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79
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Canada's Naval Technical Forum

Spring 2016

Staff College in Chile: A Once-in-a-lifetime Experience

CNTHA News Inside!

Also in this Issue:

- Forum: The Canadian Institute of Marine Engineering
- NCM Awards – Recognizing Excellence
- NTO Winter Hockey Classic – A New Tradition

Canada

Well done the gun's crew!

Photo by Cpl Stuart MacNeil, HMCS *Winnipeg*

Ship's staff and a Technical Assistance Visit team from Fleet Maintenance Facility Cape Breton changed out HMCS *Winnipeg*'s 57-mm main gun barrel in 24 hours during a rest and maintenance period in Toulon, France last November.

see News Brief page 15

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Maritime Engineering Journal

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Commodore's Corner

Forum/Letters

Feature Articles

News Briefs

CNTHA News

LCdr Amit Bagga described his year-long staff college program at the *Academia de Guerra Naval* in Valparaíso, Chile as a personally rewarding and professionally satisfying experience.

Photo courtesy LCdr Amit Bagga

Current and past issues of the *Journal* are available online at the website of the Canadian Naval Technical History Association – www.cntha.ca

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Commodore's Corner

By Commodore Simon Page, OMM, CD

Naval Engineering and Program Management with a Focus on Performance

As the HCM-FELEX project continues to progress soundly, and at-sea achievements by our modernized frigates accumulate, I can't help but think it is becoming imperative that the naval materiel enterprise enhance the value of platform and system performance in its management approach, and in the execution of the naval materiel support plan as a whole.

HMCS *Montréal*'s participation in an at-sea demonstration last fall reminds us that, ultimately, the key purpose of the naval materiel enterprise is to generate readiness at sea. Under the Maritime Theatre Missile Defence Forum, an international group that strives to enhance maritime integrated air and missile defence capabilities within a coalition, *Montréal* (FFH-336) superbly displayed many assets of her modernized combat systems suite, and successfully completed all aspects of her mission. Not too long ago, HMCS *Windsor* (SSK-877), operating under a rigid materiel assurance system, was also achieving remarkable operational and strategic success for the Royal Canadian Navy and the Canadian Armed Forces.

Through the Maritime Equipment Program Management (MEPM) Strategic Initiative (MSI), the integrated program management thrust brought superb rigor and consistency to the way the overall equipment program management is executed within the MEPM division. A hierarchy of plans, from the Through-Life Management Plans and culminating with the comprehensive Materiel Equipment Program Plan (MEPP), captures all aspects of the program including schedules, milestones, costs, resources and risks. Perhaps lost in the intricacies and convolutions of such plans however is the fundamental element of performance.

Interestingly, the Naval Materiel Assurance (NMA) thrust of MSI within a larger Naval Materiel Management System context introduces an emphasis on our roles as

RCN photo by John Clevett
Inset photo by RCN

HMCS *Montréal* launches two Evolved Sea Sparrow (ESSM) surface-to-air missiles off the west coast of Scotland as part of a multinational network interoperability "At Sea Demonstration" last October with the Maritime Theatre Missile Defence Forum.

design and system authorities. The NMA thrust has taught us to ensure our platforms, equipment and systems are safe to operate, environmentally compliant, and fit-for-purpose – in the end, *performant*. It is time for the naval materiel management enterprise to increase its focus on performance from both a platform and system perspective.

Our platforms in-being are aging and some of our marine systems need particular attention. Similarly, the systems making up the new *Halifax*-class combat systems suite will need close monitoring to ensure specifications are met until end of life. Initiatives and governance programs such as Supportability, Reliability, Availability and Maintainability (SRAM), the Signature Management Working Group, and the Energy Efficiency Working Group will need to be more at the forefront of our activities and preoccupations.

One of the key objectives of the SRAM program within the submarine program is to avoid lost sea days – undoubtedly a variable that should matter to all us in MEPM. The tool will examine many elements such as operational deficiencies, high-priority material requests, unsatisfactory condition reports, and root cause investigations, and produce a performance dashboard that will enable the anticipation of key problems, the dynamic resolution of key issues, and the optimization of readiness. When an asset comes back from a deployment, all elements associated with performance should be examined so that improvements can be introduced before the next deployment. Other forums such as the Naval Architecture Technical Meetings will further bring value to the platform performance domain by focusing on fundamental yet vital items such as structures, corrosion and fatigue.

As engineers we are, and remain, technical and design authorities responsible for all aspects of the RCN's assets including how well our naval systems perform at sea. We need to be in a position to assess, predict and track performance with a view to anticipating problems and issues before they arise and become difficult to manage and resolve. The same way MEPM conducts a series of Maritime Equipment Program boards to ensure the proper execution and management of the MEPP, a new series of boards focusing on asset performance at sea will be initiated in fiscal year 2016-2017. This will also introduce a more relevant liaison between MPEM and the Directorate of Naval Requirements (DNR) that is focused on ensuring all warfare capabilities are properly addressed and managed throughout a platform's life.

When all is said and done, monitoring and studying the performance of our platforms and systems will enable the MEPM division to support the RCN in a more effective manner, especially as we introduce new classes and support older ones. It should be fundamental to what we are doing.

Geoff Simpson – DM/CDS Leadership Award

The director of the Halifax-Class Modernization/Frigate Life Extension (HCM/FELEX) project, **Geoff Simpson**, has been recognized as a leader who exemplifies visioning and strategy skills, and has achieved outstanding results in meeting defence priorities.

These qualities are the criteria used in selecting the recipient of the Deputy Minister/Chief of the Defence Staff Award for Management Excellence – Leadership Category. Mr. Simpson was presented his award by General Jonathan (Jon) Vance, Chief of the Defence Staff, and John Forster, Deputy Minister of the Department of National Defence.

The HCM/FELEX initiative consisted of more than 150 individual engineering projects that required oversight, integration and effective implementation. Mr. Simpson's exceptional leadership, dedication and professionalism shaped the success of the highly-complex $4.3 billion modernization program.

In December 2014, HMCS *Fredericton* deployed as the first modernized frigate from the program in support of Operation Reassurance, demonstrating the return to superb operational effectiveness. It was pointed out that this deployment spoke very highly of Mr. Simpson and his team's impressive performance in transforming the *Halifax*-class frigates to continue to be world-class and modernized naval assets for the RCN and the Government of Canada.

Mr. Simpson was praised for exhibiting rare leadership performance to the highest of professional standards in delivering a unique and essential maritime capability.

FORUM

The Canadian Institute of Marine Engineering

The Institute for Canada's Naval Engineers and Technologists

By Don Wilson, Captain RCN (Ret'd), CD, P.Eng., FCIMarE

It's probably a fact that we are all members of associations of one kind or another, whether they be provincial regulatory bodies or learned societies. We belong to the one or ones that best suit our needs, or provide the social or professional contacts we desire. The aim of the Canadian Institute of Marine Engineering (CIMarE) is to identify and support the needs and aspirations of Canadian engineers and technologists working in the marine field. The Institute provides a vehicle to advance marine engineering in Canada.

