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Maritime Engineering Journal

72
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Canada's Naval Technical Forum

Fall 2013

Magnetic stealth –
A state-of-the-art degaussing system for Canada's *Kingston*-class maritime coastal defence vessels

Also in this Issue:

- Dockyard Lab Report: *Halifax*-class DFO tank ballast debris
- Canada's War in the North Atlantic – A view from the lower deck

Canada

Global partnership at work – *story on page 7*

Following the dissolution of the Soviet Union in 1991, nearly 200 decommissioned nuclear-powered submarines from Russia's Northern and Pacific fleets urgently required dismantling to avoid terrorist and environmental risks. Retired CSE LCdr Rick Kerwin tells the unusual story of Canada's involvement.

Photos courtesy DFATD

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Maritime coastal defence vessel HMCS *Goose Bay* patrols for mines off Norfolk, Virginia during Exercise Frontier Sentinel 2010.

DND Combat Camera photo by Cpl Rick Ayer, Formation Imaging Services, Halifax, Nova Scotia.

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Commodore's Corner

By Commodore Marcel Hallé, OMM, CD

HCM-FELEX – The complex work we do


Photo by Brian McCullough

HMCS *Calgary* one year ago. The ship has since completed successful sea trials of the *Halifax*-class integrated platform management system.

Simply put, the support required to maintain our ships and submarines to ensure they remain safe, compliant with environmental legislation and operationally relevant in the maritime threat domain of today and tomorrow is very complex. Nothing illustrates this complexity better than the current program that is underway to modernize the *Halifax*-class frigates. The former Assistant Deputy Minister (Materiel), Mr. Dan Ross, made it clear that the Halifax Class Modernization (HCM) and Frigate Life Extension (FELEX) is arguably the most complex program within the department. As we near its half-way point, I thought it would be fitting to provide an update and give my perspective on what is often referred to as a "no-fail" mission to ensure that the workhorse ships of the Royal Canadian Navy are able to respond to the future needs of the Canadian government.

To better understand its complexity, the program can be split into two parts: its scope and the program management regime that underpins it; and its governance structure. At a cost of roughly $4.3B, funded through National Procurement votes for sustainment work and Capital votes for new capability, HCM-FELEX consists of more than 150 discrete projects supported by two multi-ship contracts (through Irving Shipbuilding Inc. in Halifax, and Seaspan Shipyards in Victoria), a combat systems integration contract with Lockheed Martin Canada, and the work of the navy's two fleet maintenance facilities – FMF *Cape Scott* in Halifax and FMF *Cape Breton* in Esquimalt.

Successfully integrating the dedicated efforts to design, plan, procure, integrate and execute a program of this enormous magnitude from the many highly-skilled teams and suppliers is what makes HCM-FELEX complex. The technical, procurement, requirements and program management communities resident within the RCN, ADM(Mat), Public Works and Government Services Canada (PWGSC) and industry have to come together in a carefully choreographed manner. This is well managed under the strong leadership of Mr. Geoff Simpson and his highly skilled and dedicated project team, whose constant focus and challenge are to make sure the program is implemented as planned.

The second part is the important enabler – a robust governance structure. The Committee of Sponsors, the highest level of governance for HCM-FELEX, is co-chaired by the Commander of the RCN and ADM(Mat). Its members consist of the leadership from Irving, Seaspan, Lockheed Martin Canada, PWGSC, DGNFD (naval force development) and DGMEPM. In addition, Cmdre Daniel Sing (DGNFD) and I co-chair the DND internal HCM Oversight Committee which is fed by the great work coming from the HCM Working and Sub-Working Groups. This hierarchical governance structure has been very effective in providing program oversight that represents best practice, and points to the importance and benefit of getting the governance right.

So where are we at the mid-point in this project? I can state with pride, resulting from all the great efforts from those involved, that the program remains on schedule and on budget to achieve its initial and final operational capabilities in 2015 and 2018, respectively. In August, HMCS *Montreal* became the fifth ship to be returned to Canada when she was turned over to FMF *Cape Scott* by the shipyard. The focus has now begun to shift from shipyard production issues to ensuring that all necessary requirements are in place to achieve high-level readiness for this class as we embark on trials at sea. This path to high readiness will not be without its challenges, but the successes achieved to date give me confidence that HCM-FELEX will remain on schedule in returning the frigates to their critical role as the effective workhorses of the fleet.

On this note, HMC ships *Halifax* and *Calgary* will soon be ready to commence sea acceptance trials on the east and west coasts to confirm the functionality of the new integrated combat system. A key component to the overall command management system (CMS-330) is the significant effort associated with software development, including that to integrate legacy sensors with new weapon systems. This work has been both considerable and challenging, and the sea trials scheduled for this fall should verify the extensive testing of the CMS-330 conducted at the Land Based Test Site in Dartmouth over the last year.

Earlier this year, HMCS *Calgary* completed first-of-class sea trials of the *Halifax*-class integrated platform management system, the results being a complete success. The IPMS delivers to the ship an integrated means of monitoring and controlling the ship's propulsion, electrical functions, auxiliaries and damage control machinery and systems, providing the crew new advanced functionality with equipment health monitoring, an on-board training system, CCTV integration and an interface with the ship's new combat management system. The implementation of this major enhancement continues with follow-on ship trials for *Fredericton*, *Montreal* and *Winnipeg* into early 2014.

Other challenges facing the program include the effort required to address IT security (ITSEC) requirements needed to safeguard CMS-330. The implementation of the HCM solution includes a CMS-330 that leverages commercial off-the-shelf hardware and software, thus compounding the complexity of an overall ITSEC solution. Through strong working relationships and collaboration between the project and IT security teams, solutions to reduce the risk are being developed and implemented, and in turn are mapping a path that future projects can follow.

The current success achieved with the modernization program of the *Halifax*-class is a testament to the tremendous work of a multitude of highly skilled teams across the navy, key government departments and industry. Though there continue to be tough challenges to overcome, I have every confidence that this program will deliver highly effective combat capable frigates as scheduled so that the RCN will be better equipped for tomorrow's maritime threats.

As we near the half-way point of HCM-FELEX, the many people involved in this most complex program can take great pride in their achievements to date. Delivering a modernized *Halifax*-class is nearer to being realized. Thanks to the complex work we undertake as a naval materiel acquisition and support community in supporting world-class naval vessels, the Government of Canada will have greater options in delivering maritime effect both at home and abroad in an ever-increasing threat environment.

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.

Kingston-Class to Deploy State-of-the-Art Degaussing System

By T. Wayne McIsaac

DND photo by Cpl Martin Roy, Formation Imaging Services, Halifax, Nova Scotia

The 50-metre *Kingston*-class maritime coastal defence vessels (MCDVs) built in the mid-1990s have been stalwart in carrying out the roles for which they were designed. Manned mainly by the Naval Reserve, these 12 ships have been active, spending significantly more time at sea than originally envisaged. Especially now with the *Halifax* Class Modernization and Frigate Life Extension Project (HCM/FELEX) well under way, the MCDVs frequently find themselves doing patrols that were often performed by the heavier class ships.

These versatile ships were designed to carry a number of different role-specific payloads. Although the *Kingston*-class is intended for operations in continental North American waters, some vessels have sailed across the Atlantic to Europe and as far away as Hawaii in the Pacific to participate in multinational training exercises. One of these payloads allows the MCDVs to conduct mechanical minesweeping. For a steel-hulled ship it is critical to have the ability to degauss – or remove the magnetism from – the vessel.

During construction all 12 ships were outfitted with a system of three degaussing coils running athwartship, longitudinally and vertically. However, only three of the ships were outfitted with the power supplies, controllers and masthead magnetometer. The original equipment manufacturer went out of business five years after delivery of the hardware, so parts were no longer available. Since part of the finishing of the job for the MCDV project was to fit degaussing control equipment in all ships, a capital project was stood up in 2009 to purchase and install degaussing equipment for the class.

