CANADIAN NAVAL REVIEW

VOLUME 10, NUMBER 1 (2014)

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Canadian Naval Review is published by the Centre for Foreign Policy Studies (CFPS) at Dalhousie University. It is a professional journal examining a wide range of maritime security issues from a Canadian perspective. In particular it focuses on strategic concepts, policies, operations, history and procurement of the Canadian Navy, plus national security in general and marine/ocean affairs. This initiative brings together members of the Canadian defence and academic communities and is a component of the Centre's Maritime Security Program.

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Credit: Cpl Michael Bastien, MARPAC Imaging Services

*HMCS **Regina** crew members assemble on the flight deck to cheer on Canadian Olympians while the ship is in the coastal waters of the Philippines on 31 January 2014 during deployment for **Operation Artemis**.*

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War and Economics: The Real Threat to the Canadian Navy

Fire on board any ship is a terrifying experience. On a naval vessel that is carrying a very combustible cargo it is especially the case. Fortunately the fire on board HMCS *Protecteur* in February 2014 did not cause fatalities and the ship did not sink, but the event will still be disastrous for the Canadian Navy's efforts to maintain a robust and independent capability for the foreseeable future. The navy is now reduced to one operational replenishment vessel until the two long-awaited replacement vessels are completed (hopefully before 2020). The fact that *Protecteur* was saved is testament to both the bravery and excellent training of the men and women of the Canadian Navy. Unfortunately it seems unlikely that the vessel will return to service.

There has already been significant commentary on the dire straits that the navy faces with this loss. It will face tremendous difficulties in maintaining its ability to operate independently in both the Atlantic and Pacific Ocean. It will now require the direct assistance of friends and allies, particularly the United States, to maintain its engagements in the Pacific Ocean. This is coming at a time when the importance of this region is growing.

The forces that are now placing the navy in such a difficult position are the very forces the navy is needed to battle to ensure that Canadians remain secure; i,e., fighting war and protecting trade. For the last decade, the Canadian Forces have been at war in Afghanistan. At roughly the same time, Canada's major trading partners have been experiencing economic difficulties that have brought on a worldwide recession. The navy is designed to fight wars to defend Canada. It is also designed to ensure that Canada's maritime trade is protected to provide for the economic security of the country. Therefore, to have a truly secure Canada, there is a need to protect both national security and economic security. Without one you cannot have the other. And paradoxically fighting to ensure national security can ultimately have a negative impact on economic security. This in turn can then seriously diminish the ability of the state to afford new equipment to face future threats to national security.

The loss of *Protecteur* is now making clear the impact of two powerful events that have placed the navy in a very difficult position. Neither is maritime specific and neither originates in Canada but both are now combining to challenge the future of the Canadian Navy. The first is the Afghanistan war and the second is the 2008 economic crisis. It is becoming clear that the Canadian economy has been much more strongly affected than most have recognized. The cost of the war and the fallout from the economic crisis now threaten the badly needed ship replacement plan so carefully developed in the Canadian shipbuilding strategy. There has been no official statement that the objectives of the strategy are being reduced or eliminated, and most government officials go to great lengths to reassure that there is no problem. But no actual construction has yet begun. Furthermore, Canada's current financial situation and statements from the government that it plans to reduce overall spending, plus an impending federal election, mean it is likely that the navy will face significant cuts and/or delays to its plans to rebuild and modernize. Exactly what this means is not yet clear. But the signs are ominous.

Credit: U.S. Navy Mass Communication Specialist 3rd Class Johans Chavarro

*HMCS **Protecteur** is towed behind the US Navy's guided-missile cruiser USS **Chosin** (CG 65) on 1 March 2014.*

The full impact and true costs of the Afghan war will not be determined for some time. The Canadian government has grown increasingly reluctant to share economic information in an open and understandable fashion. We do not even know the full physical and mental costs that are faced by veterans, let alone the total bill for the war. How much of the resources that were expected to pay for the rebuilding of the Canadian Forces as expressed in the Canada First Defence Strategy were spent on the war? It will be for historians and defence economists to determine what the true costs were but we know that the war was expensive and that the defence budget is finite. It is impossible to avoid the conclusion that ongoing capital

Credit: MCpl Patrick Blanchard, Canadian Forces Combat Camera

Canadian dignitaries welcome home Canada's last troops returning from Afghanistan on a CC-177 Globemaster at Ottawa International Airport on 18 March 2014.

replacement programs have already been affected by the costs of the war.

A further complicating factor facing naval planners in the current environment is the reality that despite the navy's massive effort to support the government's commitment to the 'war on terror' in the early years, its role has been forgotten already. Almost all of the media stories and government statements about the Canadian withdrawal from Afghanistan have begun their narrative with the decision to deploy land forces. There has been no mention of *Operation Apollo* as the real beginning of Canadian involvement in the war. This is both disappointing and problematic. While the navy does not take part in operations with the expectation of gratitude or recognition, such collective amnesia can cause decision-makers to lose sight of the utility of Canadian sea power. If Canadians only recall the role of the army in the Afghan war there is a possibility that as difficult cuts are made to future capital programs, the importance of modern sea power will be overlooked. Following 9/11, the navy was ready and able to deploy virtually all of its fleet to support the allied effort to contain both Al Qaida and the Taliban in waters around the Middle East. This is not to take away from the superb effort that the land forces provided, but Canadians need to be reminded that it was a joint air, sea and land commitment in the war.

At the same time, the Canadian government is suggesting that its management of the Canadian economic system saved the country from the ravages of the mistakes made by Americans and Europeans. The government deserves credit for keeping the worst of the recession away from Canadians, but the reality is that Canada is a trading state that depends on the economic health of its economic partners. Given the length of time that it has taken both the Europeans and the Americans to recover from 2008, it is not surprising that the Canadian government now finds it necessary to be particularly careful with its spending. This recession was caused by bad government policies not by direct threat to maritime trade routes, but it illustrates what will happen if maritime trade is threatened or disrupted in the future. Canada will need new replenishment vessels, new Arctic offshore patrol vessels and new surface combatants to ensure that it can provide for the protection of maritime trade. The paradox is that the current economic crisis is now threatening to prevent Canada from acquiring the very tools that it will need for the future.

Credit: Adrien Veczan, Chronicle-Herald

*FGS **Bonn** of Germany is docked at the Navy Dockyard in Halifax. A design adopted by Canada and more urgently needed than ever.*

Thus the Canadian Navy now faces a paradox of immense proportions. The war in Afghanistan proved that the Canadian Forces need the ability to move quickly and with little notice to support allies and to counter threats to Canadian security. The economic crisis of 2008 demonstrated how dependent Canada is on the economic well being of its trading partners. The fact that we have had a crisis in both national security and economic security underlines the need for a modern, robust and capable Canadian Navy that can play a vital role if this happens in the future. But the impact of these two events means that the Canadian Navy faces severe challenges to getting all or even part of what it needs. The loss of *Protecteur* and the difficulty procuring its replacement serve to underline the challenges that are now appearing for the future of the navy – just when we will need it the most.

Rob Huebert
University of Calgary

Crewing Strategies for the Royal Canadian Navy's Future Ships

Commander Ian D.H. Wood*

The Royal Canadian Navy (RCN) is in the midst of several major capital shipbuilding projects including the Arctic Offshore Patrol Ship, the Joint Support Ship and the Canadian Surface Combatant. Understandably much of the early activity has been focused on the preparations for designing and building these platforms. But it will become equally important to take a close look at the personnel considerations for these next classes of ships. The issue of crewing is important because we have a window of opportunity while we are still designing the ships to make sure that we get the human dimension planned out before steel is cut. Even though we expect that these new ships will possess leading edge technology, the crew size and skill composition will also have a significant impact on their operational effectiveness. As a result of the direction provided by the Commander of the RCN, Vice-Admiral Mark Norman, in "RCN Executive Plan 2013-2017,"[1] naval and research staffs have already begun to scope out some of the important aspects that will affect the crewing of future RCN ships. New crewing concepts may permit the RCN to sustain more persistent forward deployments thereby offering the government a greater range of options as it considers its international engagement.

This article will highlight some considerations that the RCN and its peer navies are already exploring and suggest other areas that the navy might want to consider as it prepares crewing strategies for the new classes of ships. The navy will increasingly need to leverage both technology and human innovation in order to identify some of the internal force structure changes that may be required to crew these exciting new ships optimally.

There is a small group of researchers looking at human factors and crewing in the maritime domain and this article is designed to stimulate further discussion in this area.[2] One of my goals is to investigate how novel approaches to crewing might allow for a more flexible generation of capabilities leading to higher readiness at potentially lower cost.

Over the past 30 years many of the world's navies have had a dramatic increase in the percentage of their funding that they have to commit to satisfy the burgeoning costs associated with their personnel. Some of the world's navies are consuming well over 50% of their budget on personnel costs. As a result there have been efforts to create innovative classes of ships that more effectively integrate the ships' operational capabilities and require less crews than were needed in earlier decades.

Credit: Cpl Anthony Chand, Formation Imaging Services Halifax

HMCS ***Toronto*** *arrives at the jetty in Halifax.* ***Toronto*** *was based in the Arabian Sea for almost a year but rather than sail the vessel back to port to replace the crew, the navy flew a new crew to it.*

One of the earliest examples of this new approach was the German MEKO-class ship begun in the 1970-1980s. MEKO stands for *Mehrzweck-Kombination* (multi-purpose-combination) and it is a concept in modern naval shipbuilding based on modularity of armament, electronics and other equipment, aiming at ease of maintenance, and cost and crew reduction. This class of ship was followed by the Danish Standard Flex in the 1980-1990s which further leveraged the advantages of modular design and execution. Other navies are embracing these new design concepts in ship classes such as the US Navy Littoral Combat Ship (LCS), the Royal Navy Type 26 and 45, Australian Air Warfare Destroyer (AWD) and French/Italian European multi-purpose frigate (FREMM).[3] This illustrates that the through-life costs of crewing a major combatant have become an increasingly important element in the design/acquisition process.

Canadian Naval Context

As we begin to look at the design and crewing concepts of the RCN fleets of tomorrow, it is important to consider the strategic context of today. The RCN has a reputation as a globally deployable, sea control navy that is capable of achieving decisive effects at sea, and it is hoped that it will contribute to decisive joint effects ashore tomorrow. The RCN is not a particularly large navy and therefore

must be careful in the way it expends both its human and materiel resources. Given the small numbers in the RCN force structure, the navy cannot afford to miscalculate the needs of its future crews. This is also particularly acute because the navy intends to replace two classes of ship (*Iroquois*-class task group destroyer and *Halifax*-class multi-purpose frigate) with one class, the Canadian Surface Combatant. There is the potential for both efficiencies and risk in such an approach so careful ship design and personnel planning will be essential.

Given that it is still early days in the design of these ships, the RCN will want to be careful not to create an expectation of personnel savings that would lead to a premature draw-down of the force structure in the navy in a way that might seriously impede its ability to operate these ships. Early indications show that naval planners will not require fewer personnel but instead will need to renew the way in which the present level of force structure is organized, trained and equipped. Some naval occupations may need to be amalgamated so as to evolve with changes in technology, and personnel will need to be reallocated within the RCN to meet the needs of the transition to the new fleet.

The RCN does not have the luxury of numerous ships and submarines and deep force structures that some navies possess. All personnel and fleet units must therefore be treated as a precious and limited quantity. The RCN is, however, a full-spectrum navy with highly skilled personnel and robust capabilities, and trains to be able to fight in some of the most difficult maritime environments in the world. Traditionally the RCN's operational and training credo has been the ability to overcome the effects of two major compartment emergencies while continuing combat operations in a multi-threat environment (all in a 24/7 operational tempo), whereas some navies accept only one major area of damage and are willing to declare their ships out of action if a certain level of damage cannot be overcome. As a result, Canadian naval units have always been built to very high design specifications with a high degree of survivability, compared to some navies that build their ships with a more lightweight design philosophy for operations in lower threat environments and for shorter periods of time. The RCN's limited number of platforms, robust design and operational philosophy mean that it has not been inclined to operate its ships with the modest, and in some cases near skeleton, crews that some navies have found to be acceptable.

There may well be a minimum crew size below which one cannot safely pass and many good minds are tackling this issue as we speak. The successful combatting of major fires during cruising operations in Canadian naval ships and submarines *Kootenay*, *Ottawa*, *Chicoutimi* and most recently *Protecteur* would not have been possible if minimum safe crew levels had not been sustained. It is important to understand that if you want to reduce the crew size *and* achieve the same survivability, you may try to replace human capacity with highly expensive integrated emergency systems but these are not yet foolproof. RCN planners must be careful not to be seduced by the desire to reduce people for the promise of savings because they will still desire a navy that can undertake protracted operations.

Emerging Trends and Drivers

With that context in mind let us look at some of the trends that are influencing naval design around the world. Warships are not just an accumulation of sensors and weapons but a complex system to be designed and optimized as an *ensemble* of people and equipment. Ships such as the French/Italian FREMM frigate were designed and built with the specific purpose of optimizing the integration of shipboard systems to reduce the demand for crew and create life-cycle cost savings. In modern ships, there is a heavy reliance on sophisticated automatic systems, and improvements in 'man/machine interfacing' have guided the design work to create a capable ship that can be operated with a basic core crew as low as 100 personnel.[4] (For comparison purposes, the RCN *Iroquois*-class destroyers have a crew of around 250, and the *Halifax*-class frigates have a crew of about 220.) New designs are being carefully studied to ensure that these ships will have the right

Credit: PH 2 Tracy Lee Didas

*A port bow view of the Argentine destroyer ARA **Sarandi** (D-13), a **MEKO**-class ship, underway, 18 October 1990.*

Credit: Wikimedia Commons

*French Navy frigate **Aquitaine** (D650) is the lead ship of the **FREMM**-class in French service, 14 December 2013.*

balance between reliance on technology and reduced crew size that will still permit them to operate in difficult environments.

Modern warship designers are also relying on human-centric design philosophies that will bring together the needs of both the human and the technical/weapons systems in a final warship design. By factoring in the needs of the crew earlier into the design, navies may, over time, achieve personnel savings but not at the detriment of their operational endurance.

Naval ships will also have greater flexibility built into their design that will allow them to be regularly and continuously modernized at lower cost. Reserving the ability to add shipboard space and weight to the initial designs along with a more open physical and technical architecture will be integral to the configuration of ships to avoid obsolescence. A modular design approach will most likely be the planning norm, which will allow ships rapidly to reconfigure their roles, equipment and personnel to provide greater mission flexibility. Navies are also seeking to achieve more commonality of systems across their various fleets. This will enable the usage of similar equipment and systems across numerous platforms at sea and in shore command facilities. This commonality of systems might also reduce the training burden across the various fleets allowing for personnel to be more easily moved from one class of ship to another.[5]

Other areas are being developed that will affect the crewing strategies in modern warships, including:

- artificial intelligence and automated decision aids for mechanical and combat systems;
- use of collision avoidance matrixes for navigation and anti-collision systems;
- advanced fuel systems and power supplies for enhanced endurance;
- automated food preparation and cleaning support services;
- crew performance monitoring practices and technologies;
- low labour seamanship systems for tasks such as replenishment, anchoring, berthing and towing;
- unmanned vehicles and robotics;
- low maintenance surface finishes and materials; and
- use of remote monitoring to shore support establishments for shipboard systems.[6]

We have looked at some of the technical trends in the world's navies, and let us now drill down into specific discussion of crew sizes and other important matters that the RCN is considering to prepare for the future fleet.

Early studies in the area of crewing amongst some of Canada's allies focused on reducing the crews as much as possible.[7] It was believed that through the use of new technology such as modular weapons, sensor packages and whole-ship integrated combat and damage control systems navies could move away from traditional levels of shipboard manning. An extreme example of this reduction in crew size can be found in the Singaporean *Formidable*-class frigate. She is a 3,200-tonne, full-spectrum warfare-capable platform with a crew of only 70 plus 15 aircrew. However these ships are designed to operate in the littoral regions, which is different from the RCN which operates in both continental and international expeditionary environments. Navies around the world watched the introduction of the US Navy's Littoral Combat Ship (LCS) as an example of this approach. These ships were leading edge when they were introduced five years ago. Early in the LCS program the USN introduced the notion of an LCS 'hybrid sailor' whereby every sailor (no matter what trade or rank) was given multi-taskings all the way from shipboard cleaning to operating fighting equipment. After observing the lessons from this early LCS experience and as the ships began to deploy further afield in international operations, the USN chose to enlarge the crew size to enhance the ship's mission flexibility and to improve the endurance of the crew.[8]

Based on the example of the LCS and other new classes of ships, researchers have moved away from merely trying to reduce crews to trying to 'optimize' crews. The concept of crew optimization looks at the new trade skills that might be needed to operate these types of ships.[9] Researchers have also developed a better understanding of how the cost of ship crews accumulates over the life of a class of

ships, thus focusing on through-life costs to give a more comprehensive and enduring view.[10]

One of the novel crewing methodologies that is being explored is a 'scalable' crewing concept. In this approach navies would have a 'core' complement of personnel that could safely navigate a ship through basic operations and they would scale up the crew complement with 'flex' crews as the mission required. In this way the scalable crew would be adjusted to the needs and the risks of the missions that are to be executed. With the flex crewing options, the necessary equipment for these personnel would either be preloaded on the ship or brought with the crews as they augment the core team, and this would allow the ship to handle the escalation of mission complexities.[11] The ship's 'core warfare' teams (Anti-Air, Anti-Surface, Anti-Submarine, including Mine Warfare and Land Attack) could also be augmented as required depending on the intensity of the mission. This would overcome any endurance and/or fatigue issues. Some of the flex crew modules that could be considered include:

- Special Operations Forces;
- Maritime Interdiction and Boarding Teams;
- Information Warfare (communications intelligence and linguistic support);
- Preventative Maintenance (to preserve the ship's fitted equipment on long deployments);
- Uninhabited Vehicles (aeronautical, surface and subsurface);
- Tactical Development, Experimentation and Research and Development;
- Space Support;
- Supply and Sustainment; and
- Husbandry and Cleaning.

Credit: U.S. Navy, Wikimedia Commons

*The littoral combat ship pre-commissioning unit **Independence** (LCS 2) is the second ship in a new design of next-generation combat vessels for close-to-shore operations. The ship has a core crew of less than 40 sailors and is able to reach a sustained speed of more than 50 knots.*

These scalable crews could also be adjusted to meet the different intensity of various missions. In the RCN's case the scalable crews could, by way of example, be developed to meet the escalating needs of the six core missions that are given in the Canada First Defence Strategy.

The RCN implemented its own version of scalable crewing with tiered readiness policies that have been gradually perfected over the past decade to focus allocated funds to precisely defined readiness outcomes. In addition, the RCN has adopted a de facto flex crewing approach, during the current period of reduced fleet capacity, to optimize its ships as training platforms, but more could be investigated in this domain.

