CANADIAN GLOBAL AFFAIRS INSTITUTE
INSTITUT CANADIEN DES AFFAIRES MONDIALES

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POLICY UPDATE

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The National Shipbuilding Strategy (NSS) is consistent with the "Build in Canada" shipbuilding policy, which when fully implemented will deliver ships for the Royal Canadian Navy and the Canadian Coast Guard, employing two shipyards competitively selected in 2011.

Some suggest other nations have done things that would have resulted in better value for money than is observed with the NSS in implementation. It's also suggested that Canada's approach to shipbuilding with the NSS is unusual.[1] In fact, many NATO nations long ago rationalized their shipbuilding activity to one or two shipyards focused on delivering types of ships for their navies, and routinely as prime contractor, just as Canada is now doing. These shipyards have preferred to use major equipment suppliers they have worked with for decades for various reasons, rather than selecting equipment suppliers for a given project through open competition. The NSS is unique in that it is new for Canada and only now evolving – our allies achieved the equivalent of the NSS model some time ago.

Undeniably, the NSS is not perfect. In terms of the launch, which was done by any standard in record time (three-and-a-half years from conception to birth), hindsight indicates that some things could have been done differently with potentially better results. The early execution was also a learning experience. For example, the parties struggled to adopt practices appropriate to a 30-year program of work rather than a series of discrete shipbuilding projects. But as with every truly complex endeavour of such proportions, NSS has many challenges. The following discussion will examine broad subjects which shape the naval shipbuilding decision-space in all seafaring nations.

Oversight

From the earliest days of 2010 as the competition was launched to select two shipyards, a multi-tiered governance structure was in place to oversee the work. The overseers were drawn from all stakeholder departments and central agencies, at the directors-general, assistant deputy minister and deputy minister levels. This internal governance hired many companies to independently review various aspects of the execution. More recently, an independent advisor was brought onboard to provide input to the senior decision-makers – Rear Admiral Steve Brunton, retired from the Royal Navy (who incidentally recused himself from the CSC selection activity over a potential perception of conflict of interest with his previous U.K. work with BAE). Ministers have also had varying levels of oversight in various committees.

Every nation building naval ships has had similar oversight mechanisms. But many of our allies have periodically become concerned with performance, to the point of calling in external experts

[1] http://byers.typepad.com/files/byers-shipbuilding-report-embargoed.pdf

to look end-to-end at warship procurement practices. And while NSS has benefited from many third-party engagements, they have typically been narrow in scope.

Good governance is always a challenge. Too much and you lose agility, with burdensome reporting. Frequent changes in those governing mean that both continuity and expertise suffer. Add attributes such as competence/insight into the business at hand, availability of time invested, behaviours and transparency, and one understands why creating and sustaining good governance is a perpetual challenge everywhere.

Every one of these oversight challenges was present at times in NSS. But in large measure, decisions taken have routinely been informed by those at lower levels who have the experience to do an effective option analysis and/or have access to external parties that do.

The one exception where experience was lacking in government and with third parties was the launch of the original National Shipbuilding Procurement Strategy (NSPS, now known as the NSS). None of our allies had applicable experience in modern times when NSPS was being conceived, but all of our allies had and still have indigenous naval shipbuilding capability. The objective was never in question – the outcome of NSS as long-term strategic relationships between one or more shipyards and their governments is substantially the international norm. Thus, while not perfect, the governance has generally delivered.

Cost Estimation

Those in Canada well schooled in this area point out that there are two issues at play: the ability to estimate costs, and the communication of cost estimates to the public.

The Cost Estimate – Many primers and standard methodologies are in use to generate cost estimates today. The International Cost Estimation and Analysis Association is one useful source of such information and accreditation. Suffice to say that one starts out with many assumption-based unknowns such that early cost estimates can be expected, with a selected confidence factor, to fall somewhere in a range. As work is done and decisions taken, the level of uncertainty is reduced so that there is convergence on a more realistic cost estimate.

It should be no surprise then that estimating costs to set budgets for complex projects is no easy task anywhere. Our allies have not perfected this either, as is evident from the media if one scans naval shipbuilding articles. Budget overruns of 10 per cent have been common (and in the hundreds of millions of dollars), with some well north of 20 per cent, and delays are also the norm.

