Naval Shipbuilding in Canada

Canada is currently undertaking the revitalization of its federal fleet. The decades-long project, involving the investment of billions of dollars, will see the renewal of the Royal Canadian Navy's (RCN) and Canadian Coast Guard's (CCG) aging fleets, modernizing their vessels and enhancing their ability to fulfill the multivarious roles and responsibilities required of them in an increasingly complex geopolitical and geostrategic climate. In doing so, the strategy will also see the continued revitalization and renewal of the Canadian shipbuilding industry, which had largely atrophied after years of no significant vessel construction contracts. Despite the progress that has been and that continues to be made under the NSS, criticism endures surrounding the seemingly ever-increasing costs of the construction projects, as well as the apparently recurring delays. However, a contextualization of these increasing costs and delays – and why they inevitably occur – is warranted, as they are issues that will confront most countries in their procurement processes.

Increases in the projected cost of a ship as its procurement process progresses often elicit ire from critics. However, they are also inescapable. A primary reason for such increases is that the initial figure that a government announces as the expense for a ship's procurement is always merely an estimate. Evaluating at such an early stage the overall cost of a ship is extraordinarily difficult, if not entirely unfeasible. According to naval engineer David Peer, "Initial cost estimates for a purpose-designed ship typically quote an error of ±40%, so the risk of under- or over-predicting cost with early estimates is significant."[1] Indeed, acquiring sufficient data to inform an accurate cost estimate is challenging. In Canada, not only is information from domestic production out of date, if not entirely unavailable, given that no major warships had been (at the time of the National Shipbuilding Procurement Strategy's inception in 2010) constructed in Canada for over two decades,[2] but acquiring information internationally can also be problematic. Some nations are not willing to share details of their procurement expenses, and even if they were willing, differences in the vessels as well as in the costs for materials, technology, and labour would all minimize the usefulness of such international comparisons in formulating an estimated cost in Canada. Nor is utilizing comparably sized commercial cargo vessels to estimate costs a feasible alternative. In contrast to naval ships with their large crews (the size of which may, of course, change as unmanned ship technologies advance), commercial vessels operate with small crews and with a focus on maximizing their cargo space. Naval ships, moreover, have significantly more complex communication, weapon, and propulsion systems than their commercial cargo counterparts. Warships are denser and heavier, too, given their need for greater "survivability."[3] As such, the initial expense a government cites for a procurement project is invariably an estimate, particularly given the difficulty in securing adequate data from comparable vessels to inform the estimate.

Also invariably, this cost changes and evolves over time. A more formal budget emerges as decisions are reached about the ship's construction and specifications, and this budget oftentimes encompasses more than simply the cost of constructing the ship itself. Instead, the budget will comprise, for instance, long-term service and/or maintenance contracts for the vessel, which often entail sizeable expenses. Moreover, various factors utilized to develop the initial estimate will shift

over time. Steel prices, interest rates, and foreign exchange rates (which impact components sourced internationally) will all fluctuate and vary. As such, the price of a particular element will be heavily influenced by the time at which it is purchased, variances that are impossible to predict at the time of the initial cost estimate.

Given that the design and construction of a naval ship is an inherently complex process involving a variety of naval technicians, engineers, and designers from numerous manufacturers, acquiring quotes from each individual company for each individual planned component would be too extensive and arduous a process to be feasible. As such, the initial estimated design cost of a vessel is often derived from the weight of the projected vessel. In the absence of exact details about the specific characteristics and capabilities of the vessel being procured, the size of the vessel can often be compared to pre-existing ships for this initial design costing. As Peer indicates, "Historical information from a known design and cost data for selected major systems and equipment can provide first approximations of ship cost for a series of concept designs that meet the capability requirement."[4] Of course, this system is not without its faults. Oftentimes, the hull, the component on which this method is based, is not the costliest component of a ship. For instance, in the United Kingdom, "systems represent the biggest percentage of the price of a warship – 70% compared to 30% for the hull."[5] Though these percentages may vary between countries, the general trend is the same. It is the technology *inside* the vessel that bears the most significant impact on its price. Unfortunately, a government does not and cannot necessarily be aware in the beginning phases of a procurement project, when it develops its cost estimate, what specific technology will be incorporated. Decisions as to the particular capabilities of a vessel are only made following discussions with the Coast Guard and/or Navy. Moreover, because vessels in the CCG and RCN are intended to have decades-long lifespans, often being used for up to 40 years, there is a tendency to equip them with the most modern technology available at the time of construction, which often delays those decisions. Consequently, many of the components that most influence the cost of a vessel's procurement are determined and finalized as the procurement process proceeds, leading to a necessarily evolving cost estimate and inherent vagueness in the initial estimates.