Even with the possibility of scalable crews, naval planners and 'budgeteers' must not lose sight of the fact that the core crew would be designed to accomplish only the most

Credit: U.S. Navy, Wikipedia

*The **Zumwalt**-class guided-missile destroyer DDG 1000 is floated out of dry dock at the General Dynamics Bath Iron Works shipyard, 28 October 2013.*

Credit: Halifax Shipping News

Work continues on HMCS ***Charlottetown*** *at the Machine Shop Wharf, Halifax, 10 March 2014.*

basic of missions such as moving the ship from point A to B, or low intensity domestic surveillance. It would be important to set a fixed minimum number of personnel in the core crew and their specified missions so as not to give the impression that a ship with such a light crew could accomplish missions on the higher end of intensity. In this way naval manning levels would be sustained at the correct levels to meet both the high and low intensity nature of these missions.[12]

Future Work

The RCN has begun to take delivery of the ships coming out of the *Halifax*-class Modernization (HCM) program. This has been a successful program that will enhance and extend the viability of the *Halifax*-class frigates through the second half of their service (by decades if need be). While the RCN waits for the next classes of ships to be delivered, it has a good opportunity to study the effects that the advanced automation and enhanced weapons systems in the ships may offer in terms of future crewing strategies. There is also a need to consider a broader range of issues, from operating concepts to human-system integration in the modernized *Halifax*-class, recognizing that the success of future warship designs must be measured in both human and technical terms.

Over the coming decades naval planners and government procurement staffs will have to continue to collaborate closely with industry under the National Shipbuilding Procurement Strategy as they work to design and build Canada's next classes of ship. During this period of consultation naval planners/project staffs need to be aware that existing ship designs ultimately reflect a unique set of requirements and operating concepts that were developed with technologies available at the design stage in the various shipyards, and that there may be significant compromises and costs associated with changes that may need to be made to reflect Canadian requirements.

The issue of crewing is an important area of research because, as I have said, we have a window of opportunity while the RCN's next classes of ships are designed. It is important to make sure that we get the human factors of the design in hand before we begin to cut steel. I have highlighted some important considerations that the RCN and many of its peer navies are already exploring and have suggested other areas that the navy might want to continue to explore as it prepares crewing strategies for the future.

This is both an exciting and challenging time of transition for the Royal Canadian Navy but as the Executive Plan has shown, the navy recognizes the need to examine both technology and human innovation in order to identify some of the internal force structure changes that may be required to crew these exciting new classes of ships in the most effective manner.

Notes

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1. See Department of National Defence, "Commander RCN sets a course with Executive Plan," 13 January 2014. The Commander's priorities are: ensure excellence in operations at sea; enable the RCN's transition to the future fleet; evolve the "business of our business"; and energize the institution.
2. See my list of acknowlegements here.
3. Richard Scott, "Modular Warship Concepts," *Jane's International Defence Review*, September 2013.
4. "FREMM Frigate: Balance Between Stealth and Lethality," *Esprit de Corp Magazine*, Vol. 20, Issue 12 (2008), p. 36. Reduced crew size was imposed by the French Navy to reduce life-cycle costs of the ships and to solve the difficulties in hiring and retaining personnel in their navy. Additional information from an interview with Captain Olivier Casenave-Péré (French Navy Retired), DCNS Canada Office.
5. Rear-Admiral Thomas Rowden, Director Surface Warfare (OPNAV N96), "Building the Surface Fleet of Tomorrow," US Naval Institute, *Proceedings*, Vol. 140/1/1, No. 331 (January 2014).
6. Kevin Baker and Lisa Hagen, "INCOMMANDS TDP: Human Factors Evaluation of the Command Decision Support Capability Prototype," DRDC Toronto, Contract Report CR 2009-041, Toronto, March 2009.
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8. Norman Friedman, "New Roles for Littoral Combat Ships," US Naval Institute, *Proceedings*, Vol. 129, No. 1 (January 2003).
9. Patricia Hamburger, Robert Bost and Jennifer McKneely, "Optimized Crewing for Surface Ships," *Naval Surface Warfare Technical Digest*, 1999, pp. 204-215. The research attempted to find the optimal locus of manning, total operating costs and mission intensity.
10. Paul Chouinard and Commander Ian D.H. Wood, "The Department of National Defence Strategic Cost Model: Development," Technical Report TR 2007-14, DRDC Centre for Operational Research and Analysis, September 2007.
11. In order to accommodate these flexible teams the design of the next classes of ships will need to include additional bunking capacity for the crews and also flexible mission spaces to embark the various types of unique equipment that these teams would require for their operations.
12. Interview with Vice-Admiral (Retired) P.D. McFadden, Commander of the RCN 2009-2011, February 2014.

Commander Ian D.H. Wood is the Defence Fellow at the Centre for Foreign Policy Studies at Dalhousie University. He has over 30 years of service in the RCN and has served both at home and abroad in Command, Staff and Policy Advisor positions.

The Ocean Tracking Network

Fred Whoriskey and Nikki Beauchamp

The traditional definition of maritime security is broadening, in some cases somewhat uncomfortably, to include concerns that historically would not have been considered security issues. Environmental issues, for example, have the potential to disrupt social stability and generate conflict and consequently need to become part of national strategic thinking, planning and monitoring.

Ocean environmental issues are rapidly finding their way into these discussions, driven by the impact ocean dynamics have on human society, especially coastal states, in terms of resources and the increasing frequency of extreme weather events. Fisheries in many of these states range from being important to critical in providing food supplies. Many species of fish migrate, frequently over great distances, and in doing so do not respect national borders. The migrations can bring these animals into contact with fisheries within the Exclusive Economic Zones (EEZ) of multiple states, into international waters where fisheries are pursued under the aegis of international conventions or commissions, or to parts of the ocean where due to lack of regulatory frameworks or the absence of credible enforcement, they are subjected to uncontrolled or illegal fisheries.

Present technology means that there is no part of the ocean that humans cannot reach, and sustainable use of valued marine resources will depend on the management actions we take. But knowledge of the migrations of marine species and their environmental drivers is incomplete, and this poses challenges for national and international managers and policy-makers attempting to generate sustainable harvests.

Sustainably managing fish populations into the future will require a massive increase in the knowledge we have on the survival, spatial distributions and habitat use of key species of fish in the oceans, and the environmental factors that drive them. The fact that fishery resources are frequently shared among states, and these states would all benefit from their sustainable use, is a strong argument for the development of transnational research capabilities where the infrastructure, costs and the results of cooperative research programs are shared.

Recent developments in electronic telemetry (remote acoustic and satellite tracking) make it possible to obtain this knowledge, but it can be costly to do so especially for highly migratory species. The Ocean Tracking Network (OTN) is a potentially game-changing, forward-looking, cooperative research infrastructure[1] that builds on the contributions of many international partners to create a new global capability for biological ocean observation. OTN is headquartered at Dalhousie University in Halifax, and was funded in 2008 by the Canada Foundation for Innovation (CFI) to set up global aquatic animal tracking and data storage infrastructures. OTN intends to operate in all of the world's oceans. Present deployments and partnerships are active in the Arctic, the north and south Atlantic and Pacific Oceans and the Indian Ocean, and the network continues to expand. OTN provides knowledge about the movements, survival and habitat use of aquatic animals, and how environmental factors affect them. It does this by supporting a network of Canadian and international scientists (funded by the Natural Sciences and Engineering Research Council of Canada, the Social Sciences and Humanities Research Council of Canada and the Canada Foundation for Innovation) to work with the global tracking infrastructure on key science questions.

A juvenile blue shark is tagged with an acoustic transmitter off Eastern Passage, Nova Scotia, to document movements and habitat use.

An example of an element of OTN is what is called the Halifax Line. This is a line of acoustic receivers that runs across the continental shelf from Halifax to the beginning of the continental shelf edge (the point where depth begins to drop off rapidly) providing the first comprehensive coverage for many species of tagged animals migrating north-south between US and Canadian waters. This is the longest and most ambitious acoustic telemetry line in the world and is composed of more than 250 individual receivers and covers a distance of over 100 nautical miles (over 200 kilometres).

Credit: Nikki Beauchamp

A VR2W acoustic receiver is attached to a float before deployment. Moorings are comprised of an anchor, acoustic release, receiver and float. Upon recovery of the mooring, the acoustic release detaches from the anchor and the receiver floats to the surface where technicians bring it on board and offload data.

The process of aquatic tracking typically involves placing tags either externally or internally on animals, and the tags communicate to receivers that capture and store data from them. Different types of telemetry systems have been developed for animal tracking with each having its strengths and shortcomings. Radio tags communicate on radio frequencies which can transmit through fresh water to shore- or aircraft-based receivers. However, radio waves are blocked in salt water; hence the technology will not work for animals that spend part, or all, of their life at sea. Acoustic telemetry uses tags that emit coded sound signals which are picked up by receivers tuned to the frequencies of the tags. Acoustic telemetry works in both salt and fresh water, but the distance the signal carries is typically much less than that of a radio tag in fresh water, requiring a much more extensive deployment of receivers. The tag life and power (reception range) of both radio and acoustic tags depend on battery size, and this means that long-lived (10 years or more), powerful tags are big and can only be carried on very large animals (e.g., tuna, sharks, seals). Acoustic tags are now available for animals as small as five centimetres in length, but the life span of these tags is around 20 days.

The position of an animal detected by acoustic and radio telemetry is determined by knowing the position of the receiver that detected it. Additional sensors can also be placed on both radio and acoustic tags, reporting things like temperature, pressure (depth), salinity and three-dimensional swimming speed and direction. These sensors inform scientists about the environmental conditions that a tagged animal is encountering and how it is behaving. However, the sensors increase tag size and power draw, and the data they generate is only recorded when the tagged animal is in range of a receiver.

A second class of telemetry involves the use of satellite tags. These are larger and can only be used on larger animals, and typically these tags are active for about a year. For fish species that remain submerged at all times, the tags determine their approximate position at a given time by light-based geolocation coupled to the tag's clock. They can carry an array of environmental sensors including for temperature, depth, salinity and accelerometry (measuring movement velocity). The data is recorded at regular intervals and stored to memory on the tag. The tags are programmed to release on a predetermined date and float to the surface (hence the name 'pop-up tags') where they report via satellites. Due to the short timeframe in which satellites are typically in range to capture data being broadcast from these tags, the tags transmit a summary of their stored data. If the tag can be retrieved, the full data record contained in the memory on the tag can be recovered, which is a gold mine of information. A surprising number of these tags, and some acoustic receivers, are washed on to beaches where beachcombers find them and return them to the investigators.

For animals that regularly break the water surface and offer more opportunities to transmit data, satellite relay tags can be used. These have been fixed to the heads of seals or the dorsal fins of some species of sharks, and

instead of transmitting summaries of information can transmit detailed minute-by-minute data, permitting a much finer-scale documentation of what the animal was up to in a three-dimensional ocean. It also permits more accurate determination of the positions of the animals, either from Doppler calculations based on receptions on multiple satellites or, more recently, from GPS positioning.

Oceanographers are now capitalizing on the capabilities of satellite-tagged animals as a cost-effective way to sample environmental conditions. For example, satellite tags carried by southern elephant seals ranging under the ice in Antarctica have identified previously unknown sites for the formation of Antarctic deep water, a key component of global ocean circulation.[3] These data are making large contributions to our understanding of the oceans, and of how ocean processes are linked to global weather and climate conditions. The US Integrated Ocean Observing System (IOOS) is working to operationalize data from animal-borne sensors for many different user groups as one activity of its animal observation network.[4]

While OTN researchers use a variety of technologies for animal tracking, they are primarily focused on acoustic telemetry. Canadian companies are world leaders in the design and manufacture of acoustic telemetry equipment, with Vemco of Halifax, NS, being the principal global supplier of acoustic telemetry equipment for tracking aquatic animals. Vemco equipment has been deployed to all of the world's oceans and the seamless compatibility of this equipment means that tags deployed on an animal in one country will be detected should it swim over a Vemco receiver in another country thousands of kilometres away. There are more than 20,000 Vemco receivers currently deployed worldwide.

OTN has been adding new receiver lines to oceans to complement the existing deployments and fill gaps. It has been working with governments and private sector partners on placing acoustic receivers on existing ocean infrastructure, including oceanographic buoys associated with the offshore oil and gas industry. The most recent example is the addition of acoustic telemetry capabilities to the US-France-Brazil Pilot Research Moored Array in the Tropical Atlantic (PIRATA) weather and oceanographic buoy network, which spans from Africa to South America. Many states are also adapting marine autonomous vehicles (e.g., Slocum Gliders, Wave Gliders) to carry tracking units as part of the sensor suite for oceanographic monitoring.

Acoustic telemetry is being used globally to answer key questions surrounding the sustainable management of valued species. Canadian scientists are highly skilled in the innovative use of telemetry, and within the OTN they are active on the Pacific and Atlantic coasts and in the Arctic. Work in each of these areas focuses on regionally important issues needing good science to guide decision-making. The following are four examples of what is being done to monitor ocean species.

First, research being conducted on the West Coast of Canada on Pacific salmon is helping to provide information to managers and fisheries stakeholders on the

Credit: Damian Lidgard

A Sable Island grey seal is outfitted with a satellite tag (head) and Vemco mobile transceiver (back) to track its movements and interactions with other tagged animals (e.g., cod, tuna, eels, seals) it may encounter while at sea.

mortality of accidentally by-caught coastal migrating adult Pacific salmon that must be released alive. This information is also used to test ways in which this survival could be improved. A social sciences study is underway in tandem with the monitoring study to look at how to transfer the knowledge gained so it can be put to use. Researchers for this work are drawn from the University of British Columbia, Carleton University and the University of Ottawa, and they are extensively linked to government and the user sector.

A second example is a more varied group of researchers active on the East Coast of Canada. Here the migration patterns and predation upon American eels migrating from the St. Lawrence River to their presumed spawning areas in the Sargasso Sea are being studied by a team centred at l'Université Laval and linked to oceanographers at Dalhousie University. Populations of the eels have crashed (more than 95% reduction over 10 years), and the information from the telemetry work will feed back into recovery strategies. Tag temperature sensors from a 2013 study recorded a sharp spike increase to temperatures similar to those consistent with gut temperatures of two Gulf fish species, tuna and sharks, while pressure sensors revealed dive patterns consistent only with porbeagle sharks, indicating previously undocumented predation by porbeagle sharks. This work has been helpful in examining why population numbers of this species are decreasing.

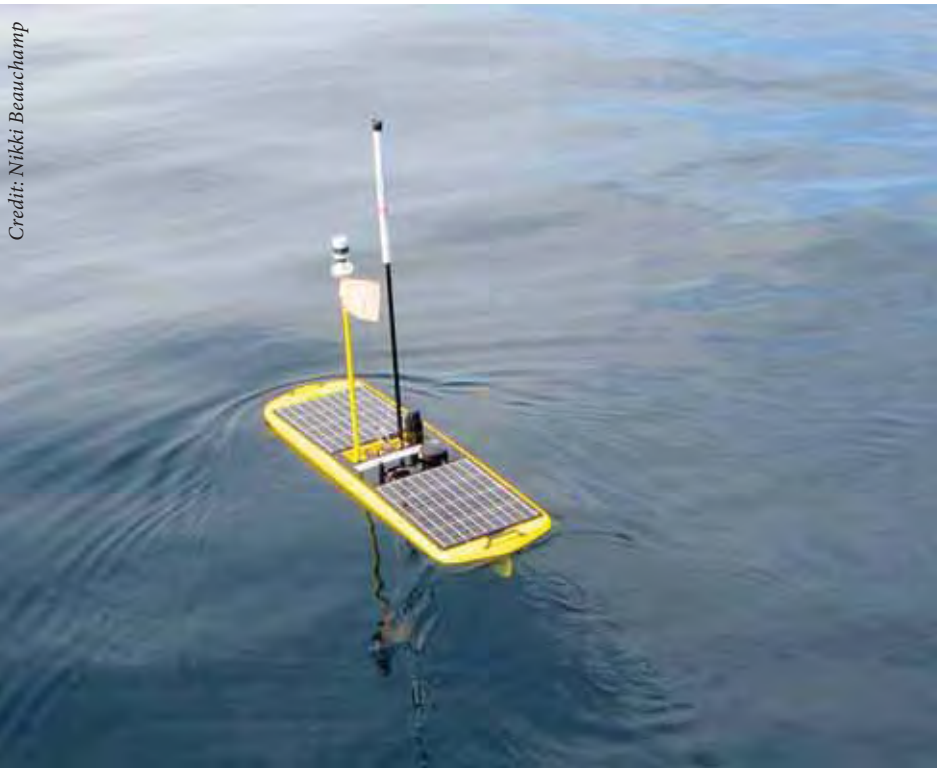
A third example is a study of Canadian Atlantic seal-cod interaction. In this case, a team from Dalhousie University in Halifax is working with scientists at the Bedford Institute of Oceanography. The seals carry newly developed combined tag-receiver units (Vemco Mobile Transceivers, or VMTs), which report real-time detections of tagged animals via satellite. Information on this project is beginning to document frequent seal-seal interactions, and so far all seal-cod encounters have not provided convincing evidence for a major impact of seal predation upon cod.

The final example is Canadian Arctic research which is providing information important for the development of northern fisheries. In the Arctic, researchers from the University of Windsor, the University of Victoria and Fisheries and Oceans Canada are using telemetry to follow Greenland halibut to identify population structure in the face of competing fisheries. They are also tracking Arctic cod, Greenland sharks and other species to fill nearly total gaps in our knowledge of what locations are occupied by these animals at what times of year.

As data-sharing protocols are established for all of these regions, a powerful global observing network for fish movements is being created. Some regions (Australia, parts of North America, South Africa) are well advanced in their observation system and have networks with compatible, well-developed data storage and exchange protocols. However, in most parts of the world the telemetry equipment is owned and operated by

Credit: Nikki Beauchamp

OTN technicians prepare to deploy a line of VR4 acoustic receivers in the Cabot Strait. This line captures movements of tagged animals in and out of the Gulf of St. Lawrence via the strait. It also captures movements of tagged halibut in commercial harvest.



Credit: Nikki Beauchamp

A Liquid Robotics' Wave Glider hosts a suite of atmospheric and sea-surface monitoring sensors. The self-propelled, solar-operated Wave Glider is also used to offload animal tracking data from bottom-moored acoustic receivers, lowering operational expenses and risk to personnel at sea.

independent scientific groups which are not yet linked into data-sharing systems. A large component of the OTN's activities involve coordinating data standards and best practices with existing networks, and assisting with recruiting new participants and data networks in parts of the world where they are currently lacking. OTN also has a talented group of specialists working on data analysis and visualization, providing new approaches and sharing the analytical code.

Internationally, researchers working with the global OTN infrastructure are also focused on regionally important issues but which have application to problems in other areas as well. For example, a recent high-profile public safety issue has erupted due to an increase in fatal attacks on people by sharks, most apparently by white sharks. OTN-linked projects in the United States (Massachusetts Division of Marine Fisheries), South Africa (Rhodes University and partners), and Australia (University of Tasmania, Western Australia Fisheries and others) are tracking white sharks in an attempt to understand the behaviour of these animals so that in turn the behaviour of people can be changed to reduce the risk of shark encounters. In Western Australia, Western Australia Fisheries has launched an ambitious study that will follow individual tagged sharks for over 10 years to see if they predictably occur at certain sites at certain times of the year (site fidelity) and to show how their behaviour changes over time. They have also created a sentinel system of acoustic receivers that report in real time the presence of tagged sharks near popular beaches. Other international projects associated with OTN range from tracking the movements of marine fish in South Africa to assist in the design of marine reserves (Rhodes University) to documenting the migrations of declining salmonid populations in Norwegian fjords (Norwegian University of Science and Technology).

