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Maritime Engineering Journal

78
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Canada's Naval Technical Forum

Fall 2015

Laser Additive Manufacturing at FMF Cape Scott – *Update!*

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Canada

CFMETR 50th Anniversary

Photo by MCpl Chris Ward, MARPAC Imaging Services

RDML Moises DelToro, Cmdre Simon Page, CAPT Francis Spencer III and CPO1 Colin Brown are briefed on the bridge of the torpedo and sound ranging vessel CFAV *Sikanni* (YTP-611) by the vessel's master, Mr. Paul Smith.

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Maritime Equipment Program Management

Commodore Simon Page, OMM, CD

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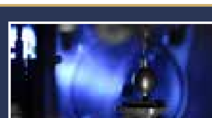

This just completed metal test object was produced by the FMFCS laser additive manufacturing team as part of its development of LAM technology parameters for naval materials.
Photo courtesy FMFCS Laser Additive Manufacturing section.

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

Innovation and the Naval Materiel Enterprise

Having assumed the duties and responsibilities of Director General for the Maritime Equipment Program Management division (DGMEPM) on July 3, 2015, it is with much humility that I follow in the footsteps of Commodore Marcel Hallé who led the Division and our Branch with grace, unmatched professionalism and fierce loyalty. During his tenure, significant and complex program milestones were achieved for the Navy, such as First Article Acceptance for the Halifax Class Modernization, and steady state operations for the *Victoria*-class submarines. I trust that all readers of the *Maritime Engineering Journal* will join me in thanking Cmdre Hallé for an exceptional tour, and in wishing him fair winds and following seas in his new responsibilities at Supreme Headquarters Allied Powers Europe in Belgium.

In my first Commodore's Corner I would like to focus on innovation – innovation within the entire spectrum of activities that make up the work we do on a daily basis. The naval materiel enterprise is an extremely complex business that requires accurate and comprehensive management. Executing a maritime equipment program that now extends well over one billion dollars, supporting major capital projects in various stages of progress, sustaining the capabilities of the Royal Canadian Navy, and ensuring the materiel assurance of all naval assets demands that we not only commit sound resources to the tasks, but that we focus on advancing the way we collectively execute this portfolio through creativity, ideas, and innovation.

It could be argued that "Innovation" is more usually associated with the pure engineering and technical solutions that derive from the research and development of new capability. Indeed, the construction of the Artic Offshore Patrol Ships (AOPS) in Halifax, the recent success of HMCS *Montréal* during a multinational maritime theatre missile defence exercise, and the implementation of a new bow sonar system on board the *Victoria*-class submarines are evidence of an innovation process that is alive and well on this level within the RCN and MEPM. In the same way, sophisticated technical achievements remain at the forefront of our advancement of smaller equipment programs relating to autonomous unmanned vehicles, the development of new electronic warfare solutions, and the integration of advanced signal intelligence on board our platforms. This is the nature of our business.

Photo by Cpl Brett White-Finkle CFSU(O) Imaging Services

Commodore Simon Page takes custody of the DGMEPM division pennant from Mr. Patrick Finn, Assistant Deputy Minister (Materiel) during the change of appointment ceremony in Ottawa on July 3, 2015. "The job of DGMEPM is all about trust," Commodore Page said.

It is also worth remembering that innovation plays a significant role in our peripheral technical domains as well. Energy efficiency, environmental stewardship, ranging, modeling, remote monitoring, systems integration – all of these are going through significant transformation, and it is imperative that the naval technical community continues to invest its creativity in these important areas. Many of the emerging technologies we are looking at as a naval materiel enterprise, such as advanced powder and liquid coating technologies for in-service and future platforms, could provide significant dividends. Inspiration can come from all facets of our maritime equipment program.

There is even room for innovation in the non-technical aspects of our enterprise relating to how we manage and govern our business. The management of complex, multi-faceted procurement projects is being redefined such that relational contracting, performance-based management, and collaborative governance are fast becoming landmarks of modern innovative management practice. The benefits of collective problem-solving and the elaboration of common

Photo by Cpl Brett White-Finkle CFSU(O) Imaging Services

Before moving on to his new appointment as Assistant Chief of Staff J4 (Logistics) at Supreme Headquarters Allied Powers Europe in Belgium, Commodore Marcel Hallé (left) offered his thanks to Mr. Finn for his "guidance, mentorship and leadership," and saluted division personnel for their "unwavering commitment to operations." To Commodore Page he said, "You'll do us all proud."

plans and objectives between service providers and the Navy are difficult to ignore. The success of the Halifax Class Modernization and Frigate Life Extension (HCM-FELEX) program was significantly linked to a proactive and innovative collaborative governance environment in which industry and government were able to discuss issues, solve problems, and achieve key schedule milestones. Moreover, the MEPM Strategic Initiative, now in its fifth year, has brought forth novel ways of managing, creating a planning culture, and formulating an integrated program view that can be used for scenario mapping and decision-making. Our industry partners today are keen to join MEPM in integrating plans and articulating common goals, something that was inconceivable just a decade ago.

Talk of innovation can sometimes seem overwhelming in the face of a crowded daily routine, but we should all at least try to transform our naval materiel enterprise into an innovative organization that continuously examines new strategies, practices, tools and technologies. Establishing a strong culture where creativity is valued should be our objective. Take some time to think about how you might improve your own piece of the enterprise, and run your thoughts past a friend. Give your ideas a "sea trial." Start small, but think big. We are all innovators by nature, so let your creativity speak. Not every innovative idea will result in a breakthrough, but enough will survive to grow into the force multipliers and game-changers that will improve the materiel readiness of our fleet.

Submissions to the *Journal*

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

FORUM

A letter from the RCN's Naval Technical Occupations Branch Advisor

It is with great pleasure that, as the newest Branch Advisor for the navy's technical occupations and editor of the *Maritime Engineering Journal*, I offer these few short notes of thanks and encouragement to all of you who make our great institution the success it is today.

Following in the footsteps of Commodore Simon Page, who now leads our organization as Director General Maritime Equipment Program Management – Chief Engineer of the RCN – I can say that he deserves the thanks of all of us for his tireless and dedicated work while he was Branch Advisor. I am certain that his sense of stewardship, compassion, sincerity, vision and leadership will continue in his new appointment to ensure our sailors and officers are well positioned to help the RCN deliver excellence at sea.

On leadership: I would encourage all naval technical officers, chief petty officers, and petty officers to review and reflect upon the concepts described in your commissioning scripts and warrant scrolls (and that our civilian workforce do similarly with their own individual terms of reference) as you conduct your duties and shoulder your responsibilities. Should you ever wonder about your calling or worth to the organization, the ideas captured in these documents should provide you with reassurance, direction and courage.

On work: I would also encourage everyone to continue to energize our institution daily through your innovation, positive and caring energy, enthusiasm and joy. Take the time to ensure your workplace is a positive space that reflects the honour of our service to the naval technical community and to our nation.

On Support: To the families that keep our workforce strong, ready and focused on the important work we do as a naval technical community, I would like to offer a simple "thank you" for everything you have sacrificed, and for your own devotion and loyalty to the defence and security of our country. It is you who ensure our success. Your fine example makes Canada a stronger nation and a richer society.

Photo by PO1 Shawn M. Kent, CFSU(O) Imaging Services

Finally, to the entire production team of the *Maritime Engineering Journal* (named in the masthead on page 1) and to the dedicated contributors who continue to give this publication life, I say thank you and well done. The vision and leadership exercised by those who conceived, maintained and supported this wonderful and amazing journal over the years was clearly well-founded as it has now served our community extremely well for more than three decades. I encourage all of you to join the conversation in creating this relevant working document for ourselves today, thereby leaving an instructive and revealing historical record of our time in service for the benefit of generations to come.

— **Yours aye,**
Captain David Benoit, CD, RCN
Chief of Staff MEPM

FORUM

Lessons in Teamwork and Adaptability

By LCdr Lorinda Semeniuk, OMM, CD

U.S. Navy photo 090526-N-9123L-094 by Mass Communication Specialist 2nd Class Byron C. Linder.