There are many reasons for this. It starts with changing requirements – an emerging offensive threat not foreseen (something more common since the Berlin Wall came down) or an in-service fleet calamity leading to the loss of sailors' lives. Regarding inflation, our allies track tailored indices for different types of ships over decades. But in the uncertain, ambiguous and interconnected global marketplace of modern times, volatility can play a huge role, as happened with the JSS first procurement activity that was terminated in 2008. As well, every budget is based

on a schedule, which is based on a plethora of informed assumptions over more than a decade as a minimum. Only in a scenario where ships will be identical to those coming off an existing "hot" production line will the schedule be relatively reliable.

In the case of all the naval shipbuilding projects in train under NSS, every budget was set prior to the conception of NSS – the NSS essentially delaying all shipbuilding projects by at least 3.5 years but more realistically by five to six years. As well, the procurement strategies changed, with the introduction of pre-selected shipbuilders under NSS. The additional time required to launch NSS enabled emerging threats to affect requirements. Inflation allowances were also impacted. But perhaps the largest contributor to the weaknesses in initial budgets was the deterioration of the capability to generate high-end cost estimates for defence platforms. This was a capability that was somewhat sacrificed in the 1990s as part of the 23 per cent reductions in all government departments to address the national institutional deficit created in the 1970s and 1980s. Fortunately, the Department of National Defence has reestablished this skill set and now has an enhanced cost-estimating capability.

Communication of the Cost Estimate – No organization starts an expensive project based on the proverbial blank cheque. In democracies, there is an added responsibility to communicate with the public. And as many international experts have determined, the first number communicated on an expensive defence project is the one that everyone remembers and measures the government's performance against.

It is not surprising that governments struggle with what to communicate at the launch of any complex procurement, especially a shipbuilding project. One can understand the tendency to shy away from ranges because of the perception that they do not know and are gambling with taxpayers' money ("It will cost between x and 3x"). As a result, a single number is preferable, but at what confidence factor? The 100 per cent confidence factor could be 4x-5x, but is a worst-case estimate that risks the very launch of the project due to sticker shock. So do they choose the 50 per cent or 80 per cent confidence estimate? In many instances due to competing priorities, decision-makers cannot invest the time required to truly understand the complicated set of nuanced options offered.

There is also the question of what to include, and nations differ. Does one include all personnel costs or just the cost of the incremental human resources? What about ammunition (missiles are not cheap) and how much is required up front? Should the forecast of the through-life cost be provided, and based on what assumption set (inflation, period of service, usage/maintenance profile) for an asset not yet even designed? In some cases the announced cost estimate is for the ships alone, which could be only 50 per cent of the all-up cost if all cost contributors are included as is the practice in Canada.

In Summary - All budgets are based on a myriad of assumptions that are typically time-sensitive. Hence, announcing any cost estimate is politically risky, that risk significantly influenced by the importance of defence to the citizens – if you live in daily fear of attack by enemies, the cost of insurance does not matter as much. And the viability of any cost estimate is directly proportional

to the timely execution to the assumed schedule. Staying on schedule is a critical factor in mitigating a degree of the risk. Schedule is worthy of a separate discussion because, in the execution of complex projects, schedule is king.

Procurement Strategies

The strategy to be used to execute the procurement is indeed critical to every weapon system platform acquired. One can buy something (something already designed that is in-service) and decide to either modify it or not. One can decide to design-and-build to a set of requirements. The government can be the integrator and responsible prime or lead on the activity; alternatively a private sector company can do this for the government as prime contractor. One can direct the implementation contract(s), or compete some or all of them. And in every case, one must decide what procurement strategy to employ to provide decades of in-service support after delivery.

Figure 1: Canada's new interim AOR ship for the Royal Canadian Navy, the MS Asterix. *The* Asterix *is a former commercial container ship, purchased by Federal Fleet Services in 2015, and converted into a supply ship for the Royal Canadian Navy by Davie Shipbuilding as part of Project Resolve. (DefPost)*

In the case of an existing or imminent capability shortfall, ships are often taken up from the merchant fleet or from another nation and modified to satisfy essential needs. This was done recently to address Canada's seagoing tanker deficiency with the Interim Auxiliary Oiler Replenishment project. However, such approaches are typically interim measures as they do not truly address the client's full set of requirements in a sustainable way. Canada also did this in the latter part of the last century to commission HMCS Cormorant as a deep diving ship, which delivered about 20 years of service. The Australians obtained HMAS Sirius in a similar manner as

an interim capability. But such an approach is unlikely to endure for three decades, due to such things as the cost to maintain converted ships that were not built for purpose.