Partnership approaches to building global observing networks have parallels in other science fields. Partnerships develop because of the need scientists have for information which is often not obtainable with their limited resources and funding. The weather services of national authorities have been sharing their marine weather observations internationally for decades. These data have provided critical elements for decisions about evacuations and mitigating the destruction of commercial ports, infrastructure and ultimately loss of human life.

The 2002 World Conference on Sustainable Development identified the need for states to share the data they are collecting from their earth observation system so that effective decisions can be made for global problems. This galvanized the formation of the Group on Earth Observations (GEO) which has launched and continues to develop the Global Earth Observation System of Systems. These systems encompass a broad array of monitoring programs in the physical and biological sciences. In making the information from these systems widely available, the hope is to permit better weather forecasting and response planning for extreme storm events, and food security (for example, advance global harvest projections). OTN has similar aspirations for Canada and the Canadian Arctic frontier; its knowledge will inform management activities and policy development nationally and internationally in ways that conserve and sustain valued ocean biological resources.

Notes

1. See, S.J. Cooke, S.J. Iverson, M.J.W. Stokesbury, S.G. Hinch, A.J. Fisk, D.L. Vanderzwaag, R. Apostle and F. Whoriskey, "Ocean Tracking Network Canada: A Network Approach to Addressing Critical Issues in Fisheries and Resource Management with Implications for Ocean Governance," *Fisheries*, Vol. 36 (2011), pp. 583-592.

Fred Whoriskey is a research scientist who works on fish migration, and is the Executive Director of the Ocean Tracking Network.

Nikki Beauchamp is the communications officer for the Ocean Tracking Network.

The Battle of the Indian Ocean 2039?

Major (Retired) Roy Thomas

An Indian Ocean conflict may have already commenced! In 2009 near Bab Al-Mandabe Straits an Indian submarine and two Chinese warships manoeuvred to test the weaknesses of their respective sonar systems before the submarine broke off contact.[1] Even if you don't believe that the conflict has commenced, what about the future? The next *Red October* novel may well feature submarines of the Chinese and Indian Navies. Predictions have been made that on the 100th anniversary of the Battle of the Atlantic there could well be a Battle of the Indian Ocean. It is important to determine the role of the Canadian Navy in such a confrontation, conflict or outright war.

The present situation is that these two superpower rivals in Asia, the Chinese and Indian civilizations,[2] are both competitors and partners. Unfortunately, the current trend seems to be to enhance the competition rather than the partnership. This could ratchet up the India-China tension and perhaps lead to a war between the two powers. A stable environment maintained by China, India, the United States, Russia and Japan would be the one most desired by Canada and the international community but is perhaps the least likely to occur. Another, very undesirable, scenario is, of course, the achievement of Asian dominance by China.[3] This rivalry between the Chinese and Indian civilizations – both emerging as superpowers which by 2039 will likely have surpassed the United States in economic clout – "will play out less on land than in a naval realm."[4]

Canada in the Indian Ocean

What would Canada's roles and interests be in a potential Sino-Indo conflict? Both China and India have histories that date back thousands of years, and Canada has but a short history as a state, and significant diasporas of both Indian and Chinese origin. It is hard to imagine either Chinese or Indian decision-makers seeing Canada as anything but a vassal of its giant American neighbour. The American objectives are to maintain an open Indian Ocean highway, defend chokepoints at either end of the Indian Ocean, and keep an eye on the Indian Ocean as a secondary front in the broader Asian region. These would appear to be strategic aims of Canada as well. Therefore any Royal Canadian Navy (RCN) role in preventing a China-India war from starting in the most likely flashpoint, the Indian Ocean, must be seen in the context of the US Navy capabilities. But Canada's anti-submarine legacy during the Second World War and the Cold War suggests a possible path for a Canadian contribution.

If Canada continues its specialization in anti-submarine warfare (ASW) and counter-mine operations, the RCN will "offer a capability that is in relatively short supply but is crucial to ensure American operational successes."[5] While the US Navy is a dominant navy, it cannot be

Credit: Indian Navy/Wikimedia Commons

*An Indian Navy flotilla of the Western Fleet escorts INS **Vikramaditya** (R33) and INS **Viraat** (R22) in the Arabian Sea 10 January 2014.*

everywhere and do everything – the ocean expanses are huge and even the US Navy is spread thinly. The Indo-Pacific region is increasingly a submarine-rich environment as countries increase their submarine capabilities. There is definitely a submarine dimension to any Indian-Chinese maritime competition, confrontation, Cold War or outright combat in Indian Ocean waters. Certainly China has become a maritime power. Its present fleet of 70 submarines approaches that of the USN total of 73, in numbers if not quality, and is equal to Russia's estimated 70. India and Japan each have 16.[6]

If we look at the member states of the Indian Ocean Naval Symposium (IONS), an initiative that seeks to increase maritime cooperation among navies of littoral states of the Indian Ocean region, we can see that the number of submarines is an impressive 72. Among the Southeast Asian and Asian littoral members, Australia and Thailand have six submarines, Singapore and Indonesia five, and Malaysia two for a total of 24. Myanmar and Timor Leste are not expected to get submarines. The submarine fleets of the South Asian littoral member states include India's 16 and Pakistan's five for a total of 21. Bangladesh may acquire submarines but Seychelles, the Maldives and Sri Lanka are unlikely to do so. The total submarine count for the West Asian littoral members is the three that Iran has. Bahrain, Iraq, Kuwait, Saudi Arabia, the United Arab Emirates (UAE) and Yemen are not predicted to obtain submarines. The East African littoral member total of 24 is perhaps skewed by the inclusion of the French Navy's fleet of 15 and Egypt's six. South Africa has three but other members, Comoros, Djibouti, Eritrea, Kenya, Madagascar, Mauritius, Mozambique, Somalia, Sudan and Tanzania are unlikely to be able to afford submarines. However, a wide range of submarines of IONS members alone could be underneath the waters of the Indian Ocean at any one time.

Not only is ASW capability in short supply in the USN, this is likely the case for the navies of the majority of these IONS members. Canada can contribute by compensating for IONS deficiencies in ASW and by assisting in the building of ASW capacity.

The Aim of Developing Canadian Situational Awareness

The exact nature of the RCN contribution in place by 2039 requires development of a made in Canada situational awareness plan. There are two aims in developing Canadian-specific awareness of the Indian Ocean situation. The first objective is to obtain the information not readily available from allies or from aerospace assets that would inform Canadian decisions as to what the nature of a progressively greater RCN role in the Indian Ocean should be. This is what I call 'big picture' engagement. The second aim is make the future naval leaders and their current bosses, whether military or civilian, aware on a continuous basis of what is happening in the Indian Ocean and its littoral regions through Canadian eyes!

Credit: Internet

*A conventionally-powered **Yuan**-class submarine, one of 12 in the Chinese navy.*

Big picture engagement for situational awareness is required initially. The Department of National Defence (DND) and the RCN should participate with 'observer status' in the IONS. At the same time DND should insist that Canada join China, Britain, Japan, France and Egypt as dialogue partners in the Indian Ocean Rim Association for Regional Cooperation (IOR-ARC). Apparently application for IONS observer status is underway[7] but whether Canada is seeking to become an IOR-ARC dialogue partner is unknown.[8]

Country information must be sought from Canadian attachés in the IONS states. Since the Indian Ocean will be the likely arena for any major Indian-Chinese confrontations, Canadian naval officers must be posted to the attaché staff of these two emerging superpowers – or to the position of attaché.[9] There are only two attachés among the East African littoral states neither of whom are from the RCN. These should be replaced with naval officers. Canada's single Gulf attaché, also not a naval officer, should similarly be replaced by a naval officer. The information sought by attaché staff must be focused on the Indian Ocean.

Canadians, rightly or wrongly, are more acceptable in many littoral IONS member states than any other of the observer states. In the next decade there should be consideration of deploying additional naval attachés to other Canadian Embassies around the Indian Ocean that

presently have no Canadian Forces (CF) attachés on staff. Assigning naval officers to the existing attaché positions as well as ensuring Canada's observer status on the IONS would greatly increase situational awareness. This would in turn contribute to making informed decisions about expanding the Canadian naval attaché presence around the Indian Ocean rim.

At the same time, a program of briefings on the Indian Ocean delivered by naval officers from IONS member states could be initiated in the CF Staff College and naval training establishments. These briefings should also occur in a range of forums attended by Canadians interested in defence and be sponsored by non-government bodies and universities. The Ambassadors of IOR-ARC and IONS member states could be requested not only to provide senior Canadian military and political leaders with Indian Ocean perspectives but also be invited to share these insights in CF training institutions and with the public. In particular the Chinese and Indian attachés accredited to Canada could be invited to talk about their navies, ideally in forums that permit questions. Naval officers from those IONS states without accredited attachés should be sponsored to come to Canada with invitations to address a range of audiences. The leaders of tomorrow must start being exposed to the situation in the Indian Ocean rim today.

Situational awareness about the Indian Ocean must also be developed among the possible leaders of the military as Canada considers the 2039 centennial commemoration of the Battle of the Atlantic. Most if not all military and naval leaders participate in Staff College training. But it should not just be *Canadian* officers who participate in Staff College courses. Analysis of the 1,522 naval officers who have participated in programs conducted by the Canadian Forces College over the past dozen year, indicates that only 174 have been foreign naval officers.[10] *No naval officer has been from China, India or any African country.* Only 20 naval officers were from countries participating in the IONS, and this includes 11 from Australia and two from France, two countries with which we have had long relations but that aren't really the major players in the Indian Ocean. (France is a member rather than an observer in the IONS by virtue of colonies designated as departments of France.) This situation could be remedied by at minimum inviting India and China to send naval officers to Staff College training. Kenya and South Africa could also be invited to send naval officers. The Canadians sent to the Australian and Indian Staff Colleges should be naval officers. Furthermore, consideration should be given to training some Canadian naval officers to speak Chinese with a view to having them attend Chinese naval staff training.

Credit: Wikimedia Commons

A Guard of Honour at the officer training establishment of the Indian Navy, the Ezhimala Naval Academy.

Other avenues for developing situation awareness of the Indo-Pacific region must be explored. An exchange of naval officers with Australia and India in an appropriate planning staff position should be initiated. Similar exchanges with China for naval personnel should be pursued once a Chinese language capability is developed. As well, Canada's exchanges with its major ally must be reviewed, and more USN exchange positions must be sought for Canadian naval officers in positions related to the emphasis on ASW and the Indian Ocean. The suggestion made in a commentary in the fall 2013 issue of *Canadian Naval Review* that cruises to the Pacific Ocean for naval cadets should be adopted needs to be refocused on the Indian Ocean as a primary destination.[11] This would be exposing a wider range of Canadian naval officers to the Indian Ocean – the likely scene for future naval confrontations – very early in their careers.

Using Technology to Determine the Best RCN Responses

One of the ways that the increase in situational awareness could be used would be to develop a computer-based war game mechanism for studying the RCN's role. Gaming could provide scenarios in anti-submarine warfare in various permutations of confrontation, conflict, Cold War and combat. The ASW strategy for dealing with possible scenarios involving the Chinese-Indian navies in the Indian Ocean must be explored, and war games are the best way to do this. The use of war games was behind the USN strategic decisions regarding carrier employment in World War II. According to Williamson Murray, an American historian and author, "[u]ltimately Newport's [home of the USN Naval War College] war gaming became a key element in the institutional process by which the US Navy worked out answers to fundamental issues

Credit: Wikimedia Commons

A Mikoyan MiG-29K of the Indian Navy in flight over islands, 14 December 2011.

that confronted all navies in developing carrier aviation beyond the Royal Navy's achievements in World War I."[12]

As technology gets more and more sophisticated, so too do war games and simulations. Simulation technology now makes it possible to generate scenarios with a wide range of variables.[13] The USN may already have such games developed but ASW aspects and indeed an RCN role would have to be programmed into the games – or new games developed – to make the game(s) of immediate use to Canadian strategists. For example, the immediate problem to be examined via war games is what role the RCN can and should play in an Indian Ocean where Chinese and Indian warships and submarines are testing each other's capabilities. The options of non-aligned naval states in keeping sea lanes open in a Cold War scenario must be explored. A longer-range issue to be explored might be that of the role of unmanned aerial vehicles (UAVs) launched from ASW surface platforms in the Indian Ocean region. It is not too late to use war games to explore whether or not UAVs should replace helicopters on ASW warships. Coordination with aerospace surveillance assets could be also examined for all scenarios, particularly the flow of information regarding submarines.

A major research and development (R&D) emphasis on ASW must be undertaken immediately with the short-term aim of addressing deficiencies not being worked on in other countries, and considering new concepts over the longer term even at the expense of programs for other services.[14] Both China and India are looking abroad for energy supplies – the Chinese search for energy sources has touched Canada's political landscape – and there can be no doubt about where the Chinese and Indian civilizations will collide. The energy flow from the Gulf will remain in the foreseeable future the Achilles heel of both India and China, and other flashpoints remain as irritants. The number of submarines available to interfere with this seaborne energy flow and perhaps provoke outright combat makes ASW technological development an essential requirement, indeed a Canadian priority. Canada should be a leader in developing ASW technology. Canada's success at basing helicopters on ships must be replicated with further innovation in the decades ahead. In this era of limited funding, other navies are not putting money into surface ASW R&D. Canada can do this, although perhaps it will have to occur at the expense of other programs.

The overall aim is to use simulation technology as well as new Canadian innovations discovered as a result of R&D to create an ASW Centre of Excellence which attracts prospective foreign participants. The participants may include practitioners and academics, some of whom may pay or be charged for their access for study or training.

A Canadian Naval Presence

In addition to the cadet cruise proposal, a slightly more expensive plan would be the diversion of the Canadian warship now on station in the Gulf to make port visits, to Hambantota in Sri Lanka, Gwador in Pakistan, the Maldives and Singapore. In 2013 HMCS *Regina* visited Mumbai and Vice-Admiral Maddison visited India at the same time. I presume that, after the signing of an initiative on military cooperation between Canada and China in June 2013, visits to Chinese ports will also follow. Information gathered from attachés can be used to direct further port visits. Within the next decade, port visits to the East African littoral states participating in IONS should not only showcase Canadian ASW assets but host demonstrations of Canadian expertise and assets in short off-shore cruises.

The Pacific focus suggested in some Canadian naval circles has likely already begun to occur in RCN tactical ASW training as well as with Royal Canadian Air Force (RCAF) anti-submarine assets. The focus should be now be adjusted to concentrate specifically on the Indian Ocean, an area which may not have received much attention in ASW training although Canadian warships have had a presence in the Gulf and off Somalia for some time. Within the next decade Indian Ocean navies should be

Credit: United States Navy, Mass Communication Specialist Seaman Kevin T. Murray Jr.

*Canadian frigate HMCS **Charlottetown** (FFH 339) is an example of Canada's current ASW capability.*

invited to Canadian tactical ASW training in a form of a Naval Training Assistance Plan (NTAP) similar to the Military Training Assistance Plan (MTAP) with strategic purpose. The main goal of sharing training should be development of interoperability in ASW operations with states not part of NATO. Another goal would be exposure not only to Canadian naval expertise but also to Canadian technology. This training will also increase the situational awareness of Canadian naval officers participating in joint and combined exercises.

Conclusion

The RCN has an opportunity to prepare for the next most likely conflict, the Battle of the Indian Ocean. Rather than re-fight the Battle of the Atlantic 100 years later, or the Cold War that followed, the RCN must determine what its role should be under very different circumstances. To prepare the first step properly the RCN must develop situational awareness of the naval challenges across the spectrum of conflict in the Indian Ocean region. Canada must move to acquire the region-wide perspective offered by participation in the Indian Ocean Naval Symposium as an observer and the Indian Ocean Rim Association for Regional Cooperation as a dialogue partner. In addition, Ambassadors and attachés from countries with Indian Ocean interests must be invited to brief not only Canadian military leaders but also political leaders and Canadians on an ongoing basis on the current situation in the Indian Ocean region.

Credit: Master Corporal Peter Reed, Formation Imaging Services, Nova Scotia

*Something for Canada to emulate? Local spectators welcome the Chinese ship **Zhenghe** to Canada in June 2012. **Zhenghe**, a naval training vessel, was visiting Halifax as part of a goodwill tour of 11 countries.*

As well, naval officers must be selected as Canadian attachés for India, China and East African littoral states, and these states must be invited to send naval officers as attachés to Canada. The RCN's leaders in 2039 must be made aware now of the Indian Ocean situation through Staff College exchanges, staff appointment exchanges and training with IONS member navies. The increased awareness developed through Canadian focus on the region must be tested in war games for thorough analysis of the best role for the navy as the Indian Ocean situation changes through the decades ahead. At the same time, Canada must consider a NTAP for East African countries that would raise the capabilities of their navies to contribute to any cohesive attempt to reduce the potential for conflict in the Indian Ocean region.

Notes

1. Mohan Malik, *China and India: Great Power Rivals* (New Delhi: Viva Books, 2012), p. 358.
2. A testimony to the fact that India and China are not mere sovereign entities is the fact that Chinese treatise *The Art of War* was written before Christ was born and the lesser known Indian work on governance, Kautilya's *Arthshastra*, is almost as old. Both offer advice still useful today.
3. See Malik, who lays out five possible scenarios for the region. These scenarios are discussed in detail in the chapter "Triangles, Tilts and Strategic Futures," in *China and India*.
4. Robert D. Kaplan, *Monsoon: The Indian Ocean and the Future of American Power* (New York: Random House, 2010), p. 13.
5. David S. McDonough, "The US Pacific Pivot and Implications for the Future of the RCN," *Canadian Naval Review*, Vol. 8, No. 4 (Winter 2013), p. 22.
6. Data on submarines obtained from Wikipedia.
7. A letter to the author from the Minister of National Defence, 1 February 2013, states that the RCN "had made application for observer status at IONS."
8. A letter to the author from the Parliamentary Secretary to the Minister of Foreign Affairs, 20 December 2013, only advises that Canada is not a dialogue partner in IOR-ARC at the time of writing with no indication that such a position was being sought.
9. An email of 19 November 2013 from Colonel (retired) David Burke, a former Canadian Defence Attaché to China, advised the author that a key recommendation he had made in his final report was that this billet should be filled by a naval officer. The present Defence Attaché in China is indeed a navy Captain.
10. An email of 9 July 2013 from the Assistant Registrar of the Canadian Forces College provided the country of origin of the 1,522 naval officer in his database for the following CFC courses, JCSP, CSC, JCSP (DL) Parts 1 and 2, JSOP, ELP Part 2, NSP AMSC, and NSP NSSC, and JSOP. I recognize that the Toronto Staff Course no longer has a dedicated naval program. However the Staff College is supposed to prepare officers from all services for staff and supervisory positions in National Defence Headquarters. Perhaps as early as 2019 consideration should be given to introducing Indian Ocean naval content into the Staff College for consideration by *all* students.
11. Brian Wentzell, "Is it a Pacific Pivot or a Canadian Presence in the Pacific Rim?" *Canadian Naval Review*, Vol. 9, No. 3 (2013), p. 29, talks about training cruises to the Pacific. I contend that a more desired destination would be East African littoral regions.
12. Williamson Murray, "Innovation: Past and Future" in Williamson Murray and Alan R. Millet (eds), *Military Intervention in the Interwar Period* (Cambridge: University of Cambridge Press, 1996), p. 393.
13. Janet Thorsteinson, "Reality of the Virtual World," *Canadian Naval Review*, Vol. 9, No. 1 (2013), p. 29.
14. Mark Tunnicliffe, "Today's Science for Tomorrow's Navy," *Canadian Naval Review*, Vol. 9, No. 1 (2013), p. 19.