CIMarE was formed in 1976 to provide an organization with a truly Canadian focus, independent of its UK-based predecessor, the Institute of Marine Engineering (IMarE). We will celebrate our 40th anniversary in 2016 with seven regional branches and more than 400 members on our roll.

In 1978 the National Council of CIMarE began acknowledging excellence in naval engineering by awarding prizes to DND's top Marine Systems Engineering Certificate of Competency (Part I and Part II) candidates. The following year the CIMarE began holding annual technical conferences known as *Mari-Tech*, hosted first by the Atlantic Branch in Halifax. In 2012 the Ottawa Branch hosted a very successful *Mari-Tech* in partnership with the Eastern Canada Section of the Society of Naval Architects and Marine Engineers (SNAME). The event was attended and supported by a strong contingent of Ottawa-based RCN engineers, along with many representatives of major marine equipment and other support industries.

Depending upon their specialties, naval engineers are in an excellent position to seek membership in a variety of marine-oriented associations including: the Society of Naval Architects and Marine Engineers (SNAME); the American Society of Naval Engineers (ASNE); the Institute of Electrical and Electronics Engineers (IEEE); the Institute of Marine Engineering, Science and Technology (UK) (IMarEST); and the Canadian Institute of Marine Engineering (CIMarE).

While most of these groups cater to one particular branch of engineering, membership in CIMarE exposes marine engineers *and* technologists to papers covering a wide range of marine technical topics, authored by a diverse field of RCN, government and private industry marine professionals. Apart from creating an opportunity to broaden one's horizons generally, CIMarE offers refreshing opportunities for members to interact professionally outside of the work situation – something that is crucial to ongoing work satisfaction and organizational excellence. For RCN engineers and technologists, and others, the Institute offers one more avenue for continuing professional education. Members have exclusive access to technical presentations and publications, a members list with some contact information, and the *Marine Engineering Digest* (*MED*) – a publication that has taken several forms since its inception in 1980 as a means of communicating with members.

Visitors to the revamped (2012) CIMarE website www.cimare.ca will find information about our governance, objectives, scholarships and awards, and branch-sponsored events. The website also links to the popular Mari-Tech website www.mari-tech.org that provides information on our upcoming conference in St. John's, NL (May 5-6, 2016), and access to the proceedings – the technical presentations – from previous years.

With seven very active branches across the country there is a CIMarE branch close by the majority of marine technical workplaces in Canada. We hope you will go online to explore what we have to offer, and then get out to one of our meetings or conferences. If, as we think, you find the experience professionally rewarding, we would look forward to welcoming you as a new or returning member of the Canadian Institute of Marine Engineering.

Letters to the Editor

[Editor's Note: The following letter was originally sent as an email message to Commodore Simon Page, DGMEPM. It has been edited with permission for use in the *Journal*.]

"Picture on the cover of the Rolling Stone..."

Simon:

I was most excited to see laser additive manufacturing (LAM) featured in the last issue of the *Maritime Engineering Journal*. LAM is a very exciting initiative, and a forward-looking technology-based demonstrator that has my full support. I continue to lead outreach with industry to seek partnership for the technology's acceptance into mainstream manufacturing, for innovative LAM solutions, and for standards development.

Your *Maritime Engineering Journal* has survived the test of time and budget pressures, and has sustained its sense of purpose for the engineering community and ship drivers alike. I just love it, and like you have spent my career reading it. I imagine you were likely inspired by the leaders of the naval engineering community whose names appeared where yours does now in the magazine, and by the decisions they took to ensure the readiness of engineering and maintenance in the RCN.

The *Journal* clearly contributes to pride in our respective professions as it keeps us informed on the exciting endeavours of naval engineers and technicians, and on the unending materiel challenges of a modern navy. Congratulations, and thanks to everyone for all that is being done in MEPM.

Fond regards,

Rear Admiral John F. Newton, Commander, Maritime Forces Atlantic and Joint Task Force Atlantic

Sir,

The photos in Issue Number 78 showing the last ASROC mounting being moved to Ottawa brought back memories. As a General List sub-lieutenant with an engineering background, I was sent to the U.S. Navy's Great Lakes Naval Training Center Gunner's Mate School in Northern Illinois to learn about the ASROC system in the fall of 1966.

From there I went to the DMCS 3 sonar section of the Directorate of Maritime Combat Systems at National Defence Headquarters to learn about sonar, and to work on interfacing the ASROC. After that I was off to the Naval Armaments Depot in Dartmouth, Nova Scotia to put together the first ASROC mount, install it on board HMCS *Terra Nova* (IRE-259), and make it work with the first digital computer we sent to sea, the UYK-501. (That same UYK-501 is now in my basement. Sadly, I was not able to fit in an ASROC mount.)

I guess the folks at NDHQ had an inkling we needed engineers for this type of work, as I was the guinea pig for what became the RCN's combat systems engineer – the CSE. I pushed the button to fire the first ASROC missile off Halifax, and thence several others on the missile range off St. Croix, U.S. Virgin Islands. USN systems were analogue and we proved that it was possible to drive a missile launcher through direct digital drive. When our test results did not agree with the range solution they of course assumed it was our system that was in error. Hours of 'discussion' allowed us to demonstrate we were correct and that every USN ASROC-equipped ship in their fleet would need to be corrected.

Yours aye,

Jim Carruthers

[Editor's Note: Jim is being persuaded to pull that old UYK-501 out of cold storage for a mentorship event where he can share his story of computers, networks and innovation.]

FEATURE ARTICLE

Staff College in Chile: A Once-in-a-lifetime Experience

By LCdr Amit Bagga

Photos courtesy La Academia de Guerra Naval, and the author

Crawling through the Chilean warship *Huáscar*, one of the oldest floating museums in the world, one stands in awe at the passage of time. With its massive turreted 10-inch 300-pounder guns, two-inch-thick main deck, and 4.5 inches of wrought iron side armour, the ironclad is a sight to be reckoned with. Bought by the Peruvian Navy from England in 1864, it was the site of a pivotal turning point in the Chile-Peru-Bolivia saltpetre conflict, also known as the War of the Pacific.

Precisely 138 years before my 2014 visit, the *Huáscar*, then under Peruvian command, was embroiled in a ruthless naval blockade war, laying siege to Chile's ports over several weeks, cutting off supplies and thus slowing the advance of the land war. At the height of a fierce confrontation between the *Huáscar* and the Chilean wooden-hulled corvette *Esmeralda*, the legendary Chilean national hero Commander Arturo Prat performed a valiant and self-sacrificing attempt at boarding the assailing *Huáscar*. With sword raised, he issued his famous final order to *Esmeralda*'s company: "Let's board, boys!", and advanced toward the *Huáscar*'s command tower before being fatally wounded by defensive fire. While Prat never succeeded in his attempt to commandeer the *Huáscar*, his bravery and valour under fire inspired a generation of naval officers and stirred an entire nation to turn the tide of the four-year-long war. Ultimately, Chile captured the *Huáscar* and won its prized northern territory, setting the stage for a century-and-a-half of significant global growth based on

mineral exports the world over. As a foreign student commencing naval war college in Chile, it was exciting to ponder that the gallantry, fearlessness and resolve that the legendary Arturo Prat showed aboard the *Huáscar* would resound in the numerous lessons in naval history and strategy that I would learn during the course of the year.