The requirements are obviously an important input to selection of the procurement strategy – are we buying something not available on the market (a development approach), something off-the-shelf or a modified product? As with many other nations in this century, Canada is likely to shy away from buying ships that require the expense and risk of bleeding-edge technology development. Also typically, warships cannot be purchased as is from another nation, without modification – what is pejoratively referred to as "Canadianization" in Canada. But it is essential for so many reasons. Our fleet make-up of vessel types and our suite of missions are different from those of other nations, so what we need to do in any naval vessel will be more in one area or less in another than others need to do. Our environmental laws are different. Our pilots fly off ships a certain way to meet the Royal Canadian Air Force's flight safety standards. We fight our ships differently – and historically very successfully. Our crews have a culture and way of doing business that is not identical to others. Moving away from Canadianization to the actual supplier, we typically see more requirements for change. Unless the ship supplier is merely adding your new ships to an existing hot production line, they can rarely source the same major equipment sets that were in the original design – new models are available which offer greater capability and less obsolescence concerns and/or original company suppliers have gone out of business or merged with other companies and their product lines. Hence Canada's requirements – as with most navies – drive a procurement strategy that is designed to deliver a modified military off-the-shelf ship.

There is often a desire to do a single big bang through competition for a design-and-build contract. This gives a prime great financial certainty once the contract is awarded, typically with all the responsibility. However, there are significant levels of risk involved in expecting a private sector contractor to commit to a price to deliver constructed ships at some time years down the road, which satisfy the client's set of requirements in a design that is not yet defined. This approach unavoidably introduces large contract risk premiums to assure the supplier of his desired profit. The alternative approach is design-then-build, whereby the commitment of funds is more controlled and the risks generally are lower. However, this approach does mean that the government may choose to or have to change agents when it is time to build. This means less certainty of revenue for the shipbuilder or consortia, with potential financial implications – though the intellectual property challenges alone in switching to an alternate builder and the inevitable delay in program delivery render such a change unlikely. In consultation with the NSS shipyards, Canada chose to employ the design-then-build plan, primarily as a risk treatment measure for all parties. And for Canada, it enabled better control of the commitment of funds to new shipyards that had yet to demonstrate the levels of functionality required.

In defence contracting, the selection of a prime is preferred to be from the capable (agile, knowledgeable and experienced) private sector, and it is usually left to the private sector to self-organize in this regard. For this reason, NSS was silent on who would be prime. However, when you are building high-end combatant warships, the shipbuilding time will typically be many orders of magnitude greater than the design period, so shipbuilders are very often selected as prime contractors. This avoids the overhead of a non-shipbuilding company over the many years

of a project focused on ship construction of a finalized design. It can also be risky to change prime contractors between the design and build stages in terms of accountability for performance, as both sides could blame the other for any shortfalls. Very typically, shipbuilders enter shipbuilding competitions as the prime contractor. Thus, there was an expectation for NSPS that, for most shipbuilding projects, the NSPS shipyards would be the prime contractors. Given that NSS set out to create longstanding strategic relationships with the shipyards, their selection as prime would also ensure ongoing co-operation between Canada and the prime who would be performing the key project integration tasks. As well, the integration tasks would be done in Canada to develop and enhance this critical set of skill sets, and hopefully be conducted in time largely by Canadian citizens.

Only CSC was specified under the NSPS competition to have a downstream decision on who would be the prime. This is because most shipyards construct non-naval marine platforms comprised of the hull structure, propulsion equipment and hotel services (e.g., heating/ventilation/AC, galley, accommodation). This is substantially the case for AOPS, JSS and the CCG ships. But the prime purpose of CSC is the exceptionally complex and unique weapons, sensors, high-end communications equipment and integrating combat management system to be carried by the marine platform. Therefore, Canada specifically reserved the right to designate the CSC project prime contractor to ensure that the decision was intentionally made after careful analysis for this fleet of unique NSS combatant warships.

In terms of in-service technical support, it is obviously important to have it in place when navies accept the first ship in a new class into service. Therefore, one must develop a strategy to achieve this very early on, preferably concurrent with the procurement strategy development to acquire ships. This is important because it is in acquisition of the artifact where such things as the approach to spares ownership, maintenance, intellectual property and the like are enabled. Having it in place well before the ships arrive is prudent, so long as companies are not paid for services not needed. In the case of the Arctic Offshore Patrol Ships and the Joint Support Ships In-Service Support contract (AJISS), the contract could be designed such that there would be no significant incremental cost for JSS before the first new tanker enters service, even if dramatically delayed. This is because the contract will be focused first on the AOPS, the third ship of the class now in construction.

