



**CANADIAN GLOBAL AFFAIRS INSTITUTE
INSTITUT CANADIEN DES AFFAIRES MONDIALES**

Launching the Canadian Surface Combatant Project

by Ian Mack
December 2020

POLICY PERSPECTIVE

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The Canadian Surface Combatant (CSC) acquisition project is now under contract to conduct design work leading to delivery of 15 frigates to replace the capabilities that existed in the three Tribal-class destroyers (now retired) and the 12 Canadian patrol frigates (modernized in the last decade). As the CSCs start to take shape there will be greater interest in terms of the capabilities, status, schedule and cost of the acquisition.

I also note the appearance of more articles on the CSC project and some that cause me concern in terms of the conclusions reached. It therefore appears timely to look back at how CSC has arrived at this moment by offering a perspective from the experience of one who was involved – and many would say one who at least shares the accountability for the current state of affairs. And I would ask for the reader’s understanding of the fact that my comments are somewhat limited so as to respect the confidences of the parties involved.

Background

The CSC project has arguably been underway since its announcement over a decade ago as part of the Canada First Defence Strategy of 2008, although work really began in 2012. Table 1 identifies the key milestone dates in the project’s history.

CSC project announced in Canada First Defence Strategy	2008
Lessons from terminate JSS procurement applied and NSPS created	2008
NSPS announced	2010
ISI starts work as selected NSS shipyard for CSC	2012
Preliminary statement of requirements signed	2012
Project approval received and project definition commences	2012
Preliminary detailed SOR generated	2014
Industry engagement commences	2014
Procurement plan (most capable design) approved	2014
Pre-qualified list of bidders created	2015
Initial requirements reconciliation	2015
New procurement plan (most qualified team) approved	2015
Independent review panel for requirements acquisition supports SOR	2015
Draft request for proposals available to potential bidders	2016
Request for proposals released to potential bidders	2016
Three bids received	2017
Preferred bidder announced	2019
Contract awarded for initial design work	2019

Table 1 – CSC Milestones Achieved

The Treasury Board’s complexity and risk-assessment system identified the CSC project as a category 4. It is a complex project and such endeavours have been studied globally over the last 15 years. Fundamental to complex projects is the understanding that the levels of uncertainty



inherent to the global marketplace have created a situation in which schedule (and thus cost) is unlikely to be estimable with any confidence in the early stages. I have often remarked that the complexity inherent in procuring warships is akin to continuous crisis decision-making when lost in a hurricane whiteout – until the squall passes, visibility remains challenged. This fundamentally occurs because of the many unforeseeable and emergent risks in long-term endeavours of strategic impact with very large sets of stakeholders and the need to address all aspects of such endeavours holistically from a systems perspective. In the past decade, a body of knowledge and set of new practices have emerged, relating to complex endeavours such as the CSC project, which justify this unique set of expectations.

NSPS and CSC

The National Shipbuilding Procurement Strategy (NSPS, now known as the National Shipbuilding Strategy [NSS]) was initiated in 2008, announced in 2010 and entered implementation in early 2012. The intent was to address the boom-and-bust cycle of federal fleet construction which, by 2008, had led to the atrophy of Canada's large-ship construction capabilities. The adopted methodology was similar to that used by many allies in terms of establishing strategic relationships with Canada's shipyards (initially two and recently modified to three). The initial competitive sourcing of two shipyards occurred in 2011 to create sustained shipbuilding activity for 25 years or more in each. NSPS affected the CSC project by including it in the combat package of naval shipbuilding work which Irving Shipbuilding Inc. (ISI) won.

This paper addresses NSPS only to the extent that it has affected the CSC project. For those interested in the details of NSPS (the good and the not so good), I refer you to a [number of papers](#) that I have written for the Canadian Global Affairs Institute (CGAI).

It is important to realize that NSPS set out to reap the benefits of a strong collaborative relationship between Canada and ISI which, since 2012, has played out for the CSC project in a number of ways:

- A multi-tiered joint governance structure between Canada and ISI has enabled an integrated approach to identifying risks and mitigation options; The project has benefited from ISI's ability to contract quickly when external assistance was needed;
- The request for proposals (RFP) to select a military off-the-shelf-warship design for modification to meet Canada's requirements was developed jointly by Canada and ISI, the latter providing important commercial considerations;
- ISI's encouragement to maintain progress in navigating the challenging government processes of the project definition phase was essential to achieving the actual dates identified above after 2014.



