Maritime Future

Louise Mercier

Canada's maritime sector is a cornerstone of national security, economic prosperity and technological innovation. From the Royal Canadian Navy (RCN) and the Canadian Coast Guard (CCG) to Canada's shipbuilding industry, the need for a highly skilled workforce has never been greater. Yet, despite significant investments in new talent, there remains a critical gap in targeted programs that cultivate future marine professionals from an early age. The Sea Cadet Program and the Navy League Cadets, under the stewardship of the Navy League of Canada, represent a largely untapped resource in addressing this challenge. Investing in these programs can help build a sustainable pipeline of professionals with a deep-rooted passion for maritime careers.

Since its establishment in 1895, the Navy League of Canada has played a pivotal role in fostering national maritime interest. Initially formed to ensure adequate naval defence of Canada, the organization has evolved to promote maritime affairs and advocate for policies relevant to Canada's maritime environment. Its modern-day youth programs for boys and girls – Navy League Cadets (ages 9-12) and Royal Canadian Sea Cadets (ages 12-18) – have trained generations



Credit: Navy League of Canada

The Navy League of Canada badge.



Twenty-two Sea Cadets sailed on Orca-class training craft in September 2023 in Victoria.

of Canadians in seamanship and leadership activities promoting personal wellness and discipline. During both World Wars, the Navy League proved instrumental in supporting the merchant navy and operating hostels for seafarers. Since then, it has remained committed to youth development and maritime education, yet its full potential remains under-utilized in today's marine workforce strategy.

A strategic approach to investing in Canada's maritime future should consider three key pillars:

1. **The Cadet Program.** The Sea Cadet and Navy League Cadet Programs provide essential training and education for young Canadians, fostering skills in navigation, seamanship and leadership. These programs serve as an initial stepping stone for youth interested in maritime careers.
2. **Defence and Security.** The Royal Canadian Navy is responsible for national defence, while the RCMP and Canadian Coast Guard undertake constabulary duties and ensure safety in Canadian waters. Ensuring a robust future workforce in these areas requires a structured pipeline of young talent already engaged in maritime training.
3. **The Defence and Marine Sector.** Shipyards, marine industries and defence contractors contribute to government safety and security policies. A coordinated effort to support, engage and nurture young Canadians

through the Sea Cadet Program will help sustain a workforce ready to contribute to national and industry priorities.

Every year, thousands of young Canadians participate in the Navy League and Sea Cadet Programs, developing an awareness of and interest in maritime pursuits and valuable skills in navigation, sailing, marine engineering and leadership. Many cadets demonstrate a strong interest in maritime careers but lack a structured pathway into the industry. Unlike other sectors, such as aviation or engineering, where targeted scholarships and transition programs exist, the marine sector has yet to consider or attempted to integrate Sea Cadets into its long-term talent development strategies.

By investing in mentorship, scholarships, apprenticeships and direct recruitment initiatives for cadets, Canada's maritime sector can benefit from a workforce that is already enthusiastic, disciplined and partially trained. These young individuals are more likely to pursue careers in the RCN, CCG, commercial shipping, naval architecture, marine engineering and shipbuilding if engaged and informed early. For those who show interest, they should be given proper support during their transition to post-secondary education and the workforce.

The Canadian marine industry, particularly shipbuilding, faces a growing demand for skilled labour amid workforce shortages. Programs like the National Shipbuilding Strategy (NSS) and fleet renewal initiatives require a continuous influx of naval architects, engineers, shipwrights and logistics professionals. While investments in workforce development are ongoing, they often fail to leverage pre-existing training programs like the Sea Cadet Program.

A structured cadet-to-career pathway could bridge this gap, ensuring a steady stream of motivated recruits for marine-related college programs and apprenticeships. By partnering with the Navy League of Canada, shipyards, maritime institutions and industry stakeholders could create funding mechanisms, internship opportunities and attraction programs tailored for cadets who have already shown an affinity for life at sea.

A combined program that supports and nurtures these young Canadians is an investment in a talent pipeline with significant untapped potential.

A Call to Action

At the Navy League, we recognize the strategic value of investing in the Sea Cadet Program. Strengthening ties between cadet training and professional maritime careers will not only benefit individual cadets but also enhance Canada's long-term maritime readiness and industry sustainability. By fostering this connection, Canada can



ensure that its shipyards, naval forces and commercial fleets remain robust, innovative and staffed by dedicated professionals who have been inspired by the sea from an early age. Investing in cadets today means securing the future of Canada’s maritime excellence. ⚓

The Canadian Surface Combatant Project Needs to be Modified

Roger Cyr

Canada’s defence policy, *Strong, Secure, Engaged* (SSE), has committed to investing in 15 Canadian Surface Combatant (CSC) ships. Known as *River*-class destroyers, these ships will be Canada’s major surface component of maritime combat power. The design is based on the Type 26 British ship with its effective warfare capability and versatility. These 15 ships are intended as replacements for the three *Iroquois*-class destroyers that were decommissioned many years ago, and the 12 *Halifax*-class frigates that are still in operation and, despite being almost 30 years old, are expected to be in service for some 30 years more.

However, the choice of this design is wrong. The new ships are too expensive and complex to build. They may be an ideal replacement for the three destroyers, but they are unsuitable and costly to replace the 12 frigates.

The three *Iroquois*-class (the DDG-280 class) ships were labelled destroyers because of their capabilities and size. Launched in the 1970s, they carried two Sea King helicopters and, because of their weapons systems, were designated as area-wide anti-aircraft defence. The last destroyer, HMCS *Athabaskan*, was decommissioned in 2017.

The 12 *Halifax*-class frigates (FFH-330 class) are multi-role patrol frigates that came into service starting in 1992. HMCS *Halifax* was the first of the Canadian-designed and Canadian-built vessels which combine traditional anti-submarine capabilities with systems to deal with surface and air threats as well. Displacement is about 5,000 tons.

The first CSC, or *River*-class destroyer, is expected to be commissioned in the early 2030s. At approximately 8,000 tons, the replacement vessels will have a displacement that will be 60% heavier than the existing *Halifax*-class frigates and presumably provide a wide area-air defence capability and anti-submarine as well as anti-ship warfare capability. The build is estimated today to cost over CA \$80 billion and the 15th ship is expected to join the fleet 30 years from now. Assuming 2% inflation rate per year over that time, the real cost will be well over \$100 billion just for the acquisition of these ships. That works out to over \$6 billion per ship. If there are no delays in construction, which is unlikely, it will take some 30 years to have all ships operational.



Credit: Marine Nationale

The French Navy FREMM frigate FS *Bretagne* (foreground) sails with USS *Porter* (middle) and Italian Navy FREMM frigate ITS *Carlo Margottini* during exercise Formidable Shield 2023 in the North Atlantic.



Credit: United States Navy

A rendering of the US Navy's *Constellation*-class frigate. Although intended to be based on the FREMM to speed up delivery times, the design has been changed and the build is now experiencing significant delays.

The Canadian government originally specified that the combat management system should be the CMS-330 system, which is the same system that is fitted in the *Halifax*-class frigates. This would maximize the Canadian content of the new warships. It would also make for commonality of operations and training. However, the government has now agreed to have the Canadian combat management system replaced by the American Aegis system. This would allow the Americans full control and oversight over the supply of parts, modifications or future upgrades. It would also possibly be subject to tariffs and extortion. Canada would have no control of the ship's combat management system for at least 60 years – that is, 30 years to build, and over 30 years after that for the in-service period. That would be the situation for the Canadian naval fleet of 15 major surface combat-capable ships.

The Canadian government has contracted with Irving to build only the first three ships. If it does indeed proceed with these three destroyers, then it must do so with the use of the Canadian CMS-330. In light of the evolving geopolitical situation, the Canadian Surface Combatant project needs to be halted, and the requirements clearly established. Affordable options have to be considered, such as more Canadian content in the design and more

shipyards involved in the building process to shorten the delivery time-frame.

