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Maritime Engineering Journal

71
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Canada's Naval Technical Forum

Summer 2013

HMCS *Victoria's* successful torpedo sinking of a target ship during RIMPAC 2012 marked the 'end of a long beginning' for Canada's submarine program

CNTHA News Inside!

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- CNTHA chairman Pat Barnhouse asks, 'Where have all the innovators gone?'
- Forum: One engineer's new perspective on national strategy and the military industrial complex

Canada

Murmansk Veteran

Story and photos by Brian McCullough

Second World War navy veteran *Earl McKeogh* now calls Ste. Anne's Hospital in Montreal's West Island home, but once upon a time this 87-year-old former stoker was living aboard ship on wartime convoy duty. He survived the Murmansk run.

McKeogh, who completed this beautiful kit model of the Flower-class corvette HMCS *Snowberry* six years ago, served in a number of HMC ships including *Arnprior*, *Stettler* and *St. Francis*. When we spoke last December I asked him what he recalled of his time escorting the Murmansk convoys.

"The weather," he said. "It was real rough. You didn't need much else after that." He paused for a moment, then added: " Everything goes along fine until… We were just sitting ducks. We were in the middle of everything."

And that says it all.

(My thanks to Ste. Anne's Hospital communications advisor André Boudreau for providing access to the ship model case.)

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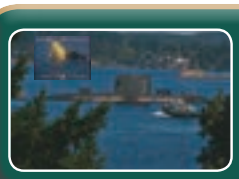

HMCS *Victoria* returns to Esquimalt on September 14, 2012 following her successful live-fire torpedo shoot during Exercise RIMPAC.

DND Combat Camera photo by Cpl Michael Bastien, MARPAC Imaging Services.
Inset Canadian Forces photo by 407 Long Range Patrol Squadron, Comox, BC.

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Commodore's Corner

By Commodore Marcel Hallé, OMM, CD

The End of a Long Beginning

Given my background as a submariner, some may accuse me of being biased in my first Commodore's Corner as DGMEPM by touting the success of the submarine program. Nonetheless, the progress of the *Victoria* class has been a Herculean feat in which we can all take pride. For those who saw the video clip of the elation that erupted in HMCS *Victoria's* control room when she successfully sank a decommissioned U.S. naval ship with a Mk-48 torpedo as part of the Rim of the Pacific exercise last summer, the excitement was palpable. The sense of achievement felt by the submarine's crew resonated throughout the Canadian Armed Forces and even the country itself as various media picked up on this good news story – and rightly so. As RCN Commander VAdm Paul Maddison told *FrontLine Defence* magazine last fall during *Victoria's* ramp-up toward high readiness, the *Victoria*-class boats are now "at the end of a long beginning."

Sinking a ship with a torpedo is only made possible through the complex work and dedicated effort of many competent professionals within the technical, procurement and operational communities. More than just the weapon and its fire-control system have to function properly. The platform's entire 'system of systems' must come together in carefully choreographed unison to achieve mission success. This requires an integrated approach from the people who support these technically complex vessels within ADM(Mat), the RCN, and all the other organizations that make up the naval materiel enterprise – including other Canadian government departments and industries, and those of our allies. The folks involved in the *Victoria*-class program can take pride in the fact that the long, 12-year journey since this class was first acquired has finally culminated with the ultimate demonstration of the true lethality of this strategic capability.

The *Victoria*-class story is but one of many chapters in our rich, 103-year naval history, and representative of the many technical and procurement hurdles our navy has had to overcome to achieve and maintain operational success. The modernization of the *Halifax*-class frigates is currently the most complex project within the department, but even this huge technical challenge means that another important chapter is being written in the delivery of highly capable, modern ships to the RCN. With HMCS *Halifax* and *Calgary* well into their sea trials, this project is progressing well, and leveraging the collective experience gained from previous projects. Significantly, the *Halifax*-class Modernization and Frigate Life Extension (HCM-FELEX) program continues to establish new benchmarks through innovative methods of corporate governance and risk management, and through its unique approach in building strong relationships within and across the navy, government and industry. The HCM-FELEX program is well positioned to achieve a successful outcome, and thus serves as a good example for other complex projects of this nature.

As we embark on the next chapters of our fleet replacement, the collective challenge within the technical community is to continue to leverage the expertise from those who have done it before, apply what has been learned, and persevere when difficulties arise. This will ensure that when we switch the 'safe-to-fire' key to 'fire' and launch the weapon, it will successfully hit its intended target.

Submissions to the *Journal*

The *Journal* welcomes **unclassified submissions** in English or French. To avoid duplication of effort and ensure suitability of subject matter, contributors are asked to first contact the production editor. Contact information may be found on page 1. Letters are always welcome, but only signed correspondence will be considered for publication.

FORUM

Industrial College of the Armed Forces: A Naval Engineer's Perspective

By Cdr Marc Batsford

[Editor's Note: The ICAF is now The Dwight D. Eisenhower School for National Security and Resource Strategy.]

This article is an account of an extraordinary opportunity given to an RCN naval engineer to take an intensive 10-month professional military course at the Industrial College of the Armed Forces (ICAF) at the National Defense University (NDU) in Washington, DC. The program, leading to a Master of Science degree in national resource strategy, is normally offered to Canadian military logistics officers. However, during the 2010/11 academic year, one of two ICAF course seats available to Canada was offered to a naval technical officer.

Photo courtesy the author

The author (right) with fellow Canadian ICAF student, Chris Mitchell.

The College – Where Military History and Modern Strategy Meet

ICAF is one of five U.S. military service colleges, all co-located at Fort Leslie J. McNair, that make up the NDU – the premier joint professional military educational institution for the U.S. senior military services and leading U.S. government officials.

NDU is at the heart of one of the oldest military posts in the country. Fort McNair, established in 1797 and subsequently designated the Washington Arsenal (the first national arsenal) from 1816 to 1881, is the site of the trial and execution of the Abraham Lincoln assassination conspirators.

The ICAF class of 2010/11 consisted of 318 national and international students. Of these, 184 were senior officers from the various U.S. military services. The remainder included 95 from other government departments (OGDs), international military officers (two of the 28 were Canadian), and 11 senior executives of prominent U.S. and international industries. The student body was organized into 21 seminars of roughly 16 people each.

The faculty of approximately 100 full-time professional instructors at the PhD level, many of whom were retired U.S. military officers, was complemented by active service military officers, seconded senior OGD representatives and one member of the industrial sector. These experts offered a wide strategic spectrum in support of the College's learning objectives.

Like the Canadian Forces College, ICAF uses a blend of Socratic learning and Bloom's Taxonomy to deliver the curriculum in two semesters: August to December, and January to June. The program consisted of guest lectures, seminars, exercises, written reports, individual and group assignments, and domestic and international field studies.

Guest speakers included high-level U.S. government and military representatives, as well as senior corporate leaders, offering a wide strategic perspective in support of the College's learning objectives. Our speakers included Linda Hudson (CEO BAE Systems North America) and Tony Paradisa (President of Boeing's Global Support & Services Business Unit); MGen Douglas Fraser (Commander Southern Command), Michael Chertoff (former Secretary of Homeland Security), and Gen. David Petraeus (Commander International Security Assistance Force – Afghanistan). A real highlight was attending President Barack Obama's speech on Libya in the main NDU theatre on March 28, 2011.

First Semester Focuses on Four Core Strategic Areas

The first seminar's core component featured four graduate-level courses: National Security Studies, Strategic Leadership, Economics, and Military Strategy and Logistics. These courses provided a fundamental understanding of national power and the instruments used to secure national interests, and served as a platform for the remainder of the program.