Contracting

The nuances in contracting are legendary. And I beg forgiveness from my many contracting colleagues for the over-simplifications that follow.

Competition has always been favoured to achieve good value for money. This is especially so in Canada – occasional comparisons by Canadian officials with the contract choices of select allies have indicated that Canada awards significantly fewer sole source defence contracts by most metrics.

Competition is based on a request for proposal (RFP) with an evaluation system which is tailored to determine which proposal will deliver value where it is considered most important (e.g., technical, industrial benefits, price). Getting the RFP just right is no small feat. Under the Defence Procurement Strategy, Canada's procurement organization must engage all interested bidders before drafting a contract. While this is a critical step, the bidders are understandably biased to provide advice that favours their own cause over their competitors – so while valuable, it must be scrutinized with great wisdom and business acumen. One cannot ask for too much in the RFP (the budget will be at risk) or too little (over decades, sailors' lives could be at stake). Therefore, the procurement team must find the right balance by working with the naval client (who quite rightly wants it all to safeguard Canada's sons and daughters in uniform) and the suppliers (who offer what they have and often little more). One must insist on seeing evidence which confirms that what is in each proposal is credible. One must worry about thousands of details. One must address the unique requirements of multiple ministerial mandates. And even once released, some bidders decry the RFP and gesture towards litigation. It should not then be surprising that many RFPs require rewrite and amendment or reissue. All of this takes time, and the ability of anyone to forecast how long it will take for this step is questionable.

To win, some companies will resort to over-promising for a low price to win the contract. In such cases, any contract put in place will be challenged from day one, as the client attempts to enforce the agreed trading deal and the supplier works to exploit loopholes and government behaviours and to subsequently reopen the contract to cover their costs and increase profits. Such a scenario almost invariably leads to sour relationships and disappointment on all sides. There are two related truisms. One, you get what you pay for. And point number two relating to competition – quality is more likely to be delivered when companies work with a partner with whom they have a solid relationship based on past successful delivery of products, albeit at a higher price. (It should be noted that the latter of these two is not a practice embraced universally in public sector procurement). All this is to say, competition is no panacea, especially when the RFP Evaluation plan significantly values lowest price-compliant.

Where there is little complexity (meaning little uncertainty so minimal risk for all), fixed- price contracts are indeed appropriate. Treasuries and the public love the certainty – the price will never change, no matter how high it may be. Regrettably, this is not the case when being asked to design complex naval vessels or significantly modify an existing design. Nor is it the case when building a first ship of class in any shipyard, let alone an NSS shipyard (new facilities, new equipment, new processes and new workforce). A classic example of this fact has been the traditional naval shipbuilding practice in the U.S. to do ship design and low rate production at cost-plus. The batching approach to complex warships is another example used widely where fixed-price contracts are considered once the first batch of ships has been constructed and ship construction has been de-risked. It is true that you can employ fixed-price contracts in such uncertain scenarios, but they include significant risk premiums – this being a key factor to the termination of the first JSS procurement process due to affordability. But once the first batch of three or more ships have been built by the shipbuilder and both parties understand the real costs and profit margins, a fixed-price contract for follow-on ships is often appropriate. (As one

overlaps ships on the yard's production line, it is not effective to just build one before moving to a fixed-price deal, for many reasons).

It should be noted that, for NSS, this is not prudent with so few ships of class for most shipbuilding projects. It is also noteworthy that AOPS was not batched either, although six ships were required. This issue was a critical consideration during contract negotiations for the construction of AOPS, and in the end was decided taking into consideration other factors such as the benefits to the broader NSS program of work and the need to invest in the strategic relationship. But clearly, CSC is a good candidate for consideration of such an approach, as was done successfully in the 1990s for the Canadian patrol frigates.

The decision not to employ fixed-price contracts does not mean a blank cheque. Ship design and initial ship construction contracts typically include ceiling prices (the expected cost, with a contingency to address the risk of uncertainty), after which profits are at risk. Such contracts can be interpreted by shipyards as a penalty for poor performance. Because the risk to the supplier is much reduced, so too is the profit level. Other positive incentives are typically also built in, including the employment of separate shared risk pots for various factors. These sorts of contracts were key contenders for use in the early stages of NSS. With regards to the first ships to be built in the new shipyards, with new facilities, new equipment, new process and a new work force, fixed-price contracting would have been inappropriate.

