



## Maintaining the Naval Fleet

Sustaining the fleet of the Royal Canadian Navy (RCN), as well as its status as a blue-water navy capable of deploying across oceans in service of Canadian objectives internationally, requires close attention to the maintenance of its vessels. When such global operations expose the RCN's fleet to temperature extremes, varying from the Arctic cold to the heat of the Caribbean, the equipment deployed for such operations is subject to considerable wear and tear. Even exposure to salt water and air while docked can impact a vessel's electrical and mechanical equipment, on top of the wear sustained during travel.

Consequently, a regimented and regular system of maintenance is essential for naval vessels to remain in adequate condition to deploy and fulfill their operational mandates. Since a vessel's capacity to successfully undertake a mission is contingent on both the training of its personnel and the readiness of its equipment, fleet maintenance is integral for ensuring this continual operational readiness. Adequately maintained equipment and machinery typically has a lower likelihood of failing during a deployment, and as such, the RCN ensures that the equipment and machinery aboard its vessels is completely operational prior to any departure or deployment. This maintenance is also imperative for crew safety, in its capacity to minimize the risk of machinery breaking and mitigate the possibility of flooding, fires, spills of hazardous materials, or the vessel sinking. Maintenance is furthermore critical for the sustainment of the RCN's fleets given Canada's proclivity to operate warships for extensive periods of service. From its hull to its weapons system, from its propulsion system to its navigation and communications technologies, all elements of a warship require regular maintenance and check-ups to ensure that the vessels can operate for the decades-long lifespans required of them. Of course, as vessels age, maintaining them becomes more complex and intensive – and expensive.

Maintenance activities fall under two categories. While corrective maintenance seeks to repair a component or element that has broken, preventive maintenance aims to ensure that those components or elements do not break in the first place. This preventive maintenance is a priority for the Navy, which engages in routine inspections and maintenance of all vessel equipment to ensure that no element fails and to prolong the vessel's lifespan as much as possible. The Navy may premise the frequency of these routine inspections and maintenance either on time (e.g., the number of hours a diesel generator has functioned) or the equipment's condition (e.g., the number of rounds that a gun has fired).

There are, moreover, three lines or levels of maintenance workers. At the forefront is the vessel's crew, which conducts minor repairs and routine service. Submarines and warships carry technicians in their crews to perform necessary repairs to keep equipment operational, using spare parts on the ship that are restocked at its home port prior to any exercise or mission.<sup>1</sup> The second maintenance line is the Fleet Maintenance Facility (FMF). With two located in Canada – FMF Cape Breton in Victoria and FMF Cape Scott in Halifax – the FMFs can conduct most repair and maintenance duties while vessels are alongside. They boast specialized shops (for instance,

propulsion, radar, sonar, electrical, communication, etc.) and trained workers to contend with more complex equipment and systems. Personnel at the facilities also have access to the Naval Supply System, a sizeable warehouse located in the dockyard that contains spares for all RCN-used equipment. The third and final line of maintenance is the Original Equipment Manufacturer (OEM). The RCN maintains maintenance contracts with the manufacturers of the complex equipment utilized in vessels, and thus this line of maintenance is reserved for issues and systems that neither the vessel's crew nor the FMFs are qualified to address.

Such maintenance duties can remove a vessel from service for lengthy periods of time, depending upon the scope and complexity of the maintenance being conducted. Time frames range from short work periods (SWP) of between one and three weeks, to long/extended work periods (EWP) of weeks to months, to an extended docking work period (EDWP), which can last for several years. Unless a mission-specific fitting is required or an urgent repair must be conducted, vessels undergo their work periods in turn. When a vessel enters its maintenance period depends in part on the location of the maintenance, since maintenance on a vessel must be prebooked and prescheduled to ensure the requisite parts and workshop are available. It also is contingent on the Operational Schedule of the Navy. For instance, the RCN demands that a minimum of eight of its 12 frigates can deploy at any given time, and thus maintenance schedules consider the need to ensure that adequate numbers of vessels are available for any commitment that could arise.