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Navigating the NSPS: A Case for the JSS and Hybrid Coastal Vessels*

Andrew Harmes

Credit: RCN

*HMCS **Winnipeg**, seen here near Vancouver, BC, is one of the last major Canadian naval procurements.*

During the early years of Stephen Harper's tenure as Prime Minister, the Canadian government's commitment to defence spending steadily increased. Highlighted by the 2008 Canada First Defence Strategy which promised spending growth at an annual increase of 0.6% in real terms, the increased financial commitment aimed to rebuild the military capabilities that had depleted during the deficit-eliminating years of Prime Minister Jean Chretien. Since then, however, global financial uncertainty has led the government to reconsider defence expenditures. Lieutenant-General Andrew Leslie's 2011 spending review recommended that overhead costs be reduced to allow for investment in actual military capabilities. While Harper has endorsed this 'teeth' versus 'tail' approach, the planned $2.1 billion in cuts to military spending by 2015 mean that the capabilities of the Canadian Armed Forces are no longer immune.[1]

Moving forward in an increasingly constrained budgetary environment, it is important that the Canadian government develop a concise strategy. Maritime security is key to Canada's strategic defence and economic well-being. Nonetheless, it is expected that the Royal Canadian Navy (RCN) will have its funding reduced anywhere from 17 to 20%.[2] This will make the already difficult task of patrolling the world's longest coastline and conducting missions abroad even more challenging.

In adapting to reduced funding, Canada's maritime forces must first alter their threat and priority assessment. Even after the end of the Cold War, focus has remained on capability-based planning in which emphasis is on military combat effectiveness. While such an approach is still relevant, it is not in line with the current maritime security environment. The threats in the 21st century are varied and responding effectively often requires constabulary and diplomatic maritime operations. Addressing these varied threats demands an increased ability to operate in littoral waters where speed, flexibility, supply and amphibious capabilities are essential. Conventional naval power in destroyers and frigates – in addition to being a difficult political investment – is not particularly effective in this environment. Most important here are logistical support and multidimensional coastal engagement abilities; two things that are not reflected in current fleet planning. Therefore, to make the transition into the 21st

Credit: Corporal Johanie Maheu, Formation Imaging Services, Halifax, Nova Scotia

*Sailors' families wave as HMCS **Fredericton** returns home after a long deployment. HMCS **Frederiction** was deployed on a six-month mission to the Arabian Sea, Gulf of Aden and Horn of Africa to conduct anti-piracy and counter-terrorism operations alongside NATO and coalition partners.*

century security environment, the government must give priority in its procurement strategy to developing hybrid coastal vessels and operational support ships. This would provide the mid-intensity combat and logistical capabilities necessary to satisfy the Canadian public and ensure national security.

The Sea Environment and Economic Security: The Away Game

Despite having oceans on three coasts, Canadians generally fail to recognize the importance of the sea to the economy and national security. While Canada's land border with the United States receives much attention for its economic and security importance, the maritime dimension receives considerably less. Canadians see a container being transported by rail and forget that it probably entered the country through a port. The reality is that 90% of global and 42% of Canadian trade travels by sea and any significant interruption to Canada's maritime trading network would be crippling to the economy.

Addressing the maritime realm of national security and trade concerns involves considering both the 'home' and 'away' game. In terms of the away game, Canada has an interest in ensuring that vital sea lines remain open and secure. In past years, this meant a military role set almost exclusively in the North Atlantic. Today, the away game means focusing on Asia and the Pacific Ocean. The Asia-Pacific region is increasingly important economically and countries there are either expanding or modernizing their maritime power projection. China for example, has invested in conventionally-powered attack submarines, missile technology meant to keep US aircraft carriers at bay, and a string of ports in South Asia.[3] Adapting to this shift means the RCN will have to focus more on the West Coast, and adjust capabilities to align with the complexities of the Pacific environment.

Also key to Canada's away game is ensuring that acts of piracy committed near strategic chokepoints do not disrupt global trade. Despite the recent decrease of pirate attacks off Somalia/East Africa, this still involves looking towards South Asia, and a focus on the waters of the Indian Ocean. Simply put, it is not in Canadian interests to have the cost of goods – like oil on its way to Asia or manufactured goods on their way to Canada – increase because pirates are able to slow transit and increase overhead costs. To protect commercial shipping lanes, and keep the RCN as a Rank 3 medium global force projection navy, it is important that it has sufficient capabilities to operate far from domestic waters, whether countering piracy, participating in disaster relief operations, or evacuating Canadians from crisis situations in other countries.

The Home Game and Canada's Changing Maritime Territory

There are no fewer challenges when it comes to the home game of maritime security. First of all, continuing with

Credit: Capitaine Dennis Noel, Affaires publiques, QGDN (Ottawa)

*A CP-140 Aurora from 405 Long Range Patrol Squadron, Greenwood, NS, flies over HMCS **Shawinigan** off the coast of Resolution Island during **Operation Nanook** 2013 on 20 August 2013.*


Credit: Corporal Jessica Reynolds, 14 AMS Wing Imaging

Colonel Iain Huddleston, Wing Commander at 14 Wing Greenwood, announces four additional CP-140 Aurora aircraft will be modernized to gain new and enhanced capabilities, during a press conference in Nova Scotia on 19 March 2014.

the issue of trade, there is an ever-present possibility that one of the cargo containers arriving daily at Canadian ports might contain a serious threat such as a weapon of mass destruction. Major Canadian ports are gateways to the North American market and if a security breach were to shut down one of the ports for an extended period of time, the economies of both Canada and the United States would be affected in a cascading trickle-down effect.

Second, with the Arctic containing approximately 25% of the world's untapped oil reserves, and as global warming continues, there is the potential for Canada's North to become a new frontier for drilling and resource exploitation. This resource potential raises important sovereignty concerns but there are also a number of security issues at stake. Canada's vast expanses of ungoverned northern territory might catch the eye of terrorists, illegal immigrants and criminals as North America's weak underbelly – where they can get people and weapons within the continent's borders. And if the ice melts, more ships will use Arctic waters to cut transport distances between Europe and Asia, increasing the potential for disastrous oil spills and/or difficult rescue operations. Furthermore, the Arctic's largely untapped but fragile fishing grounds will gain the attention of commercial fishers. Overfishing would deplete stock and deny locals both an important food source and a means of livelihood – this would provide a similar scenario to what happened off the coast of Somalia in the 1990s and contributed to the explosion of piracy there.

On top of all this, Canada's maritime responsibilities have the potential to be enhanced even further with the pending submission to the United Nations claiming that the country's Arctic seabed extends beyond the 200-nautical mile exclusive economic zone (EEZ). Indications are that this could potentially increase Canada's ocean territory by approximately the size of Alaska.[4]

Matching Challenges with Capabilities: A Difficult Song and Dance

The task for the Canadian government is to match the variety of security challenges with effective capabilities. This is by no means easy. Managing Canada's home game is going to be increasingly difficult because the opening Arctic waters and the continental shelf claim put additional stress on maritime patrols. Canada's Pacific and Atlantic coastal waters have already strained maritime surveillance forces, without the addition of the Arctic Ocean to the task. The RCAF's 18 Aurora long-range patrol aircrafts are getting old and the 12 *Kingston*-class maritime coastal defence vessels (MCDVs) are slow and cannot operate in ice. The Canadian Coast Guard's (CCG) largest and most capable heavy icebreaker, *Louis St. Laurent*, is only able to operate in the Arctic during the warmer months and is scheduled for decommissioning in 2017.

All this illustrates a delicate situation facing the RCN in the future. The government has planned to address this capability-challenge gap by investing heavily in ship procurement. The National Shipbuilding Procurement Strategy (NSPS) involves work projects valued around $33 billion that are supposed to provide the RCN with six to eight Arctic/Offshore Patrol Ships (AOPS), two Joint Support Ships (JSS), and a 15 ship Canadian Surface Combatant (CSC) fleet to replace the three *Iroquois*-class destroyers and 12 *Halifax*-class frigates. There are also plans to build a new *Polar*-class icebreaker and a number of specialty vessels for the Canadian Coast Guard (CCG).[5]

The issue with the NSPS is that it is basically stuck between a rock and a hard place. On the one hand, there is a significant strategic benefit to providing Canada's maritime forces with a massive financial investment; the oceans which have traditionally protected the country are now the source of vulnerability and are an increasingly complex security environment. But at the same time, Canadians do not feel a sense of urgency for such grand investment. They are still feeling the effects of economic uncertainty and after a 10-year combat role in Afghanistan, there is a high level of 'war weariness.' Canadians are putting emphasis on domestic matters associated with their day-to-day well-being and are cautious when it comes to high spending on distinctly military projects. This security and domestic policy environment is difficult for Canada's strategic-level decision-makers. But such scrutiny might be useful if it forces decision-makers to re-evaluate and be extra diligent in outlining future priorities. This planning is all the more important considering that room for error is almost non-existent after the Auditor-General found that the funds budgeted for the NSPS are insufficient.

At or very near the top of the priority list should be the Joint Support Ship (JSS) project. Canada's contribution to disaster relief in Haiti following the 2010 earthquake could have been larger and more effective "if only the navy had the right mix of ships."[6] The problem is that the *Iroquois*-class destroyer and *Halifax*-class frigate which were sent do not have sufficient sea-lift capacity; they have neither the cargo space to carry required relief supplies, nor the ability to unload without port facilities. The JSS would go a long way in addressing these problems. The proposed JSS would have the self-unloading amphibious ability to deliver materials and people ashore, as well as a cargo capacity about three times greater than what the destroyer and frigate had combined.[7] This would increase the RCN's ability to respond to situations where airborne relief is unavailable, and port infrastructure is non-existent. Without this sea-lift capacity, Canadian humanitarian and disaster relief efforts might look good but the actual assistance is dubious. Ken Hansen sums it up when he says that "life-saving cargo ... left floating offshore is just as useless as cargo in an aircraft unable to land at the airport."[8]

The JSS would by no means be the solution to all of Canada's maritime needs, but it would be an extremely valuable investment given that the ship would be in line with both the public's perception of utility and national security priorities. Humanitarian and disaster relief efforts are an important component in Canada's international identity as a middle power. Even if it is not always accurate, Canadians like to see themselves as good international citizens, and therefore tend to support aid missions. But the use of Canadian maritime forces in this multilateral context is also strategically aligned with national interests. Engaging in humanitarian assistance operations does more than just provide the RCN with justification for maintaining a capable fleet in times of relative peace, it helps to maintain international order. Countries affected by humanitarian crises can represent significant security threats because of their potential to descend into violence, become safe havens for extremists and transnational criminals, or for refugees to destabilize neighbouring countries. Providing effective relief assistance helps to reduce the chances of disaster-stricken regions becoming failed states – something that minimizes security risks, increases international stability, and is ultimately beneficial for promoting international trade.

Credit: Cpl Chris Ringius, Formation Imaging Services Halifax

*German Navy ship **Bonn** sails in formation with HMCS **Ville de Quebec** during a multinational fleet exercise on 26 February 2014.*

The JSS would be able to conduct maritime operations far away from Canadian waters, including the increasingly important, and increasingly contested, waters of the Asia-Pacific region. While most attention has been focused on the contested waters, there is also the potential that naval operations in the Pacific will take place in the littoral regions where fast attack craft, small suicide vessels, and conventionally-powered submarines are "superbly suited for hiding in the shallow, congested waters around the western Pacific's island chains."[9] This is a setting where expensive warships like the JSS or CSC vessels would be easy targets.

While Canada could address this by developing its own submarines – in particular ones equipped with Air Independent Propulsion (AIP) systems allowing for submergence for as long as two weeks at a time – submarines are a tough sell to the Canadian public. The *Victoria*-class submarines bought from Britain in 1998 have had multiple problems. Submarines might be effective in protecting sovereignty in Canadian waters, but they have the same military-only air about them that warships carry. When the public thinks of submarines, they think of the Second World War and German U-boats, or the Cold War and nuclear submarines – they don't think of sovereignty patrols, fishery patrols and humanitarian assistance.

Rather than invest further in submarine capability, Canada could go in a completely different direction. It could develop a sort of hybrid vessel which is smaller than the proposed AOPS and has the speed, flexibility and firepower necessary to engage in mid-intensity coastal combat. Having the JSS to provide fuel and supplies would enable smaller coastal ships like this to conduct operations far from Canadian waters, but it would still have all the necessary tools for constabulary roles at home. This would be much better received by Canadians than more investment in attack submarines.

Incorporating such a ship into the NSPS would change the plan almost completely. The ability to operate effectively in coastal waters means this combat-capable hybrid ship could also be used in Canada's Atlantic and Pacific waters, leaving the AOPS – which could then be reduced in numbers – to focus exclusively on the north. And while

the multidimensional nature of such a ship means a complex and costly design, the reduction in AOPS and CSC ships means that more money might be opened up for the JSS project. The significance of this cannot be overstated. The 2013 Parliamentary Budget Office's (PBO) feasibility study on the JSS project found costs to be much higher than those determined by the Department of National Defence (DND). The PBO determined that the project would cost $3.28 billion and recommended a $4.13 billion budget (and three ships), while DND estimates were $2.53 and $2.6 billion respectively.[10] With the PBO basically saying that even two of the ships are unaffordable in the current NSPS, reducing expenditures on the AOPS and CSC vessels would be extremely valuable in ensuring that this discrepancy is addressed and the JSS procurement is carried out. Having only two supply ships is limiting enough in that the moment one is deployed or in need of maintenance there will be only one ship available; freeing up money to add a third one would provide the RCN, and Canadian maritime forces in general, with important operational flexibility.

There are, naturally, problems with this idea. It is not guaranteed that smaller ships designed for littoral areas will be cheaper than other ships. The US Navy can attest to that with its capable but extremely expensive Littoral Combat Ships. Another problem with using small ships in the away game is they may not be pleasant to travel across the Pacific in! As well, Canada does not have a history of or expertise in operating in littoral environments. The littoral environment is extremely complex – ships can be hit by missiles fired from land, there could be mines, the coastal features, ocean and atmospheric conditions can be difficult, and traffic can be significant – and it is not something to be jumped into. Nonetheless, reorganizing the NSPS to reflect this plan could allow Canada to play a constructive role in the maritime environment both at home and abroad.

Conclusion: Hybrid Coastal Vessels and Joint Support Ships

The maritime security environment in the 21st century presents diverse challenges for Canada. The home game is growing more demanding with the expansion of domestic ocean territory to the Arctic Ocean, and the away game is now taking Canadian maritime forces farther from domestic waters than it traditionally has before. To make everything even more complex, the geographic distance of the away game is juxtaposed with a threat that tends to operate in littoral waters. Basically, in a future operational scenario where Canada's maritime forces would have to go to the Asia-Pacific region, they would have to travel thousands of kilometres and then face an opponent that excels in close proximity coastal fighting.

Credit: MCpl Colin Kelley, Formation Imaging Services, CFB Halifax

*With an inflatable boat of Army Pathfinders on the stern, HMCS **Windsor** emerges from the waters of St. Margaret's Bay, NS. Exercise Joint Express in 2006 was the first time the Canadian **Victoria**-class submarines practiced 'float on, float off' capabilities for covert insertion and recovery of personnel.*

To prepare for this, Canada would be better off having a combination of smaller hybrid coastal combat vessels and large supply ships, rather than a fleet of conventional surface destroyers. With logistical support from the JSS, the speed and flexibility of a coastal combat vessel would be effective in foreign littoral waters, and also be extremely useful in enhancing Canada's constabulary capacity to patrol its own waters – something that would be welcomed in the domestic political setting. Added to this is the fact that supply ships would improve Canada's ability to conduct disaster response and humanitarian aid operations. Such diplomatic operations are a two-for-one deal in that they are supported by Canadians and aligned with the priority to maintain a stable international order.

Given all this, Canada should significantly reduce investment in conventional combat capabilities and give priority to the JSS project and a multidimensional combat-capable coastal vessel. Canada's maritime forces would then be able to assume a balanced role in the 21st century security environment that encompasses military, constabulary and diplomatic operations at home and abroad.

Notes

* This article was originally written for the political science course "Pirates, Profiteers and Protectors of the Seas," at Dalhousie University.

1. Evan Solomon and Kirsten Everson, "Retired Generals Take Aim at Ottawa's Handling of Defence Cuts," CBC, 18 December 2013.
2. Scott Taylor, "It's Pay the Piper Time at Defence," *The Chronicle Herald*, 3 March 2013.
3. See Tom Aagaard, "Maritime Security in the Pacific: Canada and the New Asian Naval Arms Race," in *From Sea to Sea: The Search for Maritime Security*, The Atlantic Council of Canada (2012); George Petrolekas and Ferry De Kerchove, "The Strategic Outlook for Canada 2013," Conference of Defence Associates, February 2013; and Christian Bedford, "String of Pearls: China's Maritime Strategy in India's Backyard," *Canadian Naval Review*, Vol. 4, No. 4 (Winter 2009).
4. Michelle Zillo, "Shelf Watch 2013: Canada Set to Claim Massive New Seabed Territory," *iPolitics*, 5 January 2014.
5. See Department of National Defence, "National Shipbuilding Procurement Strategy" and Public Works and Government Services Canada, "Construction of Small Vessels."
6. Brian Stewart, "Just How Shipshape Are We?" CBC, 10 February 2010.
7. *Ibid*.
8. Ken Hansen, "Volumetrics and Strategic Effect," Topic 14, Broadsides online discussion forum, posted 16 February 2010.
9. Aagaard, "Maritime Security in the Pacific," p. 25.
10. Office of the Parliamentary Budget Officer, "Feasibility of Budget for Acquisition of Two Joint Support Ships," 28 February 2013, p. 1.

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A National Strategy for Maritime Security of the Undersea Domain

Commander David Finch

Because the economic well-being of states across the globe depends heavily upon the trade and commerce that traverses the oceans, maritime security must be a top priority. Maritime security is required to ensure freedom of navigation and commerce. States have a common interest in achieving three complementary objectives: facilitate the vibrant maritime commerce that underpins economic security; protect biodiversity and marine-based resources from exploitation; and protect against ocean-related terrorist, hostile, criminal and dangerous acts. At a minimum, each state bears the responsibility to assure the safety, security, economic and environmental well-being of the maritime commons and maritime approaches to the country. For some states the national condition is limited to territorial seas (extending 12 nautical miles), for others it is the Exclusive Economic Zone (EEZ) (extending 200 nautical miles) and for others it is the global maritime commons.