HMCS *Protecteur* (AOR-509) conducts an underway replenishment in the Pacific Ocean with the American Arleigh Burke-class guided-missile destroyer USS *Fitzgerald* (DDG-62) in May 2009. *Protecteur* was decommissioned in May 2015 after 46 years of service.

I joined HMCS Protecteur (AOR-509) as the ship's marine systems engineering officer (MSEO) in the summer of 2008 at the start of her return trip from Op Altair, which included circumnavigating the globe. I had just come from a very *Halifax*-class based career stream which included: executing all of my training in HMCS *Vancouver*, acting as a National Defence quality assurance representative during several *Halifax*-class docking work periods and an *Algonquin* refit, completing my MASc in control systems, and working on the *Halifax*-class Integrated Platform Management System project in the Maritime Equipment Program Management (MEPM) division at headquarters in Ottawa. I had been on board an AOR only once, and then just for a meeting. Needless to say, the task ahead of me was daunting. I had to learn a new ship, and refresh myself on everything I had learned in my training (six years earlier), all while fulfilling the duties of the Marine Systems Engineering head of department.

Prior to joining *Protecteur* I had received a bit of general training in smaller boilers while undergoing Phase 6 training at HMS *Sultan* in the U.K., so was familiar with some of the terminology. But I had not experienced a steam-driven engineering plant like *Protecteur*'s, where steam drives the electrical power, the RAS (replenishment at sea) cargo pumps, and the main lube oil pumps, among other things. I had a lot to learn. I was very nervous about joining a new class of ship, knowing that her systems and her role in the RCN were so different from what I had previously experienced. On the plus side, since I've always suffered from a bit of seasickness, I was very glad to be joining a much larger and more stable ship.

Also, before leaving for *Protecteur*, I was encouraged by my co-workers in MEPM to speak to the life-cycle materiel managers (LCMMs) who were responsible for *Protecteur's* systems. The ship was nearly 40 years old, and talking to them about any issues they were having with systems or with the availability of parts proved to be one of the smartest things I could have done prior to joining the ship. The information I received from the LCMMs proved invaluable during my tour as head of department. I also borrowed the Phase 6 "req package" from a friend who had trained in sister ship *Preserver*, and photocopied the massive binders full of information. I planned to read and study all of it in order to arrive on board prepared. While I did start this endeavour I hardly made a dent in the information. In the end, I arrived in *Protecteur* relatively unprepared (at least from the level of preparedness I was aiming for), and I was very nervous.

I first set foot on board *Protecteur* in Chenai, India, after spending 36 hours in airports and in the air. I quickly shook off my jet lag, and the turnover commenced. My only memories of this experience include lip-reading while touring the noisy boiler room and engine room, and only grasping about half of what was being said to me. But what was immediately clear to me was that the personnel of the Marine Systems Engineering department were smart, proud and happy. They had worked hard to keep their ship running through a demanding deployment, and as many folks will know, repairs in *Protecteur* did not often happen easily. Parts were scarce and often required extensive research to locate, and conditions during maintenance were routinely uncomfortable and sometimes dangerous.

Because of their extensive knowledge of the ship and her systems, I often held team meetings in the MSE office with all PO2s and above in the department in order to flesh out repair plans and ensure I had all of the bases covered prior to briefing the CO. During engineering drill sessions and practice boards at all levels, I took the opportunity to ask the most random questions to ensure I really understood the intricacies of the plant. I think that not having done my training in *Protecteur* helped me to focus on my job as a manager, while trusting and supporting the department in the planning and conduct of maintenance and repairs. Our roles were different and distinct, and were based on our experience and expertise. There were no attempts to step on each other's toes when it came to recommending repair options and briefing authorities either on board or ashore. We relied on each other's knowledge and skills to execute our work in the most efficient way possible. As a team, we were able to succeed.

The MSE team that I had the pleasure of working with overcame tremendous challenges during my two years on board, including one leaky tube, many issues with the forced draught fans for each of the boilers, and the concurrent catastrophic failure of both turbo-alternators and a diesel generator. (Luckily, the generator failures occurred within a minute of securing Special Sea Dutymen after coming alongside, or we would have needed a tow.) We approached each challenge as a team, and together worked hard to overcome each of the issues. We received stellar support from the chain of command and the shore support agencies, but, in my (biased) opinion it was the men and women of the MSE department who ensured *Protecteur* was able to proceed to sea as planned.

> *"We are rarely posted to positions where we must do it all alone, so we must not allow ourselves to be a single point of failure."*

My favourite example of the teamwork I experienced in *Protecteur* was inspired by the Chief Engine Room Artificer, CPO2 S. "Stanley" Smith. The ship's program had been very busy and we had just returned from sea, but were due to sail again in a few days. During a routine hydrostatic test a leaky tube was detected in the port boiler. FMF Cape Breton in Victoria was able to provide subject matter expertise to the team, but did not have the capacity to execute the repair in time for *Protecteur* to sail according to schedule. CPO2 Smith gathered the department in the hangar, explained the situation, and asked for volunteers to support the repair throughout the weekend (multiple shifts were needed in order to meet the time line). This was not a routine job, and many members of the team had not participated in this particular repair before. To a person, every single member of the department stepped forward and volunteered their entire weekend, eager to learn a new skill and be part of the team responsible for executing this critical repair. Such attitude was the norm within the department, and made the MSE department a pleasure to be a part of every day.

While my time in *Protecteur* was extremely demanding and pushed me outside of my comfort zone on a daily basis, it also taught me many valuable lessons that I have used in subsequent postings, including teamwork and adaptability. By adaptability I refer to the fact that as naval technical officers (NTOs) we must be able to take the detailed knowledge of systems and processes we have learned in our various postings at sea and ashore and adapt them to new environments, new vessels and new problems. New challenges provide us with opportunities to take our experience and apply it within a new paradigm – an exercise that, as RCN officers, we are well trained and extremely able to do.

The benefits of teamwork cannot be overstated. We are rarely posted to positions where we must do it all alone, so we must not allow ourselves to be a single point of failure. Reliance on our teams, whether to overcome challenges or celebrate achievements, is essential to the continued success of the organization. My time as MSEO in *Protecteur* taught me that, despite all of the preparation and effort applied to NTO training, it is just the tip of the iceberg and there is always more to learn.

LCdr Lorinda Semeniuk served in HMCS Protecteur *from 2008 to 2010, and is now the Platform Systems Manager for the Canadian Surface Combatant Project in Ottawa.*

Photo by Cpl Roxanne Shewchuk, Rideau Hall © OSGG, 2013.

LCdr Semeniuk was presented the Order of Military Merit (Officer) by His Excellency the Right Honourable David Johnston, Governor General and Commander-in-Chief of Canada, during an investiture ceremony at Rideau Hall on March 5, 2013. The OMM was created in 1972 to recognize meritorious service and devotion to duty by members of the Canadian Forces. *Photo GG2013-0007-021, used with permission, courtesy Office of the Secretary to the Governor General.*

FEATURE ARTICLE

FMFCS Laser Additive Manufacturing Update

By G.R. Pelletier and Matt Barnett

Photos courtesy Fleet Maintenance Facility Cape Scott

The Fleet Maintenance Facility Cape Scott (FMFCS) laser additive manufacturing (LAM) system was first introduced in the Spring 2014 (No. 73) issue of the *Maritime Engineering Journal*. As explained in the initial article, the system was acquired from the National Research Council (NRC) in London, Ontario.

This prototype LAM system (Figure 1) is comprised of three primary pieces of equipment: a Sulzer Metco powder feeder, a Rofin-Lasag laser, and a five-axis Aerotech motion system. All operations are conducted inside a Class 1 enclosure for personnel safety. Build occurs in an inert argon atmosphere (purged of O_2) to prevent oxidation and contamination of work piece and metallic powder. Basically, the metallic powder is blown onto the work piece or substrate in the path of the fibre optic laser beam, thereby melting the powder.

What is so wonderful about this technology is that of the 60 or so pieces of machining equipment found at FMFCS this is the only one that *adds* material rather than subtract it, and unlike the welding process the heat-affected zone is negligible. By tweaking the numerous parameters and using superior quality powders, obtaining the mechanical and chemical properties of particular component specifications and standards is now possible.