Magnetic Fields of the Ship

Virtually any ship can be regarded as a ferromagnetic body, and placing this body into a magnetic field will change the field's behaviour. Magnetic influence mines and other such weapons are triggered by this change. The overall strength of the change depends on the dimensions of the ship and its design, the permeability of the hull's material and the equipment it has installed.

Generally, three different effects determine a ship's total magnetic field as measured along its athwartship, longitudinal and vertical axes:

- permanent magnetism caused by the structure of the ship, the fabrication method used and the equipment installed;
- induced magnetism caused by the influence of the Earth's magnetic field acting on the ferromagnetic mass of the ship; and
- eddy-current magnetism caused by the movement of the ship in the Earth's magnetic field.

Ships such as the *Kingston*-class require protection should they be required to operate in a mine danger area where magnetic influence mines might be present. For this they rely on their fitted degaussing system to minimize the magnetic field effects by generating counteracting fields.

The *Kingston*-class Degaussing System DEG COMP MOD 2

A request for proposals was generated through Public Works and Government Services Canada and put out to industry in 2011. A number of suppliers responded and the most technically compliant, lowest-cost bid was submitted by L-3 Communications MAPPS Inc. of Montreal. The design and build of the equipment was subcontracted to a sister company of the successful bidder – L-3 SAM Electronics in Hamburg, Germany. L-3 SAM has been a world leader in degaussing systems and has provided DG equipment to navies worldwide.

To meet the RCN's technical statement of requirements, L-3 MAPPS provided a system that is currently in use by the German and Indian navies, among others. The system can be both automatic and manually controlled. The compensation fields are generated by means of a degaussing triple probe, the degaussing control unit (DCU), the degaussing amplifier cabinet, and the fitted coils.

The DCU is the heart of the system, interfacing with all external data sources and the degaussing power supply units (DG-PSU). It provides all control and monitoring functions. The data containing permanent and variable magnetic fields are used to individually control the DG-PSUs to generate the required current output for each DG coil to compensate for the permanent and induced magnetic fields. The degaussing amplifier has three power supply components to energize the assigned degaussing coils which are identical apart from their individual coil supply voltage.

One of the sources feeding the control unit is the triple probe located atop the mast and as far away from any magnetic material as possible. The probe has sensors associated with the ship's three axes, and gathers information about the magnetic earth field components in the ship's geographic location, as well as any fluctuations caused by the ship's movement through the water.

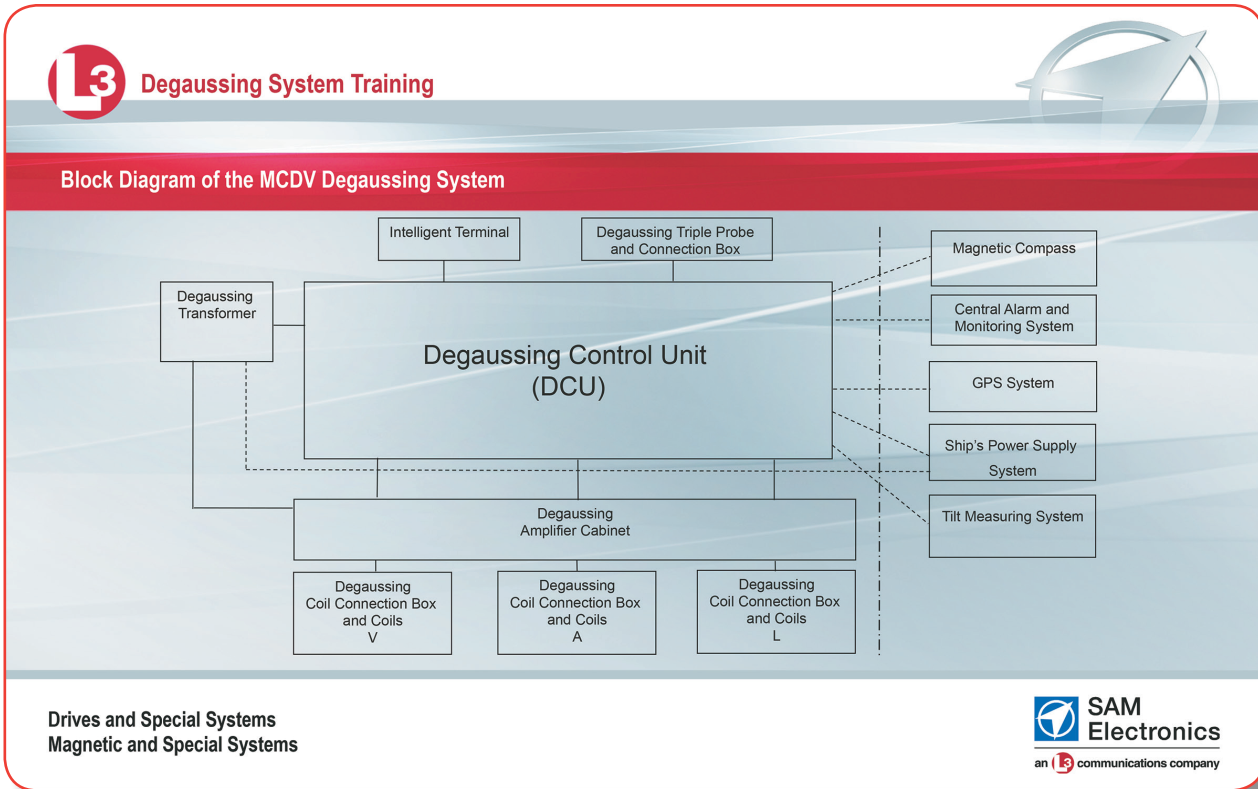
New also will be an intelligent terminal located on the bridge of *Kingston*-class vessels to replace the bridge degaussing control unit. This innovation, designed by L-3 SAM Electronics and deployed on the new German frigate and by the Indian Navy, offers command personnel a magnetic prediction of the ship according to operational conditions. The unit can stand alone or be part of the newly acquired DEG COMP MOD 2.

The intelligent terminal is designed for the following operational modes: signature prediction, optimization of ship's magnetic signature, mine hazard calculation and remote control functions. The unit mimics the control panel. Information downloaded during ranging is stored and monitored by the IT system, allowing it to identify deficiencies in any coil, suggest a solution to optimize the coils and warn of impending problems related to the ship's magnetic ability to go near a mine field. Operators believe that this equipment will enable better decision-making related to the safety of ship and crew when in hostile waters.

Project Status

Factory acceptance tests have been conducted on the degaussing equipment for the *Kingston*-class vessels. The majority of the components have been delivered, with the remainder expected to be handed over by September 2013. The equipment will be installed in the ships during planned short work periods, extended work periods and scheduled dockings.

An important part of the work in setting up the ships' new degaussing system will be to *deperm* the vessels. This special procedure involves temporarily wrapping a ship in heavy gauge cables and pulsing high-energy electrical currents against the hull and superstructure to reduce the ship's magnetic signature to as close to zero as possible. Afterward, the ship will be placed on a navy degaussing range where data on its magnetic signature can be gathered. This data will be uploaded to the onboard DCU so that controlled electrical currents can be sent to the fitted coils to obtain the best possible overall magnetic signature.



Illustrations courtesy L-3 Communications MAPPS / L-3 SAM

The plan is to have at least two ships installed, depermed and ranged by the end of 2013. The remaining ships will cycle through until all work is completed by the end of 2015.