Traditionally this interest applied only to the surface of the maritime areas, and more recently above the surface, not *below* the surface. In recent years, Canada has demonstrated an interest in the undersea domain in its EEZ and the global maritime approaches to its EEZ, yet has done little to support enhanced awareness of what is taking place there. The undersea domain component of maritime security requires special attention within maritime policies and strategies due to difficulties and constraints associated with physical sensing in the undersea environment.

Historically, World War II submarines almost succeeded in closing the maritime commons through the interdiction of the critical sea lines of communication (SLOCs). In response, anti-submarine warfare (ASW) strategies and tactics were developed to counter the threat to SLOCs. This effort developed the awareness of the undersea environment and, henceforth, people became conscious of an unseen threat adversely affecting national well-being. Yet, despite this, much of the work about the need for maritime awareness and appropriate response mechanisms stressed the more easily observed surface and air components of the maritime domain. The need to know what is occurring in the undersea maritime domain has gone largely unacknowledged with the exception of tacit awareness of the threat posed by submarine platforms and the need to counter them with capable submarines or other ASW capabilities.

National and international maritime security concerns require policy strategies to address the traditional undersea submarine threat to SLOCs. But beyond the undersea threats of the 20th century, there is a need to address the threats of the 21st century. These include threats relating to undersea telecommunication infrastructure (the backbone of the global communication commons) and the security of biodiversity and marine-based resources in the EEZ and continental shelf areas. Undersea threats also include unsanctioned maritime biological or geophysical resource exploitation and protection against undersea enemy, terrorist, criminal and dangerous acts. Finally, addressing undersea security threats involves developing the means to sense catastrophic geophysical maritime events, such as tsunamis, as a way to save human life.

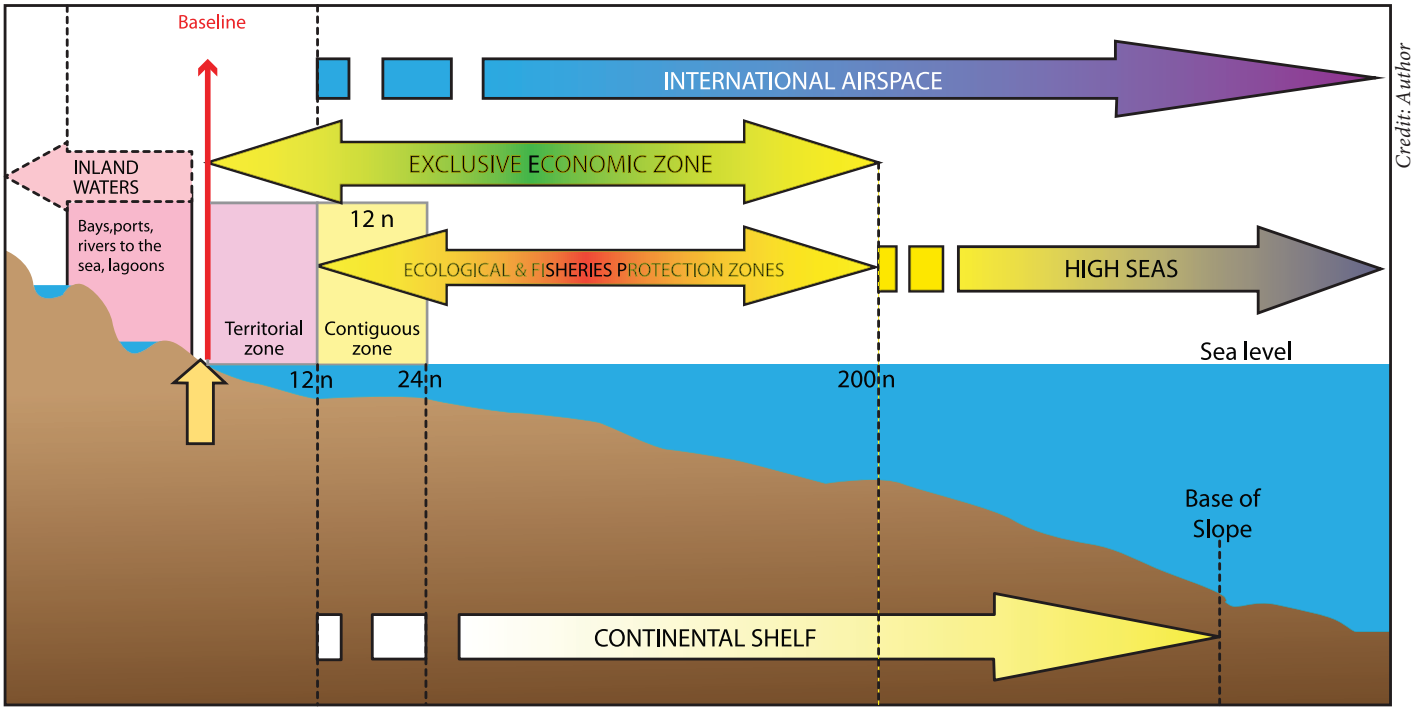
Credit: Canadian Forces Combat Camera

*HMCS **Windsor**, a **Victoria**-class submarine, is shown here moments after surfacing in the Atlantic Ocean off the coast of Halifax, 22 September 2004.*

Domain Awareness

The maritime domain consists of the seabed through to the surface of the oceans, seas, bays, estuaries, islands, coastal areas, and the airspace above these, including the littoral regions (see Figure 1). Maritime domain awareness (MDA) is the understanding of anything and everything associated with the maritime domain that could have an impact on the security, safety, economy or environment of a state. Obtaining and maintaining accurate undersea domain awareness (UDA) is a key element of active and layered MDA security. If you have domain awareness, this

Figure 1. Maritime Regions Associated with Security, Safety, Economy or Environment



facilitates more expeditious and precise national response to situations of concern. Domain awareness is a critical enabler for all strategic, operational and tactical actions in the maritime domain.

As noted, the undersea infrastructure component of maritime domain awareness has largely been ignored up to now. This is ignorance is no longer acceptable. There is a need for a strategy to achieve awareness of the undersea domain which contains biological and geophysical resources and undersea cables, and is the environment which permits stealth threats to SLOCs. The maritime domain cannot be made secure and the global maritime commons is in jeopardy without the ability to obtain information and develop response mechanisms that relate to the undersea domain.

The *undersea* domain is that portion of the maritime environment from the water's surface down to the seafloor and into the seabed. Despite being out of sight, an event in the undersea domain could nonetheless affect the national interest and have a significant impact on security, as well as social, political and economic stability. Undersea domain awareness development requires a surveillance and reconnaissance infrastructure to obtain information and create actionable knowledge of geophysical marine activity and lawful operations. It would also include collecting information about unlawful or hostile acts committed by foreign states and non-state actors such as, for example, acts of terrorism, marine resource exploitation, acts of insurgency or military activity in undersea areas of a state. Response to such events requires national-level decisions which must be augmented by communications and information exchange to support timely response. It also requires capabilities designed to operate within the domain.

Undersea domain awareness operations are conducted with the intention to obtain the information required to support political, economic, social and security objectives relevant to national interests, and to promote control of the seas and national SLOCs. Undersea operations stemming from national interests are conducted for several purposes. They establish actionable information pertaining to the undersea interests of the state, and they do this while monitoring and/or denying the unlawful operation of adversarial agents. Table 1 proposes a basic concept which must be considered in the development of an undersea domain awareness strategy.

The unifying objectives of an UDA strategy are to:

- detect and geographically localize adversarial platforms/capabilities;
- develop tactics, techniques and procedures to achieve freedom of manoeuvre for national capabilities to sense and respond to undersea domain adversarial agents;
- integrate persistent, deployable and rapidly deployable undersea sensing and response capabilities systems to enhance the ability to neutralize UDA security threats;
- increase operator proficiency at analysing information sets;
- incorporate leading edge technologies;

- develop a decision-making process to optimize the creation and use of UDA equipment.

The objective of UDA operations is to assist in the establishment or maintenance of maritime awareness and superiority by denying adversaries the ability to operate in an undersea area of national interest. This is accomplished through detection, identification, tracking and engagement (response) to adversarial operations in the undersea environment. It is crucial to know who is doing what in the undersea domain. Unobserved and un-located adversary actions could lead to a negative impact on vital national interests, with possible adverse safety, security, economic and environmental outcomes.

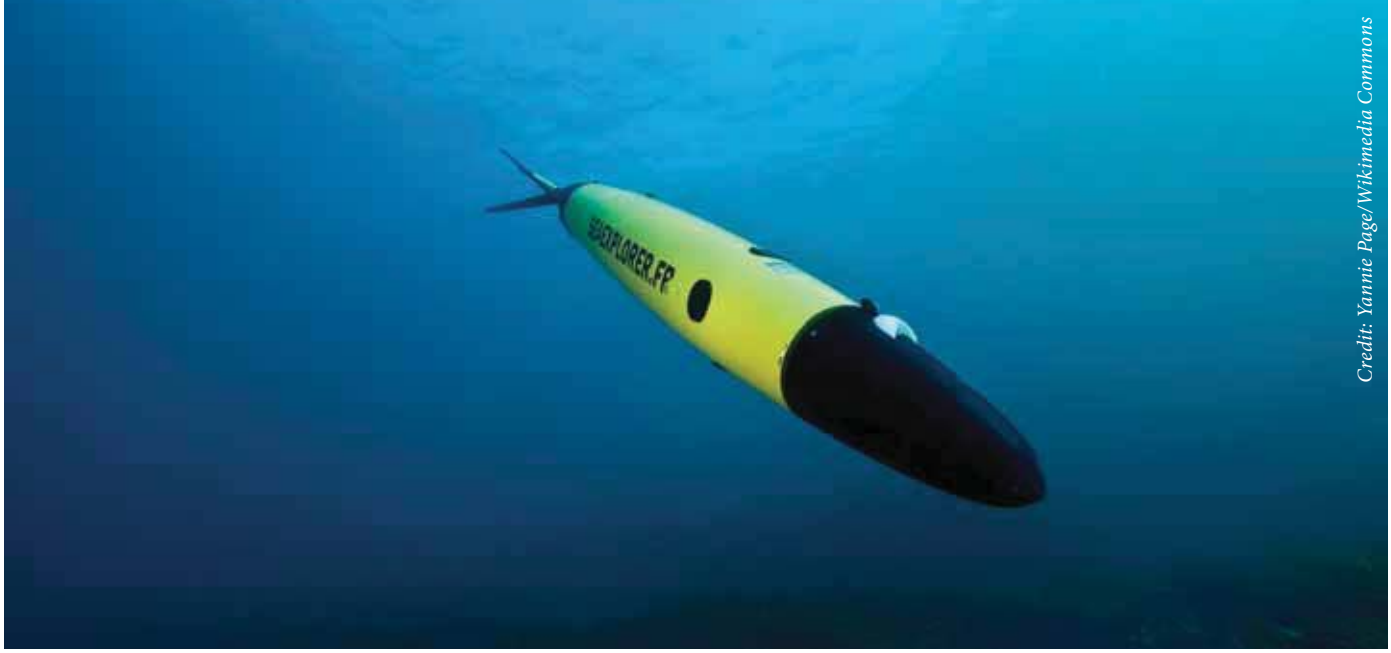
The physical characteristics of the undersea domain have a significant impact on UDA, and make it much more challenging than for the other domains. The highly variable acoustic properties of the underwater environment will affect the ability to detect, identify, track and, when required, respond to undersea activities. Factors that may affect the acoustics include surface shipping, inherent environmental noise and oceanographic properties (ice movements for example, or the contours and make-up of the ocean floor), and seasonal weather patterns. The effectiveness of undersea sensor placement will be highly dependent on the acoustic properties of the waterspace and water column from the sea surface down to and into the seabed (e.g., temperature, salinity, pressure). Acoustic sensors allow us to find out a lot about undersea areas, but acoustics will not be the sole detection capability. There are also non-acoustic detection systems (such as satellite imagery) or non-traditional sensing regimes under development as part of the Ocean Observatory architectures. An excellent example of this emergent capability is the NEPTUNE/VENUS system at the University of Victoria in British Columbia which integrates a wide range of undersea sensors, predominately for scientific research, that could be leveraged as a model to support national UDA objectives.

The goal of UDA is to provide a wide variety of information that allows a state to counter adversarial submarine and unmanned underwater vehicle operations, as well as monitor biologic and resource exploitation, and develop scientific understanding of the undersea domain. The aggregation and integration of UDA information permit the development of a comprehensive picture about everything that is occurring in the ocean from the surface through the seabed. This objective will be achieved through the understanding of oceanography and other marine sciences that define the undersea environment. UDA is an aggregation of maritime undersea monitoring strategies, processes and data relating to:

- oceanographic parameters;
- the density of biological entities such as fish, whales, plankton, or other species;
- geophysical activity of the earth's crust for tsunami warning;
- maritime industrial exploration and exploitation efforts; and,
- security and defence, including tracking the threat posed by submarines, mines and the employment of undersea systems by transnational agents – for example criminal gangs – seeking to avoid detection during smuggling operations.

Table 1. Undersea Domain Awareness Strategy

Strategic	Eliminate adversary stealth operations in the undersea domain of the maritime approaches
	Achieve transparency of the world's oceans to detect adversarial platforms while maintaining freedom of manoeuvre and stealth for own undersea capabilities
Operational	Prevent adversary platforms from obtaining positions of influence
	Achieve command, control, intelligence, surveillance, reconnaissance (C2ISR) of the undersea domain to ensure precision response mechanism and options
	Maintain deployable and rapidly deployable UDA sensing regionally to augment persistent cueing infrastructure as the means to localize adversarial agent activity with precision
Tactical	Achieve response solutions on adversarial platforms/capabilities before adversarial agents reach a position of influence
	Maintain ability to counter adversarial operations in the undersea domain of national interest
	Achieve self-defence sensing and response capabilities



Credit: Yannie Page/Wikimedia Commons

A SeaExplorer glider diving, 22 February 2012.

If Canada has capabilities in undersea domain awareness and security monitoring, this will provide political leaders with strategic warning, assured communications and precision positioning of defence assets. UDA capabilities have evolved considerably in recent years with multiple agents designing and fielding multiple platforms or systems specifically designed to generate critical undersea information. If this information is all integrated, it would provide a seamless representation of UDA throughout maritime approaches of interest. As well, the disaggregation of undersea security, commerce, resource exploitation and science agents has improved survivability by increasing the number and diversity of potential resources and capabilities operating in the undersea environment. With more actors and more sources of information it complicates the calculus of an adversary's decision and decreases the likelihood of successful evasion of undersea awareness capabilities.

Modern UDA seeks to align and analyse the efforts of multi-faceted, multi-tier and multi-jurisdictional entities through the integration of quantifiable sensor or system-level capabilities. The goal is to change the undersea environment from something that is unknown to an environment in which we have multiple sources of information that provide a detailed picture.

Conclusions

Defending against threats that come from the sea and minimizing damage and expediting recovery from catastrophic events in the maritime domain is a fundamental role for each state with a maritime boundary. But a state must concern itself not only with threats *from* the sea but also threats *to* the sea. To safeguard the ocean and its resources from unlawful exploitation and to develop risk awareness of the economic movers within the maritime domain, governments seek to maximize domain awareness.

Control of the seas, or more specifically for our purposes, the undersea areas of national interest, necessitates capability development to promote maritime domain awareness. Increased maritime resource exploitation, biologic and geophysical, the use of the undersea domain as a transportation means for communications and commerce, and ocean observation operations conducted underseas compel the development of capabilities to promote knowledge of what is happening in this domain. Like maritime domain awareness in general, undersea domain awareness requires architecture to analyse the information that is collected, and translate it into strategy and policy for power projection and defence. States must defend their national interests, and in most cases this involves defending the sea lines of communication including the undersea domain. Without awareness it is difficult to build security. Layered security integrates prevention, interdiction and preemption with protection, deterrence and defence activities at a national level, and then integrates this with international layers of security. A comprehensive security picture needs the integration and analysis of multiple sources of information to present as clear representation as possible of all domains which could affect the national interest.

It is time to articulate a national security policy to address undersea security concerns. Canada is a maritime state, and ignorance of what is taking place within the undersea domain only serves to encourage unregulated and perhaps unfriendly exploitation of the unseen, un-sensed domain.

Commander David Finch is an undersea warfare specialist with the RCN, with 35 years experience developing systems, tactics and procedures required to render the oceans transparent. He is currently serving as a missile and space domain analyst at NORAD, USNORTHCOM in Colorado Springs.

New Strategy Supports Canada's New Fleet

Janet Thorsteinson

In early February 2014 the government moved to repair defence procurement. As a recent publication from the Canadian Defence and Foreign Affairs Institute put it, "[f]or years, successive Canadian governments have been overpromising and under-delivering on defence procurement. Timetables have slipped even as repair and maintenance costs for aging equipment have soared, while elaborate rules have obscured the acquisition process in a bureaucratic fog."[1]

The new Defence Procurement Strategy (DPS) changes Canadian military acquisition in some fundamental ways bringing a new emphasis on economic benefits here at home and greater support for sales abroad, without compromise to the mission of the Canadian Forces. In brief, a committee of Cabinet Ministers and a committee of Deputy Ministers will now oversee a Defence Procurement Secretariat hosted within Public Works and Government Services Canada (PWGSC). Equipment requirements will be subjected to early and independent review, and an export strategy will support the domestic industry.[2] In a bureaucratic 'reverse takeover,' the comprehensive DPS mirrors the single sector 2010 National Shipbuilding Procurement Strategy (NSPS) with its use of a secretariat to centralize functions distributed among federal departments, and in its goal of optimizing the benefits of defence spending.

The DPS also builds on the NSPS 'value proposition,' the requirement for successful bidders to contribute a percentage of contract value to projects that build Canadian industrial capacity away from their factories or shipyards. As Mike Greenley the Chair of the Canadian Association of Defence and Security Industries said, "[t]he requirement for domestic value propositions that are to be weighted and rated as part of procurement evaluations represents a sea change in this country's approach to defence acquisition. It is long overdue. It is recognition of the importance of having a healthy domestic defence industry from a sovereignty and national security perspective."[3] The requirement for successful bidders to distribute 100% of the contract value to companies across Canada will remain, although those Industrial and Regional Benefits (IRBs) will become Industrial and Technological Benefits under the new strategy. According to Industry Canada, "[b]idders will be motivated to put forward their best industrial plan for Canada, as these plans will be scored on the quality of their Value

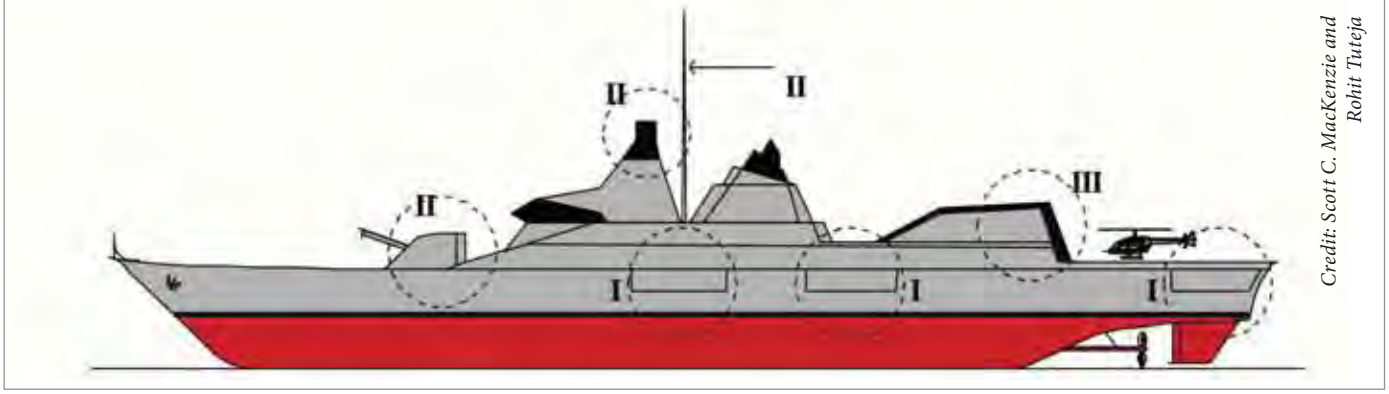
Credit: Irving Shipbuilding

Diane Finley, Minister of PWGSC, along with Peter MacKay, Minister of Justice and Regional Minister for Nova Scotia, announced on 6 February 2014 that two new tasks with a potential value of $53.5 million have been authorized for the construction of the Arctic/Offshore Patrol Ships under the NSPS.