It is important to bear in mind, however, that there are no manufacturing or inspection specifications and standards for this emerging technology (especially considering our prototype system). While much research and development has been ongoing into this technology by the medical and aerospace industries, the titanium and aluminum alloys used by these industries are not commonly used on our naval platforms. FMFCS has therefore had to procure custom powders and develop specific LAM parameters for naval materials.

FMFCS Development

With the assistance of Defence Research and Development Canada Dockyard Laboratory Atlantic (DRDC DL (A)), and the Dalhousie University Engineering Department, FMFCS has been developing LAM parameters for materials commonly found on Royal Canadian Navy (RCN) platforms – materials such as Monel, AISI 4140 steel, and nickel aluminum bronze (NAB). Parameters must be developed for each of these materials as there are no constants. The primary parameters that must be developed for each unique powder are: powder feed rate; travel/toolpath speed; ideal laser spot size; laser power, pulse duration, and frequency. Parameters also require adjustment depending on the number of times a powder has been reused; and even the build direction requires thorough consideration.

RCN platforms are required to perform under broad extremes of temperature, sea condition, and operational environment, so resistance to shock, toughness, and other properties such as component resistance to wear and corrosion are critical. FMFCS must therefore develop LAM parameters that will increase the service life of various assemblies to meet a wide range of applications, thus minimizing the requirement for valuable repair resources and possibly increasing the time a ship can remain at sea.

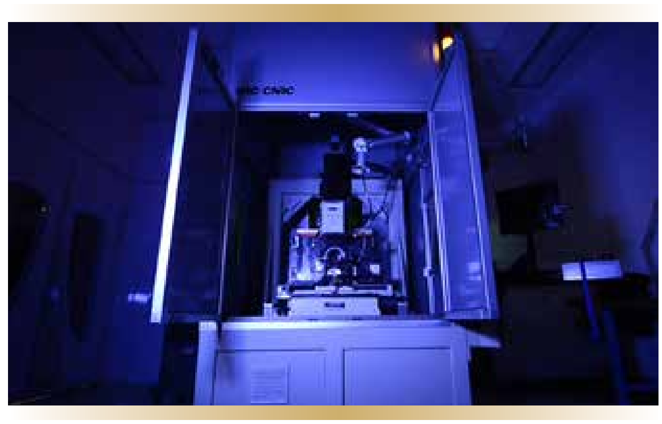

Figure 1. The FMFCS LAM system

One benefit FMFCS has in the development of this technology is that we have access to our own non-destructive testing (NDT) capability for surface and subsurface defect inspection through FMFCS Naval Architecture Office (NAO) Engineering. Another valuable asset is the DRDC DL (A) Radiography Laboratory located just metres away from the LAM system. Until more experience is gained with this emerging technology, due diligence is being exercised by X-raying critical work for further confidence.

Continued on page 11

Table 1. Laser Parameter Optimization for Monel.

Test Sample	Pulse Peak Power kW	Pulse Duration ms	Frequency Hz	Powder Feed Rate g/min	Tool Path Speed inch/min	Hardness HRB	Tensile MPa	Yield MPa	Elong. %
ASTM B164						85 - 97	Min 600	Min 415	Min 20%
A3	0.5	10	20	12	16	85.7	616	390	24.6
B3	0.6	10	20	12	16	86.0	620	382	25.6
R1 B3	0.6	10	20	12	16	88.6	616	405	26.3
R1 B3, 1	0.6	10	20	8	16	91.2	648	414	33.3
R2 B3	0.6	10	20	6	16	90.5	655	424	34.4
R3 A3	0.5	10	20	6	16	90.2	657	434	32.0

Notes: Build orientation – X direction; Z height – 0.01"; R1 powder reused once; R2 reused twice, R3 reused 3 times. Crosshatch build method.

FMFCS LAM System Upgrading By Matt Barnett

It is hard not to do the impossible when you have access to one of the best repair facilities and some of the best tradespeople in the world. Fleet Maintenance Facility Cape Scott (FMFCS) is the East Coast RCN repair facility and houses the RCN's new laser additive manufacturing (LAM) system. Lately our team has made some system modifications that have benefited our client – the RCN.

The FMFCS LAM system is a prototype system designed by the National Research Council in London, Ontario, and we are developing this emerging technology for RCN naval platforms. Ships are large platforms that come with large components. Our expertise has permitted us to develop a method for accommodating and working on components larger than the initial 46x46-cm size limitation of the LAM enclosure.

One current use of FMFCS LAM system is to repair worn, corroded, and/or damaged shafts. Cost savings can be realized by repair over replacement with this type of component; an additional bonus is that the LAM system can also actually improve the mechanical wear and corrosion resistance properties originally existing in plain carbon steel shafts.

As a prototype system, NRC delivered a LAM system with configurations better suited to smaller component repair or manufacture. Modifications were necessary to increase the machine's capacity. Members of the FMFCS machining services section and the LAM team successfully designed and built a jig to support and locate large cylindrical components, thereby increasing the capacity of the machine tenfold. Figure 1a shows the jig after an anodized coating had been applied, while Figure 1b shows the jig system in use during a specific repair (without protective coating – we wanted to complete the repair first).

Our machine shop's more conventional equipment was used to create the new LAM shaft jig. A new water jet was used to cut the frames out of aluminum plate, after which adjustable bearing supports were manufactured and attached. The adjustable rollers (Figure 1c) give us the ability to accept shafts of various diameters. Finally, the adjustable aluminum frame was mounted onto a wheel and track system that supports all the weight of the components as they are rotated and fed linearly through the LAM cladding process.

In-house problem-solving is a demanding yet essential capability when developing an emerging technology. Tailoring it toward Navy-specific repair work requires conventional knowledge, experience with naval platforms, and imagination – a skill set readily available at FMFCS.

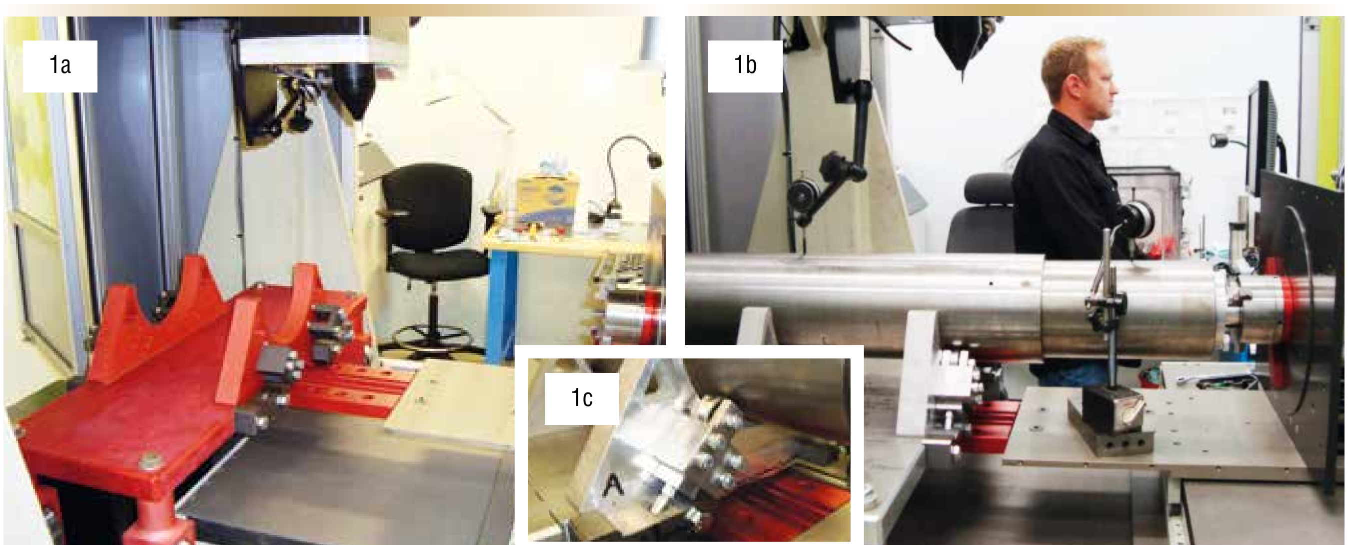

Figure 1a. The shaft LAM jig after application of an anodized protective coating. Figure 1b. The (uncoated) shaft LAM jig with a shaft in-situ to be worked on. Figure 1c. Adjustable rollers permit work to be done on varying shaft diameters.