The location of a vessel's construction is a further consideration that significantly impacts the cost of its procurement. A ship can either be purchased "off the shelf" (for instance, purchasing an existing ship) or constructed in Canada. For a domestically produced ship, a design would necessarily be sourced from industry either within or outside of Canada, since the RCN's design offices have long been closed and the Canadian government therefore no longer possesses the ability to design vessels. For some people, efficiencies of scale and labour costs make procuring a vessel internationally an attractive prospect, with the argument being that Canada could secure vessels more expediently and inexpensively if they were constructed or purchased from elsewhere. While this debate often resurfaces, many others perceive it as a false debate.[6] It is a fact that the vast majority of states with mature navies construct their own naval ships and possess a strategic alliance of some sort with domestic shipbuilders. Therefore, the United Kingdom secures its vessels domestically from BAE, Germany from B&V, and France from The Naval Group/DCNs. Even in the United States, where shipyards are private, certain shipyards specialize in particular types of vessels. Most of Canada's allies are of the stance that protecting their long-term national security interests requires possessing the ability to construct, repair, upgrade, and sustain their own naval vessels. Due to these sovereignty considerations – as well as the desire to create jobs and promote industries within their own borders – the national shipbuilding industries in these states

have no competition for contracts for coast guard and naval acquisitions. Such considerations strongly deter a state like Canada from purchasing a naval ship "off the shelf."

Costs also typically increase throughout the vessel's construction as delays are encountered. Expenses increase in tandem with rising labour costs and the prices of raw materials. Fluctuations in inflation – which is generally higher for the defence industry than the broader population – also impact the initial budget.[7] Indeed, thanks to inflation, the value of the budget initially allotted to the project deteriorates as the vessel gradually takes shape, with Peer summarizing that although "[t]he time value of money is often ignored in the discussion," a product budget "buys less" with each year it "sits unused."[8] Such delays in procurement, then, combine with the gradual selection of specific ship components, delineation of long-term service/maintenance contracts, and changes in raw material, interest, inflation, labour, and foreign exchange rates to produce procurement budgets that inevitably evolve and increase as the vessel moves closer to completion.

However, such delays are often unavoidable. Overall, the procurement of a vessel in Canada is a lengthy and time-consuming process. The process begins with the government's recognition of a capability gap or that a vessel is either at or near the end of its useful life. The government then decides the capabilities it desires in the new vessel, issues a request for proposals for the vessel's design, cautiously examines and assesses the resulting bids, and negotiates with the selected shipyard to confirm the details of the procurement. The design itself can move through several phases, including a design study, feasibility study, preliminary design, and contract design, before a detailed design is finalized. Only then can the actual construction activities commence.[9] Therefore, acquiring a vessel is not an immediate or expeditious process. As Peer explains, "the time it takes to buy a warship must include all design activities as well as construction. If you had to wait for your car to be designed and then built, car buying would also be a long process."[10] However, that this process is such an extended ordeal is not necessarily negative or undesirable, given the exorbitant sums of taxpayers' money involved and the government's desire to minimize, as much as feasible, any opportunity for lawsuits or disputes emerging from unsuccessful bids. The price of this caution is, of course, a slower process of procurement.

The National Shipbuilding Strategy, formerly known as the National Shipbuilding Procurement Strategy, intends to not only revitalize the fleets of the RCN and CCG but also rejuvenate and reinvigorate the Canadian shipbuilding industry. Historically, the industry has waxed and waned in a boom-and-bust cycle: the government would order a vessel, the shipyards would be engaged temporarily in the production of that vessel, and, following its completion, the shipyards would lose capability and workers in the years and sometimes decades before another ship was ordered. A core objective, then, of the NSPS/NSS was to shift the domestic shipbuilding industry away from this cycle by developing a project that would ensure the continual construction of ships over a prolonged period of time. At the strategy's commencement, then, there was necessarily some delay while the contracted Canadian shipbuilders modernized and equipped their facilities in preparation for their awarded construction projects. A similar complication arose from the personnel requirements to undertake the construction work. Since Canada had not seen a major naval shipbuilding project for two decades, there were few people with experience or expertise in the management of a project of such scale. Hiring and training personnel at the shipyards – and cultivating experience in the workforce – both required time. This, too, was a source of concern and initial delay.

The procurement of a warship is furthermore a lengthy process due to the complexity of the vessel itself. The design considerations are numerous and multifaceted. A warship is a vessel that, in addition to floating, must be capable of moving and fighting. As such, designing and constructing such a vessel demands careful attention to such features as the hull's security and strength, the structural stability and balance required to float, the propulsion system needed for movement, and the vast array of weapon systems, communication systems, and sensors integral for fighting.