Propositions. In other words, industrial considerations will factor into determining which bidding firm wins the contract."[4]

The value propositions will be scored, in part, by their contribution to Canadian key industrial capabilities (KICs), as identified by the Report of the Special Adviser to the Minister of Public Works and Government Services (the Jenkins Report) in February 2013. The Jenkins Report put forward six interim KICs: Arctic and maritime security; protecting the soldier; command and support; cyber-security; training systems; and in-service support.[5] The report made it clear that these capabilities were suggestions and not recommendations. The criteria are designed to provide a framework – to be finetuned after consultations with stakeholders – for analysing Canadian defence industrial capabilities and the potential of these capabilities for growth.

The new procurement strategy was announced with Canada's two biggest defence acquisitions already in different stages of progress: the shipbuilding program; and the CF-18 fighter aircraft replacement. The latter project became mired in controversy after the government selected the F-35 Joint Strike Fighter (JSF) in 2010. While the purchase decision remains in doubt, its offset program is going ahead, providing employment and benefits to companies across Canada. Companies have an inside track to the global F-35 program but they must compete



Credit: Scott C. MacKenzie and Rohit Tuteja

Modular Capability Options, SCSC Sketch Concept. Annex C, "Modular Capabilities for the Canadian Navy's Single Class Surface Combatant," DRDC, February 2006.

to win and keep the business. That business will, in future, depend upon Canada actually purchasing the aircraft.[6] Industry Canada noted that "[b]y being directly involved in the design of JSF parts and subsystems, companies have been able to build on Canadian strengths, establish new strategic product development capabilities in Canada and position themselves for future opportunities in technologically advanced aerospace and defence projects."[7] The merits of the aircraft aside, the decision to bypass the conventional and safe route of 100% IRB offsets was a bold one. If the JSF is the eventual choice to replace the CF-18s, it will be interesting to see whether its benefits package will be adjusted to the strictures of the DPS.

Credit: MCpl Marc-André Gaudreault, Canadian Forces Combat Camera

Royal Canadian Air Force CF-188 Hornet fighter aircraft proceeds with air-to-air refueling with a Colombian Air Force Boeing KC-767 tanker during Exercise Maple Flag 2013 (JOINTEX) near Cold Lake, Alberta, on 29 May 2013.

The other major procurement project, the National Shipbuilding Procurement Strategy, raises its own questions about how the requirements of the new DPS will be applied. It is not clear yet how much responsibility the two shipyards designated under the program will have for selecting their suppliers. Measured by the size and scope of other large defence projects, some systems for naval and coast guard ships could, and perhaps should, constitute procurement programs of their own. How much of their own equipment will contractors and their suppliers be able to specify? The combat system of the Canadian Surface Combatant as a stand-alone procurement would be a particularly valuable contract. How will the winning systems integration company be chosen, and will separate elements of the system be separately competed?

If defence procurements have risks for governments, they can also have rewards. Within days of the DPS announcement, Ed Fast, Minister of International Trade, announced that General Dynamics Land Systems Canada had won a 14-year contract worth between $10-13 billion to build and support armoured vehicles for Saudi Arabia. Billed by Foreign Affairs, Trade and Development Canada as the "largest advanced manufacturing export win in Canada's history," the government claims that the contract directly benefits Canadian firms and will sustain jobs in Canada for years.[8]

The armoured vehicle production focused in southern Ontario, the aerospace 'clusters' in Winnipeg and Montreal, and the NSPS shipyards in Halifax and Vancouver all create opportunity across Canada. The NSPS has helped to define Canada's defence industrial aspirations by requiring successful bidders to achieve a 'target state,' at which point, "they will have the capability to build vessels at established international benchmark productivity levels."[9] With a comprehensive view of Canadian capabilities, the Defence Procurement Strategy raises that level of ambition for Canada and its defence industries.

Notes

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2. Public Works and Government Services Canada, "Defence Procurement Strategy," March 2014.
3. Mike Greenley, Chair of the Board of CADSI, "Speaking Notes," Economic Club of Canada, 5 February 2014.
4. Industry Canada, "Value Proposition and Industrial and Technological Benefits," February 2014.
5. Report of the Special Adviser to the Minister of Public Works and Government Services, "Canada First: Leveraging Defence Procurement Through Key Industrial Capabilities" (Jenkins Report), February 2013.
6. Industry Canada, "Canadian Industrial Participation in the F-35 Joint Strike Fighter Program Report," 2013.
7. Industry Canada, Media Release, "Minister Ambrose Highlights Joint Strike Fighter Program Industrial Participation Opportunities on Tour of Avcorp Industries," 31 August 2010.
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9. Public Works and Government Services Canada, "Backgrounder on the National Shipbuilding Procurement Strategy (NSPS), Year 2: A Status Update," November 2013.

After over 30 years in the public service, Janet Thorsteinson became Vice-President Government Relations at the Canadian Association of Defence and Security Industries (CADSI).

Making Waves

The Worst Procurement in the History of Canada?[1]

John L. Orr

In a press release issued by Public Works and Government Services Canada late on Friday, 3 January 2014, it was announced that an agreement had been concluded between the government of Canada and Sikorsky Aircraft to renegotiate the Maritime Helicopter Project (MHP) contract.[2] The news that the MHP is entering yet another contract negotiation triggered the customary grab bag of opinion pieces, most quoting former Minister of National Defence Peter MacKay who in July 2012, in an apparent moment of frustration, called the MHP "the worst procurement in the history of Canada."[3]

This may yet prove to be the case but hidden in Mr. MacKay's comment is the implication that in some less complicated era, major Crown projects such as MHP proceeded smoothly from the development of the Statement of Requirement (SOR) to the hammering out of the contract to the on-time, on-budget delivery of the equipment. With perhaps a few exceptions, nothing could be further from the truth.

That difficulties have been encountered in procuring a replacement for the Canadian Sea King helicopter[4] should be no surprise given the Sea King's own rocky start. Some readers of this journal will be aware that until mid-1961, the front-runner for an escort-based anti-submarine warfare (ASW) helicopter was the Kaman Seasprite and not the Sikorsky Sea King. Perhaps less well known are some of the other challenges that accompanied the selection and introduction of the Sikorsky Sea King. These illustrate the point that procurement was as difficult then as it is today.

The requirement for an escort-based ASW helicopter grew out of the threat posed by the nuclear-powered submarines of the Soviet Union to the RCN's newly commissioned *St. Laurent*-class destroyer-escorts. As such, it was one of three measures intended to address the escort's vulnerability (the other two were variable depth sonar and new hull-mounted sonars).

Before an SOR for an escort-based ASW helicopter could be issued, however, it was necessary to resolve a protracted doctrinal debate between the RCAF and the RCN over the role of the helicopter in ASW. After extensive wrangling between the two services in the Sea/Air Warfare Subcommittee of the Chiefs of Staff Committee, it was finally agreed in 1958 that the helicopter had a role in ASW and that shipborne ASW helicopter operations would fall under the control of the RCN and not the RCAF.

Credit: U.S. Navy

The Royal Canadian Navy ***St. Laurent****-class destroyer HMCS* ***Fraser*** *(DDH 233) underway during Exercise Distant Drum, 19 May 1983.*

Following the resolution of the doctrinal issues, the RCN prepared an SOR. The next hurdle was to meld the RCN SOR with a tri-service helicopter procurement program intended to combine the future helicopter requirements of the army, air force and navy. The navy resisted pressure to select the Vertol 107 tandem-rotor helicopter and instead proposed the purchase of an ASW version of the single-rotor Kaman Seasprite utility helicopter although it was not operational at the time.

Following approval by the Chiefs of Staff, the project was handed off from DND to Treasury Board recommending the purchase of the Kaman Seasprite. The Treasury Board almost immediately returned the project to DND with a number of objections, not the least of which was that the project should be delayed pending future developments in ASW helicopters. This objection was rejected in turn by DND and the Treasury Board grudgingly agreed to the project in December 1960.

But even after this painful process, the RCN never acquired the Seasprite. Following a significant increase in the price of the Seasprite as well as its inability to pass its initial US Navy preliminary evaluation, it became apparent that this aircraft would not be suitable for the RCN. This meant that the whole procurement process had to be restarted with the result that the Sea King was eventually procured for the RCN in 1963.

The Sea King ushered in a new era of technical complexity in ASW helicopter operations for the navy. The RCN's previous ASW helicopter, the Sikorsky HO4S-3, was restricted to day-only operations and operated solely from the aircraft carrier. Not only was the Sea King more than twice the weight and size of the HO4S-3, it flew from both the carrier and the destroyer-escorts, and had a complicated integrated avionics system that allowed the helicopter to transition from forward flight to a hover in all weather conditions. It was this integrated avionics system, especially in the early days, that proved to be the most difficult maintenance aspect of the Sea King to master and had a negative impact on availability.

The first four Sea Kings were manufactured at the Sikorsky plant in Stratford, Connecticut, and the remaining 37 were assembled by United Aircraft of Canada Limited (UACL) in Montréal from components provided by Sikorsky. This presented a significant challenge to UACL that was eventually overcome but there were delays in production which reduced the number of aircraft available for operations until the delivery of the final Sea King in May 1969.

During the introductory phase, a two-year operational pause was established from January 1963 until January 1965 while conversion training took place. The first four aircraft, delivered in the summer of 1963, were intended for initial cadre and operational conversion training. However, two of the aircraft were diverted to higher priority taskings – one to carry out the Beartrap trials to develop a helicopter hauldown system for landing on destroyer-escorts, and the other to evaluate the Canadian-developed Doppler Radar, the heart of the avionics system.[5] As a result, operational conversion and proficiency flying suffered and the objective of achieving a limited operational capability with the Sea King in 1965 was placed in jeopardy.

Credit: R.Leeuw, Shearwater Aviation Museum

A Sikorsky HO4S-3 Horse (S-55) No. 877.

In the fullness of time, all the difficulties involved in the introduction of the Sea King were overcome and, more importantly, were not considered to be unusual in the context of the introduction of a new weapons system. This highlights one of the major differences between then and now. The RCN of that period, and indeed the government, had a great deal of experience in defence procurement. For example, during the period from 1947 to 1967, the RCN Air Branch alone introduced three aircraft carriers, three types of fighter aircraft, three types of fixed-wing anti-submarine aircraft and four types of helicopters – including the Sea King. Is this the case now?

It is evident that defence procurement is a complex and tough business, and the experience with the MHP bears this out. However, before Ministers and the media start throwing around terms such as "the worst procurement in the history of Canada," they should take a hard look

at the context of past procurement programs which at least had the luxury of sufficient numbers of knowledgeable personnel operating within a coherent procurement system.[6]

Notes

1. This article draws on John L. Orr, "'We Came to Mow Your Lawn': How and Why Canada Acquired the Sikorsky Sea King Helicopter," a paper presented at the 18th RCAF Historical Workshop "Wings for the Fleet: Fifty Years of the Canadian Sea King," held at 12 Wing Shearwater 19-20 June 2012.
2. Government of Canada, Media Release, "Government of Canada to continue with Maritime Helicopter Project and begin retiring Sea Kings in 2015," 3 January 2014.
3. CBC News, "MacKay Says Chopper Deal 'Worst' in Canada's History," 10 July 2012.
4. There have been at least three projects and two aircraft involved with the procurement of the follow-on to the Sea King: the Sea King Replacement Project; the New Shipborne Aircraft Project (EH 101); and the Maritime Helicopter Project (Cyclone).
5. Canadian Marconi AN/APN 503(V) Doppler Radar.
6. I would personally recommend: Randall Wakelam, *Cold War Fighters: Canadian Aircraft Procurement, 1945-54* (Vancouver, BC: University of British Columbia Press, 2012); and S. Mathwin Davis. "The 'St. Laurent' Decision: Genesis of a Canadian Fleet," in W.A.B. Douglas (ed.), *RCN in Transition 1910-1985* (Vancouver, BC: University of British Columbia Press, 1988), pp. 187-208.

Three Lessons for China from Crimea

Ken Hansen

The results of a short-notice referendum on the separation of Crimea from Ukraine and its reunification with Russia were apparently 97% in favour. Russian Foreign Minister Sergey Lavrov and American Secretary of State John Kerry have met and talked but can find no common ground. This is a classic strategic impasse: the Russians view the new government in Kiev as illegitimate; the Americans, backed by their allies, view any referendum conducted under the force of arms and without an option for a 'No' vote as equally illegitimate. With neither position willing to compromise it is likely that this situation will persist for some time.

Credit: Reuters/internet

Part of Russia's Black Sea fleet.

So, what can we deduce from these events? I see three lessons in all of this for China, a country that has territorial disputes with its neighbours and may be tempted to emulate the Russian ploy to achieve a similar outcome.

The first lesson is that the international business community values stability in the marketplace above all else. Anything that threatens that stability will result in losses for the perpetrator. While diplomatic action against Russia has been slow to take shape, the investment markets reacted swiftly and savagely. Although Crimea is economically insignificant and far from major international shipping routes, the instability that has been provoked by Russia's move has met with universal condemnation by global business interests. In less than a week, approximately $60-65 billion (Cdn) was lost from the value of Russian companies. The flight of investment capital from Russian has been stupendous and it continues, although at a lessened rate. Likewise, the basic interest rate in Russia has been raised by 1.5% to 7%. This is the largest hike since the financial crisis that practically ruined Russia in 1998.[1] The economic results have been equally bad on the international currency exchanges, with the ruble trading at historically low values despite the Russian central bank spending billions to prop up the currency.[2] The Russian economy has been heavily damaged, and it will have a long road back to establishing credibility as a trading partner after its incursion into Crimea.

The second lesson China can learn is that the territorial gains may be small in Crimea but the political losses will be large elsewhere. In a 2005 speech, President Vladimir Putin characterized the collapse of the Soviet Union as "the greatest geopolitical catastrophe of the 20th Century."[3] In the same speech, he said "[w]e are a free nation and our place in the modern world will be defined only by how successful and strong we are." The victory achieved in Crimea will give the Russian Federation unfettered access to the Black Sea, an ambition that has been seen as essential to national power since Czar Peter the Great.

If the break-up of the Soviet Union was deplorable, it is possible that the consequences of this move will be as bad. By demonstrating his contempt for the sovereign authority of a neighbouring country, Putin has practically guaranteed that the remnants of Ukraine will be driven into the sphere of the West. Other states on Russia's borders

may also become increasingly suspicious of its intentions and will seek to make security arrangements with others. Outright conquest is now the only path open if Putin has further territorial ambitions he wishes to fulfil.

The Putin definition of power, one based on an anachronistic calculus about the control of territory, stands in contrast the modern concept of economic power. The Russian economy is vitally dependent on secure markets for its petrochemical products which constitute the major component of its exports. Oil prices and foreign direct investment in the economy are crucial to keep Russia's GDP growing. It has already begun to slow. In late 2013, the Russian Economic Development Ministry reduced its growth forecast through 2030 to an average of 2.5% per year, down from a forecast of 4.0-4.2%.[4]

Russian actions in Crimea will only worsen this trend. Neighbouring countries are already seeking alternate suppliers of energy, which will accentuate the fall in Russian stature. *The New York Times* reports a new era of "American energy diplomacy," led by Carlos Pascual, a former American ambassador to Ukraine, who leads the State Department's Bureau of Energy Resources.[5] Germany, which is heavily dependent on Russian imports for its energy needs, is already in discussions with the United States about securing supplies of natural gas to replace them.

The third lesson for China is that subterfuge and limited military action will not lessen the moral consequences of the aggression. Few people outside Russia believe the Russian claims that the security forces involved were from inside Crimea. The numbers, the Russian military license plates, the use of Russian military helicopters and the blockading action taken by Russian naval warships all point clearly at the source of the forces. Putin's claims of innocence were not credible from any perspective but his own.

The scope and scale of the operations indicate that only the national armed forces of the Russian Federation could have carried this out. Moreover, the detail and intricacy of both the operation and the efforts to conceal the identity of the forces means that the planning for this had been underway for weeks, if not months. This means that throughout the Olympics, while President Putin was hosting the world and conducting impromptu 'good will' visits to various team residences, he was also engaged in preparations for the takeover of Crimea. In fact, the Olympics served as a distraction to cover the ongoing operational preparations for the main event. How could anything be more damaging to the political reputation of Russia than to use the Olympic stage to portray a reputation as a global citizen and at the same time demonstrate its loyalty to past generations of aggressive empire builders?

Credit: AP Photo/Sergei Poliakov

*Ukraine frigate **Hetman Sahaydachy**, background, enters waters of the Black Sea port of Odessa, Ukraine, 6 March 2014. The ship returned to Odessa after taking part in NATO exercises.*

The moral standing of any state that takes aggressive military action will be diminished if it does so out of pure self-interest. Claims to territory that date back into another security era and a different political context have little or no bearing on how they will be judged by the international community within this context.

Given these lessons, China should be careful about how it proceeds with any plans to acquire territories that it views as ancient former possessions. The Chinese economy is far more integrated into the global marketplace than Russia's and the Chinese area of interest contains many vitally important economic commercial arteries. Any move to exert control over international waters or territories of neighbouring states will meet with far more significant reductions in economic power, political reputation and moral authority than that which has been suffered by

Russia to date. As we have seen, not a shot needs to be fired in order to suffer losses as great as those stemming from past military conflicts. There is far more to be gained through cooperation and conciliation.

Notes

1. Phillip Inman, Dominic Rushe and Alec Luhn, "Ukraine Crisis Sends Russian Stock Market Tumbling," *The Guardian*, 3 March 2014.
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3. BBC News, "Putin Deplores Collapse of USSR," 25 April 2005.
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5. Coral Davenport and Steven Erlanger, "U.S. Hopes Boom in Natural Gas can Curb Putin," *The New York Times Europe*, 5 March 2014.