A more reasonable option would be to continue to build the three *River*-class destroyers that are now planned, with the Canadian CMS-330 system, as replacements for the three *Irquois*-class destroyers. The Frigate European Multi-Mission (FREMM) should be selected for the subsequent replacement for the 12 *Halifax*-class frigates. The FREMM is a Franco-Italian family of multi-purpose frigates. The design is flexible, and there are ships already in service so it is a proven design. Italy has ordered six general-purpose and four anti-submarine variants. France, on the other hand, has ordered six anti-submarine variants and two air defence ones. The FREMM has also been exported to various countries including Egypt, Morocco, Indonesia and the United States.

In September 2017, a variant of the FREMM was offered directly to the Canadian Department of Defence. This direct bid included delivery of the first ship in 2019, if the bid was accepted in 2017, and a fixed price of \$30 billion for all 15 ships, versus the \$80 billion estimated for the government's prime contractor shipbuilding plan.¹ In December 2017 the offer was rejected by Public Services and Procurement Canada, for the reason that the unsolicited nature of the bid undermined the nature of the procurement process.



The US Navy is building the *Constellation*-class frigates, designated Guided-Missile Frigate (FFG-62), which is based on the FREMM frigate already in service with the French and Italian navies. The procurement of the first *Constellation* frigate, and subsequent ships in this class was originally estimated to cost US \$950 million or about Canadian \$1.5 billion per ship – although it should be noted that these numbers are increasing – to be built by Fincantieri Marinette Marine in Wisconsin.² The displacement of the frigate for France and Italy is about 6,000 tons.

The FREMM frigate is more suited to Canadian requirements and is obviously a better and more affordable option. The building of these 12 ships should be carried out by Canada. The work could be shared by the three shipyards that are now part of the National Shipbuilding Strategy or another shipyard to be added to the group. Since the estimated US cost to build was CAD \$1.5 billion per ship, it could be assumed that the build in Canada would be about \$2 billion each, which is much more reasonable than the \$6 billion per unit now projected.

Canada has a proud history of naval design and shipbuilding, such as the *St. Laurent*, *Restigouche* and *Mackenzie* classes of destroyers built by various shipyards. There was

also the hydrofoil HMCS *Bras D'or*, the fastest warship in the world at the time.

Given the world situation, it is time Canada stand proud again as a maritime country. The Canadian Surface Combatant project needs to be reconsidered, and a more cost-effective option should be considered for replacing the existing 12 *Halifax*-class frigates. ⚓

Notes

1. For details on this, see David Pugliese, “Firms Didn’t Bid on Canadian Surface Combatant Because of Concerns about Technical Data, Says Executive,” *Ottawa Citizen*, 19 April 2018.
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Transition to the Future RCN Fleet

Mikaël Perron

The Royal Canadian Navy (RCN) is looking forward to a bright future and exceptional capability with the arrival of the *River*-class destroyers (RCD) starting in the early 2030s, and later with a new fleet of up to a dozen new conventional patrol submarines. However, the road to the initial operational capability of the RCD is very long and much longer to the full operational capability. We won’t



Credit: Royal Canadian Navy

HMCS *Montreal* departs Halifax on 22 April 2025 for Operation Reassurance.



A depiction of the Team Vigilance proposal for the Canadian Multi-Mission Corvette.

even mention the Canadian patrol submarine horizon.... The events in today's world mean that we need to be there by our allies' side today, tomorrow and every day. In order to keep the RCN relevant in the near future, I believe that at least three main investment pillars should be pursued and prioritized.

First, the main pillar of the existing fleet is the *Halifax*-class frigates. Over the years, their combat management system, sensors and weapon systems got upgraded and were kept up to date. Significant investment is being made to maintain their operational capabilities. Now that the hulls are reaching the end of their design life expectancy, the hull and different marine systems should receive major attention in order to extend the life of these vessels. Those who follow the news have heard on more than one occasion, stories about flood or fire onboard ships of the fleet – and there may be events that did not make the news. I also hear rumors about speed limitations imposed on the ships.

Money has been set aside in order to sustain the *Halifax*-class because the navy needs to keep all 12 ships operational until the deployment of the RCD begins. How can this investment be optimized? In order to gear up for the future, I believe that we could reduce the number of crew down to eight ship sets. This would allow for at least one ship to deploy on each coast at all times. Out of the 12

frigates, there will be at least four of them out of commission undergoing major life-extending overhauls and thus not requiring a crew. In order to optimize the actual process, upon arrival at the shipyards, each ship should be stripped down and undergo a complete hull and marine systems survey to determine the extent of the required work. This would allow extensive planning and spending the maximum amount of money on actual work, not paperwork!

We should remember that the life-extension work needs to give an extra 15-20 years of operational life to the hulls. The ships need to maintain the capability to operate at all speeds and sea states of the original design. In order to do so, if it is determined that there is too much metal fatigue, we could envisage implementing an initiative such as hull strengthening beams like those that were added to the British Type 42 destroyers about halfway through their service life.

As the years pass with these extensive refits, we will also need to keep on improving the combat system and address upcoming obsolescence. For example, at some point, the RCN and Royal Canadian Air Force (RCAF) will need to transition from MK-46 to MK-54 torpedoes for the CH-148 Cyclone and the *Halifax*-class. Also, there will probably be a need to replace the Harpoon anti-ship missiles with the future Naval Strike Missiles (NSM). To



improve close-in protection, we could consider replacing the elderly Phalanx Close-in Weapon System (CIWS) with a Bofors 40-mm MK4 gun. It is actually lighter than a Phalanx mount. It would be fully integrated into the Combat Management System (CMS) 330. Given the limited number of Evolved Sea Sparrow Missiles (ESSM) carried by the *Halifax*-class (16), the 40-mm gun and its 3P munitions would give extra punch and an extended range against such threat as aircraft, anti-ship missiles, aerial and surface drones and any asymmetric devices.

The second pillar consists of the Canadian Multi-Mission Corvette Program. During the frigate life extension (FEL-EX) program, the RCN rediscovered the usefulness of the *Kingston*-class Maritime Coastal Defence Vessels (MCDVs). They were deployed regularly and gave excellent service. Now, they are at the end of their service life and are not adequate for the dangerous world in which we are living. We need ships that will fulfill the same missions but equipped with a complete self-defence capability. They also need to address the shortcomings of the MCDVs such as low maximum speed, short range and low seakeeping attributes. The RCN seems to be looking at exotic capability such as ballistic defence for these corvettes but it might be asking for too much.

Time is very important now. The RCD is a 100% solution but perhaps we should be looking at an 80% solution in this case (perfect is the enemy of good enough). The RCN was also looking at a horizon in the 2030s but I say we should speed up the process. We also need to generate a lot of new sailors who will sail the future fleet. To do so, I believe that we should look into the *Vigilance*-class proposal. The industry seems ready to fire on this one and we should maximize this opportunity in the manner of the *MV Asterix* procurement success. We should use our resources to evaluate the solidity of the proposal and rapidly get things moving.

The *Kingston*-class should be replaced on a one-for-one basis with 12 Flight II *Vigilance*-class Offshore Patrol Vessels (OPVs). With proper resources, we could see the delivery of the first ships within three years. Building them by batch would allow the builder to incorporate lessons learned from the previous batch to the next one. Such modern Tier 2 ships would give the RCN the opportunity to have many more ships globally deployed participating in global security. They would be perfect to escort capital ships and merchant ships in a restricted body of water. The *Vigilance*-class could also be employed like the Netherlands' future low-manned multi-function support

vessels, being able to launch long-range anti-air missiles receiving feed from the *River*-class destroyers, augmenting the number of available missiles. This class of ships might also develop into an exportable product. Such ships will allow the development of the skills of incoming sailors and the leadership qualities of future officers that will be required to supply crew for the *River*-class destroyers and also the future Canadian patrol submarines.