Continued from page 9

Another area the FMFCS LAM team is concentrating on is the generation of Objective Quality Evidence documentation (OQE Docs). The goal is to generate documentation on manufactured/repaired components' chemical and mechanical properties, along with results of both surface and subsurface defect inspections, so that qualified batches of specific powders with developed parameters for particular applications can be held at the ready.

Successes

Several advancements have been made with each of the aforementioned naval materials. Assistance from DRDC DL (A) and Dalhousie University has helped us advance our progress quickly and with confidence. Presented here are our successes with the different mechanical properties of the materials (a key variable). The material powders themselves are procured in accordance with the strict chemical composition tolerances of each respective material – another key variable met.

Monel

The mechanical properties for Monel were refined through specimen testing, experimentation, and microscopic examination. The test specimen in Figure 2 accessed 150 different LAM parameters and powder feed rate variables, generating valuable data required for further advancement. Process maps such as that shown in Figure 3 greatly contributed to refining the LAM parameters for Monel, and initial results of the tensile testing of the mechanical properties (Table 1) proved promising.

AISI 4140 Steel

Advancement has also been made with steel, a more difficult alloy to work with because it attracts contamination more rapidly than the other non-magnetic powders and cannot be reused as frequently (it oxidizes quickly). Even so, much success has been made toward the repair of plain carbon steel shafts that require a higher level of wear and corrosion resistance. Work on toughness (shock) properties has been ongoing. As shown in Table 2 the initial tensile testing of AISI 4140 steel has generated very high tensile strengths, but unfortunately to the detriment of the toughness properties (hardness and elongation, and thus shock properties). Further research and development is being conducted to raise the shock properties so that the LAM system can be used for a wider variety of applications (especially at temperatures as low as -30 C). Once confidence has been obtained through developed parameters, impact (toughness) testing will be conducted.

Nickel Aluminum Bronze (NAB)

There is much NAB in use on our naval platforms, in particular by the *Victoria*-class submarines where more than 300 first-level (critical) NAB components are being tracked on board each boat. The reason for this tracking is that NAB components are susceptible to selective phase corrosion, a serious issue with the Kappa 3 phase (a predominately aluminum phase) of cast, seawater-wetted components. Stagnant water accelerates the corrosion rate, and the weld repair of any seawater wetted area is prohibited due to accelerated corrosion rate in the heat-affected zone.

Table 2. Laser Parameter Optimization for AISI 4140 Steel.

Test Sample	Pulse Peak Power	Pulse Duration	Frequency	Powder Feed Rate	Tool Path Speed	Hardness	Tensile	Yield	Elong.
	kW	ms	Hz	g/min	inch/min	HRB	MPa	MPa	%
ASTM A193 B7						Max 35	Min 860	Min 720	Min 16
X1	0.5	10	20	10	12	41.0	1345	1157	4
R1 X2	0.5	12	15	10	12	43.3	1460	1140	9.8
R1 X3	0.5	10	20	10	14	41.5	1406	1140	5.8
R2 X4	0.4	10	20	8	14	43.5	1482	1135	6.9

Notes: Build orientation – X direction; Z height – 0.01"; R1 powder reused once; R2 reused twice. Crosshatch build method.

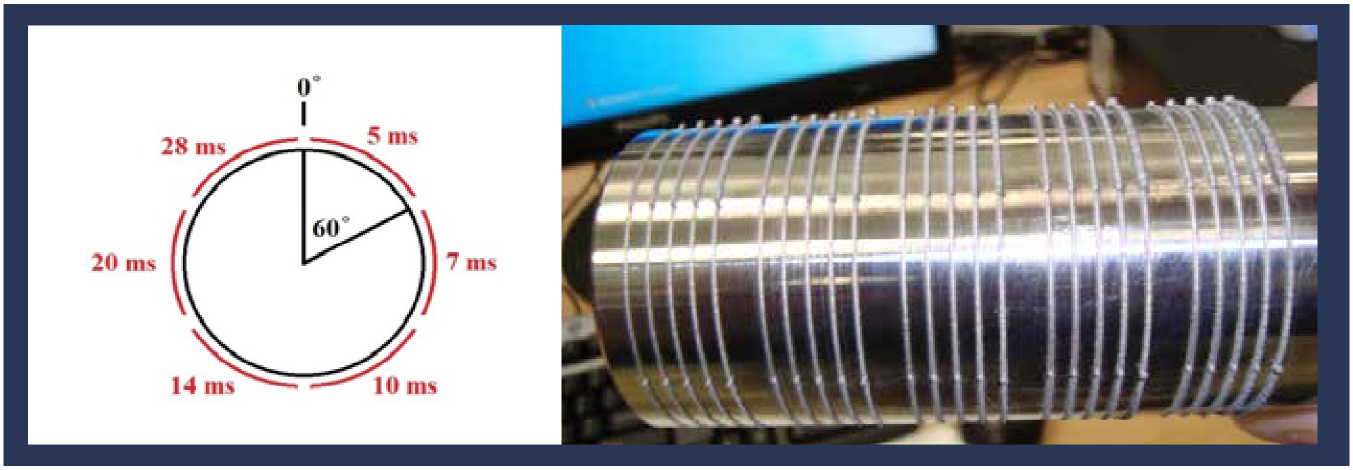

Figure 2. Test Specimen for Parameter Development: The test bar has 25 test strips arranged in five sets of five along the bar. The dial, showing an end-on view of the test bar, illustrates how the pulse duration in milliseconds (ms) was changed at 60-degree intervals around each test strip (for a total of 150 test spots along the bar).

Is NAB powder susceptible to selective phase corrosion? Corrosion test samples and microscopic test specimens have been manufactured and turned over to DRDC DL (A) for initial testing. Soon, tensile testing specimens will be manufactured to access the NAB mechanical properties within the LAM parameters developed by the FMFCS LAM team.

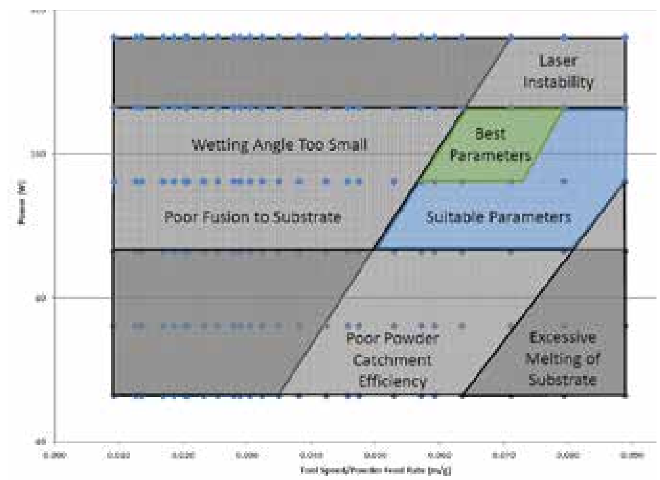

Figure 3. Monel Process Map.

The Future

One last reference to the previous feature article in issue No. 73 is that this is the first LAM system of its type to be found in a production environment in Canada. We are developing LAM parameters for naval materials that few others are working with, and have a small, but very strong team dedicated to our primary goal of providing the RCN with a cost-efficient, prompt, and reliable defect rectification capability for several different types of naval materials. Having our own NDT and radiography capabilities so close to hand, an R&D team down the street, and a world-renowned university up the street, we are in an ideal position to show that Canadian innovation is very much alive.

Acknowledgements

The FMFCS LAM team would like to thank Capt(N) Stéphane Lafond, Cdr Jay Harwood and Ian Mitchell for placing their confidence in us; Stephen Dauphinee for his engineering support and role as chief sounding board; Dr. Yueping Wang, Cameron Munro, and Scott Cameron of DRDC DL(A) for their timely, thorough work and for helping advance our development; Dr. Stephen Corbin, Clark Murray, and Julian O'Flynn of Dalhousie University Engineering Department for their superb collaboration; DNPS 2 and DNPS 4 for their encouraging support; and finally, our colleagues at FMFCS NAO NDT, specifically Andrea Colbourne and Kristen Cameron for their interest and effort in developing NDT surface and subsurface defect inspection techniques. Thank you all.