NSPS was conceived and developed to address a specific set of shipbuilding issues in 2008 in Canada. It was never seen as a silver bullet and it was understood to require all the parties involved to evolve and modify the strategy over time.

CSC was understood to be unique among the ships included in the non-combat and combat packages. All of the ships except CSC were essentially marine platforms not unlike most commercial ships in terms of being comprised of hulls, propulsion and electrical generation systems, and auxiliary and hotel services. The differences between ships were the unique requirements to address different missions, but importantly, all but CSC would largely or wholly employ commercial off-the-shelf equipment systems. However, the CSC project would deliver a weapon and sensor system to satisfy multiple roles, including combat operations, mounted on a marine platform. Further, the weapons and sensor systems required a high degree of integration, which meant that CSC would be a developmental project akin to all warships where the mission system fit was largely about the weapons and sensor systems.

Although NSPS was only a sourcing procurement for shipbuilding, everyone involved understood that the shipyards selected would be high on the list to be prime contractor for shipbuilding projects, a common approach world-wide. However, given the uniqueness of the CSC project, the NSPS office made it clear to the potential shipyard bidders in 2011 that CSC was unique among the initial tranche of ships to be built and that all decisions for assigning or competing responsibilities would be in Canada's hands. The one qualification was the intended sourcing of ISI for the construction of the ships, assuming that the shipyard would meet a defined target state in terms of the prescribed practices which would yield Canada's desired level of productivity.

Canada could therefore have taken CSC entirely outside of NSPS in running a competitive process. In such a case, teams would have been unrestricted in their arrangements with respect to the prime contractor, designers and shipyards. If this had been contemplated at the inception of NSPS or subsequently, it is unlikely that NSPS would have been viable at the point such a consideration was adopted. This is because it could have reduced the work for ISI to the Arctic and Offshore Patrol Ship project alone, thereby reintroducing boom and bust to the combat package. Thus, such an approach was never considered.

Canada conducted information gathering and analysis regarding prime contractor options for design and CSC delivery. Analysis indicated that it is common for shipyards to be assigned prime contractor responsibility for long production runs of ships. To do otherwise would mean clients paying a prime contractor for many years in spite of their minimal involvement after the first ships had been delivered and proven – such a lean prime model often being problematic. After analyzing many factors, Canada selected the shipyard prime contractor model and negotiated a related agreement with ISI.



Requirements

The definition of requirements as captured in a Statement of Requirements (SoR) for a warship that will be in service for at least 30 years is always a daunting task. The evolution of new technologies and threats leads to new weapons and sensor systems which the SoR must try to take into account. The SoR also identifies a nation's unique requirements, including such things as the roles to be performed, the high-level mandatory requirements (HLMRs) and more tactical matters such as regulatory and operating protocols. I can attest to the years of work that were invested in the CSC SoR from the time it got underway in earnest around 2008 until the release of the RFP in 2016.

The national differences mean that any off-the-shelf design will have to be modified and integrated into the selected platform. But the degree of development required also applies to the weapons and sensor equipment systems. If equipment already in service can meet the requirements, the naysayer would ask why one might procure a system likely to be discontinued long before the last ship was built 20 years after contract award and well after the first of class was delivered. If the requirements define the attributes of existing systems but require further development to be compliant, why would one pay the development costs and incur additional risks for the project?

Finding the right balance is always difficult. It is often established by identifying in the RFP the maximum degree of development that is acceptable in proposed systems, using a technical readiness level (TRL) protocol in use since the '70s – TRL1 being the least mature and TRL 9 being a mature system requiring little to no development. As a data point in the CPF project, many Canadian systems were selected that were rated at low TRL levels. Most of these worked out so that the project was respected after the fact for the risks taken. When warships will be in service for over 15 years before a possible mid-life conversion, the more common bet is on procuring weapons and sensor systems that are advanced in their development (TRL of 6/7 or more) and from a reputable company with a record of delivering what they promise. This was just one decision the Royal Canadian Navy (RCN) had to make in developing the SoR for every combat system and one that posed a dilemma – either select a high TRL and potentially risk early obsolescence, or prescribe a lower TRL and incur greater development and integration challenges.

For something as complex as CSC, the SoR remained designated as preliminary for an extended period of time. ISI assisted with an initial reconciliation of requirements in identifying companies that could conduct a comprehensive review and in contracting two reputable companies to execute an independent analysis. That work led to refinements of the HLMRs in the SoR, which enabled consideration of an improved procurement plan.

