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QUALITY VERSUS QUANTITY: LESSONS FOR CANADIAN NAVAL RENEWAL

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AIM

1. The aim of this paper is to make recommendations to Director General Future Ship Capability to best balance capabilities and numbers in the procurement of surface combatants for the Royal Canadian Navy (RCN). It will compare strategies adopted by comparable navies to reconcile quality and quantity of warships, and identify lessons for the composition of the RCN surface fleet. The potential of new technologies to affect the balance between platform capabilities and numbers will be examined. The paper will conclude that the current plan to procure surface combatants is appropriate and will recommend an emphasis on technological agility and further investigation of innovative manning solutions to enhance operational availability of RCN units.

INTRODUCTION

2. The RCN plans to replace its HALIFAX Class frigates and already-retired IROQUOIS Class destroyers with 15 new, highly capable surface combatants of a single design.¹ The project is the most expensive military procurement in Canadian history, with an anticipated through-life programme cost of \$60 billion.² Yet this unprecedented expenditure will result in a net *reduction* of one warship compared to the previous strength of 16 HALIFAX and IROQUOIS vessels.

3. The tension between procurement of a necessary number of warships, and the desire to maximise the fighting capability of each ship, is not unique to the RCN. Therefore, this paper assumes that approaches taken by other navies have relevance to the RCN's plans for renewal of its surface fleet. Discussion will focus on France, Australia and the United Kingdom (UK) as countries which compare closely with Canada in their aspirations to maintain medium sized, globally deployable "blue-water" navies, and will be based on surface combatants (frigates and destroyers)³ since these represent the largest and most expensive type of warship that the RCN plans to operate. In doing so, it will specifically exclude the extreme focus on quantity that may be taken by a coastal navy, for example the Iranian Revolutionary Guard Corps Navy (IRGCN),⁴ which seeks only to exercise sea denial and does not deploy beyond its own waters.

DISCUSSION

¹ Department of National Defence, *Strong, Secure, Engaged. Canada's Defence Policy* (Ottawa: Canada Communication Group, 2017), 13.

² Public Services and Procurement Canada, "Shipbuilding projects to equip the Royal Canadian Navy and the Canadian Coast Guard," last accessed 12 October 2018, <http://www.tpsgc-pwgsc.gc.ca/app-acq/amd-dp/mer-sea/sncn-nss/projets-projects-eng.html>. All costs in this paper are in CAD unless stated otherwise.

³ In Western navies a destroyer usually implies a larger vessel with Anti-Air Warfare capabilities, whilst a frigate is taken to mean a smaller ship biased towards Anti-Submarine Warfare. However, this is not always the case and this paper takes the position that the distinction between the two types is largely semantic, noting that the RCN's procurement plans use the generic term, "Surface Combatant".

⁴ The IRGCN operates large numbers of small craft armed with missiles, guns and torpedoes. It is distinct from the Islamic Republic of Iran Navy, which operates a more conventional force of frigates, patrol craft and submarines.

4. The assumption that unit costs for military hardware increase, in real terms, with each generation of equipment, is well established. For complex systems, this inflation factor may equate to an annual underlying cost increase of between 5% and 10% per year.⁵ A new class of frigate will have greatly enhanced combat capability compared to its predecessor but the threat will also have increased in sophistication so the benefit is, in economic terms, nullified. Even when defence budgets increase, such as in Canada under the present government's "Strong, Secure, Engaged" policy (SSE), they are unlikely to keep pace with defence inflation.⁶ Such financial pressure on warship procurement almost inevitably introduces compromise in numbers and capabilities.

5. Maritime doctrine argues that navies act through "three classical roles – war fighting, maritime security and defence engagement."⁷ A warship capable of operating in a complex warfare environment, fully interoperable with technically sophisticated allies, is able to fulfil all three roles. Such versatility, which allows the same deployed ship to switch seamlessly between roles without additional equipment or training, is considered a key attribute of sea power.⁸ Such vessels are relatively expensive and are therefore likely to be procured in small numbers.