The National Security Studies course analyzed different government strategic constructs and historical examples to trace the development of various contemporary U.S. and allied national security strategies. The Economics course used contemporary U.S. and international scenarios to understand both macro and micro economic models. The Strategic Leadership course focused on leadership techniques and organizational transformation models as applied to the U.S. 'Whole of Government' approach to international situations. Military Strategy and Logistics concentrated on U.S. government strategic interests to explain the development of national security and defence policies. The course examined how national military capability is procured, marshalled and transported globally. For example, we studied the design and construction of the Afghanistan northern supply route, providing significant insights into the challenges of global logistics.

Each student was required to complete two elective courses per semester – about 150 courses were offered between NWC and ICAF – but as an alternative to electives, a student could choose a specialized 'concentration' program, such as Procurement, Senior Acquisition, or Supply Chain Management. I found the Supply Chain Management Course to be relevant to the procurement and sustainment needs of both the RCN and the Canadian Armed Forces.

Second Semester Explores Defence Industry and Regional Impacts

While the first semester focused on national strategic security, the winter semester examined the defence industry and included a regional study. Twenty-one different ICAF industrial focused study programs were offered, chosen for their strategic relationship to U.S. national security and defence. Industry topics covered such areas as aerospace, electronics, telecommunications, education, agribusiness, transportation and shipbuilding. The domestic and international industrial linkages to U.S. national security and defence were closely examined. The course enabled us to analyze individual companies' corporate, financial, supply and HR profiles. We also gained a first-hand view through extensive domestic and international field studies of the companies.

Photo courtesy National Defense University (ICAF), Washington, DC.

Cdr Marc Batsford with U.S. General James N. Mattis, Commander U.S. Central Command. The demanding program at ICAF offered great opportunity to better understand the linkages and balances between a country's national strategy and the military industrial complex.

The regional study required the selection of one of 10 global regions and its relationship to the United States. My choice of North Africa, Turkey and the Levant was particularly interesting, given the recent spring uprising. Keynote speakers included the ambassadors to the United States from Libya, Morocco, Tunisia, and Syria, and senior embassy officials from Egypt, Lebanon, and Israel – who spoke frankly about their countries' immediate social transformations.

Rounding out the academic program were numerous voluntary activities and useful 'brown bag' sessions during the noon break, hosted by faculty members or college guests. There was a complete array of varsity and intramural sports events and many social activities. ICAF prides itself on its community volunteerism, and there were many opportunities for students to tutor young people at a neighbourhood primary school and to work on various community projects.

The ICAF program was very demanding, fast-paced and challenging, with many professional military education opportunities.

Observations and Recommendations

While my ICAF experience provides much reflection on how the Canadian Armed Forces does business, the Royal Canadian Navy might wish to consider the following personal observations and recommendations:

The RCN should consider sponsoring additional senior sea logistics and naval technical officers in the ICAF program. There is great opportunity within this program to gain better understanding of the strategic linkages and delicate balance required between all elements of national strategy and the military industrial complex.

The National Shipbuilding Procurement Strategy (NSPS) is a case in point. Given sufficient time, the RCN could develop a 'smart customer cadre' of officers who are intellectually equipped to consider the deeper nuances of government acquisition, procurement and supply chain management, while considering the necessary industrial and business priorities of the shipbuilding sector. As this truly national strategic industry evolves toward efficient, 'lean' production processes and greater productivity, the Navy's cadre of smart customers will be able to appreciate the different industrial business models, interests and motivations at play – knowledge they can use to facilitate smart future procurement and maintenance processes.

Given the government's intention to recapitalize and reequip the military under the Canada Defence First Strategy, and with the NSPS front and centre in the news, an increased academic analysis of Canada's own security and industrial nexus is warranted.

The Canadian Forces College in Toronto – academically certified as a degree-granting institution through the Royal Military College since 2002 – conducts a 10-month National Security Program that would be an ideal host for a modest defence/industrial pilot program. Such a program would serve as an excellent forum for exploring Canadian defence-industrial relationships, and for examining the challenges surrounding equipment acquisition, materiel procurement, supply chain management, and materiel support to deployed CAF operations.

An alternative would be to develop and refine a defence-industrial module in the College's newly created electives program. Although this would require additional resources, this would be offset by the benefits of having senior 'strategic thinking' officers better informed about Canadian industry, government procurement and acquisition.

This module would allow for open discussion between Canada's defence community and the industrial sector, allowing a better examination of past problems, current challenges and potential solutions – all the better to create the necessary conditions for a balanced and rationalized response to Canada's future equipment needs.

Acknowledgments

I would like to thank Isabella Grigoroff for her editorial assistance, and express my sincere appreciation to my Canadian cohort Capt(N) Chris Mitchell, the ICAF faculty and staff, and the students of ICAF Class 2010-2011 for a remarkable and rewarding year.

For his assistance with this article, the editors of the Journal would like to thank NDU Professor of Military Science Dr. Paul M. Severance, Colonel [Ret.] U.S. Army.

Cdr Marc Batsford is Section Head for Strategic Plans in the Director Materiel Group Strategic Plans directorate in NDHQ.

Letter

I stopped using my computer when I moved into the Veterans Hospital [Camp Hill, Halifax]. I asked my son to bring my laptop computer in the hope that I could send one more message on it, now that I have read the review you published in the Maritime Engineering Journal [A Sailor's Stories, MEJ No. 70]. This is a classic piece of work...an expert review. The selection of the quotes for the beginning, centre and end of the review could not be more appropriate. I want to thank you.

Yours,
Arlo Moen

Stanchion

Red sun in the morning, a ring around
the moon, the blackest black of night.
Fury on a leash for now...

Dreary days at sea, unending.
The press of space, confined; with foul and
heavy air, pitch and roll, monotony.

Men and minds
discipline held on steely springs.

– Arlo Moen (from A Sailor's Stories)

Submarine special:

HMCS *Victoria* live-fire torpedo exercise – a Canadian first!

By LCdr Craig Piccolo

(CFMETR photos by CPO2 Jens Simonsen. Aerial RIMPAC photos by Canadian Forces 407 Long Range Patrol Squadron, Comox, BC)

It was one of the longest 90 seconds in recent history for the Canadian submarine service. On July 17, 2012, as HMCS *Victoria* lurked off the coast of Kauai, Hawaii, her command team took aim at the ex-USNS *Concord* and pressed FIRE on her fire-control system, sending a Mk-48 Mod 4M warshot torpedo toward its target.

From inside Pacific Missile Range Facility, Barking Sands, staff from the USA, Australia and Canada watched the live feed of the exercise from helicopters, while Canada's minister of National Defence observed the shot from a CP-140 Aurora circling overhead. Even from hundreds of metres away, white cavitation bubbles from the torpedo were easily visible in the deep blue Pacific Ocean, drawing a line straight from *Victoria* to the decommissioned *Concord*.

Approximately a minute-and-a-half after the torpedo left *Victoria's* No. 1 tube, cameras captured a massive geyser of sea water, steam and steel erupting from the target, indicating a successful hit on the forward port side of the ship. Within 18 minutes, what remained of *Concord* slipped beneath the surface. It marked the first time that a Royal Canadian Navy submarine had ever sunk another vessel, and demonstrated the ability of the *Victoria* class to deal a lethal blow if ever required.

The four *Victoria*-class submarines are ex-*Upholder* class that were delivered from the Royal Navy under the aegis of the Submarine Capability Life Extension project between 2000 and 2004. One of the project's key mandates was to ensure a capability transfer of weapon firing ability from our navy's *Oberon*-class submarines to the newer *Victoria* class. The submarine's fire-control system would have to be upgraded, but by continuing to use the same Mk-48 Mod 4M torpedoes it would be possible to reap savings through use of the existing inventory of torpedoes and spares, while leveraging fire-control system development costs from the *Oberon* program.

HMCS *Victoria* loads an exercise torpedo at the Canadian Forces Maritime Experimental and Test Ranges in Nanoose, British Columbia in March 2012.