Commemorating and Interpreting WW1 at Dalhousie University

Colin Mitchell

This year, we are approaching a four-year centenary the likes of which the world has yet to see. Between August 2014 and November 2018, people across North America, Europe, the Middle East, Africa, South Asia and Australasia will be invited to remember the first global conflagration of the Great War. The military fatality rates for some of the major and minor belligerents give us pause for reflection: Russia, ca. 2 million; Germany, ca. 2 million; Italy, ca. 651,000; Turkey, ca. 770,000; France, ca. 1.4 million; Britain, ca. 890,000; Canada, ca. 65,000; India, ca. 75,000; and Austria-Hungary, ca. 1.1 million. When we broaden this to include *all* the allied and central powers, as well as the civilians who were affected, our duty to take time and commemorate, study and interpret these four years of 1914-1918 is clear.

Moreover, it was from the ashes of World War 1 that new nation-states were formed across Europe, Africa and the Middle East. Europe's borders were redrawn for empires like Germany and Russia, Austria-Hungary broke up completely, and the destruction of the Ottoman Empire marked a profound shift for millions of Arabs, Turks, Armenians and other ethnicities in North Africa and the Middle East. With the Balfour Declaration and the Sykes-Picot Agreement, the foundations for the states of Israel, Palestine, Lebanon, Syria, Iraq, Turkey and Jordan were being formed.

It is this monumental nature of World War 1 and its legacy that has inspired the faculty of the Department of History at Dalhousie University to launch two new courses on WW 1 in September 2014. The first class will run in the fall semester and is entitled "The First World War: Causes and Campaigns." It will be taught by Dalhousie's resident military historian, Dr. Chris Bell, and will examine the origins and course of the First World War on a thematic basis, concentrating on the military, diplomatic, political

Credit: Author

A poster showing Private Vernon Grierson is used to advertise two new history courses on WWI now offered at Dalhousie University.

and economic aspects of the conflict. Topics will include: the origins of the war and the July crisis; grand strategies in peace and war; the Western Front and trench warfare; the Dardanelles and Gallipoli campaigns; the Eastern Front; economic mobilization; and the war at sea and in the air.

The second course will run in the winter semester of 2015, and is entitled "The First World War: How it Changed Our World." This course will be coordinated by Dr. Chris Bell, but taught by a cross-section of faculty from the Department of History and beyond. A dozen specialists

will be brought in to cover their respective areas in the narrative of WW 1 and its legacy in different parts of the world. Thus, experts will speak about the war's impact in a truly *global* capacity: Canada, Newfoundland, the UK, Australia, New Zealand, South Africa, Russia, the Ottoman Empire, Germany, British India and Africa.

Of course World War 1 is also associated with a major shift in society. Some of the lectures will address the impact of the war beyond geopolitics. Traditionally cited as the harbinger of modernity, WW 1 brought about a period of painful self-reflection and societal inquiry. In this way, modes of expression underwent radical transformations in novel-writing, poetry, architecture and the arts. In terms of research, new technologies and fields of study were introduced, while existing ones in medicine, psychology, engineering and architecture were re-conceptualized. In the social sciences and humanities, disciplines such as economics, political science, history and philosophy likewise underwent significant change as societies struggled to rationalize the pain, trauma and uncertainty which dominated so much of 1914-1918.

Dalhousie University will be one of many Canadian institutions to launch initiatives towards commemoration and examination of WW 1. We are planning to coordinate these courses with ongoing events and exhibitions in Halifax, such as Citadel Hill and the Maritime Museum of the Atlantic. In this way, we hope to situate these courses with the work of local historians and specialists who can inform us of the role of Halifax and Nova Scotia in terms of WW 1. We are also planning to offer a companion series of evening lectures for both Dalhousie students and the general public to attend.

Comment on the Word Officer

Michael Prang

I am writing in refutation of the comment "Protection of the Term 'Officer,'" in Volume 9, No. 3 (Fall 2013) of *CNR*.

The comparison between the term 'officer' and the designations used by professions such as engineers and doctors is not an apt one. The policy rationale for allowing only qualified individuals to use those designations is not to acknowledge how deserving of respect their jobs are, it is consumer protection. Such designations help ensure that quality work is performed for consumers in situations where the nature of the work makes it difficult for consumers to assess its quality. This consideration does not apply to the military, since individual consumers do not engage its services. People do not say, "I'd like to annex my neighbour's yard, so I'll go to the mall to find a properly accredited military commander."

In regard to the etymological argument, as Inigo Montoya, in the movie "The Princess Bride," would say, "[y]ou keep using that word. I do not think it means what you think it means." As any research into its history would quickly reveal, the word 'officer' has never exclusively referred to law enforcement and military personnel. In short, one definition of officer is, and has been since the term came into use, one who holds an office. If past usage is any gauge, military members have no special claim to the word.

Consider the consequences of the article's proposal. If such a law were passed, Canadians from many walks of life – first officers of airliners, CEOs of corporations, etc. – would be forced to change their business cards, name tags, signature blocks and who knows what else lest they receive a threat of legal action. This would be particularly confusing for civilian Officers of the Order of Canada.

All for what? Ostensibly to increase public respect for military officers. If that is your objective, forcing the entire population to abandon the common definition of a word under threat of punishment is not the way to achieve it. I cannot imagine there being much enthusiasm for enforcing such a law, especially when the lawyers in our already busy courtrooms are themselves bound to act as officers of the court. Kind Regards.

***Editor's Note**: Good News! In the past, due to technical issues, the CNR website and Broadsides were not accessible to DND/CAF users on the government computer networks. We are happy to report that this issue has been resolved. We hope all DND/CAF government computer users will visit our sites and enjoy the content that we have to offer (www.navalreview.ca).*

A View from the West:

Illegal Fishing in West Africa: A Symptom of a Wider Problem

Jacquie Brower-Berkhoven

Increased incidents of piracy off West Africa have shifted international attention from the Gulf of Aden to the Gulf of Guinea. Although piracy is of significant international concern, illegal, unreported and unregulated (IUU) fishing is arguably of greater concern to West Africans. For countries that are incapable of effectively patrolling their own waters, illegal fishing is a systemic problem that can affect land-based state authority and threaten economic and social stability. Therefore, by building upon efforts undertaken to curb shipping piracy in West Africa, the international community can expand state capacities to counter illegal foreign fishing.

As with any illegal activity, the impact of IUU fishing is difficult to gauge. However, the estimated global economic loss from illegal fishing is likely as high as USD $23.5 billion annually.[1] This figure represents 26 million tonnes of fish or roughly one-quarter of the world catch. With large profits to be made and minimal threat of legal repercussions – due to the lack of state capacities – the incentive to fish illegally in West African waters is high. As a result, West Africa has the highest level of IUU fishing in the world with 37% of the region's catch being caught illegally by fishermen from countries like Taiwan, Thailand, South Korea and Russia.[2] This level of exploitation hampers the sustainable management of marine ecosystems severely, while compromising food security and the livelihoods of West African populations.

Senegal, one of the most stable countries in Africa, is a particular example of the scope of the illegal fishing challenge. Senegal's fisheries are among the largest and most productive in West Africa, yet they are affected significantly by IUU fishing. The abundance of marine resources has attracted foreign vessels, operating on an industrial scale, and this has led to conflict between foreign and artisanal fishermen, with accusations that the foreign vessels are exploiting Senegal's marine resources by fishing illegally. It was not until recently, however, that Senegal began to voice complaints about IUU fishing vessels depleting the region's fish stocks. These complaints call into question the security of Senegal's once thriving and dependable fishing industry.

The social consequences of IUU fishing are particularly damaging to Senegalese coastal communities but also to the country at large. Senegal's fishing industry employs some 600,000 people, 15% of the working population, and contributes significantly to the country's food security as fish accounts for 75% of the population's protein intake.[3] However, since one large trawler can catch as much as 250 tonnes of fish per day – roughly what 50 artisanal boats might catch in a year – Senegalese fishermen are having to work harder in their waters, while also having to venture further offshore. The effect of illegal fishing extends beyond the coastal areas. Senegal's rural population is heavily dependent on agriculture but during droughts and periods of low agricultural productivity, many farmers migrate to the coast in search of employment in the fisheries sector.[4] Since fish stocks are declining, many coastal people are forced to migrate to urban areas in search of work. This trend has led to food, employment and health insecurity across the country. Without better monitoring and control, Senegal's declining maritime resources will continue to endanger the health and livelihoods of the population as a whole.

Credit: Internet

Senagalese fishermen say their catches are dwindling year after year.

Senegal has a limited maritime patrol and law enforcement capability. This is unfortunate given the economy's heavy dependence on fisheries for export revenue. Although fish is the country's fifth leading export commodity, the region's demersal fish stocks are over-exploited and this reduces the actual and potential export earnings of these commodities. Furthermore, IUU fishing fleets take their catch to ports far from West Africa, which results in Senegal losing tax, port and service revenues. These losses are estimated to amount to $312 million per

The amphibious command ship, USS ***Mount Whitney*** *(LCC 20), pictured here in 2005, provides mobile command and control capability, and is permanently assigned as the flagship for US Naval Forces Europe-Africa/US Sixth Fleet.*

year, a situation that further weakens state capabilities by robbing the Senegalese government of an important source of revenue.[5]

The Senegalese Navy is the primary authority monitoring fisheries and waterways, but it is not well-equipped. Even though it receives training, equipment and support from the United States and France and relies on France to conduct aerial patrols, the navy is only 900 strong with seven patrol craft, three landing craft and no combat craft.[6] It does not have the capability to deter foreign vessels from threatening the country's maritime and economic security. Illegal fishing is one of many issues of maritime security in the region, including illegal migration and drug trafficking, with which the navy must cope. Unlike some other countries in the region, Senegal does have the legal structure needed to combat IUU fishing but due to its limited patrol and interdiction capabilities, the maritime fishing code remains largely unenforced.

The solution lies in building up state capacity in Senegal and other West African countries. The mechanisms that have been established to curb piracy and other maritime security concerns can also be used to counter IUU fishing. Efforts have been made by US Africa Command (AFRICOM) and US Naval Forces Africa (NAVAF) to help West African states maintain maritime security effectively within their territorial waters. However, increased international involvement is required. International efforts can build state capabilities by increasing the monitoring presence at sea. For instance, international partners can donate patrol ships, as has been done in Gambia, to increase the size of small navy fleets. Increased aerial patrols and an effective coastal radar system are also necessary.

In order to establish state capacities on land, international partners can build upon AFRICOM and NAVAF's efforts by training maritime professionals and helping to build maritime infrastructure. Moreover, as seen in Benin, the international community can provide artisanal fishermen with very high frequency (VHF) radio equipment to enable them to assist with intelligence reports on the location of vessels fishing illegally. These efforts should boost Senegal's monitoring, control and surveillance capability. Additionally, penalties for violating regulations should be significantly increased since currently fines represent only a fraction of an illegal vessel's operational costs and do not act as a deterrent. If sustained, proper implementation of these mechanisms could play a major role in the ability of West African coastal states to develop their maritime sectors and safeguard the livelihoods of their communities.

Illegal, unreported and unregulated fishing off the coast of West Africa is a longstanding security issue which has been difficult to counter as many coastal states do not have the capacity to patrol their own waters. However, an increased focus on the Gulf of Guinea presents an opportunity for greater international involvement. In order to enhance the well-being of West Africans, the international community should build upon efforts used to curb other issues of maritime insecurity in the region by increasing the naval capabilities of the coastal states.

Notes

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2. Chris Trelawny, "A Symptom of Wider Problems," *New African Magazine*, 19 March 2013.
3. See Marine Resources Assessment Group Ltd., "Towards Sustainable Fisheries Management: International Examples of Innovation," 2010, p. 62; and Aliou Sall. "Job Satisfaction in the Coastal Pelagic Fisheries of Senegal," *Social Indicators Research*, Vol. 109, Issue 1 (October 2012), p. 25.
4. Marine Resources Assessment Group Ltd., "Towards Sustainable Fisheries Management," p. 62
5. BBC News, "The Unequal Battle over West Africa's Rich Fish Stocks," 8 January 2014.
6. IHS Jane's Defence and Security Intelligence and Analysis, "Jane's World Navies," January 2014.

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Dollars and Sense: The Impact of Budget 2014

Dave Perry

The 2014 federal budget marked an important milestone for the Canadian Armed Forces. Combined with the other budget measures announced since 2011, the defence budget is now smaller, in real terms, than it was before the Canada First Defence Strategy (CFDS) was launched in 2008. Despite the fact that CFDS was intended to provide for long-term, real growth, the Department of National Defence (DND) has less money now, adjusting for inflation, than it did before CFDS was released.

This may come as a surprise to many, given the current government's consistent refrain about its financial support for the Canadian military. The evidence, however, shows that the Harper government has made a considerable downward adjustment to its long-term defence plans. The government pledged to provide DND with $490 billion in funding over the 20-year CFDS planning period. Since then, however, budget cuts in 2011 and 2012 through the Strategic Review and the Strategic and Operation Review respectively have reduced this amount by $32 billion over the CFDS planning period. So the $490 billion plan is now a $458 billion plan.

Furthermore, a three-year operating budget freeze introduced in 2010 forced DND to redirect $355 million a year from operations and maintenance to fund compensation increases for personnel. A similar move was announced in Budget 2014. Assuming that the impact is comparable to what occurred in 2010 (DND would not, or could not, provide the actual details), this would strip away another $236 million in operations and maintenance funding. Both moves will have a recurring annual impact. The cumulative impact over the life of CFDS would be roughly $9 billion less money than anticipated for things like training, maintenance and repair and overhaul.

Finally, on top of these cuts and forced redistributions, twice now – in 2012 and 2014 – budgetary funds set aside for capital equipment have been removed from DND's fiscal planning framework, and deferred into the future. Budget 2014 announced that "[t]o ensure that funding is available when needed for planned procurements, the Government is moving $3.1 billion in National Defence funding for major capital procurements from the 2013-14 to 2016-17 period to future years in which key purchases will be made."[1] This announcement is actually a slightly smaller version of a similar adjustment made in the 2012 budget that reprofiled $3.54 billion out beyond 2016/2017. That measure received almost no public attention, however, because it coincided with other government-wide cuts.

Credit: Irving Shipbuilding Inc.

Proposed Halifax Shipyard expansion. Funds are being used to support the modernization of Canada's shipbuilding industry.

Credit: Jim Henderson/Wikimedia Commons

*HMCS **Athabaskan** looking aft from foc'sle at 76 mm gun and bridge, 27 May 2010.*

In each case, the shift represents an adjustment to the department's accrual space for capital. Combined, $6.64 billion in DND's budgeted fiscal space has been removed in the near term, and deferred until some point after 2016/2017. When exactly the money will reappear is unknown as it is outside of the Department of Finance's planning horizon. But this is not welcome news for a department that faces urgent recapitalization pressures across several fleets. In fact, the impact is problematic. Increasingly elderly fleets must be operated longer than planned and project budgets are being eaten away by defence inflation as the delay adds up. For the navy, the impact is severe, since cost escalation for naval vessels ranges from 10-11%, meaning that delay erodes hundreds of millions of dollars a year in purchasing power.

And yet, the government has suggested that it was DND that requested this funding be removed from its budget. In Question Period on 12 February 2013, the Prime Minister stated "[t]he government adjusted DND's budget at its request, so that the money will be available when our military personnel need it. There are no cuts."[2]

So why would DND ask to have its capital funding taken away (assuming that is what happened)? According to the Department of Finance officials who were available to answer questions at the official release of Budget 2014, this reprofiling did not indicate a decision to cancel or delay any of DND's projects. Rather, the financial shift was made because DND's recapitalization program is several years behind schedule. This delay has been widely documented.[3] Each year, the government of Canada's inability to recapitalize the Canadian Armed Forces has been documented in the Public Accounts of Canada, which have demonstrated the government's chronic inability to spend all of the capital equipment funds provided by Parliament. Between 2009/2010 and 2012/2013, the fiscal years since CFDS was released for which year-end data is available, DND was unable to spend at least $1 billion in available capital funding. Annually, that represented 25-30% of the available funds not being spent as intended. This has resulted in billions of dollars in available capital funding going unused, as defence recapitalization stalls.

This delay means that although the Department of Finance had budgeted for these planned purchases, the funds it had set aside have not been needed. Equipment that was not purchased as intended has not created the annual expense that needs to be accounted for in DND's budget. Essentially, the government's inability to procure equipment for the Canadian Armed Forces has made some of DND's budget room unusable for the original intent. Consequently, that accrual space has been removed from DND's budget in the short term, with the pledge that it will be made available to DND in the future. Since this money will not reappear until at least 2017, however, there is some question about whether it will actually be there when DND needs it. There will be a federal election before 2017 so the government may have changed, and the government officials will almost certainly not be the same ones that worked out this arrangement.

For the Harper government, the fiscal impact of this procurement delay has been highly advantageous. The 2014 budget was focused squarely on setting up a return to fiscal balance in 2015. Its primary means of doing so is by reducing the cost of civil service compensation, a measure that the government hopes can save roughly $7 billion. This effort is being contested by the unions representing civil servants and is already contentious.

The deferral of DND's capital funds, however, since it is not actually a cut, has not been contentious. And it provided fully one-quarter of the overall budget measures enacted in 2014 to ensure that the government's books will be in the black ahead of the next federal election. Thus, for all its negative impacts on the Canadian Armed Forces, the failure to acquire military equipment on schedule has had at least one benefit; it has provided a fiscal windfall for the government.

Notes

1. Department of Finance Canada, Budget 2014/Economic Action Plan 2014," p. 255.
2. House of Commons Debates, 41st Parliament, 2nd Session, Hansard, 12 February 2014, available at www.parl.gc.ca/HousePublications/Publication.aspx?Language=E&Mode=1&Parl=41&Ses=2&DocId=6423998.
3. Elinor Sloan, "Canadian Defence Commitments," University of Calgary, School of Public Policy, 2013.

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Warship Developments: A Potpourri

Doug Thomas

A potpourri is either a collection of dried aromatic flowers and herbs, or a mixture of miscellaneous things. I will leave it to you, dear reader, to decide which this is.

Squabble over Crimea

The Crimean peninsula has been the home of the Black Sea Fleet (Russian, then Soviet and now Russian again) for centuries. In addition to naval ports, air bases and other installations necessary to support a modern navy, there are also shipyards in western Ukraine which build and repair warships and auxiliary vessels of all sizes (such as the Russian and Chinese aircraft carriers *Kuznetsov* and *Liaoning*). There are also many retirees who have lived in the Crimea throughout their service careers, and I am sure would prefer to remain in this area with their families rather than return to the frozen north.

All this to say that it should not be surprising that many pro-Russian ex-military people with training and recent uniforms turned out during the turmoil in Crimea to make their views heard. The Crimea which was an Autonomous Region of the Ukraine in accordance with post-Soviet era agreements with Russia, although this is now disputed, is 58% ethnic Russian and 24% Ukrainian, 12% Tatar (and 6% 'other'). One wonders whether these demographics were a major concern to the Ukrainian government during a period of lengthy discussions with Russia about renewing the bilateral agreement to lease land and facilities for the Black Sea Fleet. These leases were due to expire in 2017, but the pro-Russian former Ukrainian President Viktor Yanukovych signed an agreement with Russia in 2010 to extend them until 2042, with the possibility of further extensions. With the results of the referendum on 16 March, however, the whole situation is now uncertain – at this time it is *Ukrainian* military forces that are unwelcome in Crimea!