The third pillar consists of upgrading the RCN's existing assets. First, a helicopter hauldown system, C-Rast, should be fitted to the *Harry DeWolf*-class Arctic and Offshore Patrol Vessels (AOPVs). They need to be fully able to deploy CH-148 Cyclone helicopters. We also should find a way to store torpedoes on board for these helicopters (perhaps some purposely designed container to be fitted on the quarter deck). With the upcoming *Vigilance*-class, we could study the opportunity to up-gun the AOPVs with the same Bofors 40-mm MK4 gun, remote 20-mm gun on both sides, countermeasures and upgraded sensors.



Credit: Sutabania, Wikimedia Commons

A Bofors 40 MK4 naval gun on the Japan Coast Guard vessel *Shunkō*, seen 2 February 2024.

Also with a fleet of 12 Tier 2 corvettes, the RCN needs extra support capability. With no room in the shipyard to build extra supply ships for a few decades, *Asterix* should be commissioned into the RCN and given the same self-defence suite as the *Protecteur*-class Joint Support Ships (JSS), minus chemical, biological, radiological and nuclear (CBRN) defence of course. While the actual lease agreement for *Asterix* with Federal Fleet Services is quite expensive, we can only blame the successive Canadian

governments that procrastinated since the early 1990s on the replacement of the previous *Protecteur*-class AORs. With the new JSS becoming operational soon, the RCN will be in a much better position to negotiate a new in-service support contract with Davie/Federal Fleet Services and a new contract to supply civilian marine engineers to operate and maintain the marine systems. The remaining crew could be RCN.

These three pillars are to ensure there is no gap in Canadian support to allies and that the RCN maintains and improves the proficiencies of its professional sailors. With the National Shipbuilding Strategy now picking up speed and capabilities, we will be in a great position to replace the actual fleet we are building now with even better ships in an adequate quantity in the distant future. We will not need to stretch the life out of old hulls and may even be able to sell them to other countries. ⚓

The Rapid Rise of the PLAN

Jeff G. Gilmour

Both the Defence Policy Update, “Our North Strong and Free,” released in April 2024 and “Canada’s Arctic Foreign Policy,” released in December 2024 mention that the People’s Republic of China poses a security threat to this country.

Even though Russia is at war in Ukraine and causing NATO problems, it could be argued that only China has the wherewithal to mount a global challenge against the United States and NATO. According to intelligence experts in the United States, “Beijing is accelerating the development of key capabilities with the aim of superseding America as the global superpower. By 2035 the PLA [People’s Liberation Army] is supposed to complete their military modernization programs and by 2049 become a world class military power.”²¹ Many of Canada’s federal politicians seem concerned with our economic ties with China without recognizing the extraordinary transformation of the PLA from an ill-equipped military outfit two decades ago to a regional power today and seeking to be, in the future, a formidable global military superseding US forces.

China has broadened the scope and reach of the People’s Liberation Army (Navy) (PLAN) to operate not just in regional waters but projecting power in oceans thousands of miles from home. Its global naval presence first started in the Indian Ocean, where it began carrying out counter-piracy missions in the Gulf of Aden in 2008. Then, in 2015, Chinese naval warships were spotted in the Bering Sea off the coast of Alaska.

Although currently the PLAN is expanding its role in Southeast Asia, the South China Sea and Taiwan, China



The PLAN Type 055 destroyer Nanchang is seen by Japanese Maritime Self-Defense Force assets near Japan during April 2021.



Credit: Mass Communication Specialist 1st Class
Byron C. Linder, US Navy



The PLAN Type 054A frigate *Huangshan* receives its Z-9 helicopter during operations in the South China Sea on 16 June 2017.

has become interested in Canada’s Arctic and Northwest Passage, recognizing that Canada has done very little in the past decades to enhance its military and sovereignty profile in this area. The federal government has failed to increase the defence budget of the Canadian Armed Forces (CAF) and other relevant federal departments to improve the goals and objectives as outlined in the Arctic foreign policy statement.

Ottawa, and Washington as well, should be very concerned about the increasing military expansion of the PLAN in the Pacific and Arctic regions. Recently China has improved the effectiveness of its military arms to such an extent that, in some areas, it has already matched or surpassed the United States.²

The People’s Liberation Army (Navy)

As noted, the People’s Liberation Army (Navy) has changed dramatically in recent years from operating solely in the South China Sea to becoming a ‘blue-water’ navy. In addition, it is not only the world’s largest but also has the newest vessels. Around 70% of its warships were launched after 2010, as compared with a quarter of those of the US

Navy.³ Many of the PLAN ships are comparable to those of the US Navy.⁴

The latest vessels of the PLAN include:

1. The unmanned surface combatant *Jari-USVA*, a multi-purpose vessel, launched in November 2024 at Zhuhai, is the world’s largest uncrewed warship⁵;
2. In 2023 the Chinese launched a new class of stealthy medium-sized surface combatants, likely the size of a frigate;
3. The Type 003 *Fujian*, launched in 2022, is China’s third carrier, built in China employing an electromagnetic-type launch system. A fourth carrier is currently under construction and projected to be completed by the late 2020s. Type 004 is expected to be much larger than the other carriers and is to be nuclear-powered.
4. China launched a new amphibious assault ship called the Type 076 on 27 December 2024 at the Shanghai Shipyard.⁶ Named *Sichuan*, it is aimed to advance the PLAN’s long-range operational capability far from the Chinese mainland and is certainly not part of any littoral commitments. The displacement of the ship is over 40,000 tons, making it the world’s largest



Credit: Mass Communication Specialist 1st Class Rebecca Wolfbrandt, US Navy

The PLAN Type 052C destroyer *Xian* departs Pearl Harbor following RIMPAC 2016 on 5 August 2016.

amphibious assault ship. It will include an electromagnetic catapult system for fixed-wing aircraft. It can also carry helicopters, drones and 1,000 marines. The drones, which can be launched by catapults, will consist of China Aerospace Science and Technology Corporation (CASC) Rainbow Unmanned Combat Aerial Vehicles (UCAVs), WZ-7 reconnaissance drones and GJ-11 stealth combat drones.

5. In addition to the Type 076, the PLAN is also building up its amphibious forces by including Landing Helicopter Docks (LHDs) and Landing Platform Docks (LPDs).⁷ The Type 075 LHD is one of three currently being built, with a flight deck 226 metres (740 feet) long and 36 metres (118 feet) wide with seven helicopters landing spots. It can carry 800 troops and is equipped with 28 helicopters.
6. Many experts have tagged the Type 055 (*Renhai*-class) stealth guided-missile cruiser as one of the best destroyers in the world. The ships are 180 metres (590 feet) long, 13,000 tons full load displacement with a ship's company of over 300.⁸ They are fitted with 112 vertical launch cells for the ship's missile systems.

The PLAN intends to build 16 of these warships, with 10 already in the water. These new warships are the pinnacle of the PLAN's efforts to develop advanced long-range surface combatants for power projection around the world and to escort its new aircraft carrier fleet. These warships carry the following missile envelope:

- HHQ-9 surface-to-air missiles;
- YJ-18 anti-ship cruise missiles;
- CJ-10 land attack cruise missiles; and
- Missile-launched anti-submarine torpedoes.

