Making Waves

The Orca Project: A Procurement Success

David Peer

Recently in the news Canadians have been assailed with negative opinions on the ability of the Department of National Defence (DND) to buy ships. Media tend to concentrate on the problems; it sells papers and attracts the public interest. Unfortunately, in this media race to the bottom many good stories get lost. One example is the *Orca* project where I was the Project Manager from 2007 to 2010.

At the turn of the century, the navy began the process to replace the 1950s-era wooden-hulled training tenders. As the navy moved toward training ship operators in modern land-based simulators, a comparable sea-based training vessel became essential. The goal was to replicate the conditions aboard larger ships. On 8 November 2004, DND announced a contract for six new ships, with an option for two more, for a total budget of almost C$100 million. The *Orca* project delivered operationally ready ships to the specifications, within budget and ahead of schedule – indeed, the final patrol craft was delivered 15 months early. The project met every milestone in the contract.

Table 1. PCT* Orca*-class Design Characteristics

Length	33.00 metres
Beam	8.34 metres
Draught	2.00 metres
Displacement	210 tonnes
Speed	20 knots
Range	660 nautical miles
Propulsion	Two Caterpillar diesel engines, twin shafts, two rudders
Berthing	24 total - 5 crew & 19 others
Armament	None fitted. Strengthened foredeck to mount a machine gun
Command and Control	Integrated platform control system and integrated navigation and electronic chart display information system

Credit: MCpl Chris Ward, Canadian Forces Base Esquimalt Imaging Services

The ***Orca****-class patrol vessel,* ***Raven****, is in Vancouver Harbour 22 February 2010 during* ***Operation Podium****, the CF contribution to the security of the Vancouver 2010 Olympic and Paralympic Winter Games and part of the RCMP-led Integrated Security Unit.*

Table 2. Delivery Schedule for the **Orca***-Class PCTs*

Name	Contracted Delivery	Actual Delivery	Schedule impact
Orca (PCT 55)	November 2006	November 2006	On time, as contracted
Raven (PCT 56)	March 2007	March 2007	3 weeks early
Caribou (PCT 57)	September 2007	July 2007	2 months early
Renard (PCT 58)	February 08	September 2007	5 months early
Wolf (PCT 59)	July 08	November 2007	8 months early
Grizzly (PCT 60)	February 09	March 2008	11 months early
Cougar (PCT 61)	August 09	October 2008	10 months early
Moose (PCT 62)	February 10	November 2008	15 months early

The *Orca*-class ships are designated as Patrol Craft Training (PCTs) ships and are primarily used for naval officer training, but they can conduct other training and operational roles for the navy. The home port for the entire class is Esquimalt where they provide the training link between bridge simulators and larger ships. The *Orcas* offer training at sea. Their command and control capability, high speed and excellent manoeuvrability also allow them to conduct port security operations, search and rescue, exercises and other similar duties. Two of them were temporarily modified to accept .50 calibre machine guns for port security during *Operation Podium*, the Canadian Forces support to the 2010 Vancouver Winter Olympics.

All eight ships were built at Victoria Shipyards, in Victoria, BC. The shipyard started construction of the first ship, PCT *Orca* in September 2005 and delivered the final vessel, PCT *Moose*, on 27 November 2008. DND closed the *Orca* project at the end of May 2012, just less than 11 years after authorizing approval to start. The final tally for the project was eight vessels which exceeded contracted performance requirements that cost 1.1% below budget, and arrived 15 months early.

Despite this excellent result, the project had its share of challenges right from the beginning. The *Orca*-class was developed using a proven vessel design as a point of departure. It is an approach that the Arctic Offshore Patrol Ships (AOPS) project is following with the use of the Norwegian *Svalbard*-class. The key to success in the *Orca* project was that the designer understood the capabilities and limitations of the existing design, and the constraints and requirements of the new design, which helped quantify the change and what that might mean to the design process. It turned out to be significant.

The *Orca* design started with the Australian *Seahorse Mercator* ship design but finished considerably different. The two designs share a geometrically similar hull form, but all other systems and materials were changed. This is a natural consequence of tailoring an existing design to meet specific Canadian requirements because as soon as one aspect of a design changes it must be adapted to all other systems.