The upgrades didn't all happen right away. Since force generation was the primary initial objective for the *Victoria* class, the incorporation of weapon capability was deferred until the submarines went in for their next extended docking work period (EDWP). When *Victoria* completed her first EDWP in November 2011, the day had arrived for her to prove her weapon capability for the rest of the class. The path to RIMPAC 2012 was set, but reaching this momentous milestone had been a long journey filled with technical challenges.

LIMCAP trials

Seven years earlier, in 2004/05, *Victoria* had trialed her fitted *Upholder* weapon handling and discharge system (designed for Tigerfish torpedoes and Harpoon anti-ship missiles) and a newly installed Canadian submarine fire-control system to prove she could discharge the Mk-48 torpedo. These so-called 'limited capability' trials involved more than 80 controlled discharges of instrumented launch vehicles (essentially dummy torpedoes) that replicated the profile and displacement of a 1,600-kg Mk-48. The trials were extremely useful in that they both proved the newly revised submarine weapon operating procedures, and revealed a number of integration deficiencies in the weapon handling and discharge system that would have to be corrected during the upcoming EDWP.

Two of the required engineering changes involved problems in the torpedo discharge system. The first showed up as damage to the A-Cable power and indication umbilical between the torpedo and the inside of the tube. Video imaging during discharge suggested that the cable was striking the wall of the tube in the highly turbulent flow with enough force to break. Staff from the submarine combat systems section of the Directorate of Maritime Equipment Program Management (Submarines) in Ottawa and the U.S. Naval Undersea Warfare Center (NUWC) in Keyport, WA worked together to engineer a solution. Utilizing chemical analysis and a 3D printer, NUWC fabricated a high-density protective rubber coating for the terminal end of the A-Cables. This rubber 'boot'(*see photo*) provided enough protection for the cable without interfering with the electrical connection to the torpedo during discharge. The failure rate dropped to less than 10 percent, compared with the 80 to 90-percent rate of failure that was observed before the fix.

The second important observation to come out of the LIMCAP trials involved damage that was occurring to the torpedo-mounted dispenser (TMD) during torpedo discharge. The TMD, which is attached to the torpedo during the loading phase, then mounted to the after end of the tube prior to discharge, unspools the torpedo's guidance wire. During the discharge cycle the torpedo is initially restrained in the tube by what is known as a 'top stop and rear catch.' This device lifts shortly before the air turbine pump activates to propel the torpedo from the tube, such that for a few seconds the torpedo is unrestrained inside the tube. The damage to the TMD was probably occurring during this brief phase of the discharge cycle.

This high-density rubber 'boot' was designed by the U.S. Naval Undersea Warfare Center to protect the A-Cable ends inside the torpedo tube during discharge.

Once again, underwater cameras were used to observe what was happening inside the torpedo tube. The images revealed that at higher submarine speeds the hydrodynamic flow of water through the open bow caps, through the slide valve and out the air turbine pump inlets was pushing the unrestrained torpedo back into the tube with enough force to damage the TMD beyond repair. What to do? Shortening the delay too much between releasing the catch and sending the firing signal could result in a restrained firing, or in an otherwise unsuccessful discharge. Physical modifications to the 'top stop and rear catch' would involve lengthy and invasive alterations to torpedo tube or weapon hydraulic components.

The solution was rather simple in design, but not without engineering challenges and risks. An engineering change was developed to remount the TMD approximately 40 cm farther forward in the tube to reduce the play between it and the stern of the torpedo. This would prevent the torpedo from reaching sufficient destructive momentum in the seconds between releasing the catch and applying the firing pulse. The engineering change required welding new securing lugs (known as TMD bosses) to hold the TMDs in their new position inside the 21-inch torpedo tubes, a complex and technically risky job. Not only was there potential for permanent structural damage to the torpedo tubes themselves from the heat of welding in the enclosed space, but the soft o-rings in proximity to the weld location were also at risk. A detailed engineering analysis and a tube pre-heating trial ensured the welding procedure could be conducted safely using a surgical application of heating and cooling. It took just over a month to complete all six torpedo tubes in *Victoria*, but the results were excellent.

'Full house.' Crew members inspect their exercise torpedoes in preparation for a busy day on the fully instrumented 3D torpedo range at CFMETR.

Other modifications were implemented during HMCS *Victoria's* EDWP, some to address concerns raised as part of the LIMCAP trials, others to handle legacy reactivation issues. Improvements were made to *Victoria's* fire-control system, weapon handling system and weapon discharge system, as well as to the submarine's hydraulic systems. The weapon system had been stripped almost to bare bones and rebuilt. Upon completion, this in-depth maintenance required extensive set-to-work, test forms and trials to prove that the system was operating as intended.

The road to RIMPAC

As part of the extended docking work period, DMEPM(SM) was mandated to prove that the Mk-48 capability transfer from the *Oberon* class was a success. An additional challenge was added when it was announced at the beginning of 2012 that, within six months, *Victoria* would take part in a live-fire sinking of a target vessel during Exercise RIMPAC off Hawaii. This was a very ambitious challenge considering that the submarine had been in deep maintenance only a few months prior. A series of tests and trials would be required to incrementally prove the system in advance of such a large-scale objective. As the old saying goes, *Victoria* would have to learn to walk before she could run.

The test and trials actually started in the summer of 2011 when *Victoria* conducted a series of harbour acceptance trials during a camber dive while alongside at Esquimalt harbour. These trials consisted of 22 launch vehicle firings, which proved 'clear bore' of the weapon system and the ability to conduct successful discharges. In early 2012, *Victoria* proceeded to sea to complete sea acceptance trials, firing 18 inert launch vehicles and exercise torpedoes at the Canadian Forces Maritime Experimental and Test Ranges near Nanaimo, BC. These instrumented firings provided

The target ship USNS *Concord* explodes (inset) and sinks after taking a Mk-48 torpedo hit from HMCS *Victoria* during Exercise RIMPAC on July 17, 2012.

telemetric data that helped confirm the weapons envelope that had been developed during LIMCAP, and gave further information on guidance wire deployment during discharge.

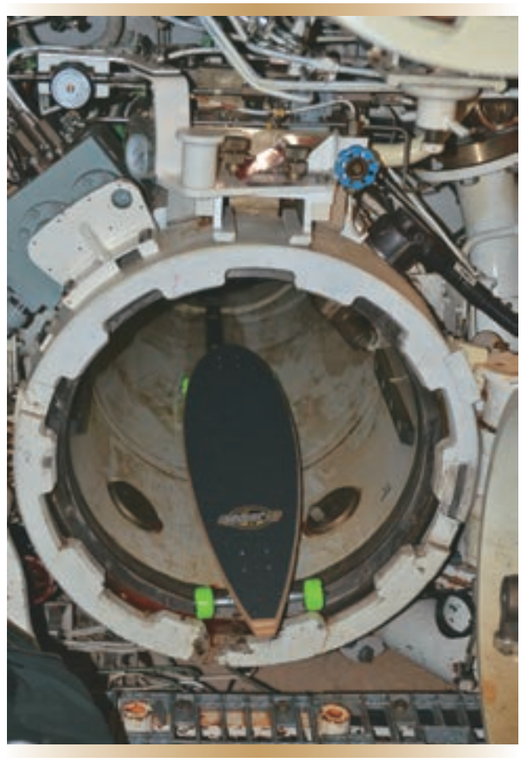
By June of 2012, *Victoria* had fired 22 more exercise torpedoes as part of her first-of-class trials and weapon certification. These discharges proved the crew's ability to safely handle a Mk-48 weapon, from receipt inspection alongside to deployment at sea.

In the seven years leading up to the RIMPAC sinkex, *Victoria* discharged more than 140 inert launch vehicles, instrumented weapons and exercise torpedoes. This data was recovered, analyzed and incorporated into new handling, loading and firing procedures, and equipment modifications. These tests and trials gave Canada the confidence to participate in one of the RCN's most significant exercise events in recent memory. HMCS *Victoria*, as part of RIMPAC 2012, was one of three submarines selected to provide the final blow in a series of sinking exercises. Submarines from Australia, Canada and the USA would be the last units to fire against three different decommissioned American vessels in day-long live-fire exercises.