Contract penalties are often employed in shipbuilding and largely around late or unacceptable deliveries. This can often lead to perverse behaviours that create such difficult relationships that success becomes impossible. Contractors' lawyers make commissions on how often they can find Canada's officials at fault for any and every kind of delay. The government's desired performance specifications are hard fought in negotiations and often dumbed down reach agreement. These approaches and others (secrets, a blame culture and access denied by both parties) cause the shipyard to cut corners in workmanship and ease quality assurance procedures to avoid delays. This is all done with the hope that deficiencies will not come to the client's attention until after warranties have been exhausted. Hence, the navy is displeased with many early performance issues and everyone ends up in court. Under NSS where the launch phase is still underway, there is a strong incentive for Irving Shipbuilding to do well to obtain follow-on contracts – this being more difficult for Vancouver Shipyard because of the initial order book which makes off-ramping projects difficult (three offshore fisheries science vessels, one offshore oceanographic science vessel, two JSS and one Arctic icebreaker). NSS is about building and sustaining a strong strategic relationship, so selective tough love is more appropriate than continuous challenge. In other words, there are merits to judiciously defining penalties to motivate timely compliance for only the few deliverables that really matter.

Before we leave this section, a word is appropriate about prior relationships and fairness. The NSPS RFP required bidders to show how they would provide a number of ship design and construction capabilities soon after umbrella agreements were set in place. This meant that they either already had indigenous capabilities or that they had a credible sub-contractor team. Therefore, these primary sub-contractors were not competed because they were selected by the

NSS shipyards as part of their team under NSPS competition, thereby providing specialist expertise upon award of contracts – expediency being of importance to Canada. However, the selection through competition of major equipment by these sub-contractors is overseen by Canada before they are awarded by sub-contractors.

Figure 2: Irving Shipbuilding's main assembly building in Halifax, Nova Scotia. (shipsforcanada.ca)

In a similar vein, Canada typically avoids directing or forbidding partnerships between private sector companies, notwithstanding that there will be cases where previous relationships could lead to perceptions of conflicts of interest. A key consideration in Canada's reasoning is the relatively small number of such private sector companies that are both available and likely to be interested in bidding on Canada's defence procurements. However, this requires Canada to take measures regularly to ensure fairness. Such a situation arose as a result of the pursuit of the AJISS contract, with the resulting perception amongst some that the subsequent but separate CSC competition could potentially be unfair. It falls to the government of Canada to employ appropriate measures as part of the CSC bid evaluation process to ensure fairness, and such measures exist. Mechanisms to do this could include such things as Canadian officials leading the majority of the evaluation areas and the presence of Canada's officials in all criteria assessments. And one would expect the government to only approve a bid evaluation employing mechanisms that assure an outcome aligned with the core principle of fairness which Canada considers to be an absolute.

Schedule

When schedule is king, repeated delays and failure to explain them to powerful government stakeholders and the public will in time jeopardize full implementation of the NSS.

Canada is well known for the extensive amount of time it takes to acquire weapon system platforms in general. There have been studies – though now dated – to show that our record on timely execution may be the worst in NATO. And when schedule slips, costs always go up – if budgets are not increased commensurately, the scope under contract must be reduced and the RCN potentially receives a less effective fleet of ships.

One should not be surprised by the propensity for delays in execution. Canada enjoys living next door to the U.S. and having strong ties with our southern neighbour. Rightly or wrongly, Canadians see the U.S. as the guarantor of Canada's defence. The corollary is that Canadians view the Department of National Defence as a government entity worthy of less interest than the business of most other departments of government. If one accepts this hypothesis, three corollaries follow. First, Canada still needs to be able to contribute to collective defence to maintain these strong ties – and especially with the Trump administration, where burden sharing by allies who enjoy the U.S. security guarantee remains an objective under the recently released National Defense Strategy. Second, Canadian politicians are unlikely to invest significant capital in finding ways to accelerate defence procurement, which represents political liability due to its expense and significant risk profile for what is essentially overhead of the undervalued defence program. And third, because it is expensive, they want industrial and technical benefits for Canadian companies from every contract, especially noting that these are high-paying jobs with the potential to fuel national prosperity. In implementation, the delivery of shipbuilding projects under NSS can be assessed as hugely expensive, well north of $50 billion. All this is to say, successive governments want to do military procurement, but with a minimum of risk. Continuous attempts to de-risk inherently complex and thus risk-laden initiatives such as shipbuilding consume a lot of effort and time.