Whether it was visiting the monumental ironclad *Huáscar*, traversing Cape Horn, or tracing the nautical steps of HMS *Beagle* aboard the Chilean naval ship *Aquiles*, staff college at the *Academia de Guerra Naval* in Valparaíso had the makings of an incredible naval dream. Armed with eight months of intense Spanish language training, I felt ready to navigate the demanding third-language challenge of rigorous class participation and syndicate sessions that I had been warned about. Nevertheless, the most appealing aspects of this busy year were not the endless readings, formal presentations or comprehensive essays in Spanish, but rather the development of friendships and rewarding professional experiences I will cherish for a lifetime. The Chilean reception was warm and genuine, resulting in a productive and rewarding exchange of ideas and cultures.

Visiting the farthest southern reaches of the Americas, you wouldn't expect to be arriving at an origin of our world's global commerce, but to the surprise of many visitors Valparaíso is a UNESCO world heritage site marking the very earliest phases of international globalization. Well before construction of the Panama Canal, Valparaíso, and to a lesser extent other Chilean ports, were the last stops for ships daring to make the precarious southern transit from the Pacific to the Atlantic and onward to Europe. Maintaining its status as a free port, Valparaíso grew to become one of the most important trade points in South America, transforming the city into an open economic zone that to this day supports Chile's global strategy on free trade policies. This vibrant economic reality is the pinnacle of the diplomatic links that Chile maintains with Canada, and coincidentally is also the foundation of our Americas focus as expressed in our global engagement and strategic documents. Maintaining a business-friendly and low-corruption environment, Chile has become a natural operating environment for Canadian commerce across several industries. In many cases companies have chosen to establish themselves in Chile as a starting point before expanding their trade interests to other economic bases in South America. As quickly became apparent, my very presence as a Canadian naval officer on exchange in Chile underpinned the importance of the vital maritime interests that preserve and secure Canada's strategic, economic and political interests in the region.

With Chile being a seismically active country, the shipyard in Talcahuano was the site of a cataclysmic magnitude 9.0 earthquake in February 2010. The enormous energy released, equivalent to 238 megatons of TNT, literally tossed massive ships like the 26,800-ton M/V Laurel ashore

LCdr Amit Bagga receives his diploma from Chilean Defence Minister Jorge Burgos (left); and with his Chilean sponsor Capitán de Corbeta Felipe Diaz Torres (right).

like plastic toys, and caused overall damage in the order of 15-30 billion USD. During an in-depth and memorable tour of the Chilean navy's primary naval maintenance and construction facility, the war college students were treated to a first-hand look at the incredible devastation that a tsunami event can impart on a shipyard and, at the same time, we gained valuable insight into the technical ingenuity and perseverance required to restore the devastated facilities. The Talcahuano shipyard completed some incredibly complex and dangerous engineering feats to return the shipyard to working order, effectively leaping back to an operational state that was far superior to the original. From the perspective of an engineer at staff college, the recovery of vessels and reestablishment of engineering operations to achieve the strategic effect of reinvigorating a shipbuilding industry was possibly the most fascinating of all operational lessons. Ultimately, the momentous events of 2010 not only brought about necessary and significant social changes, but also resulted in a complete revamping of the country's disaster response processes which were subsequently brought under naval staff control as part of their Maritime Rescue Coordination Centres. Undoubtedly, disaster response will develop into another important area of bilateral cooperation and sharing of lessons learned between Canada and Chile.

While the Chilean staff college syllabus had many parallels with our Joint Command and Staff College in areas of operational analysis, security studies and war gaming, as a naval academy the importance of maritime influence and control was particularly central in syndicate discussions and was fundamental to effective strategic thought. In particular, the evolving importance of the Pacific Ocean in the 21st century in terms of global trade, political strategy and soft power influence played a pivotal role in the development of strategic themes. In many cases, security study discussion groups hosted by various forums such as the Asia Pacific Center for Security Studies resulted in particularly energetic debates on core ideas and permitted valuable sharing of perspectives and contrasting opinions from naval officers originating from different navies with unique experiences. It was no surprise that the Chilean officers, whose country has the longest vertical coastline bordering the Pacific Ocean, would view the topics of naval power in the Pacific as particularly salient and essential to the long-term economic prosperity and security of their country.

The 151-year-old memorial ironclad *Huáscar* at the Chilean naval base in Talcahuano (Concepción) 500 km southwest of the capital city Santiago survived a 2010 tsunami unscathed.

Beyond the Pacific, mutual geopolitical interests between Canada and Chile extend in parallel to exerting influence over our respective polar regions. Cape Horn, Chile's southernmost island, is separated from Antarctica by less than 450 nautical miles directly across the Drake Passage. While the Antarctic treaty prevents claims of sovereignty, naval presence in the polar regions has become increasingly vital as more than 30 countries have set up permanent bases on the continent, and the recent increase in tourism has raised the frequency of SAR missions considerably. The importance of Chile's southern frontier was especially emphasized during a week-long joint course excursion to the region. During this time the 125 joint national and foreign students sailed aboard the amphibious ship *Aquiles* through the Strait of Magellan and Beagle Channel. Designed to bolster camaraderie and long-term professional and personal friendships, it was the high point of joint classes that were conducted periodically during the year to develop better understanding of joint operations in a combined setting.

Looking to the future, there are certainly many opportunities to build further cooperation between Canada and Chile, most notably in the areas of industrial partnerships and interoperability. The recently signed Multi-level Service Agreement via the Canadian Commerce Corporation (CCC) introduces new lines of collaboration. In the near term, the CCC will permit a Chilean resupply

ship to operate alongside our Pacific fleet, and in the longer term open up opportunities to develop greater mutual ties in operations, training and force generation.

Chile's interest in the Halifax Class Modernization combat system integrator solution culminated with a recent visit by their director of programs, research and development, Admiral Cristián Ramos Pérez, to Halifax to tour Lockheed Martin's training and test site. This was a unique opportunity for me to work with the Chileans once again, bridging the linguistic barrier and offering some naval technical advice in the mix. The Chilean delegation was highly impressed with a demonstration of the modernized combat management system they witnessed in the trainer, and with a high-level tour of the hardware upgrades recently trialed in HMCS *Charlottetown*.

In summary, a year at the *Academia de Guerra Naval* was a tremendously rewarding and satisfying experience both professionally and personally. As a close military ally, Chile shares much in common with Canada, and the opportunities for future economic, diplomatic and security cooperation are substantial. The warm hospitality extended to foreign members ensured that families were well taken care of and included wherever possible in excursions and social activities. I would certainly recommend this posting to other officers looking to extend their 'nautical reach' to the south, and enhance their professional and linguistic skills.

LCdr Bagga is the combat systems test and trials coordinator for the Halifax Class Modernization project in Ottawa. His 2014 thesis on "Canadian bilateral relations with Chile" led to a master's degree in Naval and Maritime Strategic Studies. LCdr Bagga received the top foreign student award for achieving the highest standing overall among international officers attending the Academia de Guerra Naval in 2014.

The author (second from right) achieved the highest academic standing among all international students (pictured).

