National Defence | Défense nationale

97

Since 1982

Summer 2021

Maritime Engineering Journal

Canada's Naval Technical Forum

Feature Content

RCN Auxiliary Vessels – Replacing the Legacy Large Tug Fleet

CNTHA 25th Anniversary!

Canada

HMCS *Oriole* at 100!

Happy 100th birthday to the
Royal Canadian Navy's oldest commissioned vessel!

The 31-metre ketch, originally called *Oriole IV*, was built in two stages: Started by the Dominion Shipbuilding and Repair Company Limited of Toronto for the Royal Canadian Yacht Club, a strike saw her moved down to Neponset, Massachusetts, where she was completed by George Lawley & Son and launched on June 4, 1921.

Oriole's connection to the Royal Canadian Navy (RCN) began in 1941 when the Navy League of Canada acquired her, beginning a back-and-forth with the Navy until her official commissioning on June 19, 1952. Today, she operates out of Halifax, NS as a sail training vessel and public outreach ambassador for the RCN.

— Cdr (Ret'd) Bill Gard, Halifax

Photo courtesy Roger Litwiller

Director General Maritime Equipment Program Management

Cmdre Lou Carosielli, CD

Senior Editor
Capt(N) Sébastien Richard, CD
Chief of Staff MEPM

NCM Editorial Advisors
CPO1 Monika Quillan
DGMEPM Unit Chief

CPO1 Herbert Connors
DNPS 3-3-4, DGMEPM

Project Manager
Lt(N) Youngjun Hwang

Production Editor/Enquiries
Brian McCullough
MEJ.Submissions@gmail.com

Associate Editor
Tom Douglas

Graphic Design and Production Services
d2k Graphic Design & Web
www.d2k.ca
Tel. (819) 771-5710

Maritime Engineering Journal

97

(Established 1982)
Summer 2021

Commodore's Corner

Forum

Feature Articles

Book Review

News Briefs

CNTHA News

The RCN's Naval Large Tug replacement project turned to creative solutions to manage a complex procurement during COVID-19. (Photo courtesy of Industries Océan Inc.)

***Maritime Engineering Journal* on Canada.ca:**
https://www.canada.ca/en/department-national-defence/corporate/reports-publications/maritime-engineering-journal.html

Our complete back catalogue continues to be maintained by the Canadian Naval Technical History Association at:
http://www.cntha.ca/publications/m-e-j/

The *Maritime Engineering Journal* (ISSN 0713-0058) is a **NATO UNCLASSIFIED** publication of the Canadian Armed Forces, published by the Director General Maritime Equipment Program Management, 101 Colonel By Drive, Ottawa, Ontario, Canada, K1A 0K2. Views expressed are those of the writers and do not necessarily reflect official opinion or policy. For all enquiries, including free subscriptions, please contact: MEJ.Submissions@gmail.com.

To request a **free subscription**, **change a delivery address**, or **cancel a subscription**, please contact: MEJ.Submissions@gmail.com.

COMMODORE'S CORNER

Recapitalizing the Royal Canadian Navy's auxiliary fleet

By Commodore Lou Carosielli, CD

I would like to begin this Commodore's Corner by taking the opportunity to introduce one of our newest Royal Canadian Navy (RCN) Honorary Captains (Navy) – **HCapt(N) Jeanette Southwood** of Ottawa. (See photo next page.) Honorary Captains (Navy) are distinguished Canadians – appointed by the Minister of National Defence – who are leaders in their respective fields, and take on the role of ambassador for the RCN to the Canadian people as a whole. HCapt(N)s come from all across the nation and are an integral part of the Navy family, each one committed to making a difference for Canada through their support of the RCN.

Jeanette Southwood was appointed as an HCapt(N) in late 2020 and is affiliated with Fleet Maintenance Facility Cape Scott, but will be representing the larger naval technical community across the country. An award-winning engineer, she is Vice President for Corporate Affairs and Strategic Partnerships at Engineers Canada, the national organization of the 12 engineering regulators that license Canada's more than 300,000 members of the engineering profession. Prior to joining Engineers Canada, Jeanette – a native of Cape Town, South Africa – led the Canadian Urban Development & Infrastructure Sector and Global Sustainable Cities teams at an international consulting firm where she became the first woman of colour to be appointed to the firm's senior leadership position as principal. I hope you will join me in welcoming her aboard.

When people think of the RCN, they typically think of the *Halifax*-class frigates, the *Victoria*-class submarines, the *Kingston*-class maritime coastal defence vessels, and the *Harry deWolf*-class Arctic and offshore patrol vessels. They tend not to consider the smaller vessels that make up the RCN's stalwart fleet of auxiliaries that perform a critical role in supporting the daily operations of the Canadian Armed Forces. Often taken for granted, the civilian-operated tugs, tenders, lighters and other craft that make up the auxiliary fleet are the vessels that carry out the sometimes mundane tasks of conducting harbour ship movements, supporting maintenance, delivering fuel and ammunition, supporting ranges and moorings, providing waterborne security, enabling dive operations, training search and rescue technicians, protecting the environment, and much more.

With an average age of 40 years – older than many of the people who crew them – and with disparate designs, the current fleet of auxiliaries is becoming difficult to maintain. Many of the fitted systems in the existing platforms are obsolete, and spares are no longer available, necessitating expensive and time-consuming special orders to sustain them. Crew accommodation in all vessels is significantly below contemporary standards, and not configured for mixed-gender crewing. To remediate the situation, in recent years an increased emphasis has been placed on configuration management and integrated logistics support through the Minor Warships and Auxiliary Vessels III in-service support contract, and on Naval Materiel Assurance through the Non-Combatant Classification Society contract – and more help is on the way.

The RCN and Assistant Deputy Minister (Materiel) are undertaking a significant auxiliary fleet recapitalization program, starting with the replacement of the *Glen*-class tugs and fire tugs with new Naval Large Tugs (see page 8). Delivery of the first NLTs is planned for 2022. While new stevedore barges have been recently delivered to CFB Esquimalt to support dockyard operations, a series of minor capital projects is currently underway to improve dive operations, and to modernize waterborne security assets both at the Canadian Forces Maritime Experimental and Test Ranges (CFMETR) and our dockyards. The Naval Inshore Support Vessel (NISV) project, now at the options analysis phase, aims to procure six new auxiliaries – two dive-support vessels to replace the tenders at the Fleet Diving Units, two vessels to replace the Torpedo and Ship Ranging Vessels at CFMETR, and two vessels to expand training capabilities and support domestic operations. The auxiliary fleet might not get the media attention of the larger major and minor warship fleets, but without these small vessels the RCN would not be able to conduct its essential operations.

(Continues next page...)

HCapt(N) Jeanette Southwood

Jeanette Southwood is a Fellow of Engineers Canada, and a recipient of the Province of Ontario's "Leading Women Building Communities Award." She is also the recipient of the Ontario Professional Engineers Awards (OPEA) Engineering Excellence Medal, and has been twice named one of WXN Canada's Top 100 Most Powerful Women. In 2018, Jeanette was inducted into Professional Engineers Ontario's Order of Honour, and in 2019 was inducted into the University of Toronto's Engineering Alumni Hall of Distinction, and received the Governor General's Sovereign's Medal. She has authored or contributed to many articles, book chapters, technical papers, and presentations relating to engineering research, the practice of engineering, and to the bank of knowledge around urbanization and sustainable development.

And finally, a word of appreciation to the volunteer members of the Canadian Naval Technical History Association (CNTHA) as they celebrate 25 years of outstanding support to the Department of National Defence's Directorate of History and Heritage, and to the naval technical community at large. Since 1996, these retired RCN engineers and other knowledge experts have done yeoman service in preserving the story of the RCN's technical achievements through recorded interviews with former key personnel, and through their own research. The association's newsletter, with its own editorial decision-making board, has been a welcome component of our *Maritime Engineering Journal* since 1998, and we wish the CNTHA well as they continue their important work in preserving Canada's naval technical heritage.

Bravo Zulu!

FORUM

Farewell and thank you

By RAdm Christopher Earl

I remember sitting in the back of a classroom at the Royal Military College (RMC) in the spring of my graduating year, wondering whether the class would ever end. With final exams just weeks away, I was ready to do anything to make that class go any faster. And now, decades later as I stand back and contemplate the end of my 35-year naval career, my first thought is that it went by way too fast.

I had joined the Canadian Armed Forces to get away from Alberta, away from the area where I grew up. My dad was Navy, as were my grandfather and great-grandfather, so I figured that applying to RMC was as good a choice as any. To be honest, I didn't enjoy the first couple of years there as I struggled with the restrictions and the environment. I even thought about quitting more than once, but resigned myself to completing my degree and the obligatory service that would ensue.