PCT *Orca* has 15% greater displacement than *Mercator*. The three main design drivers were requirements for increased power, Canadian accommodation standards and a significant allowance in the design for growth in weight and volume of equipment. These drivers caused an increase in hull dimensions and structural weight increased causing the speed-displacement relationship to change. The proven propulsion system of *Mercator* then ended up being too small to achieve the desired speed.

The electrical system needed a complete redesign including the addition of a third generator. Among other design

Defence Maritime Services vessel ***Seahorse Mecator*** *passes under Sydney Harbour Bridge, 29 August 2007.*

challenges, conforming to Canadian naval requirements and *Canada Shipping Act* standards meant changing electrical supply from 220Volts/50Hertz to 120Volts/60Hertz. The additional generator also triggered a complete redesign of the cooling water system.

The requirement for a 'fitted-for-but-not-with' heavy machine gun meant not only a strengthened foredeck, but the addition of extra fire protection. The designers added a firemain supply to the new ammunition storage lockers to flood them in case of a nearby fire. This requirement and a specific Canadian naval requirement for fire stations led to a complete redesign of the firemain, the auxiliary seawater system and the bilge system. As well, the Canadian habitability standards forced a complete redesign of accommodation, and the electronic navigation suite required on the bridge for officer training triggered a complete redesign of the wheelhouse layout.

The project success was due in no small part to the Deputy Project Manager, the project staff and Victoria Shipyards. The close teamwork made it happen. It is unfortunate that successes like *Orca* never reach the national stage. The project demonstrates that Canadian industry and government are capable of delivering a project to specification on time and on budget.

Maritime Commerce Resilience

Dr. Allan Bartley (Transport Canada) and Captain Andrew Tucci (US Coast Guard)

The Eastern Seaboard of the United States was hammered in October 2012 by Hurricane Sandy, one of the most destructive storms to hit the continent in recent years. Besides the devastating human impacts of the storm, including loss of life and the destruction of entire neighbourhoods, the shipping community suffered significant losses. The northeast cargo industry alone was crippled by an estimated $1 billion in damage.[1]

Hurricane Sandy provided a tragic but important reminder of the need to prepare for disasters. In today's reality of highly integrated global supply chains that rely heavily on just-in-time delivery, any disruption, from a minor accident to a major natural disaster like Hurricane Sandy, can have widespread impact – both at home and abroad – on the economy.

Post-hurricane analysis suggests that some problems reported in the storm's aftermath might have been averted through pre-event resilience planning. Gasoline shortages were widespread, causing transportation problems throughout the region, further compounded by a poor response from utility companies.[2] Even the United Nations headquarters was affected, including its data centre being flooded, and reportedly poor communications caused by many out-of-date and incorrect email addresses.[3]

Credit: Peter Tirschwell tweet

Containers were thrown around like matchsticks as Hurricane Sandy hit the Port of Newark, 29 October 2012.

To help mitigate the impacts of supply chain disruptions such as these and help the maritime domain return to pre-event operations as quickly as possible, the public and private sectors are actively engaged in resilience planning in some places.

Maritime commerce resilience planning encourages the development of all-hazard plans, agreements, protocols and tools that result in improved coordination, resilience, resumption and recovery. Resilience planning promotes an up-front reduction of gaps and vulnerabilities in the maritime supply chain, with an integrated approach bringing together multiple jurisdictions and sectors to capture a range of potential concerns and issues. After a disruptive event, resilience planning speeds recovery and helps provide a quick return to operations. As well, it helps maintain global confidence in the maritime supply chain and enhances the reputation of Canada and the United States as secure links of that chain. Recognizing this importance, both countries have embarked on joint maritime commerce resilience-related activities.

In 2011, as part of the United States-Canada Perimeter Security and Economic Competitiveness Action Plan, Transport Canada and the United States Coast Guard launched a binational initiative to develop a framework for managing maritime traffic in event of an emergency. The first phase of this initiative was a pilot project in the US Pacific Northwest/British Columbia Lower Mainland region in collaboration with the Pacific Northwest Economic Region Organization, other levels of government and industry stakeholders on both sides of the border. Through the pilot project, information-sharing protocols and communication mechanisms have been developed and were successfully validated at a table-top exercise held in fall 2012. Over the course of 2013, this initiative will be expanded to include the Great Lakes and Atlantic regions.