As well as these recent builds, China has also built other warships over the past decade. China possesses six operational *Jin*-class (Type 094) ballistic missile submarines (SSBNs). These submarines are 135 metres (approximately 443 feet) long with a 12.5 metre (41 feet) beam and can travel over 20 knots when submerged. Their weapons systems can carry 12 JL-2 submarine-launched ballistic missiles (SLBMs).⁹

The *Zhou*-class (Type 041) is a new class of attack submarine under development by the PLAN.¹⁰ This class is



expected to succeed the *Yuan*-class (Type 039A) and is believed to be the first nuclear/conventional submarine to be built by Wuchang Shipbuilding. It is the first Chinese submarine with a distinctive X-shaped stern configuration. Naval analysts describe it as a considerable advancement in sonar sensor technology and stealth acoustic signature reductions. The US Navy has nothing like the hybrid propulsion system incorporated in this submarine.¹¹

A number of military experts have outlined areas in which China has dramatically improved its military capabilities at sea. This includes anti-jamming capabilities of air-to-air and anti-ship missiles. As well, China has the world's leading hypersonic missile arsenal and has already deployed multiple hypersonic weapons systems. The US intelligence community noted in its "Annual Threat Assessment" report for 2025 that China has the ability to hit the United States with conventional weapons, compromise US infrastructure through cyberattacks, and target US assets in space. In addition, China seeks to become the top power in Artificial Intelligence by 2030.¹² In a 2024 defence survey, China ranked top in six out of seven crucial defence-related areas: advanced aircraft engines; drones and collaborative robots; hypersonic detection and tracking; advanced robotics; autonomous systems; and space-launched systems. The United States was only ahead in small satellites.¹³

The PLAN conducted two live-fire exercises in the Tasman Sea between Australia and New Zealand on 21 and 22 February 2025, continuing Beijing's plan to build a blue-water navy with global reach. In the exercises, the PLAN's ships consisted of a frigate, a cruiser and a replenishment ship. The cruiser was a Type 055 destroyer, which as noted earlier, is by far the most capable PLAN surface combatant in service.

Conclusion

The PLAN is now the largest navy in the world, with new and sophisticated warships which are operating in oceans around the globe. On the basis of China's advanced progress on hypersonic missiles, Western navies must now develop ways in which they can defend from such missiles to protect their respective surface fleets.¹⁴ As well, for several years now Russia and China have been conducting joint military exercises. Although not bordering on the Arctic Ocean, China has expressed significant interest in it. It is likely that the submarines of both countries will be employed in entering Canada's northern waters, including the PLAN's SSBNs and its new attack boats.

It is time that Canada recognizes the significant modernization and capability of the PLAN. Canada must now recognize the urgency of improving its maritime and defence systems in the Arctic to counter such potential threats in its northern region. 🇨🇦

Notes

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A View from the West:

Nine Things for a Canadian Sailor to Know Before Deploying to the Indo-Pacific

Commander Tyson Bergmann and Brett Witthoeft

Credit: Aviator Gregory Cole, Canadian Armed Forces



HMCS Vancouver and HMCS Ottawa sail in formation with MV Asterix.

The 2022 Indo-Pacific Strategy commits the Royal Canadian Navy (RCN) to sailing three warships into the Indo-Pacific region (IPR) every year making it important that sailors, defence officials and Canadians know what's going on in that strategic region and how the RCN fits into the larger picture. Inspired by a US Naval Institute blog post, "10 Things Every Sailor and Marine Should Know Before Deploying to Southeast Asia,"¹ this article is aimed at providing a Canadian perspective on the topic.

1. The Indo-Pacific region moves the world.

Because of geography and close institutional, cultural and economic ties – most Canadians live within 150 kilometres of the US border and 75% of Canada's exports go south – Canada is closely tied to the United States. However, there are big strategic changes going on in Asia that are worth the attention of Canadians. The Indo-Pacific Strategy (IPS) notes that the region is home to two-thirds of the world's people, has approximately 45% of the world's Gross Domestic Product (GDP), and is on track to have half of global GDP by 2040.² The IPR is Canada's second-largest trading region, ahead of Europe, and is projected to grow even further, especially as US tariffs encourage countries to look for new trade opportunities. Also, what happens in the Indo-Pacific doesn't stay in the Indo-Pacific – for example, port shutdowns in China due to Beijing's strict zero-COVID policy meant empty shelves and higher prices in Canada during the pandemic. As well, the public inquiry on foreign interference revealed that Indo-Pacific regimes are very interested in shaping Canadian policy and attitudes in their favour. These trends show that Canada should be aiming

for where the world is going to be, so Canadian involvement in the IPR now is essential for Canada's future success.

2. The Indo-Pacific is primarily a maritime theatre.

A glance at a map of Asia tells us a lot about the character of the region. Japan, the Philippines, Singapore and Australia are all islands that are critically dependent upon seaborne trade. South Korea is effectively an island as North Korea cuts it off from mainland Asia. Southeast Asia can be divided into mainland and maritime states, and Indonesia and Malaysia themselves are cut in two by waterways. Furthermore, the 'Indo' part of the Indo-Pacific – Bangladesh, India and Pakistan – flows into the 'Pacific' part via the Strait of Malacca. As a result, the Indo-Pacific region, unlike North America or Europe, is both divided and connected by water, which makes maritime power there especially important.

This is reflected in the numbers as nine of the top 10 ports worldwide are in Asia. China, South Korea and Japan build over 90% of all new ships every year,³ and about 33% of all trade globally sails through the South China Sea.⁴ This maritime dependence also means that there are many maritime disputes, such as over islands in the East and South China Seas, confrontations over illegal fishing, and questions of mining undersea minerals and energy. As a result, the IPR is home to the largest navies and coast guards in the world to manage these issues.

3. The Indo-Pacific region is very busy.

The region's dependence upon the seas means that maritime traffic is heavy, particularly near chokepoints such as the Malacca and Taiwan Straits in which there is constant

traffic 24/7, 365 days a year. This traffic is a mix of vessels – warships, commercial cargo ships and tankers, and fishing fleets – all sharing the same routes, creating significant physical and electronic congestion. To navigate this traffic jam, RCN operators must be proficient in reading a complex mass of transponder signals.

Even when the mess of ships can be figured out, fishers don't necessarily follow the marine 'rules of the road,' and many don't speak English, the *lingua marina* (though most merchant vessels do), forcing RCN sailors to interpret intentions and actions of other ships, such as dhows suddenly changing course and lasers being shined at the bridge. These actions aren't necessarily malicious – they may be from a fishing crew frustrated that a frigate is too close to their nets – but it does mean that hypervigilance is a must, not only to avoid creating an international incident, but also to stay a step ahead of those who may try to portray Canada as the bad guy.

4. Northeast and Southeast Asia are different sub-regions.

Despite all that connects them, Northeast Asian countries have different maritime interests, capabilities and approaches than those in Southeast Asia. The economies of Japan and South Korea exploded from the 1980s, creating critical interests in securing sea lanes (they import 97%⁵ and 98%⁶ of their oil and natural gas, and all their trade goes by sea) and upholding international rules to protect these interests. They also have an interest in countering maritime smuggling and ensuring access for fishing fleets. Threats to those interests are mainly 'hard' and 'traditional' and come from their neighbours – China through its growing maritime fleets and aggression, and North Korea through its missile launches and submarines. As a result, Tokyo has built up the Japan Maritime Self-Defense Force and Seoul has built up the Republic of Korea Navy, which are now among the largest and most advanced navies in the world.

While Southeast Asia certainly shares these security concerns, particularly when it comes to tensions with China in the South China Sea, that region tends to prioritize 'softer,' 'non-traditional' threats such as climate change, maritime piracy and illegal fishing. This is partly due to the extent of those threats, as Southeast Asia was the centre of maritime piracy in the late 1990s to early 2000s, and illegal fishing cost the region about \$6 billion in 2019.⁷ But it is also partly a matter of money – Southeast Asian economies are much smaller and were battered by COVID-19 lockdowns – so they are less able to spend on navies and coast guards and can't push back as hard against Chinese incursions.

5. China is front-of-mind for all.

China poses an interesting dilemma for most Indo-Pacific countries: it is their #1 trading partner, while also being their #1 security challenge. After Mao Zedong's death in 1976, China shifted from a largely closed communist economy to a (somewhat) open private sector which prioritized making cheap goods for export. China became the world's factory as companies across the globe turned to Chinese workers to lower their costs. This transformation propelled China into having the second-largest economy and becoming the single largest trade partner for over 120 countries, including the United States, Japan, South Korea and Vietnam. China was Canada's second largest trade partner in 2024, at 7.6%, well behind the United States at 63%.⁸ China's neighbours are tightly interwoven into China's export success, as supply lines crisscross Asia, sustaining millions of jobs.