Gigi Pelletier is the LAM Engineer at FMF Cape Scott in Halifax.

Matt Barnett is the LAM Technologist in the Machining Services section of FMF Cape Scott in Halifax.

FEATURE ARTICLE

Canadian Forces Naval Engineering School Halifax
A Chief Engineer Rank Qualification Course Technical Service Paper Adaptation

A Proposal to Modify the Integrated Platform Management System to Automate the Battle Damage Control System

By Petty Officer First Class Marc Larouche

[References and cost analysis source material are contained in the author's original document.]

The Integrated Platform Management System (IPMS) on board the RCN's *Halifax*-class frigates offers a team management function in the Battle Damage Control System (BDCS) mode of operation. Team management enhances the flow of information between all IPMS stations during a damage control (DC) event through accountability of the duty watch alongside and the damage control organization at sea.

At present, personnel tasked in response to a DC event (duty technician, attack team, boundary sentries, etc.) are manually tracked on the damage control incident board (DCIB) for their location, team status, and their use of SCBA breathing apparatus. This activity represents a significant workload that depends on the frequency and quality of communications between the damage control team personnel and the section bases. Modifying the IPMS to include an automated personnel tracking feature would greatly enhance the effectiveness of the team management function.

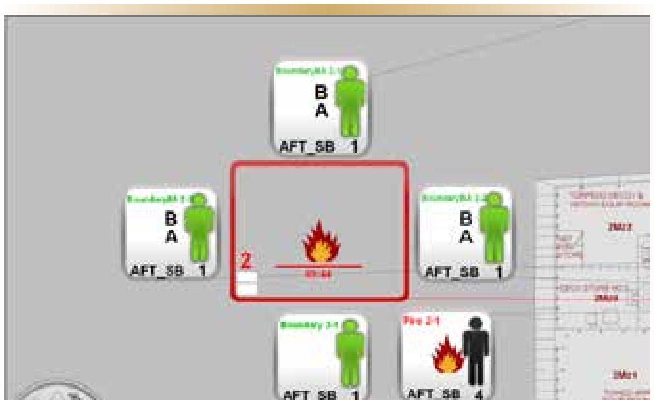

Figure 1. Suggested BDIC Icon Layout Scheme

Current Operation of the Team Management Function

The team management function is a dynamic representation of the status of the personnel involved in a DC scenario. This streamlined view of all DC actors on the DCIB offers a detailed picture of the situation to Command, allowing for focused communications, planning and execution of a more effective DC response (Figure 1).

The DCIB console operator uses the Team Config screen (Figure 2) to populate the accountability board, and then builds the specific DC teams. The operator also ensures that default positions are included for each adjacent ship in harbour that might respond to an emergency, as well as for the fire department.

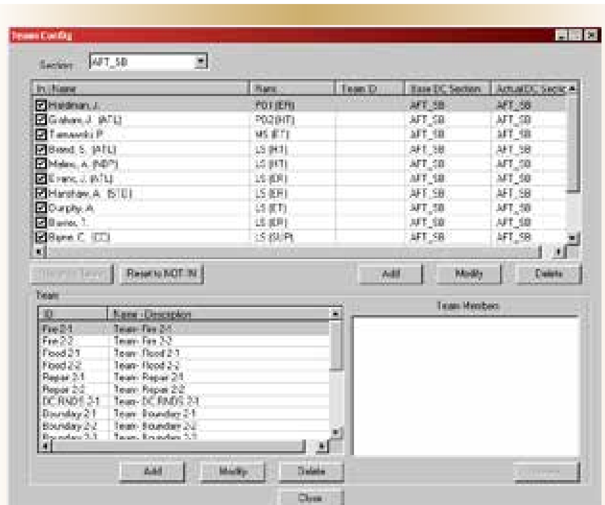

Figure 2. Team Management – personnel and team loading layout in the "Team Config" screen

When the ship is alongside in harbour the quartermaster will operate the team management function during emergencies. In addition to current DC duties, the quartermaster will place the various emergency team member icons on the DCIB, populate the response team on the display, and ensure member status is up to date as the situation develops. At sea the section base 2 I/C will manage the population of the team for a particular section base, while the communicator-plotter manages the DCIB icons on the BDCS and updates the information on activation of SCBA breathing apparatus by DC personnel.

The Problem

The lack of automation in the team management function has increased the workload of section base personnel. In addition to creating the accountability board, the section base communicator has to build DC teams using the Team Config screen (Figure 2), a task that requires a significant amount of manipulation on the large-screen display.

As the accountability board gets populated and DC teams are dispatched, the communicator has to maintain the DC team icons on the BDCS. Any lack of communication between the DC team and the section base prevents the communicator from updating the BDCS efficiently and leaves the DC organization anxious for information. The difficulty of using the DC radios inside the ship and the lack of access to a SHINCOM terminal creates the need for an alternate means of communication between the section bases and the DC teams.

Solution Option Criteria

Two reasonable options to remediate the situation were evaluated in terms of:

- Automation of the team management function, thereby freeing the operator from having to manually populate emergency team personnel lists and manage team icons;
- Ease of operation for emergency teams operating with firefighting equipment in dark, smoke-filled compartments;
- Ease of maintenance and data updating (i.e. inputting new user profiles) by ship's staff; and
- Compatibility with the IPMS.

[While rough cost estimates were worked up, costs were not considered as decision criteria since all suppliers required a site survey before offering accurate estimates.]

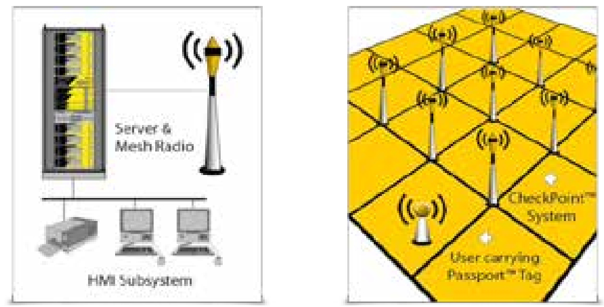

Figure 3. Tag reader configuration

Option A – Near Field Communication Tags

Option A uses a system built on near-field communication (NFC) tags, small memory devices with an antenna attached to send data wirelessly. The tags contain no batteries and receive all their power from nearby NFC readers. In this system the NFC tag is embedded in a bracelet worn by the ship's crew. Each NFC tag contains the name, rank and ship of the wearer.

On arrival at the section base members swipe their bracelets (the maximum distance is 10 cm) to a dedicated NFC reader, automatically entering their name in the team management accountability board. This feature offers flexibility in the event of personnel transfers between section bases, or personnel coming in to assist from other ships. The console operator would then only have to assign positions to the personnel on the accountability board.

Table 1. Cost estimate for Option A

Description	Cost
NFC tags bracelets x 300 @ $5.00	$1,500.00
NFC readers x 105 @ $20.50	$2,152.50
Various software (system operation, tags programming)	$7,000.00
Miscellaneous material	$6,000.00
Approximate total cost of installation	**$16,652.50**

As the DC teams move through the ship to take up their positions (DC roundsman, fire/flood boundary, casualty clear, and attack team), they swipe their bracelets against NFC readers installed on each side of watertight doors so that the section bases, HQ1 and Command can track their progress. Attack team leaders would not use their bracelets, but instead would use the NFC tag mounted on the thermal imaging camera. This setup allows tracking of DC teams not wearing NFC bracelets (the Dockyard Fire Department, for example), and frees the team leader from having to swipe a personal bracelet continually.

Maintenance of the system would consist of monthly testing of the readers. Ship's staff would also have to be able to program the NFC tags to replace lost or damaged tags, and to issue tags to new crew members.

Although L3-MAPPS does not currently offer this type of system for the IPMS, various companies do offer time management and access control programs using NFC technology. Any supplier would have to make all necessary software compatible with the IPMS. The short range of the NFC transmitters makes interference with technologies already fitted on board unlikely.