Satellite image of Hurricane Sandy approaching the US east coast 29 October 2012.

From a global perspective the US Coast Guard and Transport Canada have co-led a committee with 38 international participants to develop voluntary trade recovery guidelines for the International Maritime Organization's (IMO) Facilitation Committee. The guidelines are best practices intended for use by both countries and industry worldwide to help minimize disruptions to the supply chain in the event of large-scale emergencies or disruption. The guidelines were endorsed by the IMO Facilitation Committee in April 2013.

These two major international initiatives between Transport Canada and the US Coast Guard, as well as domestic projects being undertaken on both sides of the border, have increased resilience in the North American and global maritime supply chains. Many of the impacts on supply chains from Hurricane Sandy could have been mitigated through resilience planning, highlighting the importance of the work being undertaken by Transport Canada and the US Coast Guard in this regard.

Both countries are committed to work together to ensure the development of binational relationships, partnerships, communication mechanisms and processes that will assist in the event of a disruption. Together, Canada and the United States envision a maritime supply chain that is dynamic, resilient, safe and secure and will continue work in tandem to realize these goals.

Notes

1. "Shipping Losses from Superstorm Sandy at $1B Says Consultant," *Cargo Business News*, 5 November 2012, available at www.cargobusinessnews.com/news/110512/news1.html.
2. Vivian Yee, "Schools Reopen to Snarls; Transit Headaches Persist," *The New York Times*, 5 November 2012.
3. Matthew Berger, "The New Normal: Hurricane Sandy and the UN Response," *The Interdependent*, 26 November 2012.

Keeping Faith

Colin Robertson

Today, despite oceans at our back and the longest coastline in the world, our warship complement ranks well back, behind the Turks, Indonesians and Greeks. This is a different world from that of the brave Canadians who, 70 years ago, fought and won the Battle of the Atlantic.

At the outset of the Second World War the Royal Canadian Navy (RCN) possessed six warships and a complement of 3,500. At war's end the RCN was the world's third largest navy with a complement of 95,000 and 270 warships. It played a central role in the Battle of the Atlantic having safely escorted over 25,000 merchant ships across the North Atlantic and providing a lifeline to Britain. Our shipyards, employing more than 125,000 people, built over 4,000 vessels. Merchant ships were constructed in an average of 307 days.

This was a long time ago, but is today's world really that different? In their April communiqué, the G8 Foreign Ministers described maritime security as the "critical enabler of economic development, trade, and regional stability." Between 2003 and 2007 global maritime traffic nearly doubled. Trade has lifted hundreds of millions of people out of poverty, especially in Asia. Prime Minister Stephen Harper has said that Canada and its economy "float on salt water." On any given day, one-third of Canadian Tire's inventory is at sea.

Our maritime interests can be grouped into three baskets: advancing international law as surety for our sovereignty;

freedom of the seas for our trade and commerce; and the ability to project power through naval power.

Negotiation of the United Nations Convention on Law of the Sea (UNCLOS) is one of the greatest triumphs of Canadian diplomacy. Canadian jurisdiction was extended to the continental shelf, effectively doubling our ocean estate. And with 40% of our landmass in our northern territories, and 25% of the global Arctic, securing international recognition for Canada's extended continental shelf is a priority.

Threats on the oceans come in two categories. The first includes threats to the good order at sea, including containing piracy and the trafficking of guns, drugs and people that in 2012 cost the global economy over $6 billion.[1] In order to promote order at sea, our warships are part of the international force in the Persian Gulf working to stop piracy, and last November, HMCS *Ottawa* participated in a major drug interdiction off the east coast of Costa Rica that netted over 1,000 kilograms of narcotics.