The RCN's 12 Halifax-class frigates provide an apt case study of these maintenance duties. Divided between the Atlantic and Pacific Coasts, these frigates are the RCN's backbone. They are also ageing. The first frigate of the class, HMCS *Halifax*, entered service in 1992 – over three decades ago. The other frigates entered service between 1992 and 1996, making even the youngest vessel just shy of 30 years old. Moreover, there are no plans for the frigates' immediate replacement: the Government of Canada announced in July 2019 its plan to keep the *Halifax* class in service until the early years of the 2040s through the investment of over \$7.5 billion, at which time the Canadian Surface Combatants are planned to enter into service.<sup>2</sup> This plan means a significantly extended lifespan for the *Halifax* class, as HMCS *Halifax* will be nearly five decades old in 2040. The need, then, for these frigates to remain operationally ready and effective for an approximate two decades to come means that docking maintenance work periods are crucial to maintaining the class's reliability and availability – and thus the RCN's capabilities – until it is replaced by the River-class destroyer, beginning in the early 2030s. To divide the requisite maintenance work between various shipyards, the Government of Canada has awarded contracts to Irving Shipbuilding, Seaspan Victoria Shipyards, and Chantier Davie, with work on the frigates having commenced in the early 2020s.

A similarly appropriate case study is the RCN's Victoria-class submarines. Purchased from the United Kingdom in 1998, and operational after several years of "Canadianization,"<sup>3</sup> the Government of Canada now aims for the four submarines of the Victoria-class to remain "operationally effective" into the mid-2030s.<sup>4</sup> As such, and given the complexity of the submarines and their operation in extreme environments, the Victoria-class submarines are subject to routine maintenance based on a rotating schedule.

The government's Victoria In-Service Support Contract, entered into with Canadian industry to maintain and support the class through 2023 (and potentially beyond, if the contract is extended),<sup>5</sup> provides for any requisite engineering services, overhaul and repair, material acquisition, and

organization of the maintenance and refit schedule.<sup>6</sup> Generally, then, the plan is to operate the submarines in a cycle, according to which each submarine is available for a six-year operational period and then undergoes a two-year period of extensive maintenance. Docking work periods are to be rotated between the submarines to ensure that, at any given point, the RCN has access to three completely operational submarines while the fourth undergoes maintenance. This plan has not always been successful. For instance, after a year of intense activity in 2018, which saw the submarines travelling across the Atlantic and to Asia for various taskings, all four submarines were in maintenance in 2019, and not one deployed to sea. Several of the Victoria-class were able to return to sea in 2020.

In general, the maintenance and readiness of a vessel's equipment is a key determinant of its capacity to be effective and efficient from an operational standpoint. Given the exorbitant expense of procuring naval vessels, governments are prone to attempting to expand their lifespan and keep vessels in service for as long as possible. While the effectiveness of this can be debated, in light of the escalating maintenance costs as vessels age and the possibility of equipment becoming obsolete, it is clear that sufficient maintenance of the RCN's vessels is crucial to ensuring their continuing capabilities and capacity to protect, defend, and serve Canada.

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## References

<sup>1</sup> There is the potential to adopt and utilize 3D printers in this front-line maintenance process. Research and testing are underway to explore the ability to use such printers to manufacture parts at sea, rather than having to store parts onboard or wait on parts shipments from a vessel's home port.

<sup>2</sup> Public Services and Procurement Canada, Press release, "Halifax-Class Frigates: Maintaining Canada's Federal Fleet of Combat Vessels," July 16, 2019, [www.canada.ca/en/public-services-procurement/news/2019/07/halifax-class-frigates-maintaining-canadas-federal-fleet-of-combat-vessels.html](http://www.canada.ca/en/public-services-procurement/news/2019/07/halifax-class-frigates-maintaining-canadas-federal-fleet-of-combat-vessels.html).

<sup>3</sup> Royal Canadian Navy, "Maintenance and Modernization," last modified May 3, 2019, <https://www.canada.ca/en/navy/corporate/fleet-units/submarines/victoria-class/maintenance-modernization.html>; Department of National Defence, "Victoria-Class Submarines," [www.canada.ca/en/department-national-defence/services/procurement/victoria-class-submarines.html](http://www.canada.ca/en/department-national-defence/services/procurement/victoria-class-submarines.html).

<sup>4</sup> Murray Brewster, "Canada's Submarine Fleet Spent 'Zero Days' at Sea Last Year: Government Documents," CBC News, February 11, 2020, <https://www.cbc.ca/news/politics/submarines-canada-fleet-repairs-canadian-navy-1.5458632>.

<sup>5</sup> DND, "Victoria-class Submarines."

<sup>6</sup> Government of Canada, Department of National Defence, "Backgrounder: Victoria In-Service Support Contract," July 4, 2013.