6. Since a warship cannot be in two places simultaneously, or available for operations all of the time, an alternative approach may be required. Numbers matter and it has been postulated that "in terms of the outcome of a battle, military effectiveness is proportional to the square of quantity but to only the first power of quality."⁹ Technological innovation may change this calculation, but not the attritional nature of naval warfare or the general advantage of having more numerous forces. Others have made the case that most naval roles do not require high-end combat capabilities: "Hunting Somali pirates with a billion-pound [RN Type 45 destroyer]"¹⁰ is an inefficient application of resources; the maritime security and diplomacy roles may be fulfilled by lesser warships. The effectiveness of defence engagement relies on the implicit availability of fighting capability but any warship represents sovereign maritime power. This view supports a fleet of more numerous but less capable warships.

France

7. The French Navy (FN) provides an example of deliberate investment in less capable surface combatants to achieve greater numbers. At the most sophisticated end of the scale the

⁵ David Kirkpatrick, "Is Defence Inflation Really as High as Claimed?" *RUSI Defence Systems*, (October 2008): 70, http://www.metasums.co.uk/uploads/asset_file/17kirkpatrick.pdf.

⁶ Department of National Defence, *Strong, Secure, Engaged. Canada's Defence Policy* (Ottawa: Canada Communication Group, 2017), 43. Accounting on an accrual basis (whereby the capital cost of acquiring an asset such as a warship is spread over its useful life), Canada plans to increase total defence spending from \$17.1 bn in 2016-17 to \$24.5bn in 2026-27. This equates to an average increase of 3.6% per annum, which is less than the 5% lower threshold of historical defence inflation calculated by Kirkpatrick above.

⁷ Development, Concepts and Doctrine Centre, JDP 0-10, *UK Maritime Power* (Swindon: Ministry of Defence, October 2017), 6.

⁸ Royal Canadian Navy, *Leadmark 2050: Canada in a New Maritime World*, (Ottawa: ON, 2016), 13.

⁹ Vice-Admiral James Eberle, "The Naval Balance: Quality versus Quantity," *The RUSI Journal*, 123, issue 4 (1978): 56, <https://www.tandfonline.com/doi/abs/10.1080/03071847809422936?journalCode=rusi20>.

¹⁰ Naval Technology, "Quality vs. quantity – should navies scrap high-tech ships?" last modified 12 October 2014, <https://www.naval-technology.com/features/featurequality-vs-quantity-should-navies-scrap-high-tech-ships-4402801/>.

aircraft carrier CHARLES DE GAULLE is supported by a flotilla of approximately 12¹¹ destroyers and frigates capable of high intensity warfighting. The FN carrier task group is able to exercise sea control and to project power ashore; it provides French governments with maritime power options available to few others. However, availability of the carrier task group is limited since CHARLES DE GAULLE cannot be maintained at sea or high readiness indefinitely. A single task group does not provide the persistent, dispersed deployment of maritime power that is required to support French national strategy.

8. To maximise forward presence in its overseas territories and other areas of strategic interest, the FN has procured smaller, less sophisticated but nevertheless blue-water warships, capable of exercising French sovereignty, conducting maritime security operations and presenting a credible, if limited, warfighting capability. The six FLOREAL Class patrol frigates are an example of this approach. Built to civilian construction standards to keep costs low, these small (2,900 tonnes displacement) warships are permanently deployed to forward bases in the Caribbean and Pacific. They have a heavier armament than would be usual in an Offshore Patrol Vessel (OPV), including a medium calibre 100mm naval gun, provision for anti-ship missiles, and decoy systems, plus aviation facilities to embark a helicopter.¹²

9. Also built to commercial standards, the LA FAYETTE Class of general-purpose frigates is less capable and specialised than the surface combatants that are required to escort the aircraft carrier. Flexibility in the design has facilitated export success to Taiwan, Saudi Arabia and Singapore.¹³ The FLOREAL and LA FAYETTE Classes provide a relatively low-cost, persistent global maritime presence, enabling the maintenance of a powerful carrier battle group for the warfighting role.