The degaussing team is confident that this new DEG COMP MOD 2 will provide the RCN with a sophisticated degaussing system design that will allow mine countermeasures to be carried out in all areas where *Kingston*-class ships are deployed, both now and in the future.

Wayne McIsaac is the project manager for the Kingston-*class degaussing project in the Minor War Vessels section of DGMEPM. The other members of the team are LCdr Chad Naefken and contractor Paul Levasseur in the Directorate of Naval Requirements, Diane Plouffe in the Directorate of Maritime Procurement, and Jim Pederson in the Directorate Naval Platform Systems.*

Northwest Russia Nuclear Submarine Dismantlement Project*

By Rick Kerwin, LCdr RCN (Ret.)
Department of Foreign Affairs, Trade and Development (DFATD)

*[*Based on a presentation made by the author, a former navy combat systems engineer, to the ADM(Mat) Project Management Professional Development seminar in Ottawa on February 27, 2013. Illustrations courtesy the author.]*

A Russian *Delta III* SSBN under tow from Murmansk to the shipyard in Severodvinsk for de-fuelling and dismantlement.

Under Canada's leadership at the 2002 G8 Summit in Kananaskis, Alberta, the Global Partnership Program (GPP) Against the Spread of Weapons and Materials of Mass Destruction (WMMD) was created to address the Cold War legacy threat of WMMD, principally in Russia.

With a total financial commitment of up to $US 20 billion over 10 years for projects (including Canada's $1B contribution), G8 leaders identified the following priority areas: destruction of chemical weapons, disposition of fissile materials, redirection of former weapon scientists, and the dismantling of decommissioned nuclear-powered submarines. Following the dissolution of the Soviet Union in 1991, nearly 200 decommissioned nuclear-powered submarines from Russia's Northern and Pacific fleets urgently required dismantling to avoid terrorist and environmental risks.

In Phase 1 of the Nuclear Submarine Dismantlement Project from 2004 to 2008, in accordance with the Canada-Russia bilateral treaty, the GPP completed four implementing arrangements with the Zvyozdochka shipyard located in Severodvinsk, northwest Russia. The work involved dismantling 11 *Victor*-class nuclear submarines, and de-fuelling a Typhoon-class strategic ballistic missile nuclear submarine in a cooperative dismantling project with the US Defense Threat Reduction Agency (DTRA) and the Russian State Atomic Energy Corporation (ROSATOM). Some 5760 fuel assemblies from the nuclear reactors on board the 12 submarines were de-fuelled, and the spent nuclear fuel assemblies were sent away to safety at the Mayak Processing Association facility in the Ural Mountains.

In June 2008, the global partnership obtained Treasury Board approval for Phase 2 of the program at the same shipyard. This time the objectives were to:

- de-fuel and fully dismantle two *Yankee*-class nuclear submarines, tow the de-fuelled reactor sections to a long-term storage site in the Murmansk Region, and process the radioactive waste; and
- de-fuel a *Delta III*-class SSBN and transport its spent nuclear fuel to the Mayak facility in the Urals (again, a joint cooperative dismantlement, with the DTRA funding the elimination of the submarine's strategic missile launcher system and ROSATOM dismantling the rest of the submarine).

A Victor III SSN awaits dismantlement (left) at the Zvyozdochka Shipyard in Severodvinsk, and the same vessel 50-percent dismantled two months later (right).

De-fuelling the Russian nuclear-powered submarines involved lifting the radioactive spent nuclear fuel assemblies out of the reactors in transfer flasks, then containerizing them for safe shipment to a processing facility in the Ural Mountains.

With the spent nuclear fuel assemblies safely stowed, a special train serves as temporary storage before making the long journey to deliver its radioactive cargo to the disposal facility at Mayak in the Urals.

Canadian DAFTD observers confirm the safe transfer of the spent nuclear fuel assemblies by Russian shipyard nuclear workers.

The project was a complete success. The implementing arrangements were completed on schedule, within budget and within scope, and fully satisfied all project stakeholders from the governments of Canada, Russia and the United States. Regular project and financial audits conducted by auditors from DFATD's Office of the Inspector General were declared "unqualified successes."

The success of this project was due in great measure to the individuals and organizations involved in the Global Partnership Program's earlier phase of work. GPP Director General Troy Lulashnyk and Director Stephane Jobin, along with Senior Counsel Greg Newman, ensured the Canada-Russia treaty's implementing arrangements were sound and negotiated correctly in accordance with the TB submission. Senior Program Manager Michael Washer delivered the Phase I projects in exemplary fashion, assisted by Project Officer Yuri Novikov. DTRA's experience in dismantling SSBNs in Russia for several years before the G8 Summit at Kananaskis, so generously shared with us, was vital for Canada's success.

Rick Kerwin is Senior Program Manager and Deputy Director (Special Projects) with DFATD's Global Partnership Program.

Defence Research and Development Canada

Dockyard Lab Report: *Halifax*-Class DFO Tank Ballast Debris

By Colin G. Cameron, Ph.D.
Defence Scientist, Dockyard Laboratory (Atlantic)

[Editor's Note: The following is the first of what we hope will become a series of "science behind the story" articles based on the investigative case files of DRDC's dockyard laboratories.]

Illustrations courtesy the author

Figure 1. Poor fuel suction led to the surprising discovery of disintegrating rubber pads in a frigate's DFO tanks.

There are a number of stories to be told chronicling selected investigations at the Dockyard Laboratories Atlantic and Pacific. These labs – DL(A) in Halifax and DL(P) in Esquimalt – are part of Defence Research and Development Canada, the civilian research arm of DND. The purpose of the labs is twofold: to conduct materials science research and to provide rapid, direct scientific support to the Department of National Defence. It is the latter function that will be featured here, depicting noteworthy failure investigations and other interesting stories from the world of science.

The present investigation started, as many do, with some fairly innocuous and seemingly unrelated technical inquiries from a ship. In August 2012, HMCS *Toronto* reported having experienced poor fuel suction, so some filters were submitted to the laboratory for examination, along with some debris removed from the fuel centrifuges. There were also reports that some of the rubber pads in the distillate fuel oil (DFO) tanks were disintegrating.

The rubber pads had been installed as part of the Halifax Class Modernization/Frigate Life Extension (HCM/FELEX) program. A stability enhancement upgrade required the addition of solid ballast in the DFO tanks. This ballast – an array of encapsulated lead weights – was secured with steel beams backed by rubber pads (Figure 1). After No. 8 DFO tank had been emptied and washed, it was discovered that some pads appeared swollen and distorted, while others were not. Samples of the "good" and "bad" rubber were sent to the lab for analysis.

One of the first steps in such an investigation is to determine the composition of the materials, and to this end we have a number of powerful tools at our disposal at both Dockyard Laboratories. In this case, we used two instruments to characterize the rubbers.

First, the Fourier transform infrared (FTIR) spectrometer examines the vibrations of the bonded atoms in a molecule. Like tiny weights on minuscule springs, atoms vibrate at frequencies that are determined by the atoms' masses, i.e., which elements, and the strength of the spring (the type of bond). The energy of these vibrations corresponds to infrared light, so spectra such as those in Figure 2 will exhibit a series of absorptions, each corresponding to a specific molecular vibration at that energy. By analyzing the position of the absorptions – or, better still, having a computer match the pattern against a library – one can determine the composition of the material.

Second, the pyrolysis gas chromatography mass spectrometer (PyGCMS) is particularly useful for polymers such as these rubbers. This instrument pyrolyzes (heats in the absence of oxygen) a small sample of material until the molecules break apart. The molecular fragments then pass through a long chromatography column where they are separated on the basis of their chemical properties and then into a mass spectrometer where they are identified. In this way, one can infer the composition of the parent material from the molecular fragments.