Due to safety and other constraints, the firing mode of the Mk-48 weapon during the exercise would be a 'straight running' shot similar to that of a Second World War submarine. *Victoria's* crew was under a lot of pressure. The setup for the shot required a very high level of attention to detail in assessing slight movements of the drifting target vessel relative to the submarine's own way. Those familiar with the history of torpedo engagements will appreciate how much can go wrong in even the simplest torpedo events, but *Victoria* achieved a successful hit. It was a testament to the prowess of her crew.

The shot was truly historic. Not only did it signify *Victoria's* return to operational status, it also highlighted the fact that RCN submarines are formidable and combat-capable assets, ready to be deployed in contingencies at the discretion of the Government of Canada.

The event also highlighted the incredible amount of work and engineering expertise that went into making the shot a success. Fleet Maintenance Facility *Cape Breton*, MARPAC Fleet Technical Authority, CFMETR, USN support from NUWC, Babcock Canada and Babcock U.K., Lockheed Martin Mission Systems & Sensors, CANSUBFOR, Canadian Forces Naval Operations School, Sea Training (Submarines), DGMEPM, and especially the crew of HMCS *Victoria* all played key roles in making the sinkex a reality. Many technical challenges were confronted and skilfully resolved, allowing *Victoria* to not only run, but sprint over the finish line.



This 'Submarine Kinetic Access Tube Examination (SKATE)' board was very useful as a mechanic's dolly for torpedo tube inspections.

LCdr Craig Piccolo is the DMEPM(SM) 3-3 Ottawa subsection head for the Victoria*-class weapons handling and discharge system and submerged signal ejectors. During the RIMPAC sinkex he acted as the on-site DMEPM(SM) representative, and coordinator for contractor field service representatives.*

Submarine special:

HMCS *Victoria* first-of-class trials

By Capt. Jeff Manney, with contributions by Terry Berkley and Ian Ferguson
(Photos by Pte. Dan Moore, 19 Wing Imaging)

In the 1982 Falklands War, the sole operational Argentine submarine, the ARA *San Luis* (S-32), fired a total of six torpedoes at British capital ships. All six weapons from the modern, German-built Type 209 ran erratically, never finding their targets thanks to a mismatched lead in the fire-control system.

In the Second World War, the U.S. Navy began to address deficiencies in its Mk-14 torpedo only *after* seven months of combat and more than *800* mostly ineffective firings. By war's end, at least two U.S. submarines had fired Mk-14 torpedoes that circled back and sank them.

The period since the Cold War has seen an increased dependence on surface- and air-launched torpedoes that are required to succeed in an anti-submarine warfare environment marked by rapidly developing submarine technology. There is no room for error.

A history of missed opportunities, tragic mistakes and ever more sophisticated threats has made it axiomatic that nations with submarine and ASW forces need to maintain a robust torpedo testing program. This was the goal of Canadian and U.S. naval officials who, in 1965, formalized an enduring partnership to create a torpedo test range in the deep, calm waters of the Strait of Georgia north of Nanaimo, British Columbia.

The shared three-dimensional underwater range at Nanoose, BC operates under the control of the Canadian Forces Maritime Experimental and Test Ranges (CFMETR), and it is here, in a 220-km^2 parcel of water space known as Area Whisky Golf, that HMCS *Victoria* (SSK-876) reaped the benefits of some hard lessons learned.

On June 10, 2005 with the clock ticking on her safe-to-dive certification, *Victoria* departed the range after completing the last of 85 firings of non-running practice torpedoes. By midnight she was back alongside the navy dockyard in Esquimalt, ready to begin a seven-year Canadianization overhaul to replace her British components with hardware needed to fire the Mk-48 torpedo.

While the submarine was in refit, at CFMETR the process to move *Victoria* toward weapon certification continued unabated. Between 1999, when an *Oberon*-class boat fired its last torpedo, and March 2012, when *Victoria* returned to fire her first running weapons, CFMETR was the sole DND agency providing firing service for the submarine heavyweight torpedo program.

CFMETR's Range Operations Centre on Winchelsea Island is the nexus for three-dimensional tracking on the joint RCN/USN torpedo testing range.

Using Canadian and U.S. resources, and drawing on the deep well of torpedo expertise available at the Naval Undersea Warfare Center in Keyport, Washington, significant achievements were made with:

- installing and testing the *Victoria*-class submarine fire-control system (SFCS) components on board the torpedo tender YTT-11 (see *CFMETR's YTT 'Thunderbirds'*);
- support to the development of the weapons control module – the digital interface between the SFCS and the torpedo;
- replacing the weapons data converter;
- progressing weapon tactical development and force generation doctrine;
- developing and implementing self-noise reduction improvements in the Mk-48 Mod 4M; and
- firing a total of 56 exercise torpedoes in direct support of the *Victoria* class, including 12 Canadian Mk-48s fired on range by the Australian submarine HMAS *Collins* in 2000.

Torpedo tenders and other vessels sit ready at CFMETR's main facility at Nanoose Bay, just across the Strait of Georgia from Vancouver, BC.

That all of this occurred at a facility with just over 70 personnel attests to the steady commitment by CFMETR's staff to ensure *Victoria's* success. It speaks volumes as well to the inherent robustness of the facility's infrastructure – the centrepiece of which is a multimillion-dollar network of arrays sitting more than 400 metres below the surface of Area WG.

Anchored on the uniformly flat bottom of WG are 30 15-metre, short-baseline arrays. Each is equipped with four hydrophones tuned to receive the 75-KHz phase-shift keyed signals produced by the tracking pingers mounted on surface vessels and all underwater vehicles. The signals are amplified, multiplexed and transmitted by cable to the Range Operations Centre on nearby Winchelsea Island where three-dimensional tracking is followed with two-metre accuracy.

Three other bottom-mounted sensors allow the range to record ambient noise and communicate with submarines via underwater telephone. The range also operates a variety of ship-deployed acoustic targets, including Mk-30 mobile submarine emulators capable of running pre-programmed tracks at varying speeds and depths. For air operations, two high-power Cine-Sextant camera systems and a tracking radar record and monitor air-launched payloads. The result is an underwater laboratory unique to North America and perfectly suited to the needs of a submarine in a hurry.

By the time *Victoria* returned to the range for weapon trials in March 2012, seven years after her last visit, only two months had elapsed since her initial post-refit dive. There was a lot riding on the success of these trials. Looming on the horizon less than four months away was an Exercise RIMPAC live warshot – the first ever high-explosive torpedo firing by a Canadian submarine.

Despite intense pressure, *Victoria* completed her weapon discharge, performance and operating trials, sonar trials and first-of-class sea acceptance trials in a mere six weeks on the range. It was an extraordinary achievement. Thanks to having thoroughly tested her new fire-control system at CFMETR, *Victoria* went on to make history for all the right reasons by delivering a stunning warshot performance off Hawaii.

Capt. Jeff Manney is Project Officer, Critical Infrastructure at the Canadian Forces Maritime Experimental & Test Ranges at Nanoose, BC. Terry Berkley is the Senior Engineer. Ian Ferguson is the Project Officer, Weapons Systems.

Submarine special:

CFMETR's YTT 'Thunderbirds'

By Capt. Jeff Manney, with contributions by Terry Berkley and Ian Ferguson

Mixing a high rate of torpedo activity with infrequent sightings of submarines can prompt an astonishing question from otherwise rational observers near the Canadian Forces Maritime Experimental and Test Ranges (CFMETR): Is it true the base has underwater submarine pens?

It's a myth that has been circulating around Nanoose Bay for decades. What else, observers theorize, could explain all those firings if not a fleet of submarines hidden, *Thunderbirds* style, behind a sliding rock face in an underwater mountain?