FEATURE ARTICLE

Foreign Port Change-out of HMCS *Athabaskan*'s Starboard Cruise Gas Turbine Engine

By Lt(N) Lisa Shields, MSEO

Illustrations by PO2 Mike McLaughlan, EOOW

On Sept. 28 2015, while deployed in preparation for exercise Joint Warrior off the west coast of Europe, Her Majesty's Canadian Ship *Athabaskan* (DDG-282) experienced a failure of the starboard cruise gas-turbine engine. This article describes the failure and resultant engine change-out in a foreign port.

Iroquois-class Main Propulsion

The *Iroquois*-class propulsion plant is a COGOG (combined gas turbine or gas turbine) arrangement, consisting of two FT4 Pratt & Whitney main engines and two K570 Allison cruise engines. One main or one cruise engine can drive each shaftline. Normally, the plant is configured so as to be driving on two shafts and, depending on the required speed-of-advance, will use one of the following drive modes:

- Two main engines – full power at 27.5 kts
- Two cruise engines – maximum speed at 18 kts
- Mixed engines

In addition, the ship can be driven on a single shaft with the second shaft either locked, trailed, or dragged.

The Failure

On the evening of Sept. 28, *Athabaskan* was driving on both cruise engines when a lubricating oil low-pressure alarm was triggered on the starboard cruise engine. The engineering officer of the watch (EOOW) stopped both shafts and tripped the engine. The subsequent investigation discovered metallic particulate in the lubricating oil strainers. Ship staff removed the starter and attempted to manually rotate the accessory gearbox and consequently the engine. With even the minimal resistance encountered, it was clear the gearbox was not rotating the engine.

At first the damage was thought to be localized to the gear meshes within the accessory gearbox, which meant that only the gearbox would have to be replaced. However, after boroscoping the engine it looked as if there had been

a failure of the tower shaft that connects the gearbox to the engine's main rotor. When the accessory gearbox was removed the next day it was determined that the tower shaft (Figure 1) had indeed sheared in half, and significant debris was discovered in the upper cavity.

It is believed that the cause of the shear was a failure of the upper tower shaft bearing, which allowed the axial thrust from the N1 bevel gear to be transferred through the tower shaft bevel gear to the tower shaft. The repetitive axial thrust eventually caused the tower shaft to shear. *Athabaskan* had previously experienced failure of the electrical solenoid valve which activates during motoring or start-up/shut-down, and allows synthetic lubricating oil to flow from the header tank to the engine. Failure of this valve would have allowed the engine to rotate without lubricating oil, potentially causing the bearing failure.

Despite the best efforts of the ship's engineering department, it was not possible to remove the upper section of the tower shaft. After several overseas conversations with Engineering Operations (N37), the Formation Technical Officer, and Fleet Maintenance Facility (FMF) Cape Scott machinery inspector John Redman in Halifax, it was determined, on Sept. 30, that the best course of action would be to change-out the engine. What was clear was that *Athabaskan* would need expert assistance to execute the change-out, as quickly as possible, to allow the ship to resume its operational program with a minimum of delay.

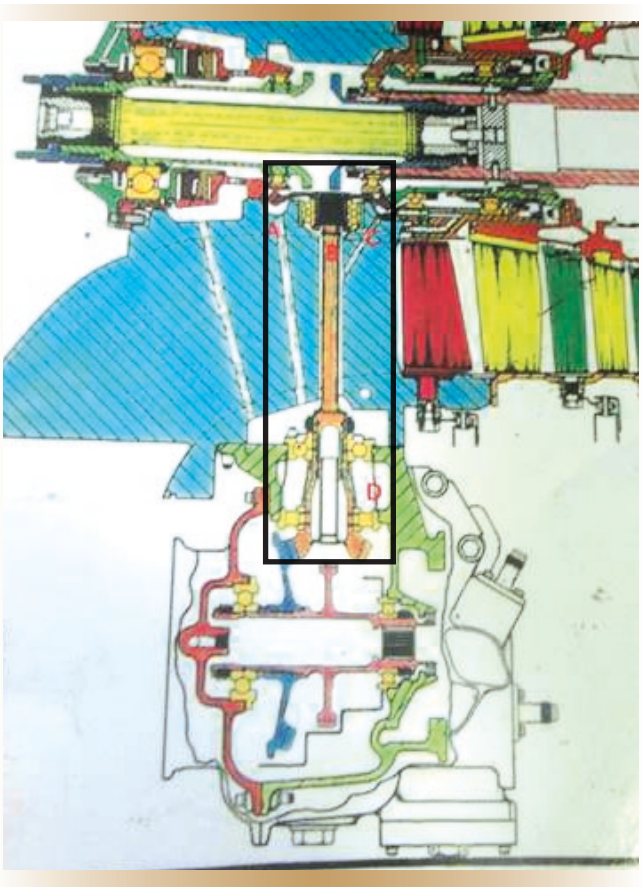


Figure 1. Location of tower shaft between the accessory gearbox and the engine shaft.

Planning for the Technical Assistance Visit (TAV)

Once the request for technical assistance was made, everything moved very quickly. FMF support from ashore was outstanding. The Cape Scott team immediately got to work getting the replacement engine and required tools ready for shipment to ensure everything would be available upon our arrival in Portsmouth, England. On Oct. 2, just four days after the engine failure, a total of 2286 kg of equipment was dispatched from Halifax to the U.K. Included were the replacement cruise engine, lifting beam (Figure 2), travel cart, lifting appliance and other tools. The ship's logistics department, ever ready to assist, put together our logistics requirements (LOGREQ) request for services at the naval base at Portsmouth, and put in place a contract for plywood, staging, tarps, crane services, and other things we would need to effect the change-out.

Athabaskan detached from the task group on Oct. 5, and arrived in Portsmouth at 1500 on Oct. 7. This was not a moment too soon as there was much work to do to prepare for the FMF team's arrival at 0800 the next day to start work. Ship's staff immediately began disconnecting, labeling and tagging all of the Integrated Machinery Control System (IMCS) connections to the engine, and removing all interference items such as guard rails, the enclosure firewall, fans, and lagging. The small intake door

Figure 2. Installing the lifting beam.

in the main machinery room was removed, and the inlet was covered with a tarp. The bypass doors were opened, and the foreign object damage (FOD) screens removed. Plywood work platforms were cut to size and installed on top of the splitters.

Athabaskan had been met upon arrival by the local company it contracted to build the staging inside the intakes, and it was quickly determined that tube-and-fitting type staging would be the best choice. The staging and lifting bar would be installed first thing the next morning. Later that night there was a very welcome sight on the jetty: our new engine had arrived. At this point, all *Athabaskan* could do was wait for the arrival of the FMF workers in the morning.

The TAV

The multidisciplinary TAV group converging on *Athabaskan* comprised a factory service representative (FSR) from Allison Gas Turbines in California, and an 11-member team from FMF Cape Scott consisting of three riggers, three gas turbine technicians, two personnel each from the plate and sheet metal shops, and a supervisor.

On Oct. 8, the FMF team got to work removing the splitters from the intakes using a pneumatically operated chain hoist attached to the lifting beam. A severe leak of ship-supplied low-pressure (LP) air caused by excessive water in the system due to a failure of the LP air dryers was easily solved by switching to a shore supply of LP air before unbolting the splitters and lifting them out.