The analyses revealed the presence of at least two different types of rubber. The distorted, disintegrating "bad" material was identified as poly(isoprene), also known as natural rubber. Generally, natural rubber is a good, inexpensive polymer with numerous applications. However, it offers no resistance to oil, and it will swell and disintegrate when so exposed. The "good" rubber turned out to be a blend of nitrile (more properly, butadiene-nitrile, and sometimes known by the eponym Buna-N) and styrene-butadiene rubber (SBR).

Nitrile rubbers are suited to exposure to distillate fuel; the less expensive SBR is not. Supposedly the nitrile-SBR formulation was resistant to distillate, but was probably not the best material for the job. However, the EC specification (EC #20060088HFX000, Stability Enhancement – Solid Ballast) did call for a specific product, AAA-Acme Rubber CASS-.250x36-46000, which the manufacturer has since confirmed as a premium grade unblended nitrile rubber.

Knowing the base composition of the rubbers, it was useful to consider the fillers as well. What one usually thinks of as rubber (tires, shoe soles, and so on) is in fact not just rubber, but rather a combination of rubber and inert fillers such as carbon black (essentially soot), talc, clay, and calcium carbonate (limestone). These inexpensive fillers can play an important role in modifying the rubber's properties (increased stiffness, for example), but they are used mostly to bring manufacturing costs down.

Experimentally, fillers can be revealed by observing the change in mass of a sample as first the rubber and then the carbon black get burned away, heating the material first under an inert atmosphere and then in air. Figure 3 shows such thermogravimetric analysis (TGA) for the two rubbers found in the DFO tank. The compositions are similar: about 50 percent rubber resin, and around 25 percent each of carbon black and calcium carbonate.

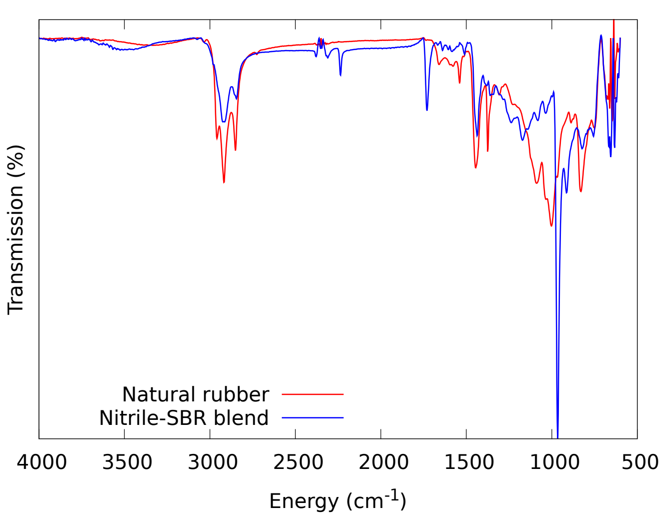


Figure 2.

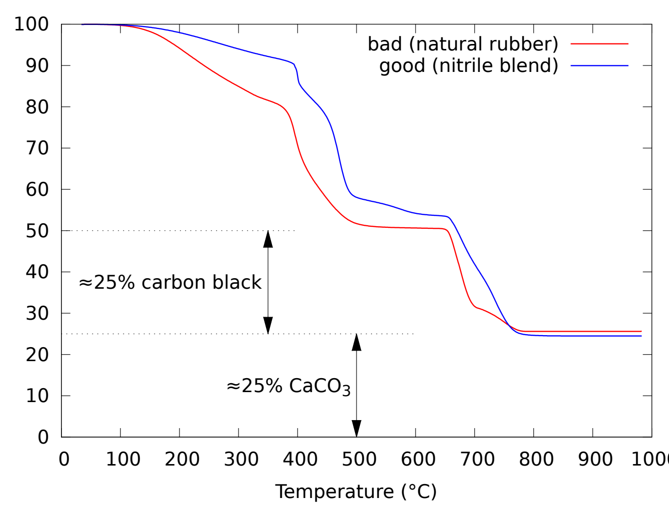


Figure 3.

Figure 4.

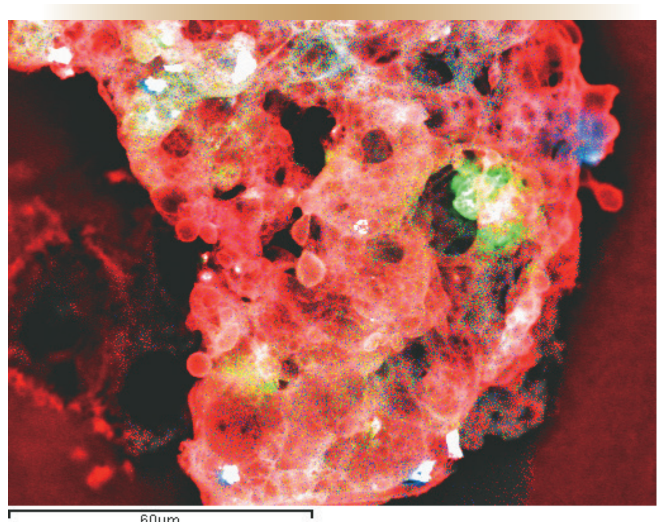


Figure 5.

Having determined the composition of the "bad" rubber, it was not surprising to find that degraded natural rubber had contaminated the fuel system. Figure 4 shows a fuel filter-coalescer that had been cut open to reveal black debris that had accumulated on the coalescing fibres. PyGCMS analysis of the black debris showed it was natural rubber, proving that the degraded rubber particles must have passed through the underlying filter element to reach the coalescing fibres. This finding was disturbing, since it implied that contamination could have entered the engines. While there was no specific evidence of this having happened, a General Electric inspector did find a quantity of unidentified black solid in one of the gas turbine filter bowls.

The post-filter fuel system contamination problem was exacerbated by the calcium carbonate filler. Figure 5 presents colour-mapped energy-dispersive x-ray (EDX) maps of the degraded rubber that had been collected downstream of the filters, and it is clear that discrete particles of calcium carbonate had also passed through. This could be problematic for two reasons. First, this hard material is abrasive, and it could accelerate engine wear. Second, calcium is known to react with certain alloys used in engines, initiating microscopic damage that ultimately precipitates failure. However, there was no evidence of deterioration when the gas turbine was inspected.

In conjunction with our Dockyard Laboratory (Pacific) colleagues, in late August 2012 we conducted a survey of the frigates that had undergone the upgrade. We found that every ballast-upgraded ship – six frigates in all – had at least some natural rubber pads installed in their DFO tanks. In fact, a hodgepodge of rubbers was found: natural rubber, nitrile-natural blends, nitrile-chloroprene blends, nitrile-SBR blends, and possibly some unblended nitrile.

Fortunately, only one other ship, HMCS *Regina*, had ballast-upgraded tanks in active use, and they were quarantined immediately. The fuel contamination problem would likely have become more widespread if it had not been discovered early on HMCS *Toronto*; work began immediately to replace the rubber pads in the affected ships.

In early September 2012, the shipyard sent the lab a sample of rubber intended for use as a substitute for the rubbers that had been used to date. The accompanying data sheet mistakenly identified the rubber as compliant with specification MIL-R-6855E (class 1), which, according to the standard, "is intended for use where resistance to aromatic, alkylate, or aviation fuel, and petroleum based lubricants is required." Our analysis revealed that this particular rubber was a nitrile-SBR blend sold by American Biltrite as product AB-364, which is not indicated as MIL-R-6855E (class 1) by the manufacturer and is probably not suited to continuous fuel immersion.

We did determine that unblended nitrile product AB-365 would, however, be suitable. Not only does it comply with MIL-R-6855E (class 1), but the manufacturer specifically confirmed that this nitrile rubber is appropriate for continuous fuel immersion.