The real answer is about as far from the hip 1960s British science fiction TV 'supermarionette' series as you can get – a pair of *Cape Flattery*-class yard torpedo tenders (YTTs) that can make at most 11 knots.

The two vessels – *Battle Point* (YTT-10) and *Discovery Bay* (YTT-11) – are much more than they appear. The American YTTs are based at the Naval Undersea Warfare Center in Keyport, WA, and are made available as part of a unique resource sharing arrangement under the international agreement underpinning CFMETR's jointly operated three-dimensional torpedo range. For Canada, and in particular the *Victoria*-class submarine program, these U.S. DoD, civilian-crewed tenders represent one of the most tangible benefits of the agreement. They are the workhorses of CFMETR.

Battle Point and *Discovery Bay* are outfitted below the waterline with a pair of Mk-59 21-inch heavyweight torpedo tubes, salvaged and rebuilt from the *George Washington*-class SSBNs decommissioned in the 1980s. The YTTs fire the majority of the more than 100 Mk-48 torpedoes (of all mods, including the Mk-48 Mod 7AT CBASS), Mk-54 and Mk-46 torpedoes launched each year for weapon testing at CFMETR. A triple set of Mk-32 12.75-inch lightweight tubes is carried on the upper deck amidships.

A large crane and an open working deck aft allow other launch modes to be used, including an over-the-side slide-and-frame arrangement for swim-out test vehicles. This flexibility allows CFMETR to conduct a full slate of torpedo trials without the need for warships to constantly call in at Nanoose Bay.

Photos by Deanne Gillespie, CFMETR

The United States Naval Ship *Discovery Bay* (YTT-11): CFMETR operates two YTT torpedo tenders that are fully equipped for torpedo launch and recovery operations on the range.

On six different occasions, the *Victoria*-class submarine fire-control system (SFCS) was installed on board *Discovery Bay* to validate the system's ability to control Mk-48 torpedoes fired at realistic targets, all without an actual submarine having to sail. The YTT was not able to carry a full suite of *Victoria*-class sonars, of course, but underwater sensor input was routed to the operators by secure communications from the range operations centre. Operators could thus update the firing solution or steer the torpedo to complete test objectives.

Heavyweight torpedo testing on the range frequently requires changing the torpedo controllers or fire-control simulators for different weapon types, so interfacing the SFCS to the YTT's launch tube was not difficult. As a secondary objective, the Canadian Forces Maritime Warfare Centre was able to further its own work in the tactical development of heavyweight torpedoes.

A by-product of this SFCS testing was the opportunity for submariners to gain hands-on experience with the Mk-48 system. Sailors from both coasts participated in the torpedo jetty inspection and acceptance process, in hanging the torpedo-mounted dispensers for guidance wire, and loading and firing the weapons.

Between 1999 and 2011, *Discovery Bay* fired 56 Canadian torpedoes using the SFCS hardware. These tests came with a variety of objectives that would, in 2012, ensure that *Victoria* would be ready for her first-of-class Mk-48 trials and eventual weapons certification.

Once *Victoria* was on the range for trials, another unique capability of the YTT came into play – torpedo bottom recovery. Most exercise weapons are designed to return to the surface at end of run, but those that cannot be made positively buoyant must be recovered from the bottom intact. Although the seabed is shallower than absolute crush depth (one reason why CFMETR's range is an ideal place to conduct torpedo tests), weapons making the 400-metre plunge are often moving fast enough to bury themselves in the soft alluvial deposits on the bottom.

The YTTs are equipped with modern recovery technology: the TROV-N (Tethered Remotely Operated Vehicle-Navy) and SORD-IV (Submerged Object Recovery Device). Using TROV-N's grappling arm, operators on the YTT can pull up to 1,800 kg off the bottom; SORD-IV's 2,700-g.p.m. seabed sediment washout system and 2,300-kg payload recovery capability allow operators to dig for heavier weapons that have burrowed deep into the silt on the sea floor.

Victoria's first-of-class trials in February 2012 included a unique series of torpedo shape handling trials (using warshot weight-ballasted shapes) in the most challenging conditions conceivable. At deep dive depth, under the watchful eyes of staff from the MEPM SM submarine management section in Ottawa, Fleet Maintenance Facility *Cape Breton* in Esquimalt, the U.S. Navy's Naval Sea Systems Command, Babcock Canada and Babcock U.K., weapons handlers on board HMCS *Victoria* successfully cycled six instrumented weapon shapes through every possible ramming, backhaul and discharge scenario.

Their aim was to validate that the capability transfer of the Mk-48 to the *Victoria*-class weapon handling and discharge system met specifications. Some of the most important data was recorded by accelerometers inside dummy weapons that subsequently went to the bottom and were buried more than eight metres deep. *Discovery Bay* undertook a marathon recovery operation, retrieving all six Mk-48s from the bottom, intact, over the course of several days. Without this ability – one surely worthy of its own *Thunderbirds* episode – HMCS *Victoria* could not have been adequately prepared in time for a RIMPAC sinkex with a live warshot weapon.

USNS Battle Point (YTT-10)

Documenting Data Quality in the Defence Resource Management Information System (DRMIS): A Baseline Assessment

By LCdr Seana Routledge

[From the author's original research paper, available upon request.]

Introduction

Data quality affects the types, potential effectiveness, and accuracy of decisions (Shankaranarayan, Ziad, & Wang, 2003). A lack of accurate data can create numerous additional costs (Breur, 2009). Without taking action to address data quality issues, organizations potentially risk becoming less effective and less efficient over time (Umar, Karabatis, Ness, Horowitz, & Elmagardmid, 1999).

To meet fiscal challenges, many government organizations seeking greater accountability and transparency engage in performance measurement activities so as to be as cost-effective and efficient as possible (Halachmi, 2005). An important use of organizational data is to conduct performance measurement activities (Cocca & Alberti, 2010) that can be based on individual data points or trends over time. In order for data to be used most effectively for performance measurement, it must be based on performance dimensions that are important to the organization (Iskandarani & Reifschneider, 2008), and must be of an acceptable level of data quality to the organization. This acceptable level will vary depending on the organization, as will the number and priority of the data quality characteristics that are used to evaluate data quality (Scarisbrick-Hauser & Rouse, 2007). However, one thing remains the same: organizations must have data with a level of quality that meets their specific needs.

The 2011 version of the Naval Materiel Management System (NaMMs) outlines several performance indicators to carry out performance measurement within the naval materiel management system using data available in the Defence Resource Management Information System (DRMIS). These performance indicators include such activities as comparing work scheduled to work completed, determining systems' availability, tracking project status, forecasting workforce availability, and so forth. However, questions remain concerning the level of quality of the transactional user maintenance data in DRMIS, and its potential usefulness.

Table 1. Overall Summary of Results

Record Type	Data Quality Characteristics	Total No. of Fields Examined	Approx. Avg. No. of Fields with Errors	Total Avg. Error Rate
Preventive Maintenance	Completeness (Number of incomplete fields)	39	8	21%
Corrective Maintenance	Completeness (Number of incomplete fields)	41	8	20%
Corrective Maintenance	Accuracy (Number of inaccurate fields)	41	4	10%
Corrective Maintenance	Total Errors (Number of incomplete and inaccurate fields)	41	12	29%

To determine whether this data quality was acceptable for use in performance measurement activities in naval materiel management, an exploratory research study was conducted. The goal of this research was three-fold. First, it was to provide a baseline assessment of the data quality of these data records in DRMIS. Second, it was to determine if the data quality is sufficient for naval materiel management performance measurement activities. Third, it was to make recommendations on the next steps DGMEPM should take with respect to data quality.

Methodology and Analysis

The methodology for this research consisted of three main studies – two different observational research sampling studies of the two main naval maintenance activity types, in which completeness and accuracy were assessed; and a series of informal interviews of five key database users.