The next steps were to install the diffuser cone counterweights, and disconnect the engine from the auxiliary gearbox by removing the output shaft and Nortesco seal. Once the splitters were out of the way the heavy lifting could begin. On Oct. 9 the lifting arm and swivel arm (Figure 3) were bolted onto the enclosure and the engine was disconnected from its mounts. The intake patch was removed. A minor difficulty occurred when it came time to remove the diffuser cone (Figure 4) as the existing weld on the bracket was not secure and had to be redone. Luckily *Athabaskan* had on its staff an expert welder. The counterweights were removed and the weld was repaired .

Finally it was time to remove the engine from the enclosure. Through careful rigging the engine was moved over to the base of the intakes and, with lifting caps bolted on, smoothly removed up through the intakes and out the bypass door (Figure 5).

Figure 3. A swivel arm was rigged to manoeuvre the engine in the confined machinery space.

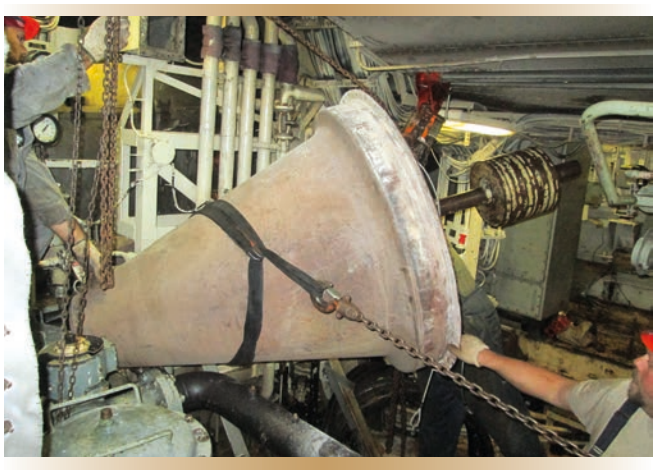


Figure 4. Removing the diffuser cone.

Figure 5. Removing the engine through the bypass doors.

Figure 6. Exchanging connections from the old engine to the new.

Figure 7. PO2 Boz welds the exhaust diffuser.

Figure 8. The new engine is eased carefully into the enclosure.

On Oct. 10, after swapping over the auxiliary connections (Figure 6), the new engine was ready to be rigged down, but just as we were about to install the engine in the enclosure a major deficiency was discovered – a crack running 90 percent of the way around the exhaust diffuser. The same diffuser is reused each time an engine is changed out, so it is quite likely this particular item had undergone years of repetitive thermal cycling leading to the failure. This had to be rectified immediately as there was no time for delay in the schedule. The Allison FSR would be showing up in two days to align the engine, and without the diffuser in place to act as the engine's counterweight the alignment would be incorrect. Again the hull techs came to the rescue, quickly welding up the crack (Figure 7) and allowing the project to progress on schedule.

The new engine (Figure 8) was finally installed on the mounts, and the exhaust diffuser and diffuser cone were connected. Russ Brown, the Allison FSR, worked diligently with the team to align the engine and ensure that the alignment between the engine output and the gearbox was absolutely straight (Figure 9). Any imbalance between the two would cause excessive vibration and eventual catastrophic failure at the rotational speeds achieved by the engine's maximum 12 500 rpm. After a long day's work the engine alignment was finally completed within specification, and with that done the crew could begin putting the enclosure back together and reconnecting to the IMCS.

With the next day, Oct. 13, came the moment all had been waiting for. With a machinery control room full of nervous engineers, the ship attempted the first dry-motoring cycle of the starboard cruise engine. The sound of the engine spooling up smoothly was met with sighs of relief and smiles on everyone's face. The second dry-motoring lasted a full minute, and again all went well. The only thing left to do was to conduct a full flash-up of the engine. The engine was brought to idle and then to ignition speed. Success!

Athabaskan conducted a basin trial the next day to prove that the engine would flash, turn shafts, and accept and relinquish power. Everything went smoothly, and with a successful basin trial behind us it was time to say goodbye to our FMF team (Figure 10). *Athabaskan* was ready to go to sea to complete a dynamic compressor variable geometry (CVG) calibration, and then a full-power trial. On Oct. 15, immediately upon securing special sea

dutymen, the call came down from the bridge to start the power trial. Thanks to some great intradepartmental cooperation between one of the electricians, an IMCS technician, and a couple of engineers, the CVG was quickly completed, allowing the full-power trial to proceed without issue. *Athabaskan* once again had two fully operational cruise engines.

Conclusion

The success of this TAV was due in large part to the teamwork displayed by the marine systems engineering department working hand-in-hand with the FMF Cape Scott team and other shore support. The success of this experience was a testament to the capability of the engineering community as a whole, and could not have been accomplished without the support and hard work of all who were involved at every level.

Figure 9. Allison Gas Turbines FSR Russ Brown ensured the alignment between the engine output and the gearbox was absolutely straight.

Figure 10. A job well done. The FMF Cape Scott team with members of the ship's company.

FEATURE ARTICLE

HMCS *Winnipeg* 57-mm gun barrel replacement in Toulon

By Lt(N) Dusan Brestovansky and Petty Officer 2nd Class Shaun O'Neil

Photo by LS Ogle Henry, HMCS *Winnipeg*

Since departing home port of Esquimalt B.C. in June 2015, HMCS *Winnipeg* (FFH-338) had a long and interesting eight-month-long deployment on Operation Reassurance, Canada's support to NATO assurance measures in central and eastern Europe.

Last August, *Winnipeg* joined Standing Naval Maritime Group One, a NATO task group consisting of high-readiness maritime units ready to assist allied nations as required. Over the next few months the ship participated in three major multinational exercises, including Exercise Trident Juncture, the largest NATO exercise in more than 20 years.

Following these intense, around-the-clock exercises *Winnipeg* took time out from operations to conduct a rest and maintenance period (RAMP) during a port visit to Toulon, France in November. The RAMP is a time set aside during major deployments to conduct repairs and maintenance on the ship, and give the crew a brief respite.

One of the scheduled repairs was the replacement of the gun barrel of the ship's Swedish-made 57-mm Bofors naval gun system, a weapon used by several navies, including those of the United States, Sweden and Mexico. Given *Winnipeg*'s operations in the Mediterranean Sea, and the number of rounds fired in training, it was imperative that the equipment be refreshed.

Photo by Cpl Stuart MacNeil, HMCS *Winnipeg*.

Weapons engineering technicians LS Connor Nijsse and MS Michael Stone remove the muzzle break from the gun in preparation for removing the barrel.

A decision was made to replace the barrel to maintain the serviceability and reliability of the gun, while also completing the normal periodic Inspection of Naval Ordnance (INO) routine. The INO is conducted to ensure the gun remains safe to operate, and to identify any defects early before they become problematic. The barrel-replacement work would be performed by a combination of *Winnipeg*'s armament technicians, and a Technical Assistance Visit (TAV) team consisting of two technicians from Fleet Maintenance Facility Cape Breton (FMFCB) in Esquimalt.