The estimated cost to install this system on a *Halifax*-class frigate would be just over $16,000 (Table 1).

Option B – Active Radio Frequency Identification (RFID)

The second option is to install a system using active RFID tags that contain a microchip and an antenna to send/receive information via a network of readers. An active RFID device (containing a power source) works anywhere from a metre up to 30 or more metres (for high-frequency devices) away from a reader. Because a tag does not need to be in close proximity to the reader, it could simply be carried in the pocket of the crew member. The system would require multiple readers per watertight zone as the readers cannot receive signals through a metal bulkhead.

The active tags would contain the member's name, rank and name of unit. Upon arrival at the section base the tag wearer's name would be sensed by a reader and be automatically added to the accountability board. The BDCS operator would then assign the member's DC role, and, as the member moved through the ship, readers located in every watertight zone would send information to automatically update the appropriate icon on the DCIB display. The section bases and DCHQ could thus follow the movements of dispatched personnel in real time, allowing them to efficiently track the advance of the attack team, monitor the back-up teams, and give clear instructions in the event that extraction of an attack team was required.

Maintenance on the system would be minimal. Monthly sensor verification would be required to ensure correct operation of the system, and the power source (batteries) for the active tags would have to be monitored for periodic recharging. (The average life of the charge is normally three years.) Ship's staff would also have to program the RFID tags as required.

The cost of a installing a system such as the S3-ID CheckPoint™ already in use in the oil and gas industry on board offshore drilling platforms might be in the order of $350,000.00 to $500,000.00 per ship. S3-DI offers both

Table 2. Option Analysis

		Option A		Option B	
Criteria	**Weighting Factors**	**Score**	**Weighted Score**	**Score**	**Weighted Score**
Automation	9	8	72	8	72
Operation	8	8	64	9	72
Maintenance	6	8	48	5	30
Compatibility	5	8	40	5	25
Total			**224**		**199**
% total			**80%**		**71.1%**

standard software modules and project specific codes designed by its software engineers. With access to the IPMS programming codes, the company would provide software compatible with IPMS/BDCS systems. The system would require emitting equipment that could interfere with equipment fitted on board.

Option Analysis

Table 2 analyzes Option A and Option B, using the criteria to produce a score for each option. The highest score is 10 (fully meets the criteria) and the lowest is 0 (does not meet the criteria). Weighting factors (10 = most important; 0 = least important) are multiplied by the score to produce a weighted score. The percentage totals represent the weighted score x 100/280 (maximum weighted score).

Both options offer a viable solution to the lack of automation of the team management function. Option A reduces the manipulation required by the console operator. The system will populate a list of the people present in the section base, but the operator is required to assign a position to each person as tasked. Dispatched personnel are required to interact with the readers by swiping their bracelet to track their progression through the ship. Minimal maintenance is required and the total cost of the system is well defined. The compatibility issue is more complex as the supplier would have to include readers and software dedicated to populate the accountability board, as well as readers and software dedicated to tracking purposes.

Option B offers a reduction in manipulation required by the console operator, who is still required to assign a position to each person as tasked. Dispatched personnel are freed from any type of manipulation as the system tracks them in real time. The amount of maintenance is marginally increased as the RFID tags must be charged periodically. The true cost of the system remains an unknown as further analysis is required to ensure proper configuration of the system's components for a naval ship. Most companies selling this type of system offer a software engineering service to blend their system with that currently used by the customer.

Conclusions and Recommendations

The aim of this technical service paper was to propose an improvement to address the lack of automation of the team management function in the Battle Damage Control System. The added manipulation by the console operator reduces the intended efficiency of the system. Two systems were introduced to provide automation: The first option offers automation with some interaction by ship's personnel to produce tracking by means of NFC tag technology. The second option offers automation with minimal manipulation by the console operator and requires further investigation to confirm the final configuration of the system.

Both systems offer amelioration to the team management function, thereby increasing the efficiency of Command and the DC organization in dealing with damage control situations. However, Option A – the use of NFC tags – offers the best solution mainly due to the low maintenance required and the compatibility with fitted equipment on board.

It is recommended that the Royal Canadian Navy trial Option A. An unsatisfactory condition report (UCR) followed by an engineering change (EC) should be submitted, and if approved the installation should be conducted on a platform going through the current frigate life-extension program so as to prevent disruption in the ship's readiness. During Phase 1 of such a trial the system should be operated during harbour readiness training to ensure proper operation for harbour duty watches. During Phase 2, the system should be used as part of work-ups. With satisfactory results on completion of trials, the system should be installed on all platforms fitted with IPMS, and plans should be made for the system to be installed on future platforms if IPMS/BDCS is used.

Petty Officer First Class Marc Larouche is the Marine Systems Engineering Training Petty Officer on board HMCS St. John's. *He completed the Marine Engineering Chief Engineer Rank Qualification Course (serial 0039) in 2014.*

Acknowledgment

Advice received from Lt(N) Jordan Caldwell in the preparation of this paper is gratefully acknowledged.

Source Document Containing Full References:

Petty Officer First Class J.E.L.M. Larouche, "A Proposal to Modify the Integrated Platform Management System (IPMS) to Automate the Battle Damage Control System," Marine Engineering Chief Engineer Rank Qualification Course (0039) Technical Service Paper, Canadian Forces Naval Engineering School Halifax, September 30, 2014.

FEATURE ARTICLE

Nuclear Vessel Visit Safety Program Renewal Initiative*

By LCdr Paul Busatta, RCN Nuclear Safety Officer

*[*This edited text reprinted courtesy* OHS Digest – *The Defence Occupational Health and Safety Newsletter]*

Photo courtesy U.S. Navy

During this past year, the Royal Canadian Navy (RCN) initiated a renewal of its Nuclear Vessel Visit Safety Program (NVVSP). The initiative's goal was to increase the RCN's operational response capabilities in the event of a nuclear vessel emergency alongside while remaining compliant with all current Defence and national regulations and legislation.

The following series of questions and answers provides insight to the NVVSP's raison d'être and the specific changes that were implemented after considerable collaboration with internal and external RCN stakeholders. The result has been improvement to the program in both efficiency and effectiveness, while maintaining the requisite due diligence and adherence to applicable safety standards, and supporting the direction of the RCN Commander, which is to "evolve the business of our business."

What is the Nuclear Vessel Visit Safety Program?

Since the 1960s, Canada has permitted port visits of foreign naval nuclear powered vessels (NPV) and nuclear capable vessels (NCV) from the United States Navy, the Royal Navy (UK) and the Marine Nationale (France) to the authorized ports of CFB Esquimalt, CFB Halifax and Canadian Forces Maritime Experimental and Test Ranges, British Columbia (CFMETR BC).

On behalf of the Canadian government the Department of National Defence (more specifically, the RCN) is responsible for the safe management of NPV/NCV visits. The RCN has established a Nuclear Vessel Visit Safety Program which provides policy direction to ensure such visits pose no adverse radiological health risk to on-base personnel or Canadian public living in the vicinity of the visited sites. A key requirement of the NVVSP is that the RCN must maintain a nuclear emergency response (NER) capability at naval ports in the highly unlikely event of a nuclear reactor or nuclear weapon accident on board a visiting nuclear powered/capable vessel.

Throughout a visit, qualified NER teams are prepared to respond immediately to:

- assist the visiting NPV/NCV in mitigating an accident;
- implement protective actions to ensure the health and safety of on-base DND personnel; and
- make protective action recommendations to civilian authorities for the health and safety of the Canadian public.

Why initiate a review of the NVVSP?

In order to provide a proper NER capability the RCN at one time had two separate NER teams, one on each coast, and each team had to perform an extensive training program that involved a large number of personnel from the Formations. Over the past ten years the frequency of NPV and NCV visits has declined significantly, as has the budget and personnel flexibility of CFB Halifax and CFB Esquimalt. During the last annual Nuclear Vessel Visit Oversight Committee meeting conducted in June 2014, both Formations articulated the need to renew the current NVVSP through the performance of an updated risk assessment that would inform the most effective alignment of finite financial and personnel resources to this activity. Consequently, the Deputy Commander of the RCN directed the Nuclear Safety Officer to enlist the support of the Director Nuclear Safety (D N Safe) and that of the Formation subject matter experts to conduct an internal program review.