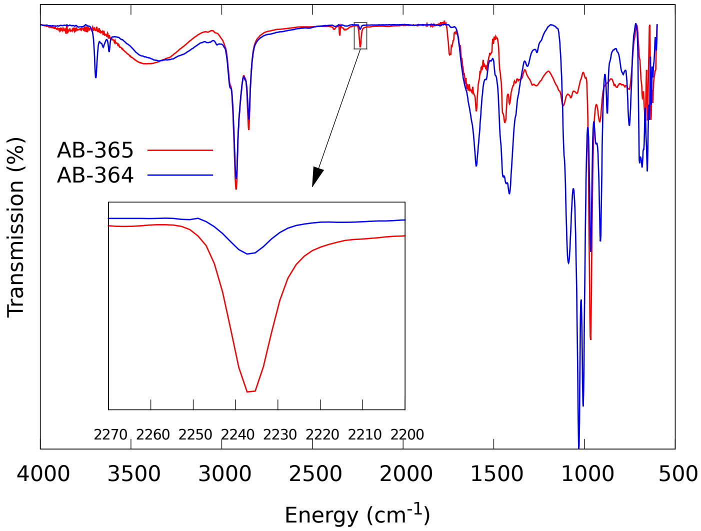


Figure 6.

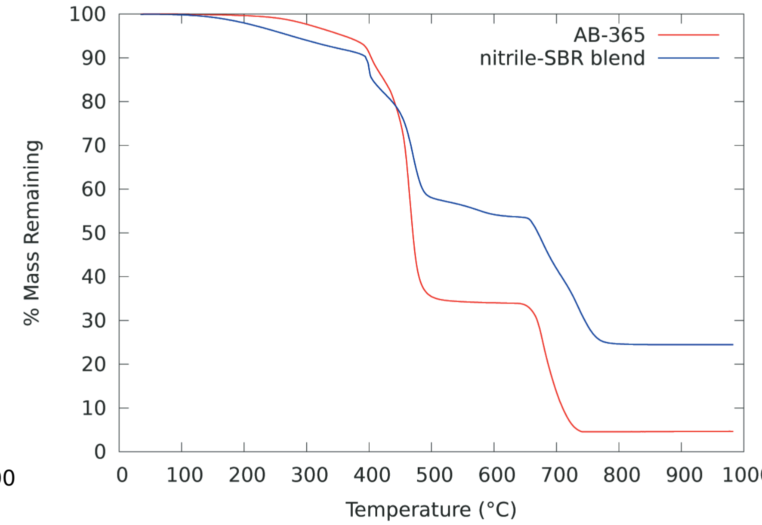


Figure 7.

The difference is clear in the FTIR spectra in Figure 6. The telltale peak at 2235 cm^{-1} is due to the nitrile portion of the molecule; a more intense peak means more nitrile content. Clearly, AB-365 has more nitrile content than the nitrile-SBR blend AB-364, and is therefore the more fuel-resistant product.

Further evidence of the superiority of AB-365 came from its TGA. Figure 7 compares the filler content of this material against one of the "good" nitrile rubbers removed from a DFO tank. AB-365 had only around five percent calcium carbonate filler, as opposed to 25 percent in the blended rubber.

With evidence that AB-365 was a high-quality unblended nitrile rubber, and with confirmation from the manufacturer that this product was suited to continuous immersion in fuel, we confidently recommended that this specific rubber be used in the FELEX ballast upgrade. The recommendation was accepted, and by October 2012 the laboratory was sampling batches of AB-365 as they were delivered to ensure that only high grade nitrile rubber was being installed.

This case underscores the importance of using the right materials. The installation of natural rubber pads was a widespread error, but if the problem had gone undetected longer their deterioration could have led to accelerated engine wear, unplanned downtime, and possibly expensive engine replacement. The "good" nitrile-SBR polymer may or may not have proved adequate in this application, but we are confident that the chosen unblended nitrile will remain stable for many years to come.

In closing, I would like to acknowledge the efforts of my DL(A) colleague John Power for his assistance with the analyses and the diligence of my DL(P) collaborator Brad Noren, who undertook the parallel effort on the West Coast. I would also like to thank Ron Cormier at DMEPM(MSC) for his helpful comments.

ABOUT THE AUTHOR

Dr. Colin G. Cameron is a chemist with a background in electrochemistry and polymer science. He has been an employee of Defence Research and Development Canada – Atlantic since 2002, working in the Materials Identification and Analysis group at the Dockyard Laboratory (Atlantic) in Halifax. His areas of expertise include electrochemical energy storage, polymer actuators, non-metallic failure analysis, and fuels and lubrication chemistry.

Book Review

Naval Gazing: Canada's War in the North Atlantic – James Neill's "lower deck" memoir tells it like it was on North Atlantic convoy duty

Reviewed by Tom Douglas

James G. Neill
Privately printed © 2006 James Neill
176 pages; Illustrated

This true story is about a corvette and its crew during the darkest days of the North Atlantic war. There is humour, excitement and tragedy in the great struggle to shepherd merchant vessels safely past the U-boat wolf packs.

Quite often the jacket blurb on a book, just like the trailer for a movie, promises much more than it delivers. In the case of a self-published recollection of life aboard HMCS *Chilliwack* during the Second World War by the late James G. Neill, who had achieved the rank of petty officer by war's end, the opposite is true. Neill's prose keeps the reader enthralled from start to finish, laughing along with the author at the foibles of his shipmates and feeling his anguish, and at times bitterness, over the tragic loss of men and materiel that he suggests might have been avoided in some instances but for human error or downright stupidity.

When the cerlox-bound memoir was brought to the *Journal*'s attention by Neill's daughter Lori, it was apparent from the title, *Naval Gazing – Canada's War in the North Atlantic: A view from the lower deck*, that the author had a wry sense of humour. And that humour is sprinkled liberally throughout the book's 176 pages. Here are just a few examples:

- *To reach the degree of perfection that the Chief Gunners Mate demanded (the only one higher than him in our world was God and even that was debatable) we suffered day after day. When he roared at some hapless individual, even the sea gulls took flight.*

- *Exhausted bodies struggled into unfamiliar hammocks where they lay unable to turn over, or even move left or right. I thought: "So this is what it's like to die slowly. All they have to do is throw a few turns around me with a rope and I'm ready." I don't know whether I was in the Navy long enough for burial at sea, but at this point I was beyond caring.*

- *Somewhere on the ship someone reported seeing rats aboard. It never happened in our mess-deck. No civilized rat would live in our appalling conditions. Nevertheless, the Brass decided it was necessary to fumigate the ship. This was a very dangerous practice. I don't know how the rats fared, but it nearly did us in.*

- *Involved was one of the old four-stacker destroyers that the Royal Navy had received from the Americans in a swap for bases in various parts of the world. This was a deal that was on a par with the one where settlers bought Manhattan for a few trinkets from the Indians.*

The excitement the jacket blurb promises occurs regularly throughout the narrative – especially Neill's descriptions of *Chilliwack*'s many encounters with marauding U-boats. One chapter, entitled Silent Sea, sets the reader's heart pounding as the ship suffers yet another engine breakdown and is a sitting duck in the middle of the North Atlantic while the hours tick by before the problem is rectified. One paragraph sums up in an understated but poignant manner the gut-tightened, perspiration-drenched emotions of the author and his shipmates as they brace themselves for what they believe is an inevitable torpedo attack:

Every half hour or so we could hear the Captain calling the engine room. "How much longer, Chief?" Up at the gun we couldn't hear the answer but wished to hell we could.

Photos courtesy the family of James Neill

Life in the messdeck of a corvette was cramped and wet. “No civilized rat would live in our appalling conditions.”