The second threat is to our strategic security – our sovereignty and resources as well as free passage on the high seas. For the last two centuries first the Royal Navy and then the US Navy have preserved maritime order and secured the sea lanes of commerce. Fiscal constraint is now straining the US capacity to do this, and it has called on allies to share the burden. For reasons of collective security and self-interest we need to do our part. We can do this if we have the maritime resources. Luckily, our *Halifax*-class frigates are being refurbished and, after a troubled refit, our *Victoria*-class submarines will soon be patrolling our waters.

An ambitious shipbuilding program has been launched to provide the coast guard with Arctic patrol vessels and the navy with new warships. The program acknowledges that ships made in Canada will cost more than buying off-the-shelf but the goal is to resurrect the Canadian shipbuilding industry. Today's warships are less about cutting steel than advanced technology and integrator systems.

Our model should be the revitalized Canadian aerospace industry. It is ranked fifth in the world in overall aerospace production, third in civil aircraft production and is well integrated in global value chains.[2] It is hoped that we can leverage our shipbuilding procurement to develop key industrial capabilities. It won't be easy. Experience tells us that it is critical to keep to agreed schedules and buy off-the-shelf as much as possible. Otherwise, we will likely have to settle for less ships and less ship.

The Auditor General has found our procurement process wanting and the Parliamentary Budget Office has already warned that replacement of our supply ships is over budget and behind schedule. We should heed the bean-counters, not just for their advice, but because their reports point out problems that do much damage to public confidence in the project.

The admirals, commodores and captains involved in the program have a lot of sleepless nights ahead of them. In addition to the seltzer, they should keep a copy of former Lockheed Martin CEO Norman Augustine's 'Augustine's Laws' close to them. Two of my favourite 'laws' are:

- Law XVI (applies equally to ships): Defence budgets grow linearly but the cost of military aircraft grows exponentially.
- Law XLVIII: The more time you spend talking about what you have been doing, the less time you have to spend doing what you have been talking about. Eventually, you spend more and more time talking about less and less until finally you spend all your time talking about nothing.

Our economy does float on salt water. Our national interest requires a strong navy, backed by a healthy shipbuilding and ship-repair industry. This is also how we will keep faith with the sailors and shipyards that won the Battle of the Atlantic.

Notes

1. "The Economic Costs of Piracy," Oceans Beyond Piracy, 2012, available at http://oceansbeyondpiracy.org/cost-of-piracy/economic.
2. Industry Canada, Press Release, "Minister Paradis Welcomes the Aerospace Review Report," 29 November 2012.

Learning about Amphibious Operations from Nelson

Ken Hansen

Pat Bolen's analysis in the Fall 2012 issue of *CNR* (Vol. 8, No. 3) of the difficulties Admiral Nelson experienced in the conduct of amphibious operations left me wanting more detail. Bolen's only recommendation was that "the Canadian navy … will need to be prepared to learn a whole new series of lessons." For an article with a title that suggests something could be learned by the Royal Canadian Navy (RCN) from an analysis of Nelson's defeats,

Credit: Warrant Officer Randolph Rice, ADM (Public Affairs), Ottawa

A Royal 22e Regiment light armoured vehicle (LAV 111) disembarks from a US Navy landing craft. The Integrated Tactical Effects Experiment took place on the US eastern seaboard in November 2006 to evaluate the feasibility of the deployment of a high readiness sea-based joint expeditionary task force for Canada.

this is precious little reward for the time it takes to read through the historical accounts.

Bolen attributes Nelson's problems achieving success in battles ashore to a basic fact: "battles on land are different from battles at sea." While this is true, the problem is more complex than the simple presence or absence of water. In fact, amphibious operations have a long history – the Romans were adept at them. So, the lessons of amphibious warfare stem from antiquity and the general assessment is always the same. From Demosthenes, in 452 BC, to James Wolfe in 1758, leaders would agree with the assessment made by American General George C. Marshall in 1944 that "[a] landing against organized and highly trained opposition is probably the most difficult undertaking which military forces are called upon to face." He reportedly made this remark during planning for the Sicilian landings. So, for assaults and raids, only two of the many forms of amphibious operations, the risk is always high.

Bolen faults Nelson for rushing to the attack during the actions he described, but provides no insights into the reason for this. He states that "Nelson's greatest strength at sea – his willingness to gamble all and win – was his greatest weakness ashore." I think there is more to it than a character flaw.