Australia

10. The Royal Australian Navy is undergoing a period of renewal and investment. Like Canada, Australia has no immediate threat to its sovereignty (although geopolitical developments to its north are driving an amphibious capability), and it has a long coastline with extended maritime economic interests. New classes of combatant are at the high end of the capability spectrum, although utilising existing designs and technology; this approach is necessary to provide the sea control capability that amphibious operations require. The HUNTER Class frigate will be built on the well-developed British Type 26 design,¹⁴ whilst the HOBART Class air defence ships are based on the F100 frigate in service with the Spanish Navy since 2002, utilising the proven United States (US) AEGIS command system.¹⁵ The cost of the three

¹¹ Jane's Fighting Ships, "France – Navy," accessed 12 October 2018, <https://janes.ihs.com/Janes/Display/1322684>.

¹² Jane's Fighting Ships, "Floreal Class," accessed 12 October 2018, https://janes.ihs.com/FightingShips/Display/jfs_1064-jfs_. Exocet MM38 has been withdrawn from service although anti-ship missiles can be reinstalled when required.

¹³ Naval Technology, "Quality vs. quantity – should navies scrap high-tech ships?" last modified 12 October 2014, <https://www.naval-technology.com/features/featurequality-vs-quantity-should-navies-scrap-high-tech-ships-4402801/>.

¹⁴ Royal Australian Navy, "Hunter Class FFG," accessed 12 October 2018, <http://www.navy.gov.au/fleet/ships-boats-craft/future/ffg>.

¹⁵ Jane's Fighting Ships, "Alvaro de Bazan Class," accessed 12 October 2018, https://janes.ihs.com/FightingShips/Display/jfs_4369-jfs_.

HOBART class has been reported at around \$8.4 billion, a considerable investment in such a limited number of ships.¹⁶ The RAN is pursuing a conventional approach to warship procurement, with a focus on technologically advanced and highly capable surface combatants.

United Kingdom

11. The UK has recently shifted its emphasis in warship procurement towards numbers over capability. This is embodied in the National Shipbuilding Strategy (NSS), which supports a strategic warship building capability whilst providing the RN with the ships it requires, including the development of exportable designs.¹⁷ This is partly a response to lessons from the Type 45 programme. The Type 45 was conceived as a class of 12 air defence destroyers but the adoption of bespoke, novel technology contributed to cost overruns and by 2004 the planned order was reduced to eight ships, of which six were eventually built.¹⁸ This reduction in the RN's surface combatant force led to a diminished global presence, for example the deployment of an OPV, normally employed for fishery protection duties, to the Caribbean in place of a frigate.¹⁹

12. The UK has learned from the Type 45 experience. Type 26 frigates, entering service in the mid-2020s²⁰, feature a relatively large hull with inherent flexibility both to embark a range of modularised capability enhancements in a dedicated mission bay and to facilitate future upgrades. These ships are designed to defend the RN's carrier task groups from submarine threats and are sophisticated combatants. Technical risk will be minimised by the use of radars and air defence missiles currently being retrofitted in Type 23 frigates. Compared to the widely-reported £1 billion unit cost of the Type 45, eight Type 26s are on order with an average price of around £460 million.²¹

13. The UK government is committed to increasing the RN's destroyer and frigate force²² but the Type 26 appears too expensive to permit this on its own. The NSS commits to procurement of at least five less capable general purpose frigates of the Type 31e Class. The design is still out to competition although the government requires a maximum £250 million (around \$425 million) per ship price and has stated that, "Exportability will be driven into the ship through a competitive price and a capability that meets already identified potential customer

¹⁶ The Australian, "Fine-tuning starts for navy's first air warfare destroyer," last modified 27 October 2017, <https://www.theaustralian.com.au/national-affairs/defence/finetuning-starts-for-navys-first-air-warfare-destroyer/news-story/dd55f6e6defac0d067560a2a520c9d55>. The figure quoted is AUS \$9.09 billion.