Preparations for the work started about a month before the TAV team was due to arrive in Toulon on November 13. Detailed planning was critical to striking an important balance between work and rest to ensure the crew was ready to complete the final portion of the deployment.

After *Winnipeg* liaised with FMF Engineering, production teams and the Lifecycle Materiel Manager (LCMM), a barrel replacement plan began to take shape. All aspects of the work had to be researched ahead of time, including delivery and customs clearances, special tools needed for the replacement, availability of a crane, and availability of the FMF subject matter experts.

The next step was to ship the replacement barrel on the scheduled sustainment flight from Canada to France. This flight, organized by the ship's Logistics department and the forward logistics support team, would be delivering the various spare parts and other items required to sustain the ship over its long deployment. This was no small feat, as three truckloads of spare parts had to be cleared through several levels of customs and inspections.

With the FMF TAV team and all of the necessary equipment in place in Toulon, the replacement barrel was craned onto the fo'c'sle so that work could begin. Universal hand signals overcame any language issues with the local crane operator.

The first task was to remove the packing grease from the new barrel, followed by a thorough cleaning and sponging. The plug bore gauge was then passed through the barrel to ensure the correct clearance for a projectile. Grease was applied to the recoil spring and the breech side of the new barrel.

Next, using the crane to support the weight of the barrel that was being removed, *Winnipeg*'s techs and the TAV team carefully rotated the old barrel to the unlocked position, then used an extractor tool to pry it away from the breech casing and free of the gun. The barrel was lowered onto a homemade cradle, and without much delay the sling was wrapped around the new barrel and the crane operator

Photo by Cpl Stuart MacNeil, HMCS *Winnipeg*.

Careful preparation was the key to success. WENG technicians remove the rammer (left) and gun camera (right).

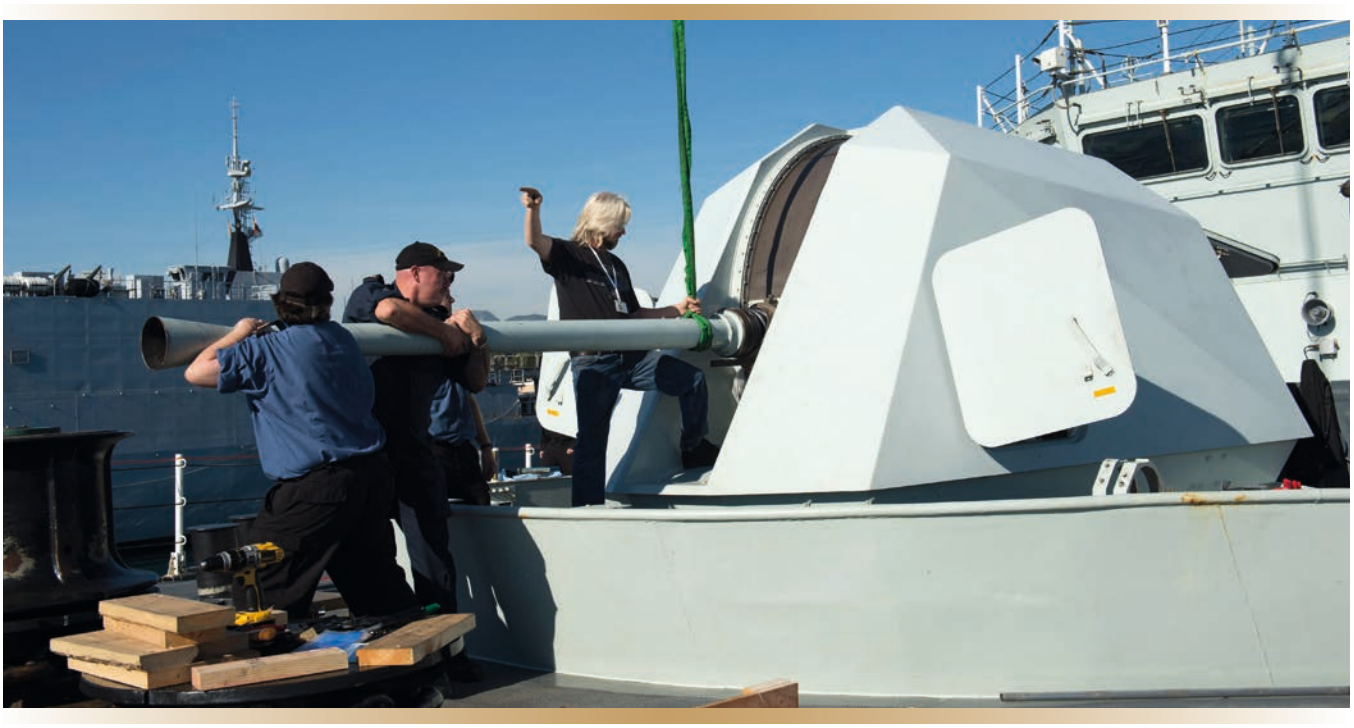


Photo by Cpl Stuart MacNeil, HMCS *Winnipeg*.

Members of HMCS *Winnipeg*'s weapons engineering department work with an employee from FMF Cape Breton to install the new gun barrel.

was given the go-ahead to begin lifting. The techs manoeuvred the new barrel manually into position, then used the extractor tool to rotate the barrel a quarter turn, locking it into position.

A few finishing touches completed the job. The flame guard was installed on the new barrel, and the weather-proofing was put in place around the base to protect against water ingress and premature rusting. The muzzle-velocity radar and gun camera were then reinstalled. FMF techs inspected the breech mechanism and associated parts (the rammer and the shift tongue), and these were reinstalled.

Using a headspace gauge, the FMF techs ensured the space between the breech face and the end of the barrel was within tolerance.

After craning the old barrel off the ship and cleaning the work site, HMCS *Winnipeg* had a brand new 57-mm gun barrel ready to go. With no major issues or delays, the job was completed within one day. That this was accomplished on the opposite side of the world from *Winnipeg*'s home port was a testament to what can be achieved through excellent coordination between ship's staff and Fleet Maintenance Facility personnel.

Lt(N) Dusan Brestovansky is the CSE Assistant Head of Department on board HMCS Winnipeg. *PO2 Shaun O'Neil is* Winnipeg*'s Senior Armament Technician.*

Photo by Cpl Stuart MacNeil, HMCS *Winnipeg*.

Search goes on for cause of 57-mm gun barrel fouling

By Lt(N) Craig Newman, MSc

Photo by LF Ogle Henry, HMCS *Winnipeg*.

The problem of 57-mm gun barrel fouling was raised during the most recent Technical Working Group (TWG) session this past November in Esquimalt, BC.

The TWG, an international forum for cooperation between the 57-mm gun original equipment manufacturer, BAE Systems/Bofors, and users of the weapon, heard from RCN personnel about concerns with excessive copper deposits after firing blind-loaded/plugged (BL/P) ammunition. Recently, Fleet Maintenance Facility Cape Breton (FMFCB) raised an unsatisfactory condition report to improve awareness within the Director General Maritime Equipment Program Management (DGMEPM) and the Director Ammunition and Explosives Management and Engineering (DAEME) of concerns about copper deposits on the barrel lands – the raised segments of the barrel rifling.