At the same time, China is the main source of insecurity. For Japan, regular China Coast Guard patrols near the Senkaku Islands and growing military exercises in the Taiwan Strait, a critical Japanese sea lane, have pushed Japan out of its post-World War II pacifism. South Korea has similar sea lane anxieties, as well as concerns about China's longstanding support for North Korea, which



Credit: Aviator Gregory Cole, Canadian Armed Forces

(From top) USS *Ralph Johnson*, JS *Izumo*, an *Oyashio*-class submarine, JS *Samidare* and HMCS *Ottawa* sail together in the Philippine Sea on 6 September 2023.

threatens South Korea on a near-daily basis. In Southeast Asia, the China Coast Guard and maritime militia often harass offshore energy platforms, and Chinese fishing fleets regularly fish illegally in the waters of Southeast Asian countries, leading to confrontations between fishers and coast guards.

Beijing knows that it has economic leverage over other countries and isn't afraid to use it. Canadians are probably aware that China banned imports of Canadian canola, beef and pork, and took the 'Two Michaels' hostage as part of its retaliation for the arrest of Huawei executive Meng Wanzhou in 2018. Beijing also banned Philippine bananas in 2012 amid their Scarborough Shoal dispute, the South Korean company Lotte was forced out of business in China after it gave land for the American THAAD missile system in South Korea in 2017, and Australian barley, beef, coal and wine were blocked after Canberra dared to call for an inquiry into the origin of the COVID-19 pandemic in 2020. Southeast Asia in particular is very aware of this trade versus security dilemma, so it prefers to downplay disputes to avoid Chinese retribution.

6. Regional relations are varied and complex.

Unlike the Euro-Atlantic, the Indo-Pacific region does not have a North Atlantic Treaty Organization (NATO) or similar alliance that navies can readily plug into. Instead, the IPR has a patchwork of bilateral alliances, organizations and 'minilaterals.' The hard alliance side is led by the United States, which has defence treaties with Australia, Japan, New Zealand, South Korea and the Philippines that form the basis for most regional military cooperation, including exercises and operations in which the RCN participates. This hub-and-spoke model, where the United States is the pivot point between its allies, is still central.



HMCS Montreal's hockey team faces off against the Philippine National Men's Hockey Team in Manila during a visit in 2024 as part of Operation Horizon.

The IPR is home to many organizations and forums for regional coordination. The big one is the Association of Southeast Asian Nations (ASEAN) and its numerous sub-groups, such as the ASEAN Defence Ministers Meeting that Canada is working to get into. There are also several sub-regional organizations, such as the South Asian Association for Regional Cooperation, the Shanghai Cooperation Organization (for central Asia), and the Pacific Islands Forum. As well, there are important high-level inter-government meetings, the key example of which is the Shangri-La Dialogue in Singapore, attended by defence ministers and military chiefs every year. On top of these are numerous free trade and economic agreements, with the main ones being the Japan-led Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the China-led Regional Comprehensive Economic Partnership (RCEP).

Finally, there are 'minilateral' arrangements which have sprung up as IPR countries see the need to cooperate but don't necessarily want full alliances. Examples include the Australia-United Kingdom-United States (AUKUS) agreement centred around building nuclear-powered submarines for Australia, and the 'Quad' of Australia, India, Japan and the United States, which focuses on naval exercises but has also worked on varied projects such as COVID-19 vaccine production and distribution.⁹

This hodgepodge of groups has both upsides and downsides. It allows countries to participate in issues important to them, but it also means there is no single club where standards are set and operations are managed. This is a challenge for Canada, which counts itself as in the Indo-Pacific region, but doesn't have large numbers of diplomats, policy officials and military officers to cover all the organizations all the time. Added to this is that each IPR country has its own different perceptions of threats and how to respond to them. The levels of risk tolerance vary significantly even among Canada's friends and allies, which means that a great deal of effort must go into understanding and managing how government priorities play out at sea. As a result, the RCN needs to be an adaptable partner that can shift from full blue-water warfighting activities with one navy in one area, to being a more back-of-house diplomatic and training partner in another.

7. Canada is not the United States.

While directly tying national security together through NORAD and the Canadian Armed Forces (CAF) regularly integrating with US military forces overseas, Canadian and American interests and capabilities are not the same in the Indo-Pacific. The United States has vastly more resources including, until 2015, the world's largest navy, while Canada only has 12 long-range frigates. This means the RCN must carefully choose where and when



HMCS *Vancouver* arrives in Busan, South Korea, during *Operation Neon* on 23 October 2023.

it has warships in the IPR. Canada also does not have the history and alliance network that the United States does and is not viewed as central to the Indo-Pacific. An annual poll of Southeast Asians in 2024 put Canada second-last in a list of strategically relevant countries.¹⁰

In terms of how this plays out at sea, aside from MV *Assterix*, the RCN doesn't (yet) have a consistent at-sea replenishment capability, which means that Canadian warships are reliant on port access and services from regional partners to operate across the region. Canada has been steadily adding to its Indo-Pacific treaties, such as the forthcoming visiting forces agreement with the Philippines, but the reality is that the RCN isn't the top priority for regional states, and an RCN warship may not get all it asks for in port. The good news is that Canada's efforts are being recognized – Canada wasn't even mentioned in that Southeast Asian poll until 2024, after the projects and efforts rooted in the Indo-Pacific Statement, such as Team Canada trade missions and new visa offices, had some time to progress.

8. Weather, weather, everywhere.

While each ocean has its own unique environment, IPR waters have special challenges as the same high winds and rain that bring nourishing monsoons also bring dangerous typhoons. Bad weather has many implications for naval operations, from altering or cancelling planned exercises, to reducing shore leave, to traffic jams as ships seek shelter from an approaching storm. The weather in the Indo-Pacific demands regular course and plan changes, including the occasional creative invocation of treaties, though this creates its own challenge, as exploiting loopholes can get the job done but may irritate foreign governments. The good news is that regional navies are used to bad weather and have well-developed responses, which may be new to the RCN, but provide an opportunity to learn from local hosts.

9. Canada has much to learn from the Indo-Pacific.

The IPS lists capacity-building as a significant contribution for Canada in the IPR. This includes exercising with and training Asian sailors, cooperating against cyber-crime and terrorism, and sharing information such as

through the Dark Vessel Detection program with the Philippines. Different Indo-Pacific navies have different missions – some have law enforcement roles, which the RCN doesn't, others focus on coastal skills that the RCN doesn't necessarily practice – which can limit opportunities for the RCN to interact. On the flip side, IPR navies regularly deal with both naval and non-traditional threats in ways to which the RCN is only intermittently exposed. Asian sailors have likely had close and dangerous encounters with Chinese forces and their neighbours, and have had to de-escalate them through creative non-confrontational means.

They are also the first to encounter new tactics – particularly those in the 'grey zone,' which are not openly hostile, but also are not peaceful – which will all-but-certainly be tried out on the RCN at some point. As a result, while the RCN is among the top tier of IPR blue-water navies and is able to boost regional capacity, Indo-Pacific navies have much to teach Canada about the reality of operating in contested waters. ⚓

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The Second Trump Administration and a Changed Canada-US Relationship

Dave Perry

As this article is written midway through the 2025 federal election campaign, international issues are playing a more significant role than in most Canadian campaigns. Aside from the ‘free trade’ election of 1988, international affairs tend not to drive Canadian votes, nor feature prominently during campaigns. In 2025, the inauguration of Donald Trump has forced international affairs on to the agenda, leading international issues and defence specifically to matter like they rarely do.¹ The combination of replacing Prime Minister Justin Trudeau with Mark Carney and Trump’s impact on the campaign has resulted in a swing of more than 25% in public support for the Liberal Party of Canada compared to the Conservative Party of Canada which had previously been coursing towards a majority.