¹⁷ Ministry of Defence, *National Shipbuilding Strategy: The Future of Naval Shipbuilding in the UK*, (London: HMSO, 2017): 27.

¹⁸ Naval Technology, "Quality vs. quantity – should navies scrap high-tech ships?" last modified 12 October 2014, <https://www.naval-technology.com/features/featurequality-vs-quantity-should-navies-scrap-high-tech-ships-4402801/>

¹⁹ Save the Royal Navy, "HMS Severn heads for the Caribbean amid questions about the RN's Offshore Patrol Vessels," last modified 18 November 2014, <https://www.savetheroyalnavy.org/hms-severn-deploys-to-the-caribbean/>.

²⁰ Ministry of Defence, *National Shipbuilding Strategy: The Future of Naval Shipbuilding in the UK*, (London: HMSO, 2017): 21.

²¹ Vice Admiral Ben Key, "Type 26 Base Porting," *Royal Navy Galaxy*, 06-2018 (8 October 2018). 8 Type 26 frigates are on order for a total price of £3.7 billion.

²² Ministry of Defence, *National Shipbuilding Strategy: The Future of Naval Shipbuilding in the UK*, (London: HMSO, 2017): 6.

requirements.”²³ It is clear that the UK has moved some way towards the French model in its adoption of less capable general purpose warship designs in order to maintain a more numerous force than would otherwise be affordable.

Impact of New Technology

14. In considering the potential of emerging technology to balance the quantity versus quality conundrum, this paper makes a distinction between technological *enhancement* and technological *agility*. Each successive generation of warship is expected to incorporate technological enhancements over earlier classes. Yet, as discussed above, any relative advantage is likely to be short-lived because potential opponents will also develop their technology. Enhancement is necessary to maintain credible combat capability but serves to increase costs. This includes “force multiplier” technology such as the US Cooperative Engagement Capability being introduced into RAN HOBART Class ships, which enables the sharing of sensor data between units so that one ship can engage a target it does not hold on its own sensors.²⁴ This provides enhanced lethality but, since the RAN only has three HOBARTs in total, it does not reduce the number of air defence ships the RAN requires to ensure sea control.

15. Conversely, technological *agility* has potential to redress the balance of quality and quantity in warship procurement. This is recognised in the RCN’s “Leadmark 2050” document, which notes that, “Recent advances in design have made it possible to build much more flexibility into warships. This includes incorporating weight, power and cooling design margins in the initial build of a ship, as well as adopting ... open architectures.”²⁵ New technologies may be incrementally acquired over the life of a warship, with reduced integration costs. The RN Type 26 frigate is an example of this approach.

16. “Leadmark” also identifies the trend towards containerisation of mission systems,²⁶ which has potential to enable very rapid integration of capabilities and to increase the combat power of any warship, for example through the operation of unmanned or autonomous systems. This could enable a vessel such as the RCN’s Arctic and Offshore Patrol Ship (AOPS), which has very limited organic weapons or sensors, to be equipped for a specific mission with distributed surface and air sensors, perhaps including kinetic effects capability, being operated and controlled from containerised systems that require only power and space. The US Navy (USN) has successfully trialled remote autonomous operation of standard ship’s boats, fitted with bolt-on control equipment, in underway force protection roles.²⁷ Thus capabilities usually requiring sophisticated surface combatants can be provided by relatively simple warships if they are designed with the size and power margins required to embark containerised equipment.

²³ Ibid, 23.

²⁴ NavalToday.com, “Australian destroyers demonstrate Cooperative Engagement Capability,” last modified 17 April 2018, <https://navaltoday.com/2018/04/17/australian-destroyers-demonstrate-cooperative-engagement-capability/>.

²⁵ Royal Canadian Navy, *Leadmark 2050: Canada in a New Maritime World*, (Ottawa, 2016), 35.

²⁶ *ibid*.