It really wasn't until my fourth year at the Kingston-based military college that I became truly invested in what I was doing. It was an opportunity to ride aboard an Oberon-class submarine that suddenly got me thinking about the professional path that I wished to pursue, and from then on submarines became my clear focus. Along the way, there would be many experiences that would help shape the officer I ultimately became, and I'd like to share two of these with you.

My first couple of days aboard an operational submarine following completion of my basic submarine course were filled with tracing systems, and starting in on completing all the many other requirements necessary to being awarded the coveted submarine dolphins. Of all the crawling around that I did to trace and understand those systems, one experience in particular heavily influenced how I would approach everything in my career from that point forward.

It was my second day on board. The submarine had just dived following an extended work period, and I had paired up with a non-commissioned member (NCM) submarine qualifier to "walk the submarine" and locate every high-pressure air (HPA) valve on the system. One particular valve was not easily accessible, and to get to it I had to contort myself under a piece of equipment. As I strained to reach the valve, a coupling suddenly let go, creating a loud air burst. Suffice it to say that air is a precious commodity to a dived submarine, and

the boat immediately went to emergency stations to deal with the situation. I was a bit awestruck as a senior petty officer calmly walked over, undid the securing mechanism to a previously unnoticed access panel, and isolated the burst. Three things immediately went through my mind:

a. Did I cause that HPA burst?
b. I'm an idiot for missing that panel, and
c. I need to be an engineering officer who fully understands how things work.

I relied on this important lesson many times over the years. It proved to be especially useful when a flood interrupted propulsion and completely blacked out a *Victoria*-class submarine at full diving depth during acceptance trials, and at other times when I found myself justifying to senior leadership the importance of setting appropriate time aside to conduct critical maintenance. The value of fully understanding all aspects of our naval technical support business cannot be overstated.

The second story I will share happened later in my career when I was the commanding officer of Fleet Maintenance Facility Cape Breton. To set the scene, let's first take a bit of a step back in time to when I was an acting sub-lieutenant, and was asked to accompany the engineer officer of my first ship to a meeting with the commanding officer of the maintenance unit. As we sat in his office,

I admired all of his beautiful handmade furniture, and also the wonderful view of the ships and maintenance jetties beyond the windows. I thought he really had the life.

Fast forward 20-odd years, and now I was the one sitting in that CO's chair and asking a junior officer if she thought she might one day like to command the maintenance facility. Her reply was a simple and surprising, No thank you! She explained that whenever she was Officer of the Day aboard her ship in the harbour, she could see the light on in my office across the way and know that I was working well into the evening. She said she had no interest in that kind of life, and it struck me how loudly our actions can speak. The lesson here was really two-fold: First, how could I bestow the importance of maintaining a good work/life balance among my team and not follow that advice myself? And, second, you never know when someone might be watching, so conduct yourself accordingly.

Each one of us contributes significantly to the naval materiel enterprise in our own way, and it is through our individual efforts that we achieve great things as a collective. As I reflect back over my career I can think of numerous examples where innovations have blossomed into what are now considered to be core business activities. Almost always, these started as simple ideas that flourished under the attention of a small team of dedicated members of the naval technical support community.

One such example is the progress made by the naval materiel management system over the years. The positive impact this system has had on readiness, and the rigour it provides across the enterprise are nothing short of outstanding. The clarity it offers alone pays huge dividends in terms of decision-making, allocation of resources, and our collective understanding and management of risk. The progress speaks to the sophistication with which we, as a community, tackle challenges and solve the most complex

of problems. It is only with the benefit of hindsight that we appreciate how the small steps have contributed to huge advances over the years.

The naval materiel enterprise is a team sport where collaboration and perseverance are the keys to success. In your career with the Royal Canadian Navy (RCN) or the Government of Canada, you have an opportunity to decide to a great extent on how you will contribute. Whether that involves building the fleets of the future, enhancing or maintaining capability in the fleets that we currently have, or developing the people and policies that the RCN needs to operate, the success of the enterprise depends on the important work you do for the rest of the team.

In departing, I offer you a few final thoughts:

- Trust your gut. You've got to where you are because you are good at what you do.
- Don't worry about your career. Do a good job in the here and now, and your career will take care of itself.
- Find a work/life balance that works for you and your family. Maintaining family solidarity and good mental health deserves as much effort as meeting the daily demands of the Navy.
- Be a mentor. No matter who you are, someone can likely benefit from your experience. Take the time to help and encourage others on the team.
- And finally, have fun. The technical business of the Navy offers incredible opportunity, so make the most of it and enjoy it to the fullest.

It has been a true privilege and an honour to serve as a naval officer and engineer, and to be entrusted to work in various senior roles on behalf of the naval technical community. As I leave the Royal Canadian Navy, I do so with the utmost confidence that the enterprise is in very good hands. Thank you for the incredible support you have given to me, and I now look forward to supporting you from the other side. I wish you all the very best in your endeavours.

Dolphin 38!
(Diesel boats forever!)

Rear-Admiral Earl's final appointment was as Chief of Staff for the Materiel Group in Ottawa. The naval technical community wishes him well as he transitions to civilian life following an outstanding naval engineering career. — Editor

FORUM

Executive Coaching Pilot Program

By PO1 Jerome Mitchell

In March of 2020, I was nominated by my Divisional Chief Petty Officer to participate in the pilot for an Executive Coaching Program sponsored by the Vice Chief of the Defence Staff (VCDS). The aim of the program was to improve existing leadership training, and the module I was involved in dealt with emotional intelligence. Emotional intelligence (EI) is the way in which we use, understand and manage our emotions to positively influence interpersonal relationships. I jumped at the opportunity, and after some initial research could see this would be an amazing program for me.

I completed an online Emotional Quotient Inventory test, and was contacted by a certified coach a few weeks later. Darlene Sabadoz from VCDS sent me a copy of my EI report that outlined where my strengths and weaknesses were over a variety of different leadership attributes, including empathy, emotional self-awareness and expression, flexibility, and problem-solving. The results were displayed against a scale representing average scores from global leaders who had been determined to have high EI. The characteristics addressed in the EI test fall under the Canadian Armed Forces (CAF) leadership training Professional Development Pillar on *Self Development*, specifically in the area of *Social Capacities*. The report also included tips on how to improve in each area, and explained how different attributes interact. Darlene and I spoke for an hour about the results, got to know one another a bit, and at the end of the hour agreed to meet again.

We have continued meeting online every two weeks, and with her guidance I have developed an informal action plan based on my test results. Since my most rewarding job positions during my time in the Royal Canadian Navy (RCN) have involved leadership and mentoring subordinates, Darlene and I discussed my future goals in these areas, and how improvement in EI could help me achieve excellence in my future career. By thinking about what I have admired in past leaders, and considering the reputation I wish to build, the report allows me to develop

"This has been an amazing opportunity..."

targets in the areas that need the most improvement. By referring back to my action plan and to the test report, and through feedback from the people around me, I am able to gauge my progress. Meeting regularly with Darlene lends a certain level of accountability and motivation, and she encourages me to continue developing my highly individualized action plan.

I am very curious to see how my EI test levels would compare now after nearly 12 months in the program. I have found it challenging to fully integrate my action plan within my regular duties, considering I have been away from my normal workplace for much of the past year due to COVID-19. However, I have been utilizing my new skills in our Microsoft Teams meetings, as well as within my family life where I have already seen benefits. In fact, incorporating this into my regular life has been seamless, as I enjoy the process and find myself wanting to improve. I am definitely looking forward to getting back into the RCN environment again so that I can put what I've learned into practice.

(Continues next page...)

This has been an amazing opportunity and I feel very fortunate to have been chosen by the VCDS office to participate in this pilot program. In my opinion, the test results were fairly accurate, even though there were a few things I disagreed with at first. The EI test report and subsequent coaching sessions have opened my eyes to areas I hadn't even considered for improving leadership. While EI should be developed early in a career, it can be a useful reflective tool for those already established in leadership positions.

For me, this experience has been nothing but positive. It has expanded my knowledge base and certainly given me the opportunity to identify attributes within myself that I can improve to achieve my goals. Darlene has been with me every step of the way, and I appreciate all of her effort and assistance in helping me develop into the better leader I want to become.

Weapons Engineering Technician PO1 Jerome Mitchell is a Life Cycle Material Manager and Taskings Coordinator within the Major Surface Combatant directorate of DGMEPM in Gatineau, Quebec.