There were two phases to the data collection activities for the three studies. The first involved mining more than 48,000 historical corrective maintenance (CM) and preventive maintenance (PM) transactional maintenance notification-type data records across the four classes of warship in the RCN between the years 2006 and 2011. Two hundred records of each maintenance type were randomly selected. PM was assessed for completeness, while CM was assessed for completeness and accuracy.

Analyzing incompleteness in PM records was straightforward: either the field was filled in, or it was not. Since many of the PM fields are filled in from the master data, they were assumed to be 100 percent accurate.

The CM records were not as simple to assess. Because of the interrelationship between the fields, incompleteness and inaccuracy in CM records had to be examined in parallel. The basis of the analysis criteria for CM was set up around being able to verify the field's completeness, correctness (in terms of the equipment and maintenance identified, functional location level and even spelling), and its validity when compared against the internal database of long text descriptions, action logs and master data tables.

The second phase of the data collection used informal interviews consisting of 20 open-ended questions to gather background and contextual information on the database and how it is used by five key positions within the RCN and DGMEPM. These key positions included users from the fleet maintenance facility, formation technical authority, the operational community, and DGMEPM. Understanding how data was collected, retrieved and manipulated by the database users was highly important to building the data quality analysis framework. In the interviews the participants were also asked to rank six data quality characteristics from most important to least important. The combined results ranked accuracy of data as most important, followed by relevance, reliability, completeness, timeliness, and currency.

Results and Discussion

From Table 1 it would appear that incompleteness in preventive maintenance records is potentially an issue. However, when completeness was ranked by the interview participants, it ranked only fourth out of the six data quality characteristics. Thus, an overall completeness error rate of 21 percent may still be an acceptable level of completeness for performance measurement activities. This was further supported in the interviews, where trend analysis was often used when errors precluded assessing individual data points.

Accuracy was a concern of the interview participants and was also the most important data quality characteristic the participants required to carry out their jobs. Some may argue that data is not accurate if it is not completely accurate. However, data is rarely completely accurate. Though organizations should expect an error rate from one percent to five percent if they do nothing to manage their data quality (Redman, 1998), an average overall inaccuracy error rate of 10 percent, as seen in Table 1, is arguably acceptable given the complexity of DRMIS and the challenging environment of naval materiel management. Interestingly enough, there was no difference in error rates over time for both preventive maintenance and corrective maintenance records; error rates were neither increasing nor decreasing systematically over the six years examined in this study. It is important to note that numerous factors not included in this study such as ships' schedules, training, the impact of limited bandwidth at sea, availability of master data for older classes of ship, system design limitations in the database, and so forth, may be contributing to the error rates. These factors should be taken into account in future assessments as they may be causing the error rates to be inflated.

Conclusion

There are problems with completeness in both PM and CM notification records, and accuracy problems in the CM notification records that should be addressed. A comprehensive analysis of data quality is recommended to determine the cause(s) of lower than optimal data quality. A comprehensive analysis should include the master data, orders, financial and logistical fields, and other data quality characteristics important to the organization beyond completeness and accuracy. As a minimum, a baseline assessment similar to what was conducted in this research study is recommended.

Once a comprehensive analysis is completed and the direction for improvement determined, the data quality should then be managed as part of the normal organizational business practices, including the implementation of a formal data quality management system. Detailed recommendations for improvement areas are made in the original research paper, including potential frameworks that can be used to conduct a comprehensive assessment. Recommendations for improvement include determining how much data the RCN and DGMEPM need to collect and what the data is going to be used for; improving system design, business processes and training; and education on the importance of data quality for the users.

Despite there being needed improvement in overall data quality, some performance measurement activities can still provide significant benefit. Such measurements as system availability, workforce forecasting, comparing work scheduled to work completed, and so forth, are still feasible, particularly when trends in the data rather than individual data points are used. To simply disregard or mistrust all data based on certain types of errors or individual experience reduces the potential power and usefulness of the information within DRMIS.

The continued use of DRMIS data was further supported in the interviews, where participants noted that data quality in DRMIS was sufficient for their jobs, had the potential to be so, or was sufficient when the errors were taken into account in the context of the decisions. The decision context within which the data quality is being assessed is often different, depending on the decision and the decision-maker. Understanding this context can help to reduce errors. Also, an insufficient level of data quality for one user may in fact be sufficient for another. As long as the issues with data quality are recognized, understood, and are taken into account, DRMIS can still provide a powerful source of information in support of those decisions.

LCdr Seana Routledge is the Primary Group Coordinator for DMMS(FM) in DGMEPM.

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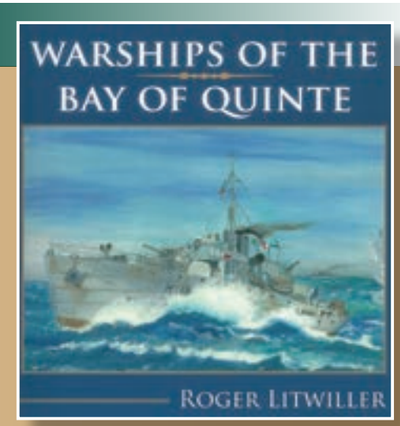
MARITIME ENGINEERING JOURNAL NO. 71 – SUMMER 2013

Book Review

Warships of the Bay of Quinte

Reviewed by Tom Douglas



Warships of the Bay of Quinte
Roger Litwiller
© 2011 Roger Litwiller
Dundurn Press
3 Church Street Suite 500
Toronto Ontario Canada M5E 1M2
ISBN 978-1-55488-929-7
198 pages; Illustrated; Author's Notes; Select Bibliography; Glossary of Terms; $28 (www.dundurn.com)

With the bicentennial of the three-year War of 1812 still in full swing, one could be excused for thinking that a book entitled *Warships of the Bay of Quinte* might well be an account of the brigs, schooners, frigates and sloops that plied Lake Ontario two hundred years ago during the dust-up with our neighbours to the south.

The first clue that the subject matter deals with another time and another place is the eye-catching cover painting, by Second World War veteran and artist Henry Winsor, of the Flower-class corvette HMCS Napanee dropping depth charges while on convoy duty in the mid-Atlantic. As it turns out, *Warships of the Bay of Quinte* is an exhaustively researched and interest-capturing history of six Canadian warships of the 20th Century: HMCS *Napanee*, HMCS *Belleville*, HMCS *Hallowell*, HMCS *Trentonian*, HMCS *Quinte I* and HMCS *Quinte II*, all named for communities on a small body of water at the eastern end of Lake Ontario between Toronto and Kingston.

The book is generously illustrated with contemporary photographs – both battle action shots and depictions of shoreside activities such as ships' christenings and ships' bell presentations. There's even a folksy photo of the real-life christening of a child aboard HMCS *Quinte* (the designation *Quinte I* would come later with the commissioning of the replacement vessel HMCS *Quinte II*) at Digby, Nova Scotia on 19 September 1944.

But even more useful and informative are the diagrams listing battle honours, commanding officers and ship specifications. Of particular interest is a series of maps and charts showing the progress of a transatlantic convoy HMCS *Napanee* took part in, including graphics indicating ships and submarines sunk or damaged.

Roger Litwiller obviously spent considerable hours doing exhaustive research on all six vessels and he has a knack for translating this research into text that is easy enough for a landlubber to understand and enjoy while not boring the bellbottoms off professional sailors. His bibliography is extensive, and a gold mine for anyone wishing to follow up with further reading.

Litwiller fills his book with interesting tidbits, such as explaining certain traditions and how they were changed to meet contemporary needs. For instance, his introduction points out that Canada's early navy followed the lead of other world navies by naming ships after famous people, places or battles. For practical reasons, this changed during the Second World War. As he puts it:

"The navy had to grow very large, very fast. The Canadian Navy started the war with six destroyers and 2,000 sailors, and before the war was over we had built the third largest navy in the world, with over 400 ships of all classes and over 100,000 men and women.