Upon assuming office, President Trump has pursued two broad tracks that have complicated Canada-US relations. The first track involves the imposition, or threat thereof, of tariffs of varying types and rates. The manner in which they have been rolled out, and then deferred in some cases, has been difficult to follow, but it started with the administration publishing its America First Trade Policy the day of the inauguration. At the time of writing, broad-based tariffs had been enacted, deferred, enacted a second time and then granted a USMCA free trade agreement exemption while tariffs on steel and aluminum and autos at a rate of 25% were put into effect. In what counts as good – or perhaps more accurately less bad than feared – news Trump’s 2 April ‘Liberation Day’ of worldwide tariffs does not appear to have changed much for Canada. So long as exports are occurring under USMCA provisions only the aforementioned tariffs apply (for now).

Estimates of the economic impacts of tariffs vary, and depend on specific application and Canada’s response, but all point to significant economic pain. The Bank of Canada estimated in January that broad-based 25% tariffs could cause Canada’s economy to contract by 2% of Gross Domestic Product (GDP), compared to previous growth forecasts.² Estimates also suggest hundreds of thousands of job losses. More broadly, the uncertainty caused by on-again-off-again-on-again threats is believed to be freezing investment in Canada and has undermined the economic premise of having predictable, reliable negotiated access to the US market.

The second broad thrust of Trump’s impact on Canadian politics is his push for Canada to become the 51st American

state, something he helpfully stated he did not intend to accomplish with military but rather economic force. The comments, initially reported as a joke after Trudeau and some Cabinet members met with the President Elect, morphed into a repeated assertion backed by constant references to Trudeau as the ‘Governor’ of Canada. While the statements from the mercurial, and inconsistent, President may have been dismissed, Prime Minister Trudeau gave them credence in a public setting noting “Trump’s threat to annex Canada ‘is a real thing’ motivated by his desire to tap into the country’s critical minerals.”³

While most of this back and forth was focused on economic issues, it quickly implicated defence issues as well. During the nine days between Mark Carney becoming Prime Minister after winning the Liberal leadership campaign and calling the election, he organized a visit to France and the United Kingdom focused on strengthening economic and security ties. Shortly after, Minister of National Defence Bill Blair announced a review of Canada’s F35 purchase.⁴ This came amidst public discussion about whether the US government held a ‘kill switch’ that could render the planes inoperable. Since then, there has been some significant public discussion about cancelling a portion or entirety of the purchase, or demanding that Canada be allowed to acquire the source code or build the jets in Canada.



Prime Minister Mark Carney signs the White House guestbook during his bilateral meeting with US President Donald Trump on 6 May 2025.



Canadian and American members involved in the *River-class* destroyer combat system development celebrate the opening of the Aegis Combat System Integration Centre at the US Navy's Combat Systems Engineering Development Site in Moorestown, New Jersey, on 21 November 2024. The Aegis system for the RCDs will be developed here.

Against that backdrop, and following the announcement by Trump that he would be imposing tariffs on the auto sector, Carney met with Cabinet and emerged to announce that the Canada-US relation was fundamentally changed. As he stated, “[t]he old relationship we had with the US based on deepening integration of our economies and tight security and military co-operation is over.”⁵

Just a few days later, Carney and Trump held their first phone call, which was reported to have had a significantly changed tone from the White House. Trump issued a statement on his Truth Social platform that actually referred to Carney as Canada’s Prime Minister and spoke favourably about the meeting, something echoed in subsequent statements. Carney’s readout of the call was similarly positive, but he indicated that the “[t]he leaders agreed to begin comprehensive negotiations about a new economic and security relationship immediately following the election.”⁶ The minimal additional impact of the 2 April round of Trump’s global tariffs, as well as the fact that four Republican Senators joined their Democratic colleagues to voice their disapproval at the US administration’s Canadian tariffs provide perhaps glimmers of hope that the economic relationship could be returned to something closer to normal.

It is not entirely clear what the future holds for the Canadian military if it needs to reset its relationship with the United States. Much of the public discussion around the implications for a reset has focused on the tight ties of the Royal Canadian Air Force (RCAF) with the United States through NORAD. It has been noted, however, that the combat system of the new *River-class* destroyers will be American and therefore similarly reliant on the United States and exposed to the same type of newfound sensitivities. It is notable that the contract for the first batch of three destroyers was signed just prior to the election call, a hugely significant and important milestone for the program, but there has yet to be any public announcement or celebration of that fact, although privately people involved in that announcement have assured that this was not due to political sensitivity.⁷

The net result of the first weeks of the second Trump administration is that the Canadian Armed Forces and Department of National Defence need to figure out what a new relationship between Canada and the United States generally means for Canada-US defence relations specifically. Part of that will inevitably include better informing political leadership about the breadth and depth of the relations we already have, and what changing some of those relations could look like in practice. As an example, there has been much focus on the inability of Canada’s future fighter aircraft, the F35, to operate independently of the United States, but in reality, most of the RCAF faces the same predicament – it relies on American support to operate in a range of ways. The RCN works very closely with the US Navy too, so charting a more independent future course will also be difficult. So far, working relationships are professed to be solid, but it seems like Canada’s political leadership has concluded that relations with the United States have been fundamentally altered by President Trump and that will have profound consequences for Canada’s defences. ⚓

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Warship Developments: “For Want of Frigates”

Doug Thomas

River-Class Destroyers

A virtual briefing by senior officers and government officials was conducted on 8 March 2025 regarding the status of the *River*-class destroyers. A contract has been signed with Irving Shipbuilding to build the first three of an eventual 15 *River*-class destroyers, the future HMC Ships *Fraser*, *Saint-Laurent* and *Mackenzie*. The briefing discussed the future role of these ships: defending North America; contributing to collective defence through Canada’s NATO commitments; and being interoperable with allies around the world. These destroyers will “provide full spectrum maritime war-fighting capability that will be able to track, identify and if necessary, destroy threats on, above or under the waters around Canada.”¹ This statement is encouraging – one hopes that their war-fighting capabilities will not be watered-down to save money as happened with the *Halifax*-class frigates.

It is interesting to note that the plan going forward is to order the subsequent 12 destroyers in batches or flights. According to the government announcement, “[b]uilding the *River*-class destroyer with a batch and flight strategy of generally three at a time provides the Government of Canada with multiple decision points to pivot if deemed appropriate based on cost, geopolitical situation, evolving technology or operational requirements.”² The briefing stated that 15 destroyers was the bare minimum to meet operational requirements. My concern is that future governments may reduce that number without replacing the missing ships with an equivalent capability – this



A rendering of the *River*-class destroyer posted by the RCN in summer 2024.

happened in the 1990s when the federal government cancelled the last batch of six *Halifax*-class frigates.

The briefing stated that the 12 *Halifax*-class frigates would remain in service for as long as they are required, but that they are now beyond their designed service life and will require increasing levels of maintenance and repair to remain operational. It seems that the first ship of the *River*-class, HMCS *Fraser*, will not be operational until at least 2031, by which time HMCS *Halifax*, the first of its class, will be 39 years old! *Fraser* will undergo a multitude of first-of-class trials to establish class characteristics, as



Sailors aboard the Arctic and Offshore Patrol Vessel (AOPV) HMCS *Harry DeWolf* conduct gunnery training with the ship’s 25-mm gun during *Operation Caribe* in the Caribbean Sea on 27 February 2025. Could the AOPVs fill the capability gap?

Credit: Royal Canadian Navy

Credit: Royal Canadian Navy



HMS Tamar, a Batch 2 River-class Offshore Patrol Vessel operated by the Royal Navy arrives in Diego Garcia on 15 February 2023.

Halifax did in the early 1990s. This will delay *Fraser* becoming operational, but at least subsequent destroyers will undergo reduced trials because of an established class baseline.

It seems likely that initially the frigates will be paid-off on a one-for-one basis as the destroyers join the fleet but, unless production of the new ships is considerably hastened, most if not all of the *Halifax*-class will be paid-off by 2036 – when the newest of the frigates will have been in service for 40 years. Optimistically there will be at most four destroyers available by then (the initial three plus perhaps the first of the second batch), so a considerable capability gap is likely for many years. What could be done to fill this gap?