What changes were recommended to the NVVSP to improve efficiency and effectiveness?

Organization: The NER organization was reduced from two permanent teams to one team consisting of two specialists and a Nuclear Emergency Response Officer (NERO) on each coast, and one qualified Nuclear Safety Officer (NSO) located in Ottawa, thus reducing the number of people required to be trained and permanently assigned to the NER organization.

Team Training: Due to the reduced personnel requirements, team training was reduced from four NER exercises (NEREX) per year to two each for CFB Esquimalt and CFB Halifax, with CFMETR being exercised as required.

Individual Training: Personnel assigned to the NER organization will receive tailored online training based on their position within the organization, while the traditional hands-on training will be focused for personnel operating in the field.

Assessment: Effective May 2015, Nuclear Emergency Response Evaluations (NEREVALs) will be conducted by D N Safe once every three years rather than every two years.

What were the results of the aforementioned changes to the NVSSP?

To validate the proposed changes, D N Safe conducted a NEREVAL of CFB Halifax in early May 2015. D N Safe used a team of subject matter experts to observe and evaluate all facets of their NER organization: NER teams, Security, First Aid, Medical and Public Affairs. The thorough evaluation process included an inspection of documentation, personnel qualifications, and equipment state, as well as an unannounced NEREX that simulated an NPV visit. The evaluation of CFB Halifax's NER organization was deemed satisfactory, proving that the proposed changes to the NVVSP were both positive and viable.

What is the impact of the NVSSP renewal and conclusions?

The projected expertise and consistent membership of this smaller pan-Navy team will remove the requirement to train and fund two larger NER teams. This will significantly increase operational effectiveness and reduce the financial and personnel burden to the Formations in supporting this capability-in-being, while remaining compliant with all current regulations and legislation that serve to protect the health and safety of on-base DND personnel and the civilian population living in the vicinity. The successful results of the last NEREVAL held in May proved that the new training regime and the reduction of personnel dedicated to NER activities meet the requisite safety standard and procedures evaluated by D N Safe.

Without a doubt, the NVVSP renewal initiative is viewed as a resounding success story and a testament to the RCN's commitment to continual improvement and optimization of resources to achieve greater effect within its mandated safety programs.

News Briefs

NCM Award: Inaugural HMCS *Sackville* Award

Bravo Zulu to **Petty Officer 1st Class Jaime Fraser**, the 2013 (inaugural) recipient of the HMCS *Sackville* Award open to weapons engineering (W Eng) technicians who complete the W Eng maintenance manager's course in Halifax and Esquimalt each year. The top four course graduates – two from each coast – are invited to undergo a supplemental board covering a broad set of W Eng and RCN topics, and it is on the basis of their performance on this board that award recipient is identified.

Petty Officer Fraser is currently serving in the Engineering Support - Underwater Weapons section of Fleet Maintenance Facility Cape Breton in Esquimalt, BC. In acknowledging her own award, PO1 Fraser recognized the accomplishment of the two graduates who scored the top marks on their respective East and West Coast courses.

HMCS *Sackville* was chosen as the name of the award to recognize technological advances in detection, navigation and communications implemented during the Second World War, many of which had a direct Canadian connection. The name also recognizes the significance of HMCS *Sackville* and the Canadian Naval Memorial Trust to the sailors of the RCN.

Photo by Ed Dixon, MARPAC Imaging Services

First Regular Force Mar Eng Certificate 2K for the RCN

Congratulations to **LS Allan Petrie** of Sydney, NS who reached a significant milestone for his career and for the Marine Engineering trade when he became the first regular force Mar Eng to achieve his Cert 2K (*Kingston* Class) engineering qualification in the RCN. Members are selected after completing their QL5 technician's course. The 2K certification involves a four-week simulator phase at Canadian Forces Fleet School (Québec) and a six-month on-the-job (OJT) period on board a *Kingston*-class ship. LS Petrie qualified in HMCS *Shawinigan* (MM-704) after just four months of OJT time.

The Cert 2K is in keeping with the "One Navy" direction where the *Kingston* class is now manned under a 60/40 reserve/regular force split. When asked what he thought about sailing in the class, LS Petrie said, "I found it an excellent way to gain diesel-electric experience to prepare me for the new *Harry DeWolf*-class Arctic/Offshore Patrol Ships which I hope to be eventually selected for. I recommend this for any Mar Eng who wants a change and wishes to learn new skills."

Photo by CPO2 Richard Bungay

***– CPO2 Richard Bungay, Chief Engineer, HMCS* Shawinigan**

News Briefs (continued)

CFMETR 50th Anniversary

Photo by MCpl Chris Ward, MARPAC Imaging Services

CAPT Francis Spencer III, RDML Moises DelToro, Cmdre Simon Page and Cdr Darren Rich at the main entrance to the Range Operations Centre, Winchelsea Island, CFMETR.

Congratulations to the Canadian Forces Maritime Experimental and Test Ranges at Nanoose Bay, British Columbia on the occasion of the unit's 50th anniversary of operations in testing torpedoes, sonobuoys, unmanned underwater vehicles and seabed arrays. The ADM (Mat)/DGMEPM Field Unit operates a shared Canadian Armed Forces and USN underwater range and is currently on its 32nd memorandum of understanding agreement between Canada and the United States.

The 130-square kilometre, fully instrumented 3-D underwater range has facilitated close to 30,000 torpedo test firings over the last 50 years. The unit represents a critical capability for both countries, and offers significant financial benefit to the Vancouver Island mid-island economy.

Brand Award for RCN Naval Architect

Naval Architect **Lt(N) Calley Gray** is presented with the American Society of Naval Engineers Brand Award by Capt. Joe Harbour, USN on June 5, 2015. She achieved the highest academic standing in her graduating class at Massachusetts Institute of Technology (MIT), earning a 5.0 GPA and graduating with a double Masters in Mechanical Engineering, and Naval Architecture and Marine Engineering. Bravo Zulu!

Photo by Shelley Gray

News Briefs (continued)

Lusitania sinking had several ties to Canada

This year marks the 100th anniversary of the sinking of RMS *Lusitania* off the coast of Ireland by a German U-boat – an event that had a number of Canadian connections.

For instance, the luxury liner, torpedoed on May 7, 1915 by the submarine U-20 under the command of Kapitänleutnant Walter Schwieger, was owned by the Cunard Line, a shipping company founded by Samuel Cunard of Halifax, Nova Scotia.

Another Canadian link to the incident was that, when world opinion raged against Germany for the loss of 1,198 passengers and crew (including three stowaways), the German High Command claimed that the ship was carrying a large contingent of Canadian troops. The contention was that with World War One raging, it was a legitimate act of war to attack the passenger liner.

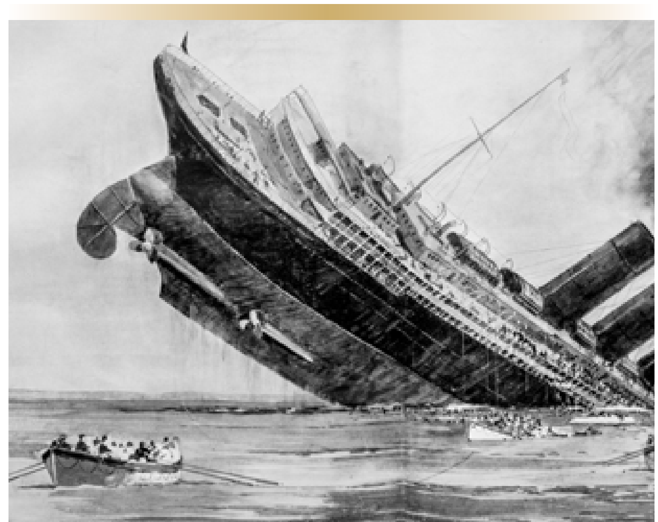

Photo: Illustrated London News, May 15, 1915

While the German claim was false, there actually were an estimated 360 Canadian civilians on board the vessel. The exact number is sketchy, as is the tally of Canadians who died that day, because many were listed on the manifest as British. The Canadian War Museum merely states that "hundreds of Canadians" lost their lives in the sinking.