USS *Truxtun*, a recently commissioned *Arleigh Burke*-class destroyer is now in the Black Sea for previously scheduled exercises with Romanian and Bulgarian naval units. It will be interesting to see if *Truxtun* operates in or near Ukrainian waters.

UK Carrier Update

HMS *Queen Elizabeth*, the first of two 65,000 ton carriers for the Royal Navy, is scheduled to commence sea trials in 2017, and flight trials with the Joint Strike Fighter, a Short Take Off But Arrested Recovery (STOBAR) variant of the F-35. HMS *Prince of Wales* will follow in a year or two.

Artist's conception of HMS ***Queen Elizabeth****.*

The current concept is that one carrier will be operational, with the other in extended readiness.

The ships are unlike any other carriers. They have two island superstructures: the forward one for ship navigation and operations; and the after one for control of flight operations. Maximum speed with her gas turbine-powered electric propulsion is projected at 25 knots which is not particularly fast by US Navy carrier standards, but probably adequate for the Royal Navy.

USN Littoral Combat Ship

The US Navy has 17 Littoral Combat Ships (LCS) in commission or under construction, but it has recently (24 February 2014) been directed to halt procurement of the ships at 32 units rather than the original 55 vessels. There are two types, a mono-hull design (USS *Freedom*-class) and a triple-hull catamaran design (USS *Independence*-class). Both types are capable of speeds in excess of 40 knots, are of shallow draft for operations in coastal waters and have large flight decks and hangars. They are designed to accept modular mission packages for surface warfare, anti-submarine warfare, or mine countermeasures operations, and to be manned with two crews to maximize their availability. There has been concern that they were very vulnerable to damage from enemy fire and had a limited capability for lengthy deployments due to issues with contracted maintenance. It does not help that the LCS was seen as a replacement for conventional frigates of the *Oliver Hazard Perry*-class, although they are very different ships.


Communication Specialist 1st Class James R. Evans

*The Littoral Combat Ship USS **Freedom** (LCS 1) underway conducting sea trials off the coast of southern California in 22 February 2013.*

In place of the intended LCS units, a general-purpose frigate will be built, and it will be significantly smaller and less expensive than the *Arleigh Burke*-class destroyers. The new ships could be based either on such successful NATO designs as the Spanish *Bazan,* an area-air defence frigate, or perhaps a navalized version of the US Coast Guard *Berthold*, the National Security Cutter. *Berthold* is roughly the size of Canada's *Halifax*-class frigate, and has a combined diesel and gas propulsion system providing a maximum of 28 knots and long endurance at economical speeds.

***HMCS** Protecteur*

Readers will know that the West Coast supply ship (AOR) HMCS *Protecteur* recently had a serious engine room fire while transiting independently from Hawaii to her home port in Esquimalt, BC. The fire was extinguished by her ship's company, with a reported 20 members injured – likely from smoke inhalation – while fighting the fire. *Protecteur* was commissioned in June 1969, and is more than overdue for replacement. It seems highly unlikely that she will be repaired and placed back in service and this will leave the Canadian Navy in a very precarious position with regard to its ability to deploy out of area.

A replacement program has been in the works since the early 1990s and it has been studied to death by various federal governments and departments for nearly a quarter of a century. It has been decided that two (or possibly three) new ships will be built by Vancouver's Seaspan Marine Corporation, with deliveries of German-designed *Berlin*-class AORs to the RCN starting later in this decade.

Protecteur and her East Coast sister ship, HMCS *Preserver*, and their highly skilled ship's companies through the years, have given yeoman service to the RCN and Canada. One hopes that this wake-up call will light a fire under the powers-that-be to expedite the program to replace them. FGS *Bonn*, an improved *Berlin*-class, recently visited Halifax so that the RCN could have a good look at their future AOR. It appears to be a very capable ship. If *Protecteur* is not to be repaired, one hopes that a replacement can be acquired until the first new ship becomes available. The Australian Navy was faced with a very similar situation some years ago when HMAS *Westralia* had a bad fire, and Australia purchased a new commercial tanker and modified it for naval use. The USN might also be able to help perhaps by providing one of its AORs either for a fixed period of three or four years, or making a suitable ship available when needed for specific exercises and deployments. In any case, the Canadian AOR can't be delivered too soon!

Credit: Halifax Shipping News

*Germany's FGS **Bonn** arrives for a port visit in Halifax, 19 February 2014.*

Book Reviews

Warriors and Wizards: The Development and Defeat of Radio-Controlled Glide Bombs of the Third Reich, by Martin Bollinger, Annapolis, MD: Naval Institute Press, 2010, 208 pages, ISBN 978-1-59114-067-2

Reviewed by David Morse

Warriors and Wizards relates the details of a year of technical innovation and counter-innovation at the height of the Second World War. The naval and air arms of the Axis powers had discovered the challenges of sinking ships from the air. While the submarine war had had considerable success in the North Atlantic, the sheer size and rapid growth of Allied maritime forces demanded an airborne response. As operations in the Mediterranean turned in favour of the Allies and as the Allies massed forces towards the campaign in Europe, Nazi air forces found themselves forced into a larger anti-shipping role and encountered significant losses of aircraft and crews – all for very little effect. The technological response was the development of air-launched, remotely controlled weapons.

Martin Bollinger analyses the impact of the introduction of these new weapons on both the Luftwaffe and the Allies. The new weapons were quickly identified by Allied naval forces and a closely coordinated program of intelligence gathering and technical examination ensued. This part of the story is the most interesting as signals intelligence, naval and air intelligence, resistance forces, technical agencies and commercial electronics companies in England, the United States and Canada cooperated to explain the new techniques and to devise counter-measures. Ships were outfitted with receivers capable of pinpointing the control frequencies, jammers were adapted from existing transmitters, a deception device enabling Allied operators to seize control of the weapons was built, operators were deployed, and a broad network of information kept the effort together – all in less than a year.

But the defeat of the weapons may not have rested on this campaign of innovation. A more prosaic explanation may lie in the increasing frequency, severity and accuracy of Allied bombing raids targeting Luftwaffe airfields. There was also the steady loss of experienced aircrew and modified aircraft as air defences above Allied convoys and forces in the Mediterranean campaigns in North Africa and Italy were improved.

The author tries to answer the question of weapon effectiveness but admits to being limited by logistical, training, technical questions for which there is no definitive interpretation. Despite extensive analysis, mission by mission, what results is a generalization that at best only one weapon in 24 sent from a German airfield scored a hit or caused damage with a near miss. The true value in this volume lies, however, not in these considerations but in the lesson that this small part of WW2 history teaches us as a precursor of the modern development of remotely launched and controlled weapons as well as the continuous stream of measure and counter-measures that have ensued.

The Epilogue provides one cogent example of this trend – the prevalence of improvised explosive devices (IEDs) in Iraq. These bombs, which are often triggered by utilizing radio links, caused a significant proportion of American casualties in Iraq. And, as Bollinger states, "again, as they did in September 1943, the United States scrambled to provide an effective defence." As the author notes "Plus ça change…."

Warships of the Bay of Quinte, by Roger Litwiller, Toronto: Dundurn Press, 2011, B&W illustrations, bibliography and appendices, 197 pages, $28.00

Reviewed by Doug Thomas

This book is the story of six of Canada's warships, all named for communities in the Bay of Quinte region of eastern Ontario. There were three corvettes, a frigate and two minesweepers, HMC Ships *Napanee*, *Belleville*, *Hallowell*, *Trentonian*, *Quinte* (I), which served in World War II, and *Quinte* (II) which was built in the 1950s.

Litwiller gives a unique account of the small ships that were the backbone of the Canadian Navy during WW II and the Cold War. These detailed stories of the ships' service provide a window on the world that led to their construction, manning and operation. It tells of the relationship with their namesake towns and records the accomplishments of these hardworking ships, as well as the occasional mistakes made in their operation. This rich and vivid account of an important part of Canada's Naval Service draws from the records of the ships, interviews with their crews, letters, diaries, newspaper articles, community libraries and photographs. You will learn about HMCS *Napanee* as she and the other escorts of convoy ONS-54 fought a five-day battle against 24 German submarines in one of the Battle of the Atlantic's most tragic battles.

There are many interesting stories in this collection: *Napanee*'s first captain, Andrew Dobson so distinguished himself that he was rewarded with command of a destroyer, HMCS *St. Croix*, a promotion that cost him his life when that ship was sunk by the first use of German acoustic-

homing torpedoes against escorts. All of the ships have notable histories, for example: HMCS *Belleville* fought successfully to rescue a torpedoed merchant ship; the link with the Battle of Trafalgar in the naming of HMCS *Hallowell*; HMCS *Quinte* (I) and her grounding and other misfortunes; the close links between the city of Trenton, Ontario and its ship HMCS *Trentonian*, and her loss late in the war with six of her ship's company.

After the discussion of the WW II ships, the second HMCS *Quinte* is discussed. *Quinte* II was a *Bay*-class coastal minesweeper that served in the RCN for only 10 years due to defence cuts – but this was longer than any of the other Bay of Quinte vessels. Although the smallest of the six, she was probably the most comfortable as habitability lessons from WW II had been learned and were being implemented in the ships being built for the post-war navy.

This is a book that many readers will find of interest. There are aspects of naval history not readily found, such as contacts with namesake towns and cities – some of which continue to this day. The book also contains detailed research on events such as the *Quinte* (I) grounding, and awards and decorations earned by members of the ships' companies. The only negative comment I would make is that a few of the many photographs are of poor quality. Nevertheless, I highly recommend it.

Network-Centric Warfare: How Navies Learned to Fight Smarter Through Three World Wars, by Norman Friedman, Annapolis: Naval Institute Press, 2009, 243 pages, index, US $32.95, ISBN 978-1-59114-286-7

Reviewed by Ken Hansen

Norman Friedman's list of publishing credits is extraordinary. Throughout it all, his style remains consistent. This book traces the early and profound influence that information age technology has had on naval forces and how they operate in combat. After a brief acknowledgement of early British developments in radio communications and its role in ocean surveillance, the book focuses almost exclusively on technical developments and countermoves by the US Navy up to the end of the Cold War. This bottom-up approach to the subject, emphasizing the technology aspects of command in a short-notice type of battlespace, comes home sharply in the 17th chapter. Here, Friedman finally acknowledges that the tactical information systems being generated during the mid-1960s "did not cover the area of responsibility of a numbered fleet commander" (p. 189). The mid-point of the book is quite late to be entering into a discussion about the effects of technology on strategic, operational and tactical command.

Friedman is not a writer for casual readers of naval history and technology: the text is simply saturated with acronyms that will defeat all but the most determined of readers. The placement of the list of acronyms at the back of the book was unwise. Moreover, the heavy emphasis on technical issues is made at the expense of drawing out clear conceptual deductions.

The main failure in Friedman's analysis, however, is that it lacks a theoretical framework. Understanding the fundamental changes that have occurred in the conduct of naval fleet engagement since WW I is essential to grasping why things have changed and what they mean. Wayne Hughes' seminal work *Fleet Tactics and Coastal Combat* explains the transition from slow gun engagements to the 'blink of an eye' missile warfare of the current era. Friedman does examine the tactical challenges of air and missile warfare in exacting detail. He acknowledges that the Japanese understood first that a combat information centre could fall too far behind to be useful. He notes that "[t]he only instant solution was to decentralize control" (p. 59). This is a key problem and would have been a worthy theme to carry consistently to the end of the book.

As technology becomes more capable, the natural tendency is to centralize control at higher levels of command. Having the Admiral practically looking over your shoulder and second-guessing every tactical decision stymies initiative and renders the human element of the tactical command system even more vulnerable to the saturating effects of swarming attack. Friedman clearly knows this, but does not wrestle the conundrum to a final conclusion.

While this book will be useful to doctrine writers, most will be left to wonder what it all means. This is the topic of the concluding chapter, which is a scant four pages long. Friedman sounds warning notes about the dangers of 'picture-centric' operations and trusting symbols that do not represent reality, either by errors in generating them or the failure to understand that images do not reflect intentions. There is no discussion of the rise of drones in naval warfare and their potential impact on command processes.

Having seen first hand the frustration that 'garbage in, garbage out' creates in highly automated naval data systems, I can only repeat the author's words. As Friedman asks, "[t]o what extend could they [at sea] trust data collected and interpreted remotely? How could (or should) they be convinced to trust systems whose workings or character of limitations were necessarily being withheld for them in the interest of security? *This problem is still with us*" (p. 18. Italics in original).

Battle of the Atlantic Place

The Battle of the Atlantic was the longest and most decisive campaign of the Second World War and a defining period for Canada. In 2011, the Canadian Naval Memorial Trust launched the Battle of the Atlantic Place Project to create an innovative experiential centre to celebrate and commemorate the extraordinary national achievement of Canadians in the Battle of the Atlantic. It will incorporate HMCS *Sackville*, Canada's Naval Memorial, the last of 269 corvettes that formed the backbone of Allied victory in the Atlantic.

Answering the Call

When war was declared in 1939 Canada was primarily an agrarian country with a population of barely 11 million, limited industry and minimal military forces. Along with residents of the neighbouring colony of Newfoundland, Canadians quickly rose to the challenge of total mobilization. Britain's survival and the ultimate Allied victory in Europe were almost entirely dependent on the supply of men, materials, equipment and food from North America. As part of the Allied forces, Canadian ships and aircraft played a decisive role in this six-year campaign.

The Battle of the Atlantic encompassed the breadth of the ocean: from the Caribbean to the Arctic, off Canada's shores on the East Coast and in the St. Lawrence to within a few miles of Quebec City. Canada played a crucial role in organizing and defending the shipping that plied these waters. The Atlantic was where Canada asserted its rightful place as a major Allied partner with the Royal Canadian Navy (RCN) coming of age and the Royal Canadian Air Force (RCAF) playing a vital role. Canada's contribution in the Battle of the Atlantic was recognized with command of the Northwest Atlantic under Rear-Admiral Leonard Murray – the only Allied theatre of war commanded by a Canadian. By 1944, Canada was responsible for the safe escort of all North Atlantic trade convoys, providing a major contribution to the forces hunting U-boats.

No other campaign of the Second World War so profoundly reflected the strengths and weaknesses of Canada's economy. There was a remarkable expansion of shipbuilding on the East Coast, St. Lawrence, Great Lakes and West Coast. More than 1,200 naval and merchant ships of different classes were built in support of the RCN, merchant navies, the Royal Navy and the US Navy, along with thousands of small craft. Most RCN ships bore names of communities across the country. Ships built by the men and women of Canada were critical to the reinforcement and resupply of Britain and by 1945 shipbuilding was Canada's second largest industry. Moreover, Canadian electronics and armaments industries provided much of the equipment carried by Canadian warships, while RCAF squadrons flew many Canadian-built aircraft.

Canadians volunteered for active service in the tens of thousands and nowhere was this more evident than in the RCN. In 1939 the RCN had a dozen ships and 3,500 regular and reserve members; by 1945 this had grown to almost 500 ships and 110,000 men and women. Approximately 90% of the wartime navy was made up of members of the Royal Canadian Naval Volunteer Reserve. The RCAF contribution to the Atlantic was also huge. Roughly a quarter of all air squadrons committed to the Atlantic were RCAF, while a quarter of all RAF Coastal Command crews were Canadian.

Canadians also joined the British merchant service and Canada's newly formed Merchant Navy, which by 1945 numbered 178 ships and almost 15,000 personnel. Life at sea for members of the Merchant Navy was harrowing. Their ships were the primary targets of U-boat attacks and almost 35,000 merchant sailors from Allied countries were lost at sea.

Battle of the Atlantic Place: Design Concept

Ten consortia comprising companies from across North America and Europe responded to the call for submissions for a design concept for Battle of the Atlantic Place. After a thorough process, a jury drawn from across Canada selected Stantec Architecture to develop the design concept for a facility to be built on a 4.5 acre area site on the Halifax waterfront.

Credit: Stantec Architecture

Aerial view of proposed Battle of Atlantic Place.

Credit: Stantec Architecture

Proposed Battle of Atlantic Place at sunrise.

Stantec has conceived a stunning LEED 'gold performance rated' structure with striking glass facades, vaulted halls and galleries, and public spaces offering spectacular vistas of Halifax Harbour. BRC Imagination Arts, an international interpretive design firm, has created a storyboard designed to provide a unique experience that will excite visitors of all ages. The experience will be extended across the country by linking with sculpted markers the hundreds of communities across Canada that gave their names to ships. These markers will incorporate codes, allowing access to a website to learn more about Battle of the Atlantic Place, and the ship that was named after their community.

Battle of the Atlantic Place will not be a museum. Visitors will be immersed in the story using interactive technologies and a multi-purpose theatre to allow the various story themes to be experienced. The story unfolds with an overview of the years and conditions on both sides of the Atlantic leading up to the war. A comprehensive treatment of Canada's involvement in the Battle of the Atlantic will follow to explore how this national commitment affected families, businesses and commerce. Stories will be told of the individual sailor's point of view, what it was like to serve at sea and how families coped, and what Canadians did in and out of uniform to support the war at sea. A simulator will allow visitors to experience operations at sea, such as a night action in a ship or a U-boat.

A strategic and operational overview of the Battle of the Atlantic will include introduction to key national and alliance leaders, the concerns and decisions affecting the war effort, and the political, economic and operational choices available to Canada. The consequences of the battle will be explored in terms of how Canada changed from an agrarian-based country to a very different industrialized country after the war.

The major artefacts – HMCS *Sackville* and an RCAF Canadian-built Canso Flying Boat – will represent all Canadian ships and aircraft, and will allow visitors to walk the decks and be under the 'protective cover' of those who placed themselves in danger to escort the convoys. The adjacent Memorial Hall will honour the over 5,000 members of the RCN, RCAF and Merchant Navy who perished at sea with the loss of 26 Canadian naval ships, 72 merchant ships and numerous maritime aircraft; it will be a place of sober reflection of service and sacrifice.

Battle of the Atlantic Place will recognize and honour a generation that faced a supreme challenge, fought with great courage and advanced Canada on to the world stage. It will open in 2017, the 150th anniversary of Confederation. Financial support for this design stage has been provided by the government of Canada, the province of Nova Scotia, Halifax Regional Municipality, and corporate and private donors. Supporting chapters across the country are being organized, as is a public fundraising campaign. Further information is available at www.battleoftheatlanticplace.ca, or by contacting the project working group at office@battleoftheatlanticplace.ca.

Ted Kelly, Chair, and members of the Battle of the Atlantic Place Working Group.

2014 Canadian Naval Memorial Trust/Oland Essay Competition

The *Canadian Naval Review* will be holding its annual essay competition again in 2014. There will be a prize of $1,000 for the best essay, provided by the **Canadian Naval Memorial Trust**.

The winning essay will be published in *CNR*. (Other non-winning essays will also be considered for publication, subject to editorial review.)

Deadline for submissions is 23 June 2014. If you have any questions about a particular topic, or submission guidelines, contact naval.review@dal.ca.

Modernizing for the future. The main girder of Seaspan's new 300t gantry crane being offloaded at Vancouver Shipyards. Various new facilities in the yard can be seen in the background.

Credit: Seaspan