Moreover, crewing the vessel comfortably and safely offers another element demanding meticulous consideration. In Canada, too, there is the further challenge of ensuring that a vessel is adequately "Canadianized," or that it addresses the various specific elements required for operations in the Canadian clime and under Canadian legislative and demographic realities. For instance, Canada has particular power supply settings and standards, stringent rules about the security of weapons aboard ships, and requirements for both air conditioning and heating in vessels (a consideration inevitably not shared by navies based in more temperate climes). Further rules govern the space provided for crew members, and policies exist regarding the accommodation of women aboard ships. Canadian vessels must be able to operate in a sometimes unforgiving and cold climate. They must also be equipped to contend with ice in the water, as well as the ice that may form on a vessel in cold weather. Canada moreover has specific rules dictating the handling of waste water. All these elements – as well as numerous others – are considerations that must be acknowledged and accommodated when designing, constructing, or adopting a vessel for use by the RCN or CCG. Ensuring a design's compliance with and incorporation of all requisite elements inevitably lengthens the procurement process. Such rules, regulations, and requirements applying to Canadian ships may differ from those of other states, making simply purchasing a naval vessel "off the shelf" a more complicated – and perhaps less feasible – option than perhaps expected.

Thus, shipbuilding is a protracted and complex process, for which the initial cost estimated is typically far surpassed by the actual cost of procurement. Both facts are unavoidable. The initial cost estimate increases as the specifics of the vessel are determined, maintenance and service contracts are reached, and delays are experienced. Fluctuations in raw material prices, labour costs, and interest, foreign exchange, and inflation rates all compel further adjustments to the procurement costs. The process of acquiring a vessel, between the announcement of its construction and its entry into operations, is lengthy, too, given the intricacies of the ships being constructed and their need to incorporate and satisfy a variety of Canadian regulations and standards. There was also the need, in Canada's case, to modernize the shipbuilding facilities and secure an adequately trained workforce before construction projects under the NSPS/NSS could commence. However, it warrants mention that increasing costs and delays in procurement are not an exclusively Canadian phenomenon but rather are experienced in many countries undergoing procurement processes. Furthermore, while the procurement process in Canada inevitably encountered growing pains in the first decade of the NSPS/NSS, the continuance of construction under the strategy will mean that personnel will continue to develop experience, shipyards will continue to improve their effectiveness and efficiency, and the government will continue to improve its cost estimations.[11] This mounting experience for all actors involved in the NSS should lead to less acute cost increases and shorter procurement timeframes, although constructing naval vessels will remain a tedious, drawn-out, and expensive process.

References

[1] David Peer, "Estimating the Cost of Naval Ships," *Canadian Naval Review* (*CNR*) 8, no. 2 (Summer 2012): 5.
[2] This does not include the eight *Orca*-class patrol vessels constructed (both on time and on budget) for the RCN between 2005 and 2008, nor the 12 *Kingston*-class Maritime Coastal Defence Vessels constructed in the 1990s. See David Peer, "The Orca Project: A Procurement Success," *CNR* 9, no. 2 (Summer 2013): 29-31.
[3] Timothy Choi, "The Costs of 21st Century Shipbuilding: Lessons for Canada from the Littoral Combat Ship Program," *CNR* 8, no. 4 (2013): 27.
[4] Peer, "Estimating the Costs of Naval Ships," 5.
[5] Choi, "The Costs of 21st Century Shipbuilding," 25. Choi notes that the expenses for a commercial ship are reversed, with the hull accounting for 80% of a vessel's cost, while the systems represent 20%.
[6] See, for example, Eric Lerhe, "Fleet-Replacement and the 'Build at Home' Premium: Is It Too Expensive to Build Warships in Canada?" Vimy Paper #32, Conference of Defence Associations Institute (CDAI), July 2016.
[7] See Mark V. Arena, Irving Blickstein, Obaid Younossi, and Clifford A. Grammich, "Why Has the Cost of Navy Ships Risen?" RAND Monograph 484 (Santa Fe, California: RAND Corporation, 2006).
[8] Peer, "Estimating the Costs of Naval Ships," 7.
[9] David Peer, "Realistic Timeframes for Designing and Building Ships," *CNR* 9, no. 1 (Spring 2013): 5.
[10] *Ibid*., 5.
[11] The first vessel of each class typically takes the longest time to build and costs the most per unit. For an exploration of this, see Howard Moyst and Biman Das, "Factors Affecting Ship Design and Construction Lead Time and Cost," *Journal of Ship Production*, Vol. 21, No. 3 (2005): 186-194.