The SoR was then integrated into the statement of work for the RFP. CSC employed a prioritization strategy commonly used in such procurements where tranches of requirements were described in technical terms and evidentiary deliverables. It was understood that once a ship design proposal was competitively selected, more detailed design work would be required to determine what could actually be achieved in a schedule-, cost- and risk-appropriate manner –



factors which could only be effectively addressed once in contract during a second reconciliation of requirements.

A simple analogy that I use when discussing the CSC acquisition model selected (modified military off-the-shelf) relates to the acquisition of a Porsche. A prospective client might establish a SoR relating to speed and luggage requirements, which the standard Porsche Targa can meet, but include the need for two passenger seats plus a baby seat. As with weapons platforms, a Porsche is a highly integrated and compact vehicle. Nevertheless, it could be significantly redesigned at considerable cost (dollars and perhaps performance) to install a third seat to accommodate a baby. While the sales agent can rightfully say that the requirement can be met, once into the details the client may choose to drop the passenger requirement, leaving just a driver and the baby seat placed securely in the passenger seat, or by accepting a fold-down baby-securing arrangement that sits in the lap of an adult passenger. Such an arrangement may already exist in a customized Porsche somewhere in the world. Both such relaxations can be seen to fall short of the SoR but may be acceptable to meet schedule and price considerations while addressing the performance desired.

For the CSC project, which selected the proposed design based on the Type 26, one would expect that the bidder did their design assessments of modifications required to meet RFP priority requirements in a compressed time frame between RFP release and bid submission while attempting to maximize the chances for success by identifying reasonable technical, financial and schedule risks. Further, the highly integrated nature of the parent Type 26 design would likely mean that the nuances in terms of the broader impacts to existing systems would only be apparent during a more detailed design process. As with the Porsche example, there might even be options employed in Australia's Hunter class modified Type 26 design that could adequately meet Canadian requirements and provide important savings in time and/or money or at reduced levels of technical risk. Such were the arguments that created an expectation during RFP development of the need for a requirements reconciliation once a preferred bidder's proposal had been selected.

However, two corollary comments are necessary. First, such changes do not change the SoR, which was the RCN's stated requirement set that shaped the RFP, and against which requirements reconciliation options would be measured and the modified frigates would be assessed for performance during the trials program. It is also important to recognize that by the time the 15th CSC would be in play around the mid-2030s and some 20 years since the SoR was set for the 2016 RFP, it is likely that a modified SoR would have been generated to address the many emergent changes in technology and threats.

Second, when deciding to replace as-bid equipment while reconciling requirements, the integrity of the competitive procurement process would have to be respected so that any subsequent equipment system replacements would not materially change (or be seen to change) the results of the bid evaluation process in terms of the preferred bidder. For example, if a number of bid systems had to be scaled back in capability or replaced with less capable alternatives, losing bidders could argue that the preferred bidder's actual design was either non-compliant with some



mandatory RFP requirement or of less overall value than their proposal. Therefore, while changes might be considered beneficial they would not be decided based merely on their merit.

Procurement Process Attributes

Once industry has been engaged, every procurement process by and large starts with an approved procurement strategy and plan. The initially approved procurement plan for the CSC project was literally a best-of-breed approach entitled the “most competitive procurement” strategy. It consisted of running two competitive processes, one to pick a warship designer and one to pick a combat systems integrator. Once selected, these two entities would be responsible for competing all of the equipments and systems. This maximized competition and could have been 10 years in the design phase with the attendant significant risk.

After the initial requirements reconciliation, it was obvious that a number of existing warship designs exhibited the refined HLMRs in the SoR. This enabled selection of a modified military off-the-shelf methodology entitled the “most qualified team” procurement strategy, which would preserve the advantages of competition while providing schedule- and cost-saving opportunities at much reduced risk. Our allies commonly use the modified military off-the-shelf procurement strategy.

With ISI pre-selected as prime contractor, and in keeping with the intended strategic and collaborative relationship, Canada and the shipyard jointly developed the RFP. However, the resulting solicitation process was required to respect all Canadian contracting principles. This meant that Canada conducted the bid evaluation with ISI providing input for consideration. The final selection of the preferred bidder employed Canada’s standard review and approval processes. The selected bid would have prescribed the equipment systems (and their suppliers) to deliver the required performance such that changes must respect the integrity and results of the bid evaluation process.