Another chapter – Runaways – vividly describes the danger when extra depth charges, stored on deck up against the bulkheads, would break loose during a heavy storm and start rolling around the quarterdeck – three-hundred-pound containers packed with the explosive Amatol TNT:

On the flat end of the depth charge there were two steel rings for lifting them from the jetty to the ship by small crane. The task for the men trying to secure the runaway charge was to hold it still long enough to get a line through one or more of the rings. Sounds easy enough. Well, anyone that has seen a corvette bouncing around in a heavy sea can imagine what it was like on the quarterdeck.

As the ship rolled, a huge swell would pour over the railing and then as the Chilliwack's bow rose up to meet the next wave the water on deck would thunder aft and the guys trying to secure the depth charge were up to their waists in water. This was very dangerous because the weight of the water could easily sweep them off their feet and carry them overboard.

Two or three times when the men seemed to have the depth charge trapped, the ship would roll and it would be off again. Hundreds of pounds of steel could easily snap a man's leg or crush fingers in its mad run across the deck. The men trying to secure the depth charge suffered a lot of bruised legs and arms as well as a thorough soaking before finally getting the job done. This was particularly tough in winter with icy cold weather.

Refuelling at sea was usually an uneventful activity, but not always. See photo at right.

The British tanker *Scottish Heather* was torpedoed as *Chilliwack* left her side after refuelling on Dec. 27, 1942. The damaged ship made it back to the U.K. under her own power for repairs.

As can be expected in a book about the cruel sea and the even crueller U-boats that lurked beneath its waves, Neill relates a number of tragic incidents that he indicates would haunt him for the rest of his life. One such episode, where the *Chilliwack* is forced to leave behind two survivors of a torpedoed merchant ship or become the next target of German submarines still in the area, would bring a lump to the throat of even the most hard-hearted reader:

Some memories die hard. One afternoon not too long ago I sat reading in the living room. My granddaughter aged five had just returned from a friend's birthday party. She sat down and emptied her loot bag with all its goodies in front of her. Amongst these treasures was a small plastic whistle. Of course she immediately began to blow long piercing blasts on it.

The unmistakable shrill sound took me back immediately to that black night in the mid-Atlantic. I headed for the door and as I stood outside I could still hear the whistle. Worse than that, I heard again the voices of those two seamen from so long ago: "Hey, Mac! Over here. Don't leave us!"

God! We were so close to saving them and we sailed away.

Tom Douglas is the associate editor of the Maritime Engineering Journal *and a 2012 recipient of the Minister of Veterans Affairs Commendation as the author of a number of books about Canada's military heritage.*

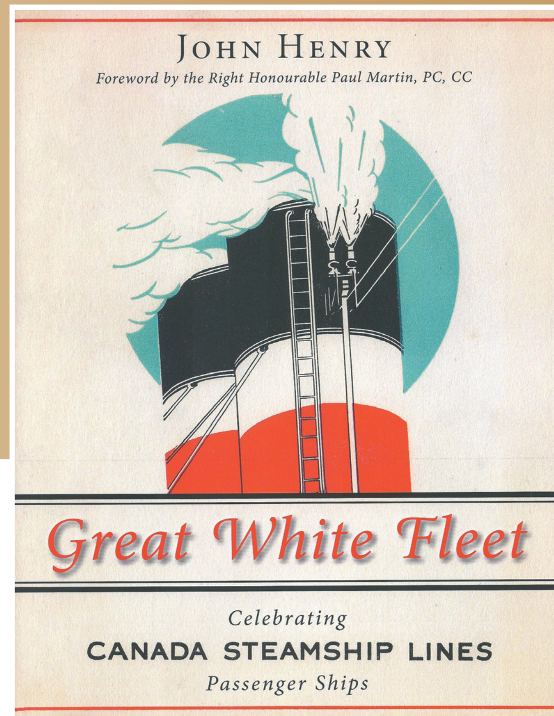
Don't leave us. A painting by James Neill depicting HMCS *Chilliwack* having to leave behind two survivors of a torpedoed merchant ship.

Book Review

Great White Fleet: Celebrating Canada Steamship Lines Passenger Ships

Reviewed by Captain(N) Hugues Létourneau

Great White Fleet:
Celebrating Canada Steamship Lines Passenger Ships
© 2013 John Henry
Dundurn; ISBN 978-1-4597-1047-4
144 pages; Illustrated; Index; $30.00



I sometimes have trouble reading coffee table books. Large, attractive, glossy – it is easy to concentrate more on the pictures than on the text. In the case of John Henry's *Great White Fleet*, released in time for the Canada Steamship Lines (CSL) 2013 centennial, the combination of text and images creates a fascinating window onto a now-vanished world.

Anyone living near the Great Lakes and St. Lawrence River systems is familiar with the CSL cargo ships – the lakers – that have plied these waterways for one hundred years. But what is almost forgotten today is that until 1963 CSL also ran a thriving passenger service.

In 1913, air travel was nonexistent, and while there were trains, road travel was arduous in the fledgling automobile age. For businessmen or families traveling from Detroit to Toronto, Montreal, Quebec City – or Tadoussac for that matter – a water-borne trip was perhaps longer and more expensive than train travel but was considered a civilized, relaxed way to reach one's destination.

In its half-century of operations, CSL's passenger arm comprised more than 50 vessels, sailing from Duluth Minnesota, to Port Arthur/Fort William (today Thunder Bay), then Sault Ste. Marie, Sarnia, Detroit/Windsor, Buffalo, Toronto, Rochester, *Kingston*, Prescott, Cornwall, Montreal, Sorel, Trois-Rivières, Quebec City, Murray Bay (today La Malbaie) and finally, Tadoussac on the Saguenay River. In those pre-Seaway days, the Prescott-Montreal run even transited the Lachine Rapids. CSL also operated two five-star hotels – Murray Bay's Manoir Richelieu and the Hôtel Tadoussac.

Inevitably, this travel mode was doomed from the start. The spectacular growth of the automobile industry, with the concurrent development of a vast system of modern roads and highways, and the eventual popularity of air travel, meant CSL's passenger days were numbered. While water travel actually increased in the Depression (many people couldn't afford cars) and during the Second World War because of rationing, these periods were, arguably, exceptions, and the decline would continue until 1965, the year CSL shut down its passenger service. That's almost a half-century ago and sadly just a dim memory.

The measure of a good book is often the degree to which it informs and entertains. *Great White Fleet* – well written and magnificently illustrated – does both exceedingly well for this fascinating subject. Bravo Zulu, Mr. Henry!

Capt(N) Hugues Létourneau lives in Québec City and is Regional Liaison Officer (Quebec) for the Canadian Forces Liaison Council.

News Briefs

Limited edition print presented to HMCS *Haida*

Editor's Note: *HMCS* Bytown *Heritage Officer Bill Dziadyk was the presenter of a limited edition print (2/300) at a dockside ceremony held August 30 in Hamilton, Ontario. The event was to mark the 70th anniversary of the commissioning of HMCS* Haida *and the commissioning and subsequent loss of the first HMCS* Athabaskan. *Here is Bill's article describing the background and significance of the presentation.*

By Bill Dziadyk, LCdr RCN (Ret.)

Photo courtesy of Parks Canada

Taking part in the HMCS *Haida* presentation August 30 were (left to right): Bill Dziadyk, LCdr RCN (Ret.) – a former Combat Systems Engineer who made the presentation in his capacity as HMCS *Bytown* Heritage Officer; David Sweet, Member of Parliament for Ancaster-Dundas-Flamborough-Westdale; Hamilton Mayor Bob Bratina; and Mrs. Vi Connolly, widow of Signalman Bill Connolly, a member of the crew of the torpedoed HMCS *Athabaskan*. Signalman Connolly, who spent the rest of the war in a German PoW camp, passed away in 2008.