Delays are therefore common, putting timely procurement execution in jeopardy across the board. But one should manage their expectations for more timely execution. Unless the world goes into a major war, Canada's strategic position changes in the world order, the U.S. applies uncommon pressure, or military procurement gets so broken that the politicians cannot take the political heat – delays will continue. There are things that could be done more expediently within the military procurement system but there must be motivation to identify those opportunities and implement the related changes. Other nations empower external czars to do comprehensive end-to-end reviews of programs and projects to identify options employed elsewhere. Then ministers specifically default to accepting proposed recommendations unless there is a compelling reason not to. Without such an approach or similar, attempts to reduce delays are likely to be more akin to tinkering at the edges.

Noting these comments relating to schedule for Canadian weapon systems platform acquisitions, it follows that significant changes of procurement strategy mid-course run a very high probability of creating even longer delays than staying the course we are now on.

So What

In the end, this is all about the future of the National Shipbuilding Strategy, an enterprise-wide change initiative of national proportions. It is truly a complex initiative that can be expected to take decades to mature, as was typically required when national naval shipyards went into place in other nations in the previous century. And as stated in the opening paragraphs of this paper, challenges will continue to emerge – challenges that will need continual and candid explanation.

For many years, our government has stated they would pursue a list of solutions to the current ills: enhanced oversight, greater shipbuilding expertise and capacity within the government, improved budgeting based on better cost estimates, and four key measures of outcome performance (timeliness of project execution, delivery of vessels within approved budgets, shipyard productivity and economic benefits).

These are not easily achieved. Internationally, nations are struggling to recruit shipbuilding expertise in sufficient quantities to manage more than one or two major naval procurements continuously over a decade and the knowledgeable people to provide mature governance. International associations engaged in complex project management research have said that in truly complex endeavours, the iron triangle of matched requirements and schedule with cost are nigh on impossible to predict with much confidence until actual deliveries occur in a sorted fashion, so an enhanced record on cost estimation is inherently unlikely.

Then there is the issue of shipyard productivity. Interestingly, when various international benchmarking experts were asked to define when the NSS shipyards could be measured to show strong productivity, they were unanimous in saying that, noting the order book for each shipyard (and especially for Vancouver Shipyard), “not for a very long time”. The shipyards are committed to reach something termed “target state” once they have effectively built a ship and thus demonstrated all the key construction activities. Target state is a set of best practices in shipbuilding, essentially the fundamentals to good productivity. But achieving target state will not necessarily deliver good productivity. Using an analogy, this is similar to being able to master the various skills of driving a car: parallel parking, changing lanes, navigating and the like. But once the driver’s licence is obtained as proof of such competencies, one is not yet necessarily ready to tackle downtown New York traffic in rush hour or the 401 in Toronto during a white-out snow squall. Having the basic skills does not make you a good driver. Under NSS, target state is confirmation that all of the basic skills are present to a reasonable level of competence, but their integration in the face of greater complexity and adversity may not yet be present. Achieving target state does not confirm that the shipyards are meeting some international productivity standard such as “tons of steel per person-year” over multiple ships – and in shipbuilding, such standards themselves are controversial.

For all of these measures, the race is on to deliver in every one of them – but schedule is king. In hindsight and noting the priority of defence for Canadians (or rather, the lack of priority), it could be argued that NSPS was the right thing to do in principle but perhaps too ambitious for Canada. But there is a counter argument if the "Build in Canada" shipbuilding policy prevails. As was apparent from the first JSS procurement activity that was terminated, the alternative in this century is likely to be best described as lurching from one crisis to another, shipbuilding project by shipbuilding project and Canadian shipyard by Canadian shipyard.

NSS is not on the rocks but it is in shoal waters. NSS can offer great benefits if Canada can stay the course. There have been and are challenges today. And because the processes shaping procurements are largely set by the client, the ball is in the government's court. Therefore, the government of Canada is encouraged to (1) commission an independent end-to-end review of NSS with the express intent of expeditiously implementing the resulting recommendations, and (2) implement frequent, regular and honest communications with the public, no matter the issues at hand. These two additional actions alone will go a long ways to keeping NSS off the rocks.

About the Author

Ian Mack *(Rear-Admiral Ret.) was the director-general in the Department of National Defence responsible for a decade (2007-2017) for the conception, shaping and support to the launch and subsequent implementation of the National Shipbuilding Strategy, and for guiding the DND project managers for the Arctic Offshore Patrol Ships, the Joint Support Ships and the Canadian Surface Combatants. Since leaving the government, he has offered his shipbuilding and project management perspectives internationally. Ian is a longstanding Fellow of the International Centre for Complex Project Management.*

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