²⁷ Office of Naval Research, “The Future is Now: Navy’s Autonomous Swarmboats Can Overwhelm Adversaries,” accessed 12 October 2018, <https://www.onr.navy.mil/Media-Center/Press-Releases/2014/autonomous-swarm-boat-unmanned-caracas.aspx>.

Maximising Availability

17. For navies that conduct their business away from home waters, actual quantity of ships is a less important measure than presence, measured by days available in an operational theatre. Modern ship designs (low technology elements such as propulsion and domestic systems) require less maintenance than their predecessors, so new warships should be able to spend more time on operations and be capable of extended deployments. In this situation, the limiting factor on persistence becomes personnel. The RN has addressed this in smaller vessels through crew rotations, enabling mine countermeasures ships to deploy to the Arabian Gulf and remain forward-based for up to three years.²⁸ The challenge in applying this to a more complex warship is one of collective training, which would likely be overcome by expanded use of synthetic methods. This implies risk to naval commanders but, if accepted, offers the potential to address the quality versus quantity conundrum by maximising availability vice quantity and not compromising on capability. Manpower, in the form of additional crews to enable rotation, is expensive so this approach would require investment in lean-manned warships unless additional resources were available.

Lessons for Canada

18. Canada is a globally-engaged nation. Its defence policy commitment to defend North America requires the ability for the RCN to operate closely with the USN. “Contribution Warfare” means that the provision of a capable asset, usually integrated within a USN or multinational task group, is likely to be of more value than an increased number of deployed warships. These factors suggest that an approach similar to the RAN would be most successful in achieving enduring defence policy objectives; in this view, the current plan to procure a single class of 15 sophisticated Canadian Surface Combatants (CSC) is justified. The CSC should be capable of fulfilling the full range of naval roles and of achieving interoperability with USN task groups.

19. However, the SSE requirement for the RCN to be able to provide two Naval Task Groups, each containing up to four surface combatants, is ambitious based on a fleet of 15 CSC.²⁹ It is doubtful that this level of commitment could be sustained for a significant period without additional combatants, although more innovative use of manpower resources and procurement of lean-manned ships could provide a partial solution. Yet a dilution in the capability of the CSC in order to finance additional warships would not support full participation in operations with allies. In this case, an approach which aims to harness the potential of technological agility outlined in “Leadmark 2050” should be implemented to enable less capable AOPS to fulfil some roles currently carried out by frigates.

CONCLUSION

20. This paper has discussed the enduring quality versus quantity debate as it applies to renewal of the RCN’s surface combatants. The varying approaches taken to balance capability

²⁸ United Kingdom Ministry of Defence, “Royal Navy minehunters return from the Gulf,” last modified 31 August 2012, <https://www.gov.uk/government/news/royal-navy-minehunters-return-from-the-gulf>.

²⁹ Department of National Defence, *Strong, Secure, Engaged. Canada’s Defence Policy* (Ottawa: Canada Communication Group, 2017), 35.

and resources in France, Australia and the UK all contain lessons that may be applied by the RCN. Technological agility has been proposed as a partial solution to maintain hull numbers without compromising on warfighting capability. Other means to increase the operational availability of warships, derived in part from this technical agility and potential reductions in maintenance and manpower requirements, should also be investigated by the RCN. Finally, this paper has not considered the sustainability of Canada's national shipbuilding capability. In the UK case, recognition of shipbuilding as a strategic asset contributed to a shift in warship procurement plans. Noting that current RCN shipbuilding plans offer little to industry beyond construction of the CSC, this is an area that merits further examination.

RECOMMENDATIONS

21. Director General Future Ship Capability is requested to note that:

- a. The current plan to procure 15 sophisticated CSC meets the RCN's defence policy commitments but incurs risk in availability and numbers.
- b. All RCN procurement projects should favour designs that maximise technical agility, in order to enable future capability growth and mitigate small numbers.

and to approve:

- c. A study to be conducted to investigate the applicability of crew rotation to the CSC, in order to increase operational availability of units.

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