The first issue is the speed of execution. Amphibious forces of the Napoleonic age were wind driven and approached the landing zone by boats under oars. The urgency for speed was a constant frustration for commanders who strove to reach objectives before enemy forces could be alerted and moved to defensive positions. While ships of sail could move more swiftly than armies on foot, attacks at ports and other prepared positions relied on stealth and speed of approach for success. Urgency was a natural condition for all commanders attempting amphibious landings.

The second issue was the general meagreness of the landing force. Amphibious forces are always constrained by the space made available to them within the ships. Warships are not designed with consideration for troops and their equipment. Marines were integral to the crew of a British sailing warship and their disembarkation meant that the ship became less effective at its primary function.

While Admiral David B. Porter said in 1863 that, "[a] ship without marines is like a garment without buttons,"[1] the truth was that they were ancillary, and not primary, to the main purpose of a warship.

The third issue was the lack of firepower and logistical support for the landing force. Boats could only transport limited weaponry beyond muskets, and these only in a disassembled condition. Unloading at the beach was difficult for the assault force and painfully slow for the naval gun teams that manned the heavier weapons. Only in the modern era have aircraft, landing craft and precision weaponry alleviated so many of the problems of effectiveness that naval commanders faced in earlier amphibious operations.

But, was Nelson's desire for swift assault out of place in the Napoleonic era? The best answer to this question comes from Napoleon Bonaparte himself. Many of his utterances urged speed, including "[h]esitation and half measures lose all in war," and, in 1803, "[y]ou can ask me for anything you like, except time."[2] Napoleon thought a plan going awry was no reason to abandon the effort and his ability to see opportunity in the face of adversity was his greatest skill. As he phrased it, "I engage and after that I see what to do." This was a remark made in 1796 during the Italian campaign. So, Nelson's comment about time – "Time is everything: five minutes makes the difference between victory and defeat" – is not at all out of place against the Napoleonic standard. Nelson was not alone in this regard. A wide array of famous naval and military leaders recommended speed for everything from strategic initiation of war to the tactical conclusion of battles.

The real lessons for Canadian naval force planners considering an amphibious future for the RCN do not pertain simply to the fact that Nelson suffered defeats. Rather, they relate to the timeless issues of speed, volumetrics and effectiveness. These doctrinal concepts are just as pertinent to missions designed to relieve human suffering as they are to missions in support of military combat objectives. It is possible to distil lessons from history, but they must conceptualised through a process of analysis that goes far beyond a recounting of the events.

Notes

1. Admiral David B. Porter, quoted in Colonel Robert Heinl, Jr., *Dictionary of Military and Naval Quotations* (Annapolis: Naval Institute Press, 1966).
2. Napoleon Bonaparte, quoted in *ibid*.

Editor's Note

On page 23 of "A Preliminary Analysis of the AOPS Design" by Ken Hansen in the Spring issue (Vol. 9, No. 2), an incorrect number appeared in Table 2. The range of the T1200-class ship is 15,000 nautical miles. The table should appear as follows. The material has been corrected in the electronic version.

Table 2. Comparison of First and Second AOPS designs with T1200-class CCG Ship

Class	T1200-class	AOPS V1	AOPS V2	Change
Displacement	8,090 tonnes	6,940 tonnes	5,730 tonnes	-17.4%
Length	98.2 metres	109.6 metres	97.5 metres	-11.0%
Beam	19.5 metres	18.2 metres	19.0 metres	+4.4%
Draught	7.2 metres	7.0 metres	5.7 metres	-18.6%
Engine Power	17,700 kilowatts	18,000 kilowatts	13,200 kilowatts	-27%
Motor Power	10,142 kilowatts	15,000 kilowatts	9,000 kilowatts	-40%
Maximum Speed	16 knots	20 knots	17 knots	-15%
Range	15,000 n. miles	8,000 n. miles est.	6,800 n. miles	-17.4%
Endurance	192 days	120 days	120 days	NC
Bunkers	2,450 cubic metres	810 cubic metres est.	690 cubic metres	-17.4% est.

Note: Estimated data are calculated using a linear relationship for displacement.