The Gap

Arctic and Offshore Patrol Ships (AOPS) could be pressed into service from time to time for specific overseas deployments to fill the low-end of the capability gap. The Danish Navy has deployed HDMS *Thetis*, an ice-strengthened patrol ship with speed and armament capability greater than that of AOPS, to missions such as anti-piracy patrols in the Red Sea and off the coast of Ethiopia and Somalia. Could an AOPS do this? The threat is minimal and the ship's fitted 25-mm gun and added .50 calibre machine guns should be adequate for self-defence against pirates. The AOPS would need to embark additional personnel for boarding parties, self-defence and communications. It is likely that additional communications equipment would be needed to provide interoperability with other ships and aircraft in the mission area. Could AOPS operate for extended periods in tropical waters. Could they embark helicopters or uncrewed aerial vessels (UAVs) that would improve their ability to perform this role and help make up for critical shortfalls, such as limited speed: only 17 knots?

Perhaps several offshore patrol vessels (OPV) could be leased for a period? The Royal Navy (RN) has leased capable offshore patrol ships for fisheries patrols in home waters and Falklands guardship duties. The United Kingdom has recently built several very capable OPVs,

improved versions of those leased for fisheries patrol, such as HMS *Tamar*, with a maximum speed of 25 knots and demonstrated ability to perform many general purpose roles. However, these ships cannot operate in a moderate or high threat environment, such as that envisioned for the *River*-class destroyer. They are not equipped with the sensors and weapons, nor the ship's companies, needed to survive higher intensity situations.

What about purchasing existing frigates or destroyers from another country or shipyard? This might be possible, but with increasing world tensions, it is likely that countries will want to increase the size of their navies, rather than reduce them as, for example, the Royal Navy did when it sold frigates to the Chilean Navy in the past decade. Sometimes governments may wish to cancel orders, and that could present an opportunity if the ships are suitable. Another thought is to order Type 31 frigates from the British shipyard currently building them for the RN, and soon for several foreign navies. If Canadian shipbuilding capacity permitted, this design could be built here but we are already at full capacity. Could Irving's Halifax Shipyard improve its capacity to build *River*-class destroyers by increasing its workforce?

Conclusion

Horatio Nelson wrote “[w]ere I to die at this moment, ‘want of frigates’ would be stamped on my heart.” In my opinion, Canada has dropped the ball on renewing its navy – again. Because shipbuilding programs are expensive, replacing existing fleets seems to take forever. Meanwhile, our ships age and require more maintenance to be effective, etc., etc. The size of our surface combatant force will be only four or five ships in another 10 years: a few new destroyers and several 40-year-old frigates. For a country with the world's longest coastline, this is simply unacceptable! We must do something to improve this situation. 🇺🇰

Notes

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Book Reviews

One Hundred Days: The Memoirs of the Falklands Battle Group Commander, by Admiral Sandy Woodward, originally published by New York: HarperCollins Publishers, 1992, 511 pages, ISBN 978-0-007-21867-7

Reviewed by Dylan Nigh

Few works successfully combine an overview of a major military operation with the personal insights of the central leaders tasked with undertaking it. One such book is *One Hundred Days: The Memoirs of the Falklands Battle Group Commander* by Royal Navy (RN) Admiral Sandy Woodward. Amongst a large pack of equally notable companions, *One Hundred Days* stands apart due to Woodward's ability to bridge the tactical with the strategic. The book broadly covers the author's career in the RN and the entirety of the Falklands War in 1982.

Woodward begins with a fast-paced recounting of the sinking of HMS *Sheffield* during some of the most intense fighting of the Falklands War. Following this quick snapshot, the reader is brought back to 1946 when the author began his time at the Royal Navy College, Dartmouth. Woodward humorously recounts his uneventful time as a student before covering his passing out in 1949, his two cruises as a cadet-under-training, and his appointment to midshipmen. We hear about assignments to ships of various natures that intertwine with promotions. This leads to his graduation from the Junior Officers War Course and his being volunteered for submarine duty; a career change that would affect the next 32 years.

By Chapter 3, a career as a submariner has led to the author's time as a Captain and his eventual promotion to Rear Admiral. After years of working within the Ministry of Defense (MOD), he is conducting exercises off Gibraltar just as Argentina attacks the Falklands. Being the closest Flag Officer to the conflict, he is quickly appointed Battle Group Commander and sent off to Ascension Island to prepare for the operation to come. Thus begins the author's recounting of the 100 days he viewed as the culmination of his entire career within the RN.

The war starts, as many do, with a general state of confusion as Woodward works to quell infighting among commanders and solidify the plan for the way forward. After preparations at Ascension and a quick battle with a pod of whales, the force progresses to the Total Exclusion Zone (TEZ) established by the British government around the Falklands. Finally, the war begins in earnest with the bombing of the Port Stanley Airfield by a Vulcan aircraft taking off from Ascension Island, 7,860 miles away. This initial strike marks the start of the battle group's ultimate strategy of convincing the 'Arg's' that a direct invasion of Port Stanley was eminent.

The actual plan involved much subtlety, with the use of diversionary movements taking place alongside the insertion of SAS reconnaissance teams. Forces managed to sink the ship *General Belgrano*, Argentina's lone cruiser, as it entered the General Warning Area established prior to the conflict. While the group was quickly establishing major gains, Woodward does not shy away from covering the major losses. For every *Belgrano*, there is an HMS *Sheffield*, and then some. The vast majority of such losses stem from the Argentinians' use of French Exocet missiles. These picked off ships in picket formation, during beach landings, and even in the heart of the battle group.

With the clock ticking toward mid-June, when the battle group would no longer be functional, losses continued to rack up on both sides. Woodward planned proactively when he could, reacted quickly when he had to, and lost countless hours of sleep along the way. He struggled with the loss of men and the weight of command. Eventually, the aerial and naval battle is won through attrition and cunning, and the landing force of Royal Marine Commandos, Paras and Special Forces are placed without the enemy's knowledge.

From this moment on, Woodward must sit back, provide support when needed, and trust the men of 3 Commando Brigade and 2 and 3 Paras. With the combined efforts of the battle group and their companions on foot, the Argentinian Commander, General Mario Menendez, surrendered the islands. The enemy were rounded up into a makeshift prisoner of war camp, terms of surrender were negotiated, and the author even managed to have an interesting run-in with an SAS team on the ride back to his flagship. Following a quick clean up, the battle group headed back to the UK, where Admiral Woodward reunited with his family and faced his greatest challenge yet, the British press.

The entirety of the story is written from Woodward's perspective and features drawings and excerpts from his personal diary throughout. This style manages to bring a sense of humanity to the otherwise sterile subject of military strategy and command. While his view is far from universal, he does incorporate the opinions and knowledge of others who have written about the conflict. Overall, he comes across as even-handed, informative and entertaining. While 'enthralled' is a stretch for a book that covers such a broad subject, Woodward manages to infuse just the right amount of detail into the work, and sneaks in more than enough laughs to surprise the reader. This book is perfect for those interested in a broad and approachable look at the Falklands War. Woodward's account of the conflict is digestible, well-paced and offers a perspective of the proverbial 'man at the top.' 🇺🇰

In the Treacle Mine: The Life of a Marine Engineer, by J.W. Richardson, Dunbeath, UK: Whittles, 2021, 224 pages, ISBN 978-1-84995-488-4

Reviewed by Brian Bertosa

With the possible exception of some liquified natural gas carriers in the Far East, there cannot be many, if any, merchant vessels now still propelled by steam. (Certain naval vessels, particularly nuclear ones, in the employ of countries other than our own are, of course, another matter.) With respect to the licencing of marine engineers today, there can therefore be precious few of them working towards their ‘steam ticket,’ i.e., the steamship certificate of competency.