Emotional Intelligence as an Effective Leadership Tool

By Erin Cruse

The Executive Coaching pilot that ran from 2017 to 2020 was delivered by the Defence Team Coaching Program, within VCDS's Integrated Conflict and Complaint Management (ICCM) division. The intent of the pilot was to assess the effectiveness of an executive coaching format in complementing current CAF professional development opportunities aimed at enhancing leadership and institutional agility.

The pilot employed a test known as the Emotional Quotient Inventory 2.0 (EQi), a self-reporting measure that provides an overall score in emotional intelligence (EI). This score was then broken down into five composite scores, with a total of 15 specific subscales covering: Self-Perception, Interpersonal, Decision-Making, Self-Expression, and Stress Management.

By using the EQi, the 85 CAF officers and non-commissioned members (NCMs) who participated in the pilot were able to identify and target specific aspects of their own emotional intelligence profile in order to improve their ability to become more effective military leaders. Workplace studies suggest that leaders with higher EI have greater levels of job satisfaction and efficacy within their teams.

The Executive Coaching Program pilot was supported by 18 coaches who guided participants individually through the process, and helped them use their EI test results to create personal action plans for ongoing leadership development. One of these coaches, Darlene Sabadoz, said the individualized approach allowed participants to explore their various plan options in a confidential environment.

"The one-on-one attention is ideal," she said. "It provides a safe space for the individual to talk to a coach, and dive deep into an area of EI the client wants to develop."

Although the pilot program has wrapped up, planners are reviewing participant feedback to determine the most effective format for future program delivery. To find out more information about the VCDS Executive Coaching Program, please email DTCoachingProgramDTCP-ProgrammedentraineursLDPDLD@forces.gc.ca.

Erin Cruse is an editorial assistant with the Maritime Engineering Journal.

*The assistance of Maj Peter Fuerbringer, Public Affairs Officer, ICCM/VCDS, is gratefully acknowledged.

FEATURE ARTICLE

RCN Auxiliary Vessels — Replacing the Legacy Large Tug Fleet

By Norma O'Rielly

Civilian-crewed tugboats in the Royal Canadian Navy's (RCN) auxiliary fleet might lack the flash and glamour of the large grey combatants, but these sturdy workhorses play an indispensable role in the movement and safety of warships inside harbour limits, and in other operations offshore.

The RCN currently operates five, 259-tonne *Glen*-class tugs – *Glenside*, *Glenbrook* and *Glenevis* in the naval dockyard at Halifax, NS, and *Glendyne* and *Glendale* in the naval dockyard at Esquimalt, BC – along with a single 140-tonne fire tug *Firebrand* on the West Coast (Figure 1). The fire tug *Firebird* in Halifax was retired from service in December 2014. The *Glens* are the largest and most powerful tugs in the inventory, and are considered the backbone of the auxiliary fleet, but after 45 years of dependable service their replacement is finally a reality and well underway.

In April 2019, a contract was awarded to Industries Océan Inc., located in Isle-aux-Coudres, QC, to build four new Naval Large Tugs (NLTs). Selected for the build is a home-grown Canadian design by Robert Allan Ltd. of Vancouver. The RAmparts 2400sx (Figure 2) is a 24.4-metre, azimuthing stern-drive tug with 60 tonnes of bollard pull, and with more than 40 of the series in service worldwide, the craft boasts a well-proven design.

On September 18, 2020 steel was cut for the first tug, signalling the start of construction of the first major RCN auxiliary since the *Orca*-class vessels were procured in the early 2000s. To appreciate this notable milestone, a review of the project history affords an insightful view of the efforts required to achieve this long-awaited day.

Photos by Brian McCullough

Figure 1. The Navy's auxiliary fleet of five *Glen*-class tugs and one remaining fire tug that entered service in the late 1970s are being replaced by four new Naval Large Tugs. At top is *Glenside* in Halifax Dockyard, and below, *Glendale* and the fire tug *Firebrand* in Esquimalt Dockyard.

The *Glens*: Operational Profile and Capability Deficiencies

To support the mission of the RCN, the Queen's Harbour Master provides tug services to facilitate safe, efficient and economical movement of the major ships of the fleet. In addition to performing harbour berthing operations – both "hot" and "cold" moves – the *Glens* carry out a variety of other support tasks, such as coastal towing, standby duties for ammunitioning and fuelling, fuel spill cleanup response, servicing naval buoys, and towing recovery barges to salvage areas.

When the current complement of *Glen* tugs first entered service in the mid-to-late 1970s, the RCN fleet was predominantly composed of destroyer escorts that displaced about 2,800 tonnes. With a bollard pull of 18.3 tonnes, the *Glen* tugs were up to the task of accommodating these ships, but are underpowered for the current fleet of 4,700-tonne *Halifax*-class frigates. For this reason, the

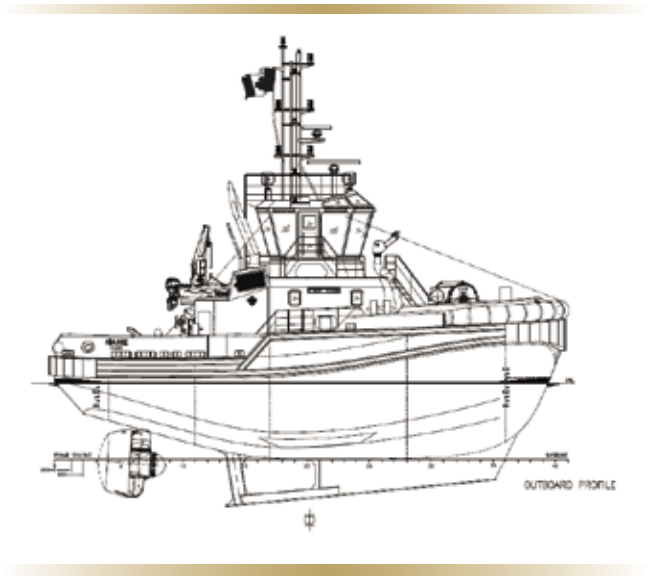


Figure 2. Modern and robust, the RAmparts 2400sx Naval Large Tug designed by Robert Allan Ltd. of Vancouver will serve the Navy's needs for decades to come.

tug services provided by the Queen's Harbour Master are at times constrained by wind and current conditions when conducting warship moves, thus reducing tug fleet operational flexibility, and impeding the efficient berthing, provisioning, repair, and deployment of the warships.

As the Navy introduces a significant number of new ships under the National Shipbuilding Strategy in the coming years, the demands on the *Glens* will increase. The first of the Arctic and offshore patrol vessels has already been delivered, with up to five more of the 6,400-tonne vessels planned. In addition, planned fleet recapitalization will deliver two 26,000-tonne (full load) Joint Support Ships, and up to 15 Canadian Surface Combatants (estimated at 9,000 tonnes each).

From a sustainability perspective, the Ruston AP3 engines in the *Glen* tugs are 1960s technology, are no longer being manufactured, and are becoming unsupportable. Consequently, the increased potential for engine breakdown coupled with prolonged repair times reduces tug availability, and imposes operational restrictions. In addition to power deficiencies and equipment life-cycle obsolescence issues, the *Glens* are not as ergonomic or as automated as equivalent modern commercial tugs, thus requiring a larger crew for safe operation.

Looking at options

It takes a lot of consultation, analysis, review, and revision to determine the preferred option for any capital project. The Naval Large Tug project became official when Identification Status was achieved in 2007, and many years were spent in the classic iterative spiral determining the requirements for a new capability: How many tugs are needed? What are the operational requirements? What bollard pull is required? What are the estimated capital, operation, and maintenance costs? Simple enough questions, but the answers required in-depth investigation. The project therefore assessed what is considered a standardized list of options:

- Retain the current fleet (status quo)
- Build new tugs
- Acquire used tugs
- Lease under long-term contract
- Contract for a combination build-and-lease alternative.

A short list of essential criteria and a list of high-level mandatory requirements were used to evaluate the various options. With questions from industry groups, parliamentarians and other government departments added to the mix, the result was a comprehensive and objective set of recommendations.

In the final analysis, the preferred option was to build, acquire, operate, crew and maintain an organic tug fleet. The project team was directed to deliver four tugs with firefighting capability, built to a proven commercial design that satisfies the operational requirements, as well as those of a recognized classification society and Transport Canada. Replacing the five *Glen*-class tugs and two *Fire*-class tugs with just four modern commercial vessels with a firefighting capacity will achieve savings in initial acquisition and operational costs, while reducing crewing requirements.

The Evolution of a Complex Procurement

Within the context of the Government of Canada acquisition process, the scope and intricacies of acquiring new tugs fit the criteria of a complex procurement. The NLT project has run parallel with the major changes and developments in government-wide procurement processes and procedures, and since reaching the Identification Phase has been following the not-so-easy, but necessary, road of complex procurement.