Anecdotal evidence suggests that one potential cause of the excessive coppering is the composition of the BL/P driving band – the band of soft metal around the widest part of the shell that engages with the barrel rifling. The driving bands manufactured in Canada differ slightly in composition from those of the original ammunition design. That being said, there are many factors inherent to the ammunition, the weapon, and the environment that could cause or contribute to the problem. These include ammunition propellant composition, barrel wear, progressive barrel rifling, salvo size, barrel damage from abrasive cleaning tools and chemicals, and the time elapsed between firing the gun and conducting maintenance.

It is interesting to note that this issue has not been observed by several other users of the weapon, such as the Swedish and Finnish navies, which do not use a plug bore gauge. This might indicate that the B/LP is not necessarily the root cause of the problem. The Canadian manufacturer of the ammunition and Directorate of Naval Combat Systems (DNCS) 6-2 staff are engaged in trying to determine the actual cause of the issue and are evaluating potential solutions, which could include modification to the ammunition or plug bore gauge, new cleaning materials, or alternative barrel coatings. Another potential solution is to reconsider the requirement to use a plug bore gauge with the weapon.

For the time being, prompt post-firing maintenance is the best means of ensuring continued operational capability of the gun. Weapons technicians and engineers are encouraged to contact their Formation Senior Inspector of Naval Ordnance for more information on this topic.

Lt(N) Newman is the Surface and Air Weapons Systems Officer at FMFCB.

News Briefs

NCM Awards – Recognizing Excellence

HMCS *Sackville* Award

Cdr Pascal Belhumeur, commanding officer of HMCS *Winnipeg*, presents combat systems engineering (CSE) technician **Petty Officer 2nd Class Peter Fraser** with the HMCS *Sackville* Award which recognizes him as the top CSE technician at Qualification Level 6B for 2014. The award was made during the ship's operational port of call in Goa, India on Jan. 9, 2016.

PO2 Fraser is *Winnipeg*'s senior fire-control technician, and is the senior maintainer for the ship's missile systems and fire-control radars. His other responsibilities include duties as the training petty officer for the CSE department.

Photo by Cpl Stuart MacNeil, HMCS *Winnipeg*

T.M. Pallas Memorial Prize

Marine engineering artificer **Petty Officer 2nd Class Jason (Jay) Clark** is presented with the Cert 3 T.M. Pallas Memorial Prize by Cdr Ed Hooper, commandant of Canadian Forces Fleet School Esquimalt. Since the award ceremony, the recipient has been promoted petty officer first class, and posted to HMCS *Winnipeg* as the marine systems engineering department regulating petty officer. PO1 Clark is responsible for duty watch rotations, departmental administration, and directing work during *Winnipeg*'s short work period. He will soon be sailing as the engineering officer of the watch, and will commence his Cert 4 training in May.

The prize, sponsored by the Canadian Institute of marine engineering (CIMarE), recognizes top performance by students on the marine engineering Certificate 4 (Engineering Charge ticket) and Certificate 3 (Engineering Officer of the Watch) courses in Halifax.

Photo by CPO2 J.P. Ayotte

News Briefs (continued)

NTO Spirit Award

"An eternally positive demeanor" was one of the attributes that resulted in **Lt(N) Aida Militaru** being the successful candidate for the 2016 Naval Technical Officer Spirit Award.

In presenting the RAdm (Ret) Ian Mack Silver Plate to the award winner, Capt(N) David Benoit, Chief of Staff for Maritime Equipment Program Management, pointed out that Lt(N) Militaru has consistently shown a sincere and determined effort to bring the NTO community together under a united front and professional identity.

Over the course of 2015, Lt(N) Militaru coordinated multiple "On the Net" social gatherings for the entire MARLANT NTO community. Liaising with all ships and shore establishments in the Halifax area, her efforts guided the "On the Net" initiative from a fledgling event to a welcome and strongly supported regular occurrence. Such events allow the NTO community to gather socially, celebrate recent achievements, and encourage mentorship and collaboration.

In September 2015, Lt(N) Militaru volunteered for the role of Visits Officer during JOINTEX 2015 and developed a detailed visits program while executing the administrative requirements of this project. Her work required coordination with the Canadian Multi-National Task Force. During this tasking, she demonstrated a high degree of diligence and professionalism, contributing positively to the professional reputation of the NTO community within the Canadian Armed Forces.

Bravo Zulu to Lt(N) Aida Militaru!

Photo by Lt(N) Jeffrey Aucoin

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.**

News Briefs (continued)

NTO Winter Hockey Classic – A New Tradition

Photos by Lt(N) Mark Dellapinna

It is rare to witness the birth of a tradition – especially in such an important Canadian field of endeavour as 'the good old hockey game'.

The inaugural Naval Technical Officer Hockey Winter Classic, held in Ottawa on February 11, started with two teams from the National Capital Region (NCR) – the Marine Systems and the Combat Systems technical community members (MS vs. CS) – or perhaps, more informally, the Pump Kickers vs. the Constant Sleepers.

Photo by LCdr Rob Waller

Team captains LCdr Michael Wood and Cdr Trevor Scurlock join RCN Commander VAdm Mark Norman for a selfie before the NTO mess dinner.

The concept arose from **Commodore Simon Page**'s determination to add a naval engineering community event to NCR winter celebrations. The event was organized by **Cdr Trevor Scurlock** and **LCdr Michael Wood** – taking into account **Cdr Rob Gray**'s suggestion that it be held the same day as the NTO mess dinner. The entire NTO community was invited to participate regardless of skill level or experience, and lines were made up to pit players of equal skill against one another, with a forced line change every two minutes. Although, judging by the deep breaths taken at the end of every shift, more frequent shift changes would have been a kinder option. (Oxygen bottles for next year's battle are already on order.)

From the moment referee Cmdre Page dropped the puck for the opening faceoff the outcome of the contest was in constant doubt, with many shots being taken, but few pucks finding the net. Each goaltender made saves no-one would have thought possible. Inspirational speeches on both benches by celebrity coach Don Cherry – who looked suspiciously like DGMEPM Chief of Staff **Capt(N) Dave Benoit** – may have inspired the CS team to overcome what seemed to be impossible odds to win the inaugural trophy created by **CPO2 Gord Malcolm**. The final score was 4-2 for the CS team.

Continued on next page

News Briefs (continued)

A full account of the action was conducted during the mess dinner that evening, with a complete dissection of each play, shot, save and pass. Judging by the smiles, jokes and ribbing after the game, everyone was looking forward to the next one...and the continuation of a great new NTO tradition.

Bravo Zulu to everyone who took part!

– LCdr Michael D. Wood

LCdr Michael D. Wood is the Chief of Staff for the NATO Seasparrow Project Office in Ottawa.

Team CS MVP [Most Valuable Player] Cdr Sebastien Richard with referee Cmdre Simon Page and MS team captain Cdr Trevor Scurlock.

MS MVP PO2 Troy Baigent with Cmdre Page and CS team captain LCdr Michael Wood.

Who *is* that man behind the CS bench?