Throughout the CSC procurement and as expected, Canada continued to hold the involved ministers and officials executing CSC to account based on assigned responsibilities in the project charter to explain what is happening and why. This was very much in play in the CSC selection process in terms of fairness, openness and transparency, and in the bid evaluation process. Similarly, the approach taken would also include the standard government provision requiring Canada’s agreement to any changes of key lower tier suppliers proposed by the contractors from those included in the bid proposal.

In the end, three full bid proposals were received to offer an appropriate competitive range of options for consideration. Interestingly, Australia established three bids as desirable to select a team to design and build the Hunter-class frigates.¹

¹ Ian Mack, “Another Way to Build Frigates,” CGAI paper, November 2019.



NSS established a more complex responsibility regime for CSC. Some responsibilities were assigned to each party and others were understood to be shared. Prudence and probity were maintained by employing joint governance, an open-book approach and integrated process principles, all of which enabled enhanced transparency by Canada into the activities of the prime contractor.

The effort required by Canada to work with ISI to reach an agreed RFP for issue by ISI was much more onerous than would have been the case otherwise. While it required considerable negotiations between Canada and ISI, it provided benefits as well. This was very evident in addressing one of the perennially challenging contractual terms – intellectual property (IP). This subject is tricky for all military procurements, as Canada wishes to maximize IP rights for itself and industry wishes to restrict the offer of broad use of their IP, especially if it is for free. ISI's input was important in bringing a commercial perspective to what could realistically be expected from bidders whose ship designs already had in place negotiated IP agreements for many key equipment systems that might be replicated by the parent design house in the CSC bid proposal. And as is the norm, equipment IP would have to be limited for use by the prime contractor and others to enable various parties to ensure ship-level design integrity and equipment installation coherence. Also, one could expect that broader client IP for contracted equipment rights as called up in the RFP would be delivered directly to Canada as the client and not through the prime.

Another critical aspect of military procurements relates to Canadian content. The winning bid clearly had to offer significant value for Canadian companies as part of the industrial and technical benefits (ITB) requirements of the RFP. In CSC, the ITB value proposition carried significant weight in the evaluation. As often happens in such cases, some well-established and very capable Canadian companies might not see their premier products in the selected bidder's proposal. In other cases, some rather risky Canadian products might be proposed. Where world-class Canadian defence exporters might not have been included, one would expect such companies to make representation as to why their equipment would be a better choice in terms of cost and/or risk. When this happens, I am empathetic but I also understand the potential for legal challenges that the winning bidder and Canada face if proposed systems are replaced by Canadian companies. I can say that CSC employed the system developed in accordance with the policies of Innovation, Science and Economic Development Canada (ISED), which continually strives to improve its policies and execution. I also can attest to the very significant effort that was expended to ensure the RFP provided as much motivation as possible for bidders to select Canadian suppliers.

Could it have been different? Had Canada long ago adopted a comprehensive maritime industrial strategy with support for a designated list of Canadian strategic industrial partners, the CSC may indeed have had more (all?) of Canada's successful defence company exporters involved, based on policy direction. However, Canada has not adopted such a strategy, for which there are both pros and cons. Such concepts have been discussed periodically during my career and at the time of my departure from government employment, there remained no consensus for change.



Transparency

Interest in the CSC project is ramping up now that a contract has been awarded for design work. The decisions being taken in terms of further reconciliation of requirements and the like are of interest to many observers as the weapons and sensor systems selected will define the CSC's capabilities. Some observers had already provided perspectives while insight into the system selection was somewhat opaque, something that has been clarified recently in at least one published article.²

Such early papers demonstrate the high level of interest, given the importance of this project to the capabilities of the RCN and the expense of the acquisition project. However, I worry that without continuing transparency, observers are likely to make assumptions without context – assumptions that can detrimentally affect the credibility of military procurement in general and CSC in particular.

In terms of the public, there are challenges to being transparent and in being seen to be transparent. The subject matter is exceptionally complex and difficult for laymen to understand. Much of the information will be dynamic as risks routinely emerge (many that are known-unknowns with a smattering of unknown-unknowns), causing observers to doubt the veracity of what is released when it subsequently changes. It is also important to recognize the degree of commercial sensitivity and corporate confidentiality implicated in key project inflection points. And with many observers inclined not to trust the information available without the detailed evidence that cannot be disclosed, there understandably will continue to be publicly proclaimed concerns.