(Continues next page...)

Since its inception, the NLT project has experienced more than its share of procurement challenges – starting with what at the time seemed an endless loop of studies for alternative service delivery versus new acquisition of Department of National Defence (DND) vessels, and then proceeding through a complete review and revamping of the internal departmental approach to project management and approval. Other challenges involved being one of the first capital projects affected by the introduction of the Independent Review Panel for Defence Acquisition for internal governance, and the reality of being incorporated as DND's cornerstone contribution to the 2014 Federal National Shipbuilding Strategy (NSS) – Small Boat Pillar. All of this has showcased the NLT project as the definition of procurement adaptability. The NSS, in particular, completely changed how the Government of Canada does business for defence acquisition. With additional oversight, formalized approval gates, and reporting for capital procurement through the Defence Procurement Secretariat, the result was a full shift in how the NLT project was governed.

In addition to the larger institution-wide changes, the NLT project team has also had to become adept at keeping a long list of stakeholders fully engaged and satisfied. Faced with some unique challenges and opportunities as other federal departments attempted to relearn how the Government of Canada procured auxiliary boats, the project team made many inroads with our colleagues. This involved such activities as:

- Developing and implementing a new method for applying industrial and technological benefits to medium-sized industries in concert with Innovation, Science and Economic Development Canada (ISED);
- Looking at industry-based cost modelling and through-life sustainability in conjunction with Public Service and Procurement Canada (PSPC) efforts to roll out sustainment business cases; and
- Working with Crown-Indigenous Relations and Northern Affairs Canada (CIRNA) to develop and apply an applicable Indigenous Set Aside.

As if imposed challenges weren't enough, the NLT project also broke new ground on its own initiative during the Definition Phase when we sought and obtained Treasury Board (TB) pre-approval for contract award. While this is not the normal sequence of events, industry consultation with potential bidders indicated that keeping bid prices valid for the 11 months the normal process would take – while potentially acceptable to larger firms – was not something tug-sized yards would want to, or even could, entertain. After much discussion, senior management from DND, PSPC and TB agreed to pilot a new approach by pre-approving the project at a pre-determined cost to be verified following selection of the winning bidder when the final cost modelling could be completed. Adopting this approach of completing multiple

DND photos by Marc Leger and Norma O'Rielly.

Figure 3. In 2019, the NLT project team travelled to Sanmar Shipyards in Turkey to inspect the *Bogacay XV*, built in 2015, which serves as the Parent Design for the Naval Large Tug. At the time, the team members were (left to right): Mike Follett (NLT Project Team, Subject Matter Expert, DND), Marc Leger (NLT Deputy Project Manager, DND), Brenda Lamothe (NLT Contract Manager, PSPC), Norma O'Rielly (NLT Project Manager, DND) and CPO 2 Bijod Emilcar (NC 2-3-6, Subject Matter Expert, DND).

Photos courtesy of Industries Océan Inc.

Figure 4. Superstructure assembled at the Industries Océan facility in Québec City is moved out of the construction hall for water transport 120 km down the St. Lawrence River to the Isle-aux-Coudres shipyard.

steps in advance of the normal schedule allowed contract award timelines to be reduced by six months, and satisfied industry in the process.

Procurement Strategy

Naval ship procurement typically starts with the development of a comprehensive set of technical requirements defining all the features, systems, and equipment. The NLT started as such a procurement, defining thousands of requirements that were released to industry for comment through numerous consultations. At the last of these Industry Day sessions, the NLT project team had a "eureka" moment while listening to what industry was telling us. Since the tugs were to be a commercial off-the-shelf design with respect to requirements, it was determined that the best way forward would be to identify and establish a basic list of essential technical criteria necessary to meet the operational profile and required capability for the new navy tugs – essentially, a subset of technical requirements.

Thousands of tugs are in service around the world, and our tugs basically have a similar operational profile. Rather than have the bidder source a tug to meet 1800 hundred requirements, 300 high-level requirements were selected as the basis for choosing the new tugs. This approach would ensure the tug chosen met the functional requirements, and would lend a greater degree of certainty for a successful procurement process. The Request for Proposals (RFP) was structured for bidders to select an existing, in-service tug appropriately identified as a "Proven Parent In-Service Vessel." It just made practical sense, and was a decision that resulted in a successful tender.

Following contract award, the project team travelled to Turkey in July 2019 to inspect the parent tug (Figure 3). This allowed for the systems and equipment featured on the parent tug to be verified and included in the reduced RFP Systems Requirement Document. This complete set of technical requirements forms the basis for vessel inspection at acceptance and delivery of the tugs.

Preliminary Design was completed in December 2019, followed by Critical Design – which sets the technical baseline for the tugs – in May 2020. The achievement of Critical Design marked the start of Production Design last June. Steel for all four tugs was received in August, and steel-cutting began in September. Construction of the first assembly unit began in November, and the keel was laid January 28, 2021.

(Continues next page...)

Photos courtesy of Industries Océan Inc.

Figure 5. The first NLT (Hull 228) takes shape at left, with an interior view of the engine room at centre, and an azimuthing stern-drive unit waiting to be installed at right.

The Impact of COVID-19 and Moving Forward

Under a normal business environment all projects take an enormous amount of collaborative effort to remain on target with schedule commitments, but the past year-and-a-half have been anything but "business as usual." The COVID-19 pandemic created unfamiliar new territory and brought with it a plethora of challenges and risks. With the work-from-home dictate in March of last year, stakeholders quickly shifted to electronic and virtual communication. In terms of productivity, the NLT project team and the contractor continue to work efficiently in the teleworking environment, conducting major design reviews without the need for a single travel form.

As the cut sections of steel are fabricated into the appropriate shapes for assembly, and the NLT proceeds with production, the pandemic continues to have the potential to affect the efficiency of the team, as well as interrupt global supply chains essential to the construction schedule of the project. Since the original schedule was based on a 2019 industry standard of just-in-time delivery of equipment and material, the project team collaborated with Industries Océan Inc. to update the project contract to allow for critical path equipment and material to be purchased early to mitigate potential delays and secure the schedule going forward.

The tugs are being built at the Isle-aux-Coudres shipyard, with structural assembly of some units being completed at the Industries Océan facility in Québec City (Figure 4). Each tug is built as 13 individual units that are assembled to form the finished vessel (Figure 5). As of April 2021, 70 percent of the hull structural assembly for the first tug, Hull 228, was completed with 10 of the 13 units assembled and welded. Structural assembly will be completed this summer, with the official launch planned for the spring of next year. Meanwhile, in May, construction started on the first units of the second tug, Hull 229.

Considering the timelines and challenges associated with the Naval Large Tug project, it is exciting to think that we will soon be welcoming modern, capable tugs into the auxiliary fleet to meet the current and future needs of the Navy. The first two NLTs are scheduled to be delivered to Esquimalt in 2022, with the final two tugs scheduled to enter service in Halifax in 2023 and 2024. When that happens, it will make a satisfying conclusion to a long and colourful story.

Finally, a "shout-out" to all those who have responded efficiently and effectively in contributing technical support to the Naval Large Tug project. Without your efforts and cooperation we could not have reached this point.

Norma O'Rielly is the Project Manager for the Naval Large Tug Project in Ottawa.

FEATURE ARTICLE

"The Persian Conversion:" A Personal Retrospective of HMCS *Protecteur*'s Gulf War Mission-Fit of August 1990

By Cdr (Ret'd) David G. MacDougall

Author's note: Thirty years ago, HMCS Protecteur returned from Operation Friction and the 1991 Gulf War having accomplished its mission as a logistics support vessel and alternate command ship for the Canadian Task Group. That the ship superbly fulfilled both roles was due not only to the valour and determination of its two crews, but also to the valiant efforts of hundreds of people in the Halifax naval dockyard and elsewhere as they prepared the ship for war over 12 dramatic days in August 1990. I was a witness to that audacious feat, and kept a diary of my experience. This article partially recounts some of the events from that amazing time.

The summer of 1990 started out relatively quietly for me. Having completed the Canadian Patrol Frigate Naval Electronics Technician (Systems) course at the Paramax Electronics facility in Montréal in mid-July, I was back in the HMCS *Halifax* shore office at CFB Stadacona in Halifax, NS. I was the ship's deputy combat systems engineering officer (CSEO), and it would be some time still before we received our new frigate from the contractor's yard in Saint John, NB.

My mind was actually on my upcoming summer leave, and on July 29 my wife and I headed out for two weeks of peace and quiet at a rustic cabin retreat in western Nova Scotia. With no TV, no telephone, and no radio other than the one in our car – which got listened to infrequently – we found what we were looking for. Cell phones and the Internet were still little more than science projects back then, so we were blissfully unaware that dark events were taking place on the other side of the planet: Saddam Hussein had invaded Kuwait on August 2, and we knew nothing about it.