When I became the Heritage Director of HMCS *Bytown* in October 2008 we performed an inventory audit of our historic heritage items. One byproduct of this audit was that we gained a much better appreciation for the value and history of the heritage items that we are custodians of.

One specific example is the Second World War painting ***Canadian Destroyer* Haida *stops to pick up survivors from the* Athabaskan**, by British artist William McDowell. Many people who viewed it over the years thought it was just a black and white print, but it is in fact the original painted by McDowell in May 1944 shortly after *Athabaskan* was sunk in the English Channel.

We believe that this Battle of the Atlantic painting is very special to the history of the Royal Canadian Navy – and we feel compelled to share it. To mark the 70th anniversaries of the wartime commissioning of HMCS *Haida* (G63) and HMCS *Athabaskan* (G07), and also the subsequent loss of *Athabaskan*, HMCS *Bytown* Incorporated arranged for 300 limited edition prints of this historic painting to be produced.

HMCS *Athabaskan* was a Tribal-class destroyer, built at the Vickers Armstrong shipyard at Newcastle upon Tyne, and commissioned into the Royal Canadian Navy on February 3, 1943. The ship was lost in the English Channel on the night of April 29, 1944 after being torpedoed by the German Elbing-class destroyer T24. (The 102-metre T24, with a crew of 205, was classed as a "*fleet torpedo boat*" by the Germans.) One hundred and twenty-eight officers and men – including Commanding Officer LCdr John Stubbs – were lost, 83 were taken prisoner and 44 were rescued by HMCS *Haida*.

It is very fitting that this historic painting is now displayed in the DeWolf Room of the *Bytown* Wardroom. In the painting we can clearly see Captain Harry DeWolf on *Haida's* port bridge wing in charge of the rescue efforts during a lull in the battle. In 1943 Capt DeWolf was the founder and first president of the HMCS *Bytown* Naval Officers' Mess. In the rank of commodore, he returned as president from 1945 until 1946. Stoker Bill Cummings, LS Bill McClure and AB Jack Hannam can also be seen rescuing six survivors before they successfully took *Haida's* motor cutter back to England, with the engine cutting in and out. The motor cutter was restored in 1992, and is now displayed next to the ship in Hamilton.

The benefactor

The painting was presented to HMCS *Bytown* by Commodore George R. (Gus) Miles while he was president of the mess from 1947 to August 1948. He had served as *Athabaskan's* first commanding officer from her commissioning until October 22, 1943, and had conducted many wartime patrols off the coast of occupied France. Miles acquired the original painting from the artist after having seen it in an article, "*The Canadian Navy Fights Its First Engagement as purely Canadian Division*," which was published in *The Sphere* magazine less than a month after the loss of his former ship.

Before taking *Athabaskan*, Miles had been CO of the River-class destroyer HMCS *Saguenay* (D79) which escorted the first convoy HX-1 out of Halifax at the beginning of the Battle of the Atlantic in 1939. In December 1940, *Saguenay* was torpedoed by the Italian submarine *Argo*, becoming the first Canadian warship in the history of the RCN to be damaged by enemy action. Miles was able to limp his ship back to the U.K., and for his "*gallantry and distinguished service before the enemy*" he was appointed a Member of the Most Excellent Order of the British Empire.

On August 27, 1943 during an anti-submarine chase in the Bay of Biscay, Miles' *Athabaskan* was struck by a Henschel *Hs 293* radio-controlled glider bomb. She was one of the first allied ships to be damaged by this new German anti-ship weapon (and, some would argue, the predecessor of today's anti-ship missiles). Once again he brought a severely damaged ship safely back to port for repairs and was awarded a Mention in Dispatches for his actions. In October 1943, Miles handed over his command to LCdr John Stubbs, just six months before *Athabaskan* was lost in battle.

Many of the survivors who are so dramatically depicted in McDowell's painting, struggling toward *Haida* in the cold dark sea off the enemy-held coast of France, were close friends and former shipmates of Cmdre Miles. His last appointment was as Commodore, RCN Barracks Esquimalt. He died on February 19, 1951 and was buried at sea from HMCS *Ontario* with full naval honours.

The artist

William McDowell (1888-1950) began his career as a draughtsman at the Vickers Naval Construction Shipyard in Barrow, England. He studied naval architecture and was an associate member of the Royal Institution of Naval Architects. He became a professional marine and war artist whose many works demonstrated precision and detail, as is effectively demonstrated in the subject painting.

McDowell painted quickly and spontaneously on beige-coloured illustration board using water and Chinese ink. This particular type of ink, derived from the fine black coatings formed inside the surfaces of oil lamps, remains one of the best archival art media ever invented. For the brightest highlights in his work – like search lights, flairs and ordnance explosions – McDowell used small amounts of white and blue gouache, a special opaque type of artist paint.

The limited edition prints

The print image has been digitally restored by Barry Tate, a professional artist and a former shipmate of mine. The original painting had ironically suffered some of its own battle scars over the years – fine scratches and nicks, a few blotches and stains here and there. Through a long process using state-of-the-art photo editing tools, Barry carefully restored the image used in this limited edition print to the original May 1944 condition of the artwork.

Framed print 1/300 was formally presented on February 1 this year by Commodore Darren Hawco to the current HMCS *Athabaskan* in recognition of the 70th anniversary of her namesake's commissioning. These limited edition prints, with certificates of authenticity, are available for sale to the public. The price is $150 plus HST and shipping.

Prints can be ordered through:
www.tinyurl.com/Haida-Athabaskan
(250) 655-4535 (8 a.m. to 8 p.m. PST)
Haida-Athabaskan@barrytate.com

Painting by William McDowell

"For courage, resolution and devotion to duty...."

The August 15, 1944 *London Gazette* recorded:

"For courage, resolution and devotion to duty in HMCS *Haida* in action with enemy destroyers and in rescuing survivors from HMCS *Athabaskan*":

Distinguished Service Medal: Petty Officer George Cyril Moon; Stoker Petty Officer Harold Douglas Richards; and Leading Seaman Robert Edwards White; and

Mention in Dispatches: Lieutenant John Crispo Leckie-Annesley; Lieutenant Phillip George Frewer; Mr. Lloyd Irwin Jones, Gunner (T); Chief Ordnance Artificer Magnus Pedersen; Leading Seaman John Ray Finch; Acting Leading Seaman William McClure; and Stoker First Class William Alfred Cummings.

News Briefs

Halifax-Class IPMS sea trials successful

Photo courtesy LCdr Trevor Scurlock

When HMCS *Calgary* completed successful first-of-class sea acceptance trials of the new *Halifax*-class integrated platform management system (IPMS) last March, the performance of the system left happy customers in its wake.

The IPMS is the technical heartbeat of the ship, integrating everything from main propulsion and electrical power distribution to machinery control, equipment health monitoring, HVAC and battle damage control.

The system performed remarkably well during a trials program that included full ahead, full astern, crashbacks and hard over steering trials at full power. The new battle damage control system went through a series of drills and exercises under the observant eye of MARLANT and MARPAC Sea Training staff who quickly noticed the system's advantages.

The use of ethernet/fibreoptic technology allows the IPMS extremely fast, reliable communication with the various ship systems. The enhancements place its capability well beyond that of the IMCS it has replaced. The new EHM server, which has a 4 terabyte hard drive, scans all field device signals and can capture up to 90 days of data at a time. This is a huge advancement from an equipment health monitoring perspective.

Watchkeepers in *Calgary*'s machinery control room were impressed with the CCTV capability of the new system – some 32 CCTV cameras positioned throughout the main and auxiliary machinery spaces, some with infrared and others that can be controlled for pan and tilt. The addition of more upper deck cameras means the MCR watchkeepers are no longer in the dark during upper deck evolutions.