Within the government, independent groups of ministers and officials have complete transparency, but this too can be problematic. I think that, through no fault of the members, senior committees have been challenged to allocate the time needed to understand the details. Even when the expertise is hired to provide independent analyses and translation for members of governance committees, it can still be difficult to invest the time needed. And we must be clear that the challenges in the CSC project are in many ways really just starting now as we move past the years of preparation and into capability solution development.

Nevertheless, having finally managed to clear the mandatory silence period between RFP release and the announcement of the preferred bidder, plus the post-contract award requirements reconciliation, I was pleased to see the released information on the presently intended CSC's weapons and sensor systems. Hopefully, this will now set a trend for the CSC project of periodic reports which will expose the key Canadian company products with the anticipated dollar value and jobs. Such reports would also be useful in providing clarity on project status and challenges faced. CSC is too big a project to remain behind the curtain. When left without knowledge, some

² Xavier Vavasseur, *Naval News*, November 9, 2020.



observers tend to create assumption-based opinion pieces which assume the worst and damage trust.

Benchmarking

Observers and organizations use benchmarking to understand whether endeavours are on the right path. I am starting to see more articles being published that raise concerns about the CSC project, based on benchmarking analyses.

Finding comparisons that match the CSC project and are seen to be of a high quality are not only important to any benchmarking but often very difficult to identify. The understandable desire to compare CSC with similar foreign procurements is fraught with challenges. But it does enrich the dialogue and is welcome if for no other reason than to understand how different organizations and nations approach similar outcomes in different ways. In the CGAI paper referenced earlier, I provided such a comparison between the procurement processes employed in Australia and Canada in the CSC and Hunter projects, for no other reason than education.

Whereas the HLMRs may be similar among nations, other important requirements differ between countries for good reasons. CSC is intended to address many roles within one platform, which some of our allies address with two or more ship designs (e.g., the U.S., U.K. and Australia) such that required equipment system standards of performance are different. They also have different environmental requirements (e.g., operations in the Arctic) and protocols for conducting operations (e.g., flight operations) which can typically be addressed without major structural changes to marine platforms. Some nations direct that major equipment systems already in their inventory be included in new platform acquisitions with less of a focus on competition. Comparisons rarely take such considerations into account.

Clearly, if comparisons occur at an early stage in developing the solution, actual outcomes are not available. This means that the attributes of CSC and any comparative warship programs are both significantly assumption-based and, while instructive, can lead to questionable conclusions.

Cost comparisons typically suffer from “apples to oranges” figures in terms of such things as what is included in project cost data and what is not, the impacts of different economies of scale and the effectiveness of the working relationships between clients and suppliers. If conducted now for CSC and long before the production design is complete, the underlying assumption set could produce conclusions relating to projected program costs of low confidence value.

For complex systems like weapons platforms, the degree of uncertainty in the global marketplace has enhanced the difficulty of predicting through-life cost estimates out 30 years into the future. Some nations now only compare such estimates between two design options to indicate which is most likely to cost less. I am not aware that the CSC project has released information on assessed through-life cost estimates and would not expect to see them for quite some time. Any such numbers generated before half of the CSCs have commenced operations and completed their first



refits should be treated with caution. And when they are estimated, they are for good reason reported distinct from the acquisition costs.

Schedules for individual acquisitions are highly dependent on the attributes of the client, key suppliers and the number of ships already delivered. With respect to the CSC acquisition project, Canada's procurement system is widely reported as routinely slow compared to allies, though as (or more) successful in terms of performance delivered and within budget. The CSC project would on the balance of probabilities exhibit such attributes. Design work is unique for highly integrated and complex products such as warships and routinely defies effective schedule forecasting. ISI is constructing the warships in new facilities with a workforce and processes never tested for the complexity inherent in a warship – schedule impacts are likely. And, as is accepted globally, production schedule predictions are misleading before three or four ships have been delivered. Thus any CSC program completion schedule generated today is, in my view, a long way from generating a high confidence level.