It was a shock to arrive back home on the evening of Saturday, August 11 to a telephone answering machine jammed with urgent messages from the authorities in Maritime Command (MARCOM). Unbeknownst to me, my leave had been cancelled, and I was to report forthwith to HMCS *Protecteur* (AOR-509) as the operational support ship's ad hoc CSEO. Canada had announced its intention to join a U.S.-led coalition against the Iraqi aggression, and the ship would be rapidly deploying as part of a Canadian task group that included the flagship HMCS *Athabaskan* (DDH-282) and the destroyer escort HMCS *Terra Nova* (IRE-259). First thing on Sunday morning I contacted MARCOM and the ship, and learned that my first task would be overseeing the tanker's urgent mission-fit preparations for deployment to the Persian Gulf in support of Operation Friction – and so began my involvement in an immense undertaking that would be dubbed, "The Persian Conversion."

I have to admit that I was feeling quite apprehensive as I made my way down to the dockyard on the morning of Monday, August 13. When I showed up at *Protecteur*'s brow around 0630, I was immediately ushered up to the captain's cabin where I met my new boss, Capt(N) Doug McClean. Also on hand were the ship's executive officer, Cdr Frank Scherber, and the combat officer, Lt(N) Russ Fowler.

(Continues next page...)

Images courtesy the author.

HMCS *Protecteur*'s mission-fit for the 1991 Gulf War was conducted during two intense weeks of activity in August 1990. While the forward 3"50 main gun on the bow, and the two Close-in Weapon Systems were highly visible upgrades to the ship's self-defence armament, dozens more "hidden" enhancements to the communications and command & control suites arguably offered more value-added to the mission.

On my way up to the CO's cabin I had seen that the ship was swarming with dockyard mateys, and that cables seemed to be hanging everywhere. *Protecteur*'s transformation was already underway.

Of the three Canadian ships being readied for deployment to the Persian Gulf, *Protecteur*'s conversion was probably the most radical. The ship carried no defensive weapons – only a basic radar and communications suite – and normally sailed with a small detachment of just five technicians to keep the few electronic systems functioning. They worked for the combat officer, as the ship carried no CSEO. Until now.

With the major threats deemed to be anti-ship missiles and sea mines, *Protecteur* required a major make-over to be fitted with an effective self-defence capability. Also, since one of the ship's alternate roles was to function as the task group command ship whenever HMCS *Athabaskan* was alongside or otherwise not in operation, *Protecteur* required a command & control system and modern, secure voice and data communications to be able to interact effectively with other coalition ships. The new self-defence weapons suite would consist of a twin-barreled 3"50-cal. main bow gun, twin 40-mm Bofors "Boffin" guns, two Vulcan/Phalanx Close-in Weapon Systems (CIWS), a Plessey Shield Tactical Decoy System, and a Super Rapid Bloom Offboard Countermeasures Chaff and Decoy Launching System – the "Super-arboc." These systems were the most visible and oft-discussed part of the conversion, but I consider the real value-added (and generally unknown) enhancements were the dozens of mission-fits involved with the communications and command & control suites.

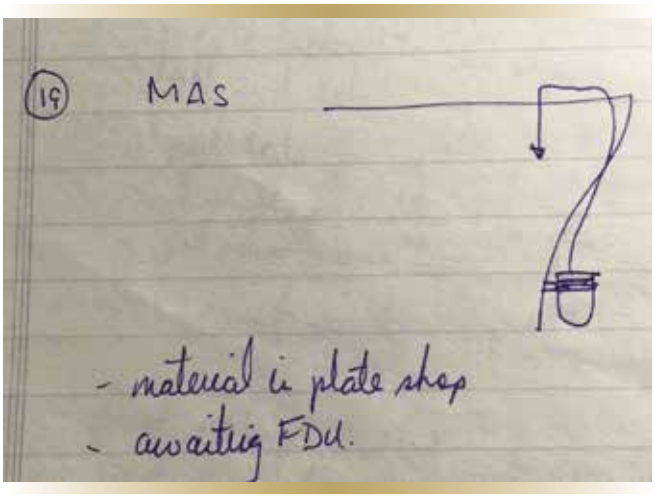
That first day on board, I was given the proposed timeline of the deployment:

- Deadline to complete all work: August 17, 1990
- Sea trials to commence: August 18
- Back alongside Halifax: August 20
- Depart Halifax on deployment: August 21
- Arrive Gibraltar: August 29
- Arrive Gulf of Oman: September 14, 1990

Also provided was the preliminary mission-fit list of all the new combat systems to be installed on board *Protecteur*. That already lengthy list would grow even longer in the coming days, and it seemed impossible that we could have everything installed and tested by August 18. Fortunately, this did not seem to faze the three key dockyard organizations tasked to get the work done: Naval Engineering Unit Atlantic (NEUA), Ship Repair Unit Atlantic (SRUA), and Fleet Maintenance Group Atlantic (FMGA).

It should not be construed that this mission-fit was in any way ad hoc, nor done without due consideration and diligence to electronics engineering imperatives such as electro-magnetic interference/compatability (EMI/EMC), and TEMPEST shielding. The dockyard engineering, repair and maintenance units cooperated closely to ensure that the equipment and systems were properly situated and installed. Ship's staff, including operators, worked side-by-side with the dockyard engineers, technicians, and fabricators, and were instrumental in making quick and effective decisions on everything associated with the mission-fit. Many times, as CSEO, I collaborated with the combat officer on these key decisions.

The bulk of the work was conducted from August 11 to August 21 while the ship was alongside the Ship Repair Unit in Halifax Dockyard. On the 21st, *Protecteur* slipped from the jetty at 1200 and headed for the degaussing range, but with so much work still happening on board with the combat systems installation, we took many of the dockyard workers to sea with us. This allowed them to continue with the set-to-work while *Protecteur* ran the degaussing range and swung the radiation-pattern mapping site.



This rough sketch of the experimental mine-avoidance sonar installation belies the extent of the engineering and logistics considerations that accompanied every aspect of the mission-fit.

My notes for that afternoon show us doing a slew of tests while the degaussing was happening: electrical power load tests to determine if we had enough electrical generation capacity for all the new electronics going in, a full suite of EMC tests to make sure the new electronics did not interfere with each other when transmitting, lots of checks with the new radars (we found out the SPS-502 mast was too low, for example), and the really big show – a CIWS Trackex of a T-33 fighter aircraft. We did 15 runs and successfully tracked and engaged the target aircraft – all on that single day!

We remained at sea overnight, and on the morning of August 22 proceeded to the gunnery range at Osborne Head where we fired 20 rounds from each barrel of the 3"50 gun, 40 rounds of 40-mm ammunition from both of the two Bofors guns, and 300 rounds of M149 depleted uranium rounds from both the forward and after CIWS systems. I spent several hours in the right-hand seat of the 3"50 turret as we fired round after round so that the Inspector of Naval Ordnance could certify the weapon. It was an enjoyable experience, but my ears rang for days afterward.

As soon as we had the ship back alongside in the dockyard, we started into what would be a hectic 36-hour period of final preparations to meet our sailing date on the 24th. August 23rd was a mad day of activity for us. One of the major tasks I managed to accomplish in that short time was to set the all-important firing safety cut-outs on the CIWS systems to prohibit the guns from shooting up our own ship. However, there was a major problem with setting the cut-outs on the forward system. At the forward end of the open pilotage atop the bridge, right in the line of fire, were two 15-m HF radio antennas situated port and starboard. As if that weren't problem enough, the antennas for the LORAN-C, OMEGA, and (new) GPS were also in the way. Setting cut-outs to clear this equipment would close off critical firing arcs for the ship.

Moving the antennas to locations out of the way of the CIWS, perhaps atop the replenishment-at-sea goalposts, was determined to be impractical since the antennas were tuned for their specific locations. Relocating them would also likely have disrupted the HF receiving system – part of our critical, long-range radio link to the naval radio station back at CFS Mill Cove in Nova Scotia – and would have required extremely long cable runs that would have been difficult to install. The rather inelegant solution was to leave the antennas in place. If the CIWS cut them off during an engagement, we had replacements lashed down below on the ship's jungle deck.

Protecteur entering Port Said, Egypt at the northern entrance to the Suez Canal in September 1990. Just days earlier, the ship lost its mission-fit mine-avoidance sonar in heavy seas.