National Defence / Défense nationale

ROYAL CANADIAN NAVY

FACT SHEET

HARRY DEWOLF-CLASS ARCTIC/OFFSHORE PATROL SHIP

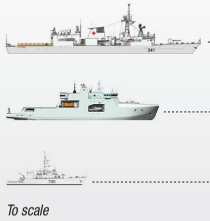
The Arctic/Offshore Patrol Ship (AOPS) project will deliver six ice-capable ships, designated as the Harry DeWolf Class, after Canadian wartime naval hero Vice-Admiral Harry DeWolf. The AOPS will be capable of:

- **armed sea-borne surveillance of Canada's waters, including the Arctic**
- **providing government situational awareness of activities and events in these regions**
- **cooperating with other partners in the Canadian Armed Forces and other government departments to assert and enforce Canadian sovereignty, when and where necessary.**

Construction of the first AOPS will begin in September 2015, with HMCS *Harry DeWolf* scheduled for delivery in 2018.

AOPS SPECIFICATIONS:

Length:	103 metres
Beam:	19 metres
Complement:	65

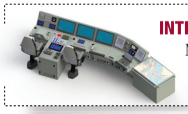


To scale

Halifax-class Canadian Patrol Frigate
Displacement: 4,770 tonnes

Harry DeWolf-class Arctic/ Offshore Patrol Ship
Displacement: 6,440 tonnes

Kingston-class Maritime Coastal Defence Vessel
Displacement: 970 tonnes



INTEGRATED BRIDGE NAVIGATION SYSTEM

Modern integrated bridge, from which control of navigation, machinery, and damage control systems can be performed.

MULTI-PURPOSE OPERATIONAL SPACE

Where operational planning and mission execution will be coordinated.

HELICOPTER CAPABILITY

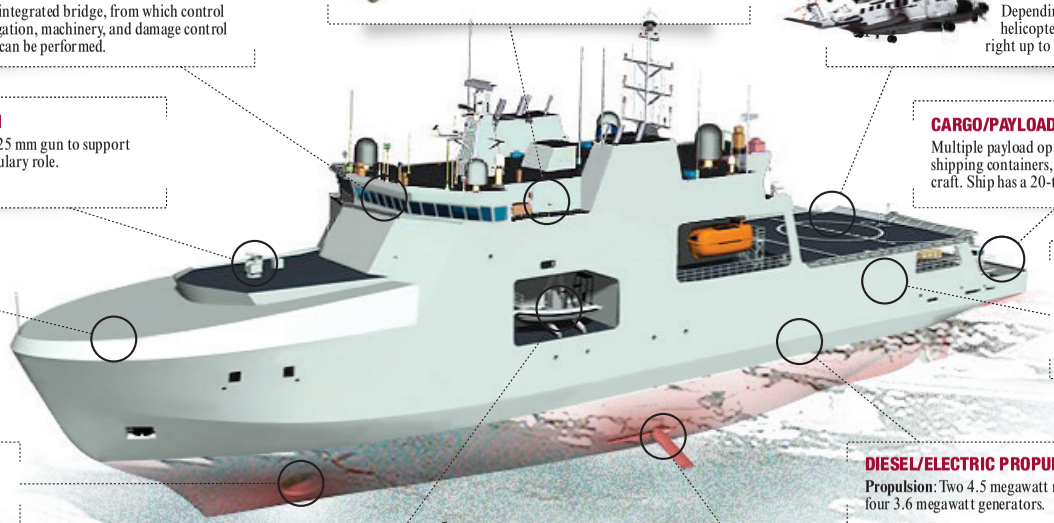
Depending on the mission, the embarked helicopter could range from a small utility aircraft right up to the new CH-148 maritime helicopter.

BAE MK 38 GUN

Remote controlled 25 mm gun to support domestic constabulary role.

CARGO/PAYLOADS

Multiple payload options such as shipping containers, underwater survey equipment, or a landing craft. Ship has a 20-tonne crane to self-load/unload.



ENCLOSED FOCSLE/ CABLE DECK

Protects foredeck machinery and workspace from harsh Arctic environment.

VEHICLE BAY

For rapid mobility over land or ice, the ship can carry vehicles such as pickup trucks, ATVs, and snowmobiles.

BOW THRUSTER

To enable manoeuvring or berthing without tug assistance.

DIESEL/ELECTRIC PROPULSION

Propulsion: Two 4.5 megawatt main propulsion engines, four 3.6 megawatt generators.

MULTI-ROLE RESCUE BOATS

Top speed of 35+ knots, 8.5 metres long. Will support rescues, personnel transfers, or boarding operations.

RETRACTABLE ACTIVE FIN STABILIZERS

Deployed to reduce ship roll for open ocean operations, retracted for operations in ice.

Royal Canadian Navy
Public Affairs – January 2015
www.forces.gc.ca

Canada

PRESERVING CANADA'S NAVAL TECHNICAL HERITAGE

CNTHA NEWS

Canadian Naval Technical History Association

End users key part of CANTASS success

Retired CSE **Cdr Gordon Graham**, project manager for the development of the Navy's CANTASS towed array sonar system in the 1980s, felt it was critically important to involve end users in evaluating development models of the equipment at sea. In this edited excerpt from a CNTHA Oral History interview from Nov. 26, 2011, Graham told interviewer Cdr (Ret.) Sid Jorna how Navy sonarmen were involved in the refinement of the RCN's towed array sonar system aboard the Defence Research vessel CFAV *Quest*:

> The first time we took something that looked like an operational towed array system to sea was the fall of 1982 when we put the first version of an experimental towed array sonar system – ETASS – on board *Quest*. We had taken early systems to sea before, where we put the array in the water, collected data on tape, and then brought it back to the lab for analysis. But this was the first time we took sonar operators with us who could say, okay this works, that doesn't.
>
> The Navy was going through a period then from a data poor environment to a data rich environment, so incorporating the operator into the detection and classification function was a key design advantage of the CANTASS system over its contemporaries. The US designed their towed array without this kind of trial and ended up automating functions that were better done by people. A trained operator could detect much more subtle signals, much earlier than any computer algorithm at the time, and perhaps even now. When we went on exercise with the Navy off Bermuda we invariably had contact on the submarine when nobody else did. We had credibility.
>
> By involving the end users – the sonarmen who would be using the equipment – every step of the way, we refined the system and made it better.

Photo by Helen Guy-Bray

CNTHA's website is in very good hands. **Jeff Wilson**, son of CNTHA webmaster and member Don Wilson, and recent masters graduate in computer science, has been providing superb website support services to us for some years. He has organized a secure hosting service for us, and is currently building a new static website that will do an even better job of blocking unwanted intrusions. In addition, the new site will have features to improve search opportunities for researchers wishing to access our archived materials more fully. Bravo Zulu, Jeff!

The real 'Spam' on YouTube

James Monteith, grandson of CNTHA founding member **Rolfe Monteith**, has posted a video of his grandfather's eloquent message to younger generations to remember the Battle of the Atlantic: "If this video motivates even some of you...to embrace the enormity of what it was and what it achieved, then I have executed my duty in honour of the men I served with and who died there," Rolfe said. Word has it that Rolfe, who lives in Wales, has a film company that is considering producing a documentary on this great naval battle of the Second World War. (https://www.youtube.com/watch?v=hpZd0Nev6MA)

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