There are of course advanced and elaborate computer models for use by organizations for planning purposes. The Parliamentary Budget Office has used such sophisticated models. These models are based largely on continually updated statistical analysis of key attributes of similar shipbuilding projects that have been completed. In my experience, they are very useful in generating ranges for cost estimates – ranges better reflecting the large number of assumptions required in the input data. In those models that I have studied, schedule is an input assumption which can have a dramatic impact in terms of the upper end of the cost estimate range for warships that have traditionally exhibited annual inflation rates of 10 per cent. Nor do they usually come with a money-back guarantee that their predictions will be valid within some small variation at project completion.

From an internal benchmarking perspective, the Department of National Defence (DND) has generated a schedule target for projects to attempt to meet – two years for SoR finalization, two years to award a contract and five years to complete delivery. Having worked diligently to get to the stage where the RFP was released, I would suggest that the application of this benchmark for CSC is unreasonable given its level of complexity and appropriately enhanced degree of scrutiny. Having been involved in progressing seven army and navy weapon systems platform projects (only one of which had a project budget less than C\$1 billion) and involved to some extent in all of the shipbuilding projects in both packages (combat and non-combat) under NSS, I can say that CSC was in a class all its own. To have expected CSC to be in contract with a competed execution team of suppliers and starting design in four years of its TB approval in 2012 would have been imprudent. However, I would hasten to add that NSPS enabled important foundational work to start with ISI within a year of the announcement of the shipyard's selection in 2011.

Regardless of these considerations, the current estimates in terms of schedule (and thus budget) are unlikely to move left. Further, a meaningful schedule and cost estimate will only be available with a high confidence factor for any shipbuilding projects under NSPS after the first three or four ships have been delivered to the RCN. Observers may understandably find the CSC schedule situation unacceptable. However, I have compared the progress of the CSC project to that of



Australia in their Hunter-class acquisition in the previously referenced CGAI paper and concluded that the times expended by each between project start and contractor selection were not that dissimilar.

Nevertheless, the fact that the CSC project was announced in 2008 and no ship is likely to be delivered before 2025 is disconcerting to all but those who have studied the journeys of complex projects. It also could introduce significant additional costs if the CPF marine platforms cannot remain in service until the first CSCs are available; the HCM/Felex midlife work of the last decade focused largely on the weapons and sensors. My experience indicates that the time lost cannot be made up to any great degree without introducing major disruptions that are equally risky – for the CSC project, this could have been acquisition of the first batch without modification from the Type 26 or global combat ship variant designs. I would add that such perceptions of concern were not helped by the continual announcement of delays based on premature schedule guesstimates – those demanded by previous government stakeholders accustomed to transactional contracting. This situation repeatedly led to dashed expectations and the perception of project failure. But NSS has matured the Canadian government's understanding of schedule realities in sequential shipbuilding of complex designs. Rather than becoming frustrated when faced with delays, those charged with executing and overseeing CSC today are more focused on doing everything practicably possible to avoid further delays.

So What?

Whether one is struggling to deliver a warship, a maritime helicopter or a tactical armoured vehicle, such complex weapons systems platform projects appear during execution to be disappointing but they can only be realistically assessed for the success of their launch strategy when they have delivered the outcome many years later. I believe that we will only know whether the decisions taken for the launch of the CSC acquisition project were adequate and fit for purpose circa 2030 and beyond – something that I am sure the auditor general of Canada will assess.

The future of the RCN's capability to meet assigned government missions is significantly vested in the CSC project. Therefore, it is essential that the CSC project succeed in delivering capable warships, but an essential enabler is the credibility of the project over time.

This is no small task in the Canadian context, which includes the perennial low opinion that many have of military procurement in general. We have seen the impact that lost credibility can have on delayed major defence projects in the recent past, which has led occasionally (but rarely) to outright cancellation.

I remain hopeful that the CSC project office will be allowed to enhance all stakeholders' understanding, including that of the citizens of Canada through engaging and meaningful periodic updates on project status. And for those of us on the sidelines, patience will be essential for enabling appropriate dialogue based on truth so as to avoid engaging in fiction.

► About the Author

*After a 38 year career with the Royal Canadian Navy, **Ian Mack** (Rear-Admiral Retired) served for a decade (2007-2017) as the Director-General in the Department of National Defence responsible for the conception, shaping and support of 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. He also had responsibility for four vehicle projects for the Canadian Army until 2015. 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. He also is allied with Strategic Relationships Solutions Inc. He is married to Alex, and has three grown children. With few accommodations for impaired mobility, he remains active. Upon retirement, he founded a small business, Xi Complexity Consulting Inc. in Ottawa Canada.*

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