Regardless, the CIWS installation and set-to-work was a truly monumental achievement by NEUA, SRUA, FMGA, and the General Dynamics field service reps – as well as by the *Protecteur* staff who worked with them the whole time. There was an immense scope of work required to get both mounts on board and functional in time, and according to the General Dynamics FSRs we established an unofficial record on the forward system – 29 hours from the CIWS landing on its seating to putting "rounds out the spout."

One of the greatest technical challenges was related to one of the less-noticed pieces of mission-fit equipment: the mine-avoidance sonar, or MAS. The Navy's operational authorities had determined that sea mines deliberately set by Iraq were among the greatest threats to our task group in the Persian Gulf – after anti-ship missiles. We pretty well knew where the fixed minefields were off the coast of Kuwait and in the Shatt-al-Arab, but the Iraqis had also dumped hundreds of untethered mines into the Gulf, and the counter-clockwise currents were slowly carrying them down the coast of Saudi Arabia toward Bahrain. Since these were a major threat to shipping throughout our area of operations, all three ships of the Canadian task group were to be fitted with a mine-detection capability. The selected MAS was an experimental system based on a Canadian commercial product – the C-Tech Spectra-Scan 3000 professional-grade fish-finding sonar (see MEJ 27).

(Continues next page...)

Protecteur already had a permanently fitted sonar system, the venerable SQS-502 (the transducer was on the keel in a retractable raft), but it was useless for mine detection as it could not "look up" toward the surface of the water where the mines floated (whether tethered or not). Plus, the SQS-502 electronics had been removed from the ship's sonar control room (SCR) to make space for the Automatic Data Link Plotting System (ADLIPS) equipment rack. A decision was taken that the MAS transducer, about 30 cm in diameter, would be mounted on the foot of the bow so it could scan upward. One problem with this was that the coaxial cable between the underwater transducer and the shipboard transceiver, which facilitated a wide-bandwidth, high-data rate for enhanced resolution, was calibrated for a maximum length of just 4.5 metres. This meant the sonar operator would have to be located down in *Protecteur's* cordage stores in the forward part of the ship, a damp, dark space without communications (another issue to be addressed). As for the transducer mounting, SRUA would have to fabricate a custom-built bracket assembly that could be bolted directly onto the foot of the bow – requiring the assistance of Fleet Diving Unit Atlantic to drill the holes and install the device.

Everything was ready on August 17, but the availability of FDUA was delayed until overnight of August 22/23. The divers worked throughout the night, drilling (with great difficulty) some 30 holes in the case-hardened steel of the foot. Another 20 holes were required to attach a cable conduit to the outside of the hull. It was noon on August 23 when the divers affixed the new transducer, and we ran the cable through a newly cut gland on the starboard side of the bow into cordage stores and attached it to the master unit. On August 24, the system was flashed-up for the first time and it worked perfectly. However, it was decided to remove the transducer for the Atlantic Ocean transit and reinstall it in Gibraltar. The divers from FDUA went down one last time just before we sailed and pulled it off.

The MAS installation was just one more example of the ingenuity and determination at work by the large number of people who were involved with "The Persian Conversion." My notes from the time show me spending many nights aboard ship, with barely enough time for a quick shower and a change of clothes. Work had gone on 24 hours a day, in three shifts, and at one point I went without sleep for 46 hours. The morning of our departure is a bit of a blur in my memory, as I was scrambling to finish off last-minute details, but it was soon time to close up for sailing. I quickly changed into my summer whites and joined the other officers on the flag deck for our grand sailpast for the fleet and the thousands of well-wishers who were lining the shore to see us off. As we departed for the uncertainties that awaited us in the Persian Gulf, Capt(N) McClean sent a message of thanks to the people in the dockyard and elsewhere for their hard work in getting *Protecteur* ready to go.

Notwithstanding the equally impressive effort to prepare *Athabaskan* and *Terra Nova*, *Protecteur*'s mission-fit was unique in its scope – a complete communications upgrade, a new command & control capability, and extensive self-protection measures. Cable-running was always the critical path due to the sheer number of systems being installed and the cable-run distances that were involved – about 11 km worth in all. Sadly, the saga of the MAS did not end well. On September 15, the day before anchoring at Port Said, Egypt prior to transiting the Suez Canal, the ship experienced rough seas in the eastern end of the Mediterranean and the transducer we had reinstalled at Gibraltar was torn away from its mounting and lost. It was never replaced.

Despite this, *Protecteur*'s success on deployment speaks volumes for the overall excellent engineering effort that was conducted by the Halifax-based engineers, technicians, riggers, fitters, welders, and painters of NEUA, SRUA and FMGA and Base Supply, and by countless other individuals in MARCOM, the First Canadian Destroyer Squadron, DGMEPM, Defence Research and Development Canada, FDUA, and the Canadian Forces Ammunition Depot. People might not always have had the answers immediately to hand, but they quickly overcame the technical challenges to create workable solutions within a seemingly impossible timeline. The transformation of the ship was as dramatic as it was extensive. Three decades later, the outstanding success of this monumental effort is as impressive today as it was then, and it remains the highlight experience of my naval career. I was glad to have been part of it.

Cdr (Ret'd) David MacDougall served as a Combat Systems Engineer in the RCN from 1980 to 2008. Previous articles of his have appeared in the Maritime Engineering Journal, issues 16, 55 and 58.

FEATURE ARTICLE

Naval Materiel Technology Management: Creating a Culture of Innovation

By Stephanie Platero – NMTM Student Communications Officer (FSWEP)
with LCdr John Faurbo – Acting DNPS 5 Technology Manager for NMTM.

In a fast-paced, data-driven and data-dependent world where the evolution of technology has led to impactful transformations across many domains, the Royal Canadian Navy (RCN) must necessarily do its best to adapt and implement integrative systems, and promote a culture of innovation within its ranks. To this end, Canada's Defence policy (*Strong, Secure, Engaged*), the RCN's Digital Navy Initiative, and the RCN Strategic Plan 2017-2022 all highlight a requirement for innovation.

In recognition of this challenge, the Director General Maritime Equipment Program Management (DGMEPM) has established a special "innovation champion" section in the Directorate of Naval Platform Systems: DNPS 5 – Naval Materiel Technology Management (NMTM), to act as a bridge between fellow innovators in the Navy, industry, academia, and other government departments. DNPS director Mark Sheppard also acts as the director of the RCN's internal Naval Technical Innovation Program (NTIP).

NMTM itself comprises three sub-sections, examining **Change Management** (i.e., knowledge management, governance, networking, communication and ideation), **Solutions Management** (i.e., management of innovation initiatives and testing), and **Human Systems Integration**.

Along with its small permanent staff, the energetic NMTM team includes anywhere from six to 15 Federal Student Work Experience Program (FSWEP) students in a given school semester. NMTM also receives valuable support from the Naval Engineering Test Establishment (NETE) in Montreal, which has been serving the RCN for over 65 years. NMTM's combined resources play an essential role in learning about, evaluating the effectiveness of, and advocating for innovative technologies that will enhance the force posture and sustained operational readiness of the RCN.

Embracing radical and disruptive technologies can sometimes be difficult for people to accept, but it is a key element of innovation that can create some very exciting opportunities. NMTM thus performs testing and validation on a wide breadth of technologies spanning artificial intelligence (AI), cloud computing, smart sustainability, digital twinning, green initiatives, fleet optimization, and people-oriented software. To better understand and exploit these emergent technologies, NMTM is working with a number of Canadian companies on many exciting projects, including the ones described below:

In partnership with Datifex Inc. of Toronto, ON, NMTM is actively working on the visualization of a digital twin tool (Figure 1) to educate DGMEPM, along with fleet personnel, on the requirements and impacts of the Naval Ship Code (NSC) and Class Certification on our fleet. A digital twin is a virtual model of a physical object that accurately responds to real-world inputs with outputs that emulate what the object would normally provide. The Smart Certification System software is an easy-to-use visualization of the NSC that demonstrates the status of the fleet with respect to certification, and provides an overview of impacted ship systems. The goal is to ensure a robust understanding of the NSC, and to support decision-making for those involved with ship certification. Furthermore, this technology will aid in understanding the utility of digital twin technology within the RCN, and its possible integration into the future Naval Integrated Data Environment.

(Continues next page...)