HMCS *Calgary* is expected to return to fleet service in 2014.

News Briefs

Joint Support Ship design chosen

The Government of Canada in early June announced the selection of a "proven, off-the-shelf" design by ThyssenKrupp Marine Systems for two Joint Support Ships being acquired for the Royal Canadian Navy (RCN) as part of the National Shipbuilding Procurement Strategy (NSPS).

The announcement stated that the ships would "provide a home base for maintenance and operation of helicopters, a limited sealift capability and support to forces deployed ashore."

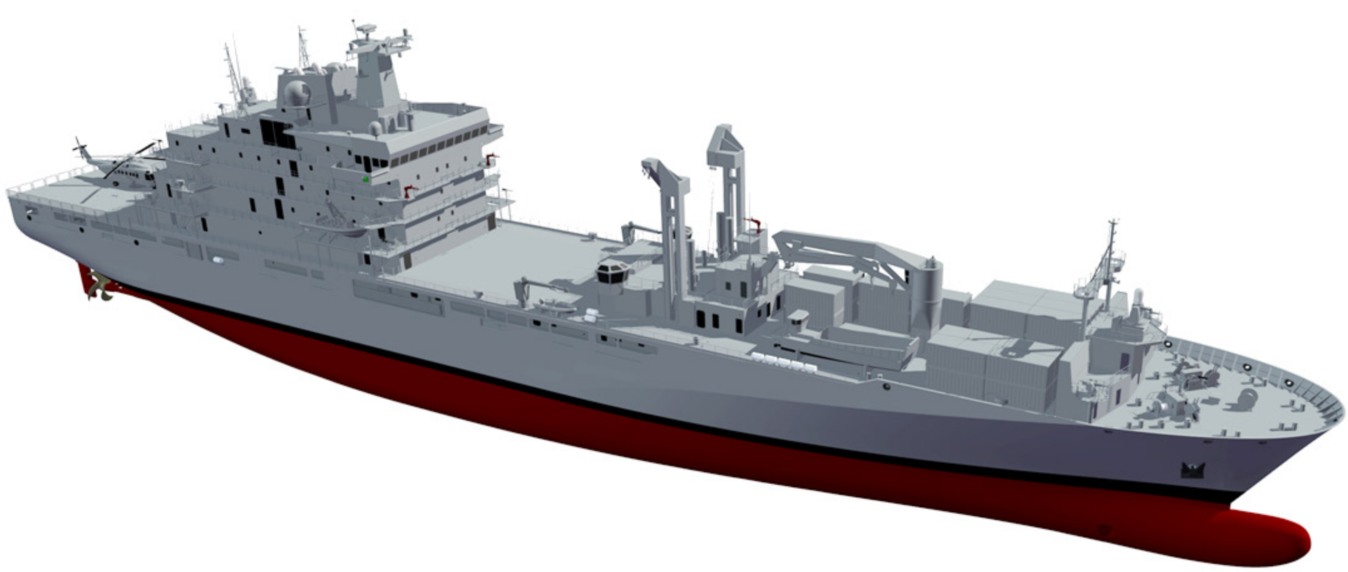
Vancouver Shipyards Co. Ltd. (VSCL) is in the process of reviewing the design in preparation for actual production. This design development work will be led by VSCL as part of the Joint Support Ship (JSS) definition contract to be negotiated between Canada and the shipyard. Once these steps are completed, Canada will acquire the required licensing for the ship design in order to build, operate and maintain the JSS. One benefit of this arrangement is the enhancement of technical skills and knowledge among Canadian shipyard staff.

ThyssenKrupp has built similar ships for the German Navy and this proven design is expected to cut implementation costs by 15 percent over a start-from-scratch plan since it reduces the risk of unexpected problems which could occur with a new design.

The main objective of the JSS project is to renew the capabilities of the two current Auxiliary Oiler Replenishment ships – HMCS *Protecteur* and HMCS *Preserver* – that are approaching the end of their service lives and need to be replaced.

A JSS is intended to increase the range and endurance of the Canadian Armed Forces by enabling naval task groups to stay at sea for long periods without obtaining provisions from ashore. It also offers the mission the flexibility to carry containerized payloads such as disaster relief supplies or portable headquarters for operations. The ships will be able to carry two CH-148 Cyclone helicopters.

The JSS will meet current and forecasted international and Canadian environmental standards in the areas of air emissions and double-hulled construction.



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PRESERVING CANADA'S NAVAL TECHNICAL HERITAGE

CNTHA NEWS

Canadian Naval Technical History Association

To fit or not to fit: Making the Case for a Command & Control System in the DDH-280

By Cdr Pat Barnhouse, RCN (Ret.)

The period 1964-1965 was a great time to be a staff officer in the Directorate of Systems Engineering (DSEng). Major shipbuilding programs were being initiated for the DDH-280 and AOR, and fundamental organizational changes were taking place in headquarters due to the early effects of integration and unification plans. DSEng, as the "link" between Director General Fighting Equipment and the rest of Chief Naval Technical Services (DG Ships, Directorate of Marine and Electrical Engineering, etc.), as well as the operational staff, gave one an unsurpassed window on all the goings-on. What follows is a description from my fading memory of one rather interesting occurrence.

DND photo by Davie Shipbuilding Limited, Lauzon, Quebec

Command & control equipment is still under cover in the operations room of HMCS *Athabaskan* (DDH-282) during construction in June 1971.

Starting with the likes of LCdr Brian Judd, LCdr Wally Lockwood and the triumverate of LCdr John Belcher, LCdr Mac Whitman and LCdr Doch MacGillivray (not to forget the pioneering work of Stan Knights with Digital Automated Tracking and Resolving – DATAR), the RCN had invested considerable effort in the development of various aspects of command and control systems (CCS). By the fall of 1964 it was already a given that the hydrofoil would have a command and control system fitted, so it seemed obvious that the recently approved "repeat *Nipigon*" – aka the DDH-280 – should be similarly equipped. Therein lay the problem.

RAdm Bob Welland was reputed to have expressed his opposition to fitting a command and control system in the 280 class, apparently stating that it was operationally unnecessary because the ASW battle was still capable of being waged successfully from the front of the bridge. I say reputed, as I have on occasion heard RAdm Welland referred to as a progressive type rather than one who dwelt in the past. In any event, it was the consensus that it would be very difficult to convince the admiral of the necessity of a CCS.

The breakthrough occurred by chance. One day in DSEng, during a visit by one of the operational staff (it might have been LCdr Dan Mainguy, or possibly LCdr Peter Traves), conversation turned to the work that was going on in NATO to adopt common message format standards for Link 11, the HF data link proposed for tactical communication between ships. Cdr Carl Ross reacted as if a light bulb had come on. He asked LCdr Jock Allan if this mode of communication for passing tactical data was proposed for NATO navies while operating together. Both Jock and the operational staff officer confirmed this was the intention. Carl then asked if a CCS would be needed to generate the required tactical data in the right format. When assured that this was the case, he said that a command and control system for the DDH-280 should be justified on this basis: simply, our ships would not be able to operate with our allies if we were not equipped to send and receive tactical data in a compatible format, and to do that a CCS was essential. Apparently, this argument won the day.

CNTHA website upgrade

We have upgraded our website to a newer version of Joomla content management software. The upgrade offers improved security and better features. The most obvious change is the new "look and feel" of the site, which we hope you will find pleasing. While we have discontinued the underused forum, we look forward to receiving your comments, suggestions and photos via our Contact Us links. Special thanks go to Jeff Wilson for his work on the upgrade.
– ***Don Wilson, webmaster***

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