Photo courtesy Walter Gregory

The Bangor-class minesweeper, HMCS *Quinte*

"We were able to build the ships and provide everything the men would need to go into battle with them, but not the comforts that make a ship a home, such as washing machines, magazines, books, mittens, writing materials, and so on. By attaching a ship to a community in name, it was hoped that citizens of the community would have a direct bond to the ship and provide the men with all the comforts of home."

The author adds that not only did this change in policy have its intended effect, it actually led to communities vying with each other to have this honour bestowed on them. In fact, so zealous did these communities become that several even suggested "…the navy…completely man 'their ship' with their own men." The navy, as Litwiller reports, refused with good reason: if the ship were ever lost, the loss of life for any one community would have been devastating.

Still, so successful was the goal of having communities 'adopt' ships that crews were inundated with gifts of chocolate, warm mittens, comforters, cigarettes and other luxuries of home life – including those sought-after washing machines! The book includes heartwarming reproductions of letters from the ships' officers thanking the local committees for their generosity. The letters show the human side of the war as no news report could do.

The book isn't all sweetness and light. The author does a 'warts-and-all' account of mistakes made in the thick of battle and the punishments meted out. He also catches the reader's interest with his blow-by-blow accounts of such operations as retrieving a couple of derelict oil barges in the middle of a mine-strewn patch of ocean and the harrowing moments when a ship is being hunted by a U-boat wolf pack.

The most poignant section of the book involves the warship named after the Kitchener-born author's adopted home town of Trenton. He starts off mildly and amusingly enough by explaining that HMCS *Trentonian* was a misnomer. The Royal Canadian Navy was prevented from calling the ship HMCS *Trenton* because a United States Navy ship already bore that name. It was proposed that it be called *Trentonia* but a clerical error ensued:

"When the clerk was typing the list, *Trentonia* followed the name of another ship, *Prestonian*, and an 'N' was accidentally added on the end of her name," Litwiller writes. "The list with *Trentonian* was sent to the king and received royal approval."

Sailors are known as a superstitious lot and some might claim that this misnaming led to the tragic demise of the ship –foreshadowed by several minor mishaps that delayed

Trentonian's entry into active service. After stellar service during Operation Neptune – the naval segment of the Normandy D-Day Landings – and what the author describes as some highly secretive escort duty, HMCS *Trentonian* was torpedoed while on escort duty in the English Channel. Once again, Litwiller's description is riveting:

"Glassco gave the order 'ABANDON SHIP' as her bow came out of the water. Kinsmen was second-last to leave the ship, followed by the skipper as he calmly stepped from *Trentonian's* bridge into the English Channel, now at the same height as her bridge. At 1340 the ship's hull became perpendicular to the water and she slipped in, stern first. HMCS *Trentonian* was gone. It took just 14 minutes from the time the torpedo struck *Trentonian* until she was lost…"

Five of the ship's crew were lost in the Channel while a sixth died in a lifeboat waiting for rescue. The remaining 95 of *Trentonian's* crew would be rescued, with two seriously wounded and 11 with minor injuries. One page in the *Trentonian* chapter of the book takes the form of an Honour Roll with photos and biographical details of the men lost in the sinking. Once again, this brings the war home to the reader in a poignant way.

Warships of the Bay of Quinte is a compelling read and an important adjunct to the history of the Royal Canadian Navy. If there is one criticism, it is that the author – or perhaps the publisher– chose not to include a map of the Bay of Quinte, thus preventing a reader who is unfamiliar with the area from getting a real feel for the tightly-knit geographical location of the place names used for the warships. But this is a small oversight that bears little more than passing reference.

Dundurn Press was obviously happy with the results of Litwiller's first attempt at book writing because the company – Canada's largest independent publisher – is coming out with his second effort in August – *White Ensign Flying* – a more detailed account of the brief, but enthralling, history of HMCS *Trentonian* from her launch on September 1, 1943 until her untimely demise on February 22, 1945.

Anyone who has read the author's first book will likely be awaiting the publication of his second one with some anticipation.

Tom Douglas is the associate editor of the Maritime Engineering Journal *and the author of* Great Canadian War Heroes – Victoria Cross Recipients of World War II *(Amazing Stories).*

Courtesy the Naval Museum of Manitoba

HMCS *Quinte*

Officer Awards

AWARDS

2012 NAVAL TECHNICAL OFFICER AWARDS

Photographs by Cpl Dan Bard, Formation Imaging Services Halifax
Notes courtesy Lt(N) Kan Tun

Naval Association of Canada (NAC) Award

A/SLt Justin Anderson receives the NAC shield from Cmdre (ret'd) Mike Cooper for achieving the highest standing in professional achievement and officer-like qualities during the Naval Engineering Indoctrination course.

Mexican Navy Award

SLt Michael Michaud (inset) was unable to be present to receive his award from Mexican Naval Attaché, Contralmirante José Manuel Guido Romero. The award, based on marks and officer-like qualities, is presented to the top Naval Combat Systems Engineering Applications Course student.

L-3 MAPPS – Saunders Memorial Award

SLt Dale Molenaar took top prize in the Marine Systems Engineering Applications Course, which includes a portion of study abroad at HMS *Sultan* in the U.K. Presenting the award are Gwen Mandeville (left) and L-3 Mapps Marketing Director Wendy Allerton.

MacDonald Dettwiler and Associates Award

Combat Systems Engineer **Lt(N) Meryl Sponder** receives a naval sword from MDA Business Development Manager Richard Billard. A naval board interviewed CSE and MSE candidates from both coasts before making their selection for top NTO who has achieved head of department qualification.

Weir Canada Award

Lt(N) Chris Kings receives a naval sword from Weir General Manager Serge Lamirande. A naval board selected the top Marine Systems Engineering Phase VI candidate following interviews of candidates from both coasts.

Lockheed Martin Canada Award

Top Combat Systems Engineering Phase VI candidate **Lt(N) Igor Polosin** receives a naval sword from Lockheed Martin representative Don McClure. A naval board made the selection after interviewing candidates from both coasts.

2012 NTO Award Winners and Runners-up

Standing – left to right: **Lt(N) Kan Tun** (awards organizer), **Lt(N) Yann Kerwin** (Lockheed Martin candidate), **A/SLt Justin Anderson** (Naval Association of Canada winner), **SLt Matt Daigle** (Weir Canada candidate), **SLt Jotham Sterling** (Weir Canada candidate).

Sitting: **SLt Dale Molenaar** (L-3 MAPPS – Saunders Memorial winner), **Lt(N) Igor Polosin** (Lockheed Martin winner), **Lt(N) Chris Kings** (Weir Canada winner), **Lt(N) Meryl Sponder** (MacDonald Dettwiler winner)

Photo by Brian McCullough

Someone always has a surprise up the sleeve at the NTO awards mess dinner.

SLt Ryan Brown, **SLt Fergus Lavelle** and **SLt Ian Daniels** examine the awards table prior to the presentation of the NTO awards in Halifax on March 20, 2013.

News Briefs

Appreciation –

Former *Maritime Engineering Journal* associate editor **Bridget Madill** and current production editor **Brian McCullough** received (very much appreciated) thanks from RAdm Patrick Finn last November for their many years of service to the naval technical community.