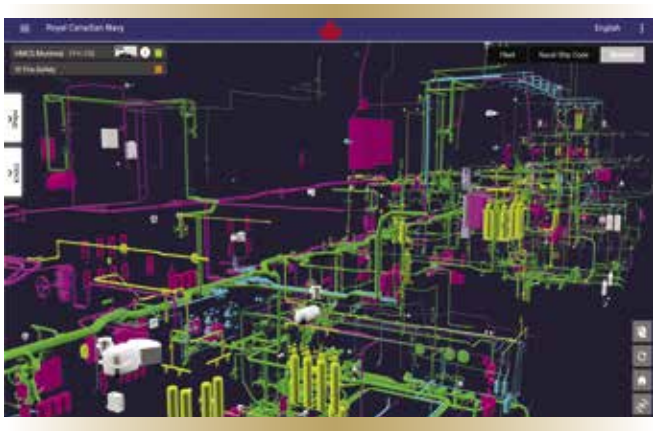


Figure 1. Datifex Smart Certification System

Figure 2. Datifex Smart Dockyard Management System

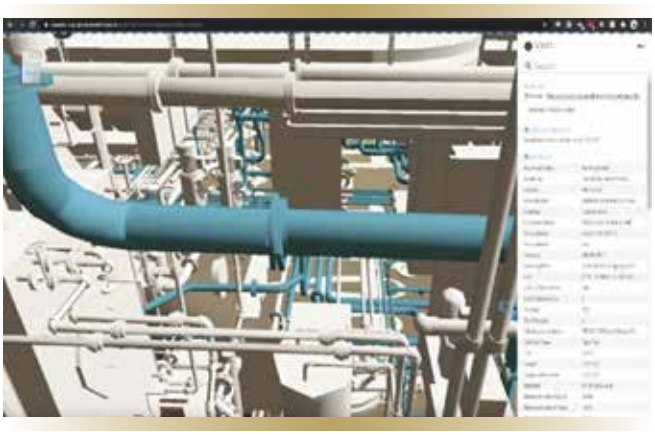


Figure 3. SmartShape Digital Twin

NMTM is teamed with Datifex on another data twin application called the Smart Dockyard Management System (Figure 2). Using the concept of a Smart City, this technology's focus is to demonstrate how the Internet of Things (IoT) and digital twins may be combined to create a day-to-day operations management system for the naval dockyards. Initially, it will showcase a modern waterfront-management toolset for the use of ship's staff, maintenance planners, and dockyard operations personnel. This project aims to increase safety and efficiency by employing real-time awareness of maintenance activities, equipment laydown areas, man-aloft activities, RF emissions zones, diving evolutions, and other hazardous activities underway in the dockyard. Other potential benefits may include the tracking of dockyard assets such as crane locations, status of jetty services, and video surveillance.

SmartShape (Figure 3) is another digital twin application that bridges digital data and 3D CAD models. It is cutting-edge technology that provides a visualization of the status of defects and survey work within the fleet. SmartShape operates in a disconnected environment (i.e., when a digital device is not continuously connected to its database) using commercial off-the-shelf mobile devices. Developed by SmartShape – Aerys North America in Ottawa, ON as "software as a service," this user-friendly application can function both online and offline so personnel (even with no technical experience) can perform data logging, maintenance tasks, and survey work with relative ease. NMTM is currently exploring further options for connections to automated maintenance systems, and other data sources, and continues to look for stakeholders for further testing.

In partnership with Ocean Floor GeoPhysics and Cellula Robotics, both located in Burnaby, BC, NMTM explored the potential of using an autonomous underwater vehicle (AUV) to conduct vessel magnetic and underwater electric potential (UEP) surveys, and investigated the benefits of using mobile ranging services as compared to fixed infrastructure. The management of fixed ranges is costly, repairs can be expensive, and scheduling range time can have major negative impacts that are often neglected for other priorities. A mobile AUV-based solution (Figure 4) could be the ideal platform to address these issues. The range can come to the ship, and can be deployed to anywhere in the world.

Further, lessons learned with this signature range drone can also be used to inform other requirements for surveillance and reconnaissance drones in future. Completed at the end of March of this year, NMTM is continuing to explore the development of this capability to support and augment current infrastructure for signature management.

After an initial augmented reality test conducted in the RCN, NMTM partnered with Kognitiv Spark of Fredericton, NB to further explore software that leverages the capabilities of augmented reality and mixed reality systems (Figure 5). To facilitate this, NMTM has procured the largest number of Microsoft HoloLens 2 mixed reality devices in Canada. The goal is to explore improved efficiencies

Figure 4. Mobile Autonomous Underwater Magnetic Signature Ranging

Figure 5. Kognitiv Spark – Augmented Reality Exploration

with ship operations, remote assistance, augmented repairs and maintenance, training support, virtual telepresence, knowledge transfer, and medical support use cases. The current focus is on developing a self-contained pack-up kit that deployed technicians can use to support unclassified repair scenarios to maintain RCN ships at a high level of readiness. Augmented reality is certainly a key technology that will shape the operational, maintenance and training landscape for years to come.

The Sky Canoe autonomous drone joint initiative brings together NMTM with Transport Canada, Independent First Nations Alliance (IFNA), the Royal Canadian Air Force, and Sky Canoe Inc. in Toronto, ON to test a novel vertical takeoff and landing (VTOL) drone system. The Sky Canoe aircraft (Figure 6) is a long-range, heavy lift autonomous cargo aircraft that operates much like a fixed-wing aircraft, but uses a unique vectoring thrust system to obtain a smooth transition from vertical takeoff to forward flight operations. It has the benefits of a helicopter when it comes to landing and takeoff ability, with the greater flight efficiencies of a fixed-wing aircraft. Sky Canoe incorporates sensors, navigation systems, communication systems and other equipment to permit operation beyond visual line-of-sight, and NMTM is exploring its potential for aerial surveillance operations and airborne delivery of life-saving equipment. Further investigations will include a hydrogen-fuelled variant (with an expected range of 2000 km), and a demonstration of its capability as an autonomous VTOL aircraft operating from a maritime platform.

Finally, OCIANA, from Global Spatial Technology Solutions in Dartmouth, NS, is a technology that simplifies the collection and distribution of information required to maintain maritime domain awareness (Figure 7).

Figure 6. Sky Canoe – Autonomous Drone

Figure 7. OCIANA – Satellite Data to provide Maritime Domain Awareness

Utilizing AI software, with open-source and commercial data, OCIANA facilitates the exchange of data between maritime security agencies. The trial will evaluate a full range of capabilities of the software including predictive maintenance and equipment health monitoring (supported by AI and IoT sensors), marine mammal and ice tracking (for navigation), fleet monitoring, risk analysis for ports of call, and vessel tracking and associated risk assessment. The aim is to enhance collaboration between government departments, and to centralize the collection and dissemination of information on vessels of interest while supporting decision-makers with timely information.

(Continues next page...)

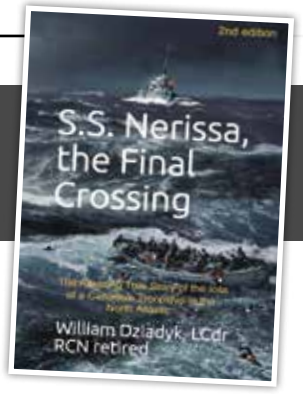
Conclusion

Since the application of all these new technologies also considers end-user workflow processes, NMTM, along with NETE, is dedicated to providing thorough validation on the use-cases of all innovations in its portfolio. With the successful completion of the Planbox innovation management platform trial, the team has implemented an interim placeholder repository to continue gathering new ideas and suggestions for improvement from internal stakeholders within MEPM and the RCN. To that end, NMTM is always looking for opportunities to explore initiatives that will help evolve and improve the day-to-day business of MEPM and the fleet.

If there are any questions about NMTM or the initiatives described above, or to submit ideas, interested parties may use the QR code embedded in this article, fill out the form at this link, https://bit.ly/2QACwWA, or contact NTIPCoord-CoordPITN@forces.gc.ca. Alternatively, Acting DNPS 5 – Technology Manager LCdr John Faurbo may be contacted at: John.Faurbo@forces.gc.ca

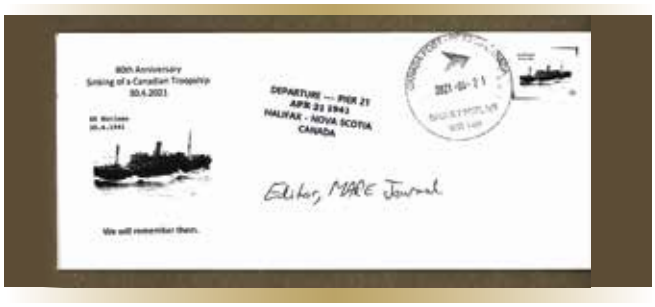
BOOK REVIEW

UPDATE — S.S. Nerissa: The Final Crossing, 2nd Edition



In our Spring 2020 issue (MEJ 92), we reviewed author LCdr (Ret'd) William Dziadyk's account of the circumstances surrounding the wartime loss of the Liverpool-bound troopship *S.S. Nerissa* to enemy action on April 30, 1941.