Perhaps the most important link with Canada resulting from the sinking of the *Lusitania* was that the world in general, and the United States in particular, condemned Germany for what was considered to be an atrocity perpetrated on innocent victims. Many historians credit the sinking with being the final straw that brought the U.S. and its badly-needed military force into the war. Beleaguered Canadian troops and their Allies on the Western Front thus benefited from the German action.

To this day, controversy swirls around the torpedoing of the ship. German apologists point out that the Imperial German Embassy in the United States ran an advertisement in 50 U.S. newspapers warning that the waters adjacent to the British Isles were considered a zone of war. Critics of the German action counter that under the articles of war passengers aboard a non-combatant vessel were supposed to be allowed to leave the ship in lifeboats before it was attacked.

In any event, the sinking of the *Lusitania* went into the history books at the time as the second-worst commercial maritime disaster after the sinking of the RMS *Titanic*, a White Star Line vessel that struck an iceberg off the coast of Newfoundland in 1912.

– **Tom Douglas**

Tom Douglas is the Journal's *associate editor. He is the author of a number of books about Canada's military heritage, including the best-seller* Valour at Vimy Ridge. *He also maintains a World War One weblog at: www.worldwar1risingfromtheashes.com.*

News Briefs (continued)

HMCS *Kootenay* ASROC launcher

You don't see this on the highway every day. An ASROC anti-submarine rocket launcher from a decommissioned Royal Canadian Navy destroyer escort made its final voyage – a road trip, this time – from the West Coast to Ottawa last May. Transport driver Laryl Foster, who took this photo of his rig and unusual cargo, said that after 20 years working in the trucking industry this shipment was by far the most interesting and unique.

An ASROC anti-submarine rocket launcher from the decommissioned Improved *Restigouche*-class destroyer escort HMCS *Kootenay* (IRE-258) was relocated from CFB Esquimalt to Ottawa's military Connaught Ranges and Primary Training Centre in May as part of the Royal Canadian Navy's effort to preserve unique naval artifacts. The 5,000-km journey of this last remaining Canadian ASROC took two weeks.

The Mk-112 launcher was a key piece of naval equipment deployed by the RCN during the Cold War era. The all-weather ASW missile system developed by the USN in the 1950s could launch a Mk-46 torpedo out to a range of about 12 nautical miles. At the end of its ballistic trajectory the torpedo separated from the rocket and deployed a parachute to slow down prior to hitting the water and starting its search pattern.

Kootenay (decommissioned in 1995) and three sister ships fitted with ASROC during a major class conversion between 1968 and 1972 carried eight conventional missiles in the launcher and eight reloads in a magazine forward of the launcher. While the four Canadian ships were capable of storing and launching a nuclear tipped version of ASROC without modification, this capability was never exercised.

Photo by LCdr Kevin Mac Dougall

MEPM project lead Wayne Yetman directs the offload of *Kootenay*'s ASROC launcher at Connaught Ranges in Ottawa where it will be put on permanent display.

– LCdr Kevin Mac Dougall, DNCS 6-2, Naval Guns

News Briefs (continued)

Enigmatic surprise for WRCNS veteran code listener

Photo by Ignetius Anton, HMCS *Bytown*

A very special presentation on Code Listening and Code Breaking during the Second World War was sponsored by DGMEPM and the *Maritime Engineering Journal* at the HMCS Bytown Crow's Nest on Aug. 19, 2015 as part of the Naval Technical Officer mentorship program in the National Capital Region.

Women's Royal Canadian Naval Service (Wren) veteran **Elsa Lessard**, and spytools collector-historian **Richard Brisson** spoke about the intricacies of intercepting and decoding German wartime messages. Lessard put a personal face on the responsibility and hardships borne by the Wren code listeners in Canada during the war, while Brisson explained the technical aspects of the German Enigma ciphering machine. Two Enigma machines and other artifacts, as well as a special naval display from **Jack Hearfield** were available for close inspection.

As a surprise for Elsa, a special prerecorded Morse Code message of thanks for her wartime service had been encoded by Ottawa amateur radio expert **Ralph Cameron** (dit VE3BBM) and enciphered by Brisson using his Enigma machine. The message was emailed to **Melissa Raven** at the Museum of Naval History in Port Burwell, ON [see MEJ No. 77, p. 21] so that it could be transmitted back to the group in Otttawa by mobile phone at a prearranged time during the presentation directly from on board the retired RCN submarine *Ojibwa* (standing in as a U-boat) by site manager **Ally Shelly**. As part of the demonstration, Brisson decrypted the message after it was received:

"Congratulations and thank you, Elsa. The work that you and your colleagues did during the Second World War paved the way for Canada's successful Cold War operations. We are in your debt." – *Tim Barrett, President of The Elgin Military Museum/HMCS* Ojibwa *at Port Burwell*

As the dot and dash sounds of Barrett's message filled the room on speaker phone, we were delighted as Lessard asked for pen and paper and began copying code from a submarine for the first time since the Second World War. The image was unforgettable.

"I am really moved by this," she said afterward. "I am overwhelmed. Thank you so much."

– **Brian McCullough**

Photo by LCdr Nick Manley

WRCNS veteran code listener Elsa Lessard copies Morse Code from a submarine for the first time in more than 70 years.

PRESERVING CANADA'S NAVAL TECHNICAL HERITAGE

CNTHA NEWS

Canadian Naval Technical History Association

When Fleet Maintenance Group (Atlantic) moved ashore

By LCdr (Ret.) Gerry Tarum – *An edited excerpt from the author's draft 2014 memoir*

In 1975 I was posted to Fleet Maintenance Group (Atlantic) as the Senior Repair Officer and Deputy Commanding Officer. I was also the project manager for the unit's move ashore from the decommissioned escort maintenance ship HMCS *Cape Scott* to a new facility adjacent to the submarine squadron in Halifax Dockyard. It was hard work moving all of the repair equipment, including a foundry, but six months later FMG was back in business.

The facility was designated as a NATO repair facility, which meant we provided mobile repair support to the Standing Naval Force Atlantic in Halifax, Bermuda, Puerto Rico and certain US ports whenever required. FMG also sent repair parties out for technical support during major exercises. With 280 FMG technicians and total support from the Admiral in Maritime Command, we were able to perform tasks that sailors had never done before – replacing the snort mast on a submarine, repairing main feed pumps in destroyers, rewinding electric motors, moulding new parts in the foundry to replace obsolete parts on pumps and motors, and even once making temporary superstructure repairs on an AOR after an accident in Puerto Rico. We also produced all of the ship badges and memorabilia that were presented to visiting ships and dignitaries.

The capabilities of our people were outstanding, and we received numerous commendations. My engineer officer, Lt(N) Duncan Leslie, was awarded the Order of Military Merit for his individual service. After three years FMG had proven that sailors could perform any repair required to keep the fleet operational, but there were complaints that FMG was taking jobs away from the Ship Repair Unit. Fleet Maintenance Group was eventually disbanded, and the personnel moved to the SRU. In July 1978 I left to become the DMCS 8 section head for electronic warfare engineering at National Defence Headquaters in Ottawa.

The CNTHA's UK-based founding member, Captain Rolfe Monteith, RCN (Ret.) (shown right), met with the rest of the Canadian Naval Technical History Association team during a visit to Ottawa on Oct. 6. The meeting was also attended by Mike Whitby, Senior Naval Historian with the Directorate of History and Heritage – our key contact for the Oral History Program. As expected, the 92-year-old Rolfe made good contributions to the discussions, especially concerning the association's roles and way forward. He also very kindly presented engraved mugs and tumblers to the other CNTHA members in recognition of their contribution to the committee.

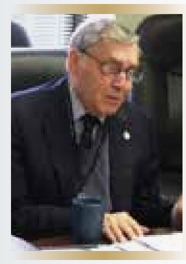

Photo by Don Wilson

WANTED: Any available details regarding the conversion of the wartime River-class frigates to establish the new Prestonian class of ocean escort frigates. These two photos show HMCS *Beacon Hill* before (K407) and after (303) her 1954-57 conversion. You can contact us at info @cntha.ca

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