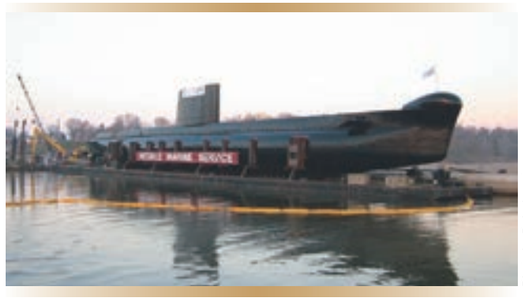
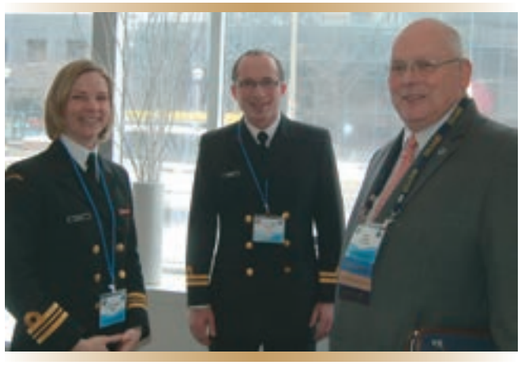


Photo by Dale Armstrong

Silent no more –

The navy's decommissioned *Oberon*-class submarine HMCS *Ojibwa* (SSK-72) is being given new life as a Cold War tourist exhibit by the Elgin Military Museum of St. Thomas, Ontario. The submarine, which served in the RCN from 1965 to 1998, will be on display at the museum's new naval history branch at Port Burwell on the north shore of Lake Erie, 200 km southwest of Toronto. A full interpretive centre is planned for 2014.



Ottawa Marine Technical Symposium –

The Eastern Canadian Section of the Society of Naval Architects and Marine Engineers, and the Canadian Institute of Marine Engineering teamed up to present an excellent program of speakers in Ottawa last February. **LCdr Robyn Locke** and **Lt(N) Christopher Hircock** were among a number of naval representatives on hand to exchange ideas with industry professionals such as SNAME president-elect **Peter Noble**. More than 250 delegates attended to discuss the theme, *Building a Stronger Foundation for the Marine Technical Community*.

MARITIME ENGINEERING JOURNAL NO. 71 – SUMMER 2013

PRESERVING CANADA'S NAVAL TECHNICAL HERITAGE

CNTHA NEWS

Canadian Naval Technical History Association

WHERE HAVE ALL THE INNOVATORS GONE?

By Cdr Pat Barnhouse, RCN (Ret'd)

The Royal Canadian Navy has a laudable history dating back to the late 1940s of innovation in designing equipment to meet operational requirements. Some of the developments have been uniquely Canadian, while others have found more universal application with other navies.

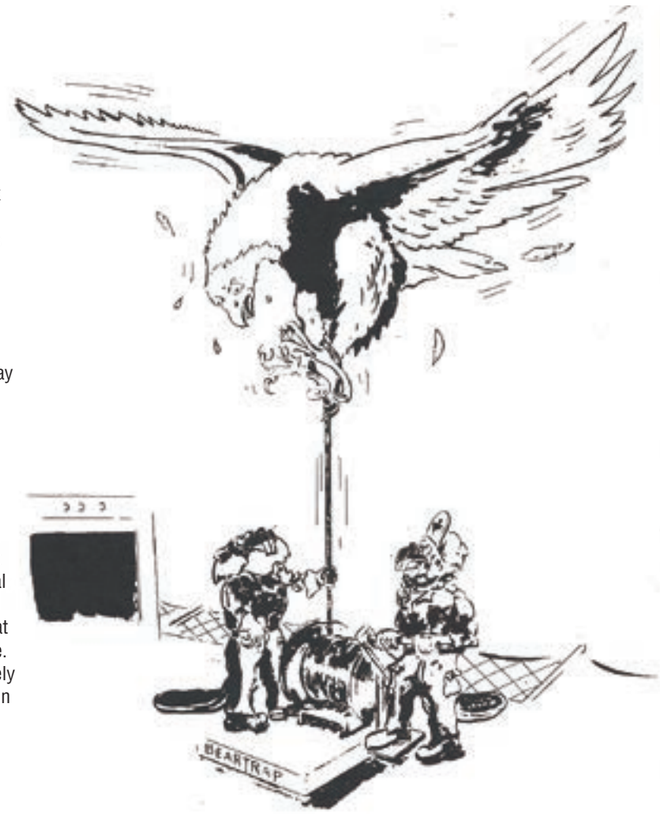
Over the past 15 to 20 years, however, the pace of innovation seems to have decreased appreciably, moving one to wonder whether this is by design or default. Surely there must exist today operational deficiencies for which our naval technical people might devise solutions – so why are we no longer seeing much in the way of breakthrough in-house innovation?

Consider what has been accomplished in the past:

When German U-boats in the fall of 1943 began deploying the GNAT acoustic torpedo that homed in on ship propeller noises, losses among allied convoy escorts were felt immediately. A swift response was needed. RCNVR Special Branch officers at the Naval Research Establishment got to work, and within a month had developed, manufactured and deployed CAT noisemaking gear that could be streamed behind a ship as an effective countermeasure. The innovative device was simple, yet it was an elegant and timely solution to an immediate operational problem. CAT gear stayed in operational use long after the war ended.

The spirit of innovation carried on into the postwar years. In the late 1940s, Lt. Jim Belyea conceived the idea of DATAR (digital automated tracking and resolving) as the first system to collate and communicate operational information between ships using digital technology. For a number of reasons, the RCN did not follow up by installing the system in ships, but it did provide the impetus for the development and implementation of naval tactical data systems, the first being the United States Navy's NTDS.

Another early postwar innovation solved a problem that had been encountered during the war – that of detecting submarines hiding beneath temperature gradients in the waters of the St. Lawrence estuary. In 1949, the Naval Staff issued an operational requirement to overcome the problem, and, in turn, the Naval Research Establishment under the direction of Capt. Arthur Peers came up with the concept of putting the sonar "below the layer." This technique of variable depth sonar (VDS) has been almost universally adopted among navies concerned with antisubmarine warfare.



Above water, the development of today's RAST shipboard helicopter recovery assist, secure and traverse system, first known as the 'Beartrap' helo haul-down system, came from a Canadian initiative to operate large ASW helicopters from destroyer-size warships. In the 1950s, a team led by Cdr Roger Dickinson was instrumental in developing and implementing the device which is still used by several navies today.

In the 1960s, a team headed by Cdr Joe Stachon took the VDS concept into its second generation, thereby keeping the VDS project alive through the turmoil of the integration/unification years. This ensured

(continues next page...)

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Pat Barnhouse asked delegates at the Ottawa Marine Technical Symposium in February,
"Has the spirit of innovation been lost?"

that a state-of-the-art sonar system would be available for both the Improved *Restigouche*-class escorts and the DDH-280 Tribal-class destroyers.

In the 1970s, LCdr Jim Carruthers (today, president of the Ottawa branch of the Naval Association of Canada) came up with the concept of SHINPADS, a shipboard integrated processing and display system that decoupled sensors, weapons and their associated control systems, then connected them all through a common bus and common displays. At first rejected by NATO and other navies, SHINPADS became widely used in various forms. The follow-on SHINCOM (interior communications) and SHINMACS (machinery control) arose out of the fertile minds of naval technical staff, with successor systems still being deployed in ships.

These innovations represented huge advances in naval technology. And there were more, notably in the areas of computer-aided sonar detection and tracking, and towed arrays. During the late 1980s and early '90s there were, at one time, about 75 minor development projects (i.e. less than $1 million each) and five major development projects underway. Impetus for these came from a variety of sources in industry and the defence science world, and also from naval technical staff who were largely responsible for identifying the potential of these developments and pushing the projects forward.

There have been some successful developments in the last 15 to 20 years, but nothing like the major innovations we were spawning up until the 1990s. Again, one is moved to ask why. I would submit that the RCN has an ongoing need of innovation to meet unique Canadian requirements that might arise out of the Canada First Strategy, and to ensure access to sensitive technologies that might not always be available to us through foreign channels.

Has the pace of operational commitments consumed all available resources? Is there a lack of resources? Has Defence R&D Canada changed its modus operandi? Is industry not interested in developmental work? Where is the spirit of innovation in navy technical circles today? The RCN has been through lean times before, and yet somehow we managed to be continually innovative. *Why not now?*

Pat Barnhouse is Chairman of the Canadian Naval Technical History Association.

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