One person who could undoubtedly function in that capacity, if he chose to do so, is J.W. Richardson, holder of a combined steam and motor first-class certificate of competency from the United Kingdom. As ship propulsion gradually transitioned from steam to diesel during the latter half of the 20th century so, too, did the training, certification and work experience of marine engineers. It is essentially this process that unfolds in Richardson’s detailed account of a working life spent (mostly) at sea. (His somewhat-puzzling title alludes to the similarity of bunker fuel and molasses.)

After completing an engineering cadetship, sponsored by Esso, at the now-defunct Poplar Technical College in London, the author joined his first ship in 1967 and ‘swallowed the anchor’ for the final time in 1993. During the period from the 1960s to the 1990s, he worked on steamships, including one with a reciprocating engine, and motor ships, both medium-speed and slow-speed. The types of vessels driven by this machinery included oil tankers, chemical tankers, container ships and all manner of cross-Channel ferries. In total, he worked on well over 30 different ships on voyages as near as the Thames estuary and as far as New Zealand.

The work is divided into 17 chapters, arranged chronologically. With the exception of a few digressions to explain technical points, including some on the navigation side, the work is essentially a long string of very well-written and engaging anecdotes. The early chapters are each devoted to one ship only, giving the author the scope both to bring out the sense of what it is like to be a novice in a strange environment and, not coincidentally, to explain to the reader at least the broad strokes of the machinery aboard that ship as he gradually gained familiarity with it. Given that these were his steam ships, this is doubly fortunate, since that technology is now largely gone. Later chapters deal with more than one ship but, according to the author, motor ships require less in the way of explanation; moreover, these are often closely similar to sister ships. Regardless of the type of ship, among the

happenings narrated here – there is much better than this, but I do not wish to steal the author’s thunder – are storms, scurvy (yes!), serious injury and even an engine-room parrot (an African Grey) that did not respond well to a generator crankshaft failure.

Although largely supplanted at sea by the diesel engine, on land, steam is still king, although it sometimes has to learn to ‘play nice’ and share the building with a gas turbine. Workers in those industries will find a great deal that they can relate to in this book, not the least of which, I’m sure, will be Appendix 1, “Eight Ways to Lose the Vacuum in the Main Condenser.” (For the terminologically challenged, there is a “Glossary and Abbreviations.”) Among those who sail for a living, who may have positively dreaded studying from a book with a title like *Reed’s Engineering Knowledge for Deck Officers*, will find in Richardson a much more congenial guide to the engine room and its people. But it is really the latter group, those experienced with ships’ machinery, for whom the author is writing, and given the dearth of previous accounts written by marine engineers, *In the Treacle Mine* fills a major gap in the literature by, and for, seagoing personnel. ⚓

Blazing Star, Setting Sun: The Guadalcanal-Solomons Campaign November 1942-March 1943, by Jeffrey R. Cox, New York: Osprey Publishing, 2020, Hardcover, 512 pages, photos/maps, ISBN 978-1-4728-4046-2

Reviewed by Chris Buckham

Blazing Star, Setting Sun is a well-written and thoroughly researched account of the Pacific War from the perspectives of the United States and Japan. The book provides a comprehensive analysis of the strategies, tactics and decisions made by both sides as well as their political, economic and cultural contexts. In this third book in his series on the Pacific War, Cox continues to impress. This book covers the five month brutal period of the battle for Guadalcanal and the Solomon Islands marking a sea change as the Allies began their push to victory and Japan its descent to defeat in the War of the Pacific.

A strength of the book is Cox’s ability to bring to life the individuals who played pivotal roles in the Pacific War. Cox weaves together the personal stories of key figures – such as Admiral Chester Nimitz, General Douglas MacArthur, Admiral Isoroku Yamamoto and Prime Minister Hideki Tojo – within the larger historical narrative. Through these personal stories, the reader gains a deeper understanding of the motivations, fears and aspirations that drove these leaders.

The book is also noteworthy for its balanced and nuanced portrayal of both the American and Japanese perspectives.

Cox does not shy away from describing the brutality of the war on both sides, nor does he hesitate to critique the mistakes and shortcomings of both the United States and Japan. In doing so, he offers a more complete and complex understanding of the Pacific War than other accounts.

One of the most interesting themes of the book is the role of intelligence in shaping the outcome of the war. Cox highlights the importance of both human intelligence (i.e., spies and informants) and signals intelligence (i.e., intercepted radio messages) in providing critical information that allowed both sides to gain advantages over their opponents. He also demonstrates how the ability to read and interpret intelligence was often the deciding factor in battles such as the Battle of Midway and the Guadalcanal campaign.

Perhaps the only weakness of the book is its focus on the military and political aspects of the war to the exclusion of other dimensions, such as the social and cultural impact of the conflict. While Cox touches on these issues, they are not given much attention. However, this is a minor criticism given the scope and depth of the book. Overall, *Blazing Star, Setting Sun* is an outstanding account of the Pacific War that will appeal to anyone interested in military history, international relations, or the human experience of war. Cox's prose is clear and engaging, and his analysis is insightful and thought-provoking. This book is a must-read for anyone seeking an understanding of the Pacific War and its lasting impact on the world. 🇺🇸

On Contested Shores: The Evolving Role of Amphibious Operations in the History of Warfare, edited by Timothy Heck and B.A. Friedman, Quantico, VA: Marine Corps University Press, 2020, 430 pages, ISBN 978-1-7320-0314-9 (paperback)

Reviewed by Muhammad Mustjaab

On Contested Shores explains the evolving role and challenges of amphibious warfare throughout the history of the US military, emphasizing its influence, current importance and future growth. The book presents a series of case studies of amphibious operations that have played a pivotal role in winning wars for the US military. While the book primarily focuses on operations of the US military, the broader themes and patterns of these case studies could be applicable to other militaries.

In Chapter 1, "The Marines have landed and have the situation well in hand," a quotation from war correspondent Richard Harding Davis sets the tone of the book underscoring how effective the US Marine Corps as the amphibious force has been with conducting landing operations. The case studies illustrate the multi-dimensional

challenges of amphibious warfare. For instance, the first case study is the landing at Collado Beach in 1847, an operation in which the Mexican military was forced to surrender during the Mexican-American War. This operation required extensive collaboration among the US Quartermaster, Army and Navy departments. Despite the geographical challenges and differences between the US Army and Navy, it was clear communication between officers, and a significant difference of resources between the US and Mexican military that played a pivotal role in the United States winning the war.

Resource availability is critical to any operation, but the need for unhindered logistics during amphibious operations is even more critical, as discussed in Chapter 4. During World War II, the United States leveraged a wealth of resources to establish reliable infrastructure and networks, enabling streamlined logistics whereas modern US amphibious logistics face significant setbacks including scarcity of resources at the war sites. The chapter suggests that solutions to these problems could be regenerative logistics, and modern-day high-tech equipment. These solutions integrate technological and social advancements, embedding sustainability and accounting for climate impacts in material development and supply chain processes.

Despite some interesting material, the book has limitations in its analysis of amphibious operations. Its research is meticulous but the book predominantly frames case studies through a narrow US military lens, which potentially constrains a truly global understanding of amphibious warfare. The volume's heavy reliance on World War II examples creates a temporal bias that obscures the evolving nature of modern amphibious strategies. Contemporary challenges such as advanced anti-ship missile technologies, urban littoral warfare, and asymmetric conflict environments receive little exploration. The book's analysis tends to prioritize traditional Marine Corps operational perspectives, overlooking emerging strategic doctrines from other global military institutions.

On Contested Shores, Volume 2, is rich with case studies and analyses about how intersectional and multi-dimensional amphibious operations are in the US military. Clear communication throughout the landing operation at Collado Beach helped the United States win the Mexican-American War, and the development of complex infrastructure networks made the United States a logistical leader during World War II. The book's narrow scope on the US military, however, limits its utility as comprehensive guidance on amphibious operations in general. 🇺🇸

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SCAN ME

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Boats from HMCS *Margaret Brooke* sail near King George Island during the ship's deployment to Antarctica in March 2025.

Credit: Corporal Connor Bennett, Canadian Armed Forces