As we subsequently reported, following the release of the book, Dziadyk received new details of the impact of the tragic human loss on the home front from a retired RCN marine systems engineer who had a family connection to the story: Capt(N) (Ret'd) Sherm Embree's uncle, Royal Canadian Army Medical Corps **Captain William (Bill) Hazen Embree**, was one of the 207 people lost in the attack by U-552 (MEJ 93). Ten of the 16 RCN personnel who were embarked also died in the attack.



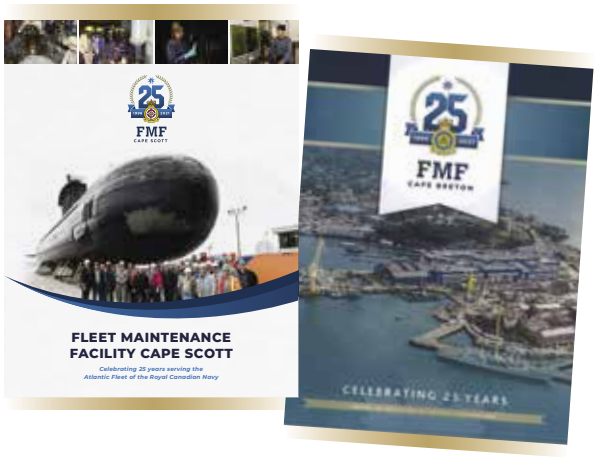
This "first day cover" envelope and personalized *S.S Nerissa* commemorative stamp were created by author Bill Dziadyk, with design assistance from his sister Susan Dziadyk, and artist Barry Tate who also designed the book's cover. Many thanks to Sherm Embree for mailing this to the *Journal* on the anniversary of the sinking.

With access to the Embree family scrapbooks, and with additional information relating to the sinking discovered through further research, a second edition of the book containing a new foreword by Capt(N) Embree was released through Amazon on the 80th anniversary of the ship's loss. Although attempts to have an official commemorative postage stamp issued to mark the anniversary were unsuccessful, a personalized first class postage stamp was produced through the Canada Post "Picture Postage" program. (To purchase booklets of the stamps, please contact sdziadyk@shaw.ca)

NEWS BRIEFS

Fleet Maintenance Facility 25th Anniversary celebrations!

As we reported in our Spring edition (MEJ 96), the RCN's two dockyard Fleet Maintenance Facilities turned the page on 25 years of outstanding engineering and maintenance services to the fleet in April. Both units – FMF Cape Scott in Halifax, and FMF Cape Breton in Esquimalt – celebrated this significant milestone with special commemorative booklets and cake-cutting ceremonies to mark the occasion. Our thanks to FMF Strategic Communications Officer Ashley Evans for sending us these photos.



FMF Cape Scott

FMF Cape Breton

NEWS BRIEFS

MS Remi Ducharme named RCN's 2020 Exceptional Sailor and Centennial Cup recipient

(From Navy News / March 1, 2021)

Master Sailor (MS) Remi Ducharme, currently serving on board HMCS *Kingston* (MM-700), has been named the Royal Canadian Navy's (RCN) 2020 Exceptional Sailor and Centennial Cup recipient.

The Weapons Engineering Technician, who held the rank of Sailor 1st Class at the time of his nomination, has since been promoted to his current rank. He received the nomination for his invaluable contributions while serving in his former ship, HMCS *Charlottetown* (FFH-339) which included his consistent professionalism and expertise on the job. He is also a community volunteer, including at Halifax's Camp Hill Veterans' Hospital, for the local Battle of Britain and 75th Anniversary of D-Day celebrations, as a mentor and instructor in the CF Aboriginal Entry Program, in the ship's Run for Wishes in PEI campaign (which raised over $26,000 for the Children's Wish Foundation), and for organizing the ship's Family Beach Day.

A fully bilingual sailor, MS Ducharme was selected for several Recruiter for a Day events in Montréal and Rimouski, QC where he promoted the Navy and answered questions from potential recruits. With his technical background, he was even able to fix problems the recruiting team had with their presentation equipment, ensuring the event could continue without incident.

MS Ducharme has demonstrated his adaptability, accepting a temporary transfer to another ship to fill in during a crew shortage while that ship was on exercise.

Bravo Zulu MS Ducharme!

Photo courtesy of Seaspan

Main engines for the new JSS have arrived!

The Joint Support Ship (JSS) project reached another exciting milestone with the recent delivery of its two main engines at Seaspan's Vancouver Shipyards.

Manufactured in Augsburg, Germany by MAN Diesel and weighing 70 tonnes each, these engines will have a combined output of nearly 20,000 horsepower to propel our future *Protecteur*-class ships at up to 20 knots. Work to integrate these engines into the ship blocks will begin in summer 2021, and represents another important milestone in the construction of our future fleet.

The JSS project has been at full rate construction since June 2020, and has thus far substantially completed 53 of its 123 blocks, with the remainder under construction.

(Courtesy MATFLASH)

NEWS BRIEFS

2021 RCN Naval Architecture Conference a "virtual" success

By Lt(N) Johnathen Baldwin, NAC Conference Organizer

Despite the challenges presented by the pandemic, the Royal Canadian Navy's (RCN) annual Naval Architecture Conference (NAC) that ran February 23-25 was a huge success. Under restrictions imposed by COVID-19, the conference was held virtually over Microsoft Teams.

In attendance this year were members of the Canadian and international Naval Architecture communities, including participants from Maritime Equipment Program Management, Major Project Delivery (Sea), the Fleet Maintenance Facilities and Fleet Technical Authorities, Lloyd's Registry and the American Bureau of Shipping classification societies, the Naval Engineering Test Establishment and the Quality Engineering Test Establishment, Defence Research and Development Canada, the National Research Council and Canadian Coast Guard, industry, and academia – representing Memorial University of Newfoundland, the University of British Columbia, and University College London.

Over the course of three days, the attendees participated in presentations and panel discussions covering a wide range of naval architecture topics, including challenges, lessons learned, and ongoing research relating to the operation and maintenance of Canada's current and future naval fleets. Two guided discussions were also included to address issues of concern identified by coastal NA authorities, such as coastal discrepancies between practices and interpretations on lifting appliance certification and trials agendas, and the applicability of current preventive maintenance routines for *Halifax*-class frigates beyond the end of design service life. While these discussions were not expected to produce any silver bullet solutions, they did serve to get a broader conversation started among the stakeholders who were in attendance.

For the first time this year, there was a special Industry Partner Session to include participation by some of the industry teams that work closely with the RCN, such as Babcock Canada and VARD Marine. An invitation also went out to junior Naval Technical Officers who might be considering pursuing careers in Naval Architecture or Marine Engineering – the intention being to encourage them to apply for the relevant post-graduate training program.

The success of the NAC can largely be attributed to the presenters who graciously volunteer their time to develop and give the presentations, and to the other participants who actively engage by stoking the discussions through their questions and comments. Preparations are already underway for next year's conference, which, if permitted, will be held in person. Many of the successes from this virtual conference can be carried forward – and ideally future gatherings may include virtual components to allow greater participation without requiring additional travel. Individuals or organizations wishing to participate in next year's RCN Naval Architecture Conference are asked to reach out to DNPS 2 for details.

Combat Camera photo by Cpl Lynette Ai Dang, HMCS *Calgary*, Imagery Technician

CNTHA 25th Anniversary!

NEWS (SUMMER 2021)

Canadian Naval Technical History Association

CNTHA News
Est. 1997

CNTHA Chairman
Pat Barnhouse

CNTHA Executive Director
Tony Thatcher

Directorate of History and Heritage Liaison
Michael Whitby

Maritime Engineering Journal Liaison
Brian McCullough

Webmaster
Peter MacGillivray

Webmaster Emeritus
Don Wilson

CNTHA News is the unofficial newsletter of the Canadian Naval Technical History Association. Please address all correspondence to the publisher, attention Michael Whitby, Chief of the Naval Team, Directorate of History and Heritage, NDHQ
101 Colonel By Dr
Ottawa, ON K1A 0K2
Tel. (613) 998-7045
Fax (613) 990-8579

www.cntha.ca

CNTHA 25th Anniversary

In its continuing mission to "Preserve Canada's Naval Technical Heritage," the Canadian Naval Technical History Association enjoys a close strategic partnership with the Royal Canadian Navy's technical community. Two years after the CNTHA was established in 1996, DGMEPM kindly began producing our unfunded association newsletter as an insert to the long-running *Maritime Engineering Journal*, for which we are most grateful. It is a truly synergistic relationship, as we now provide most of the content that the *Journal* used to cover in its Looking Back segments.

Since the late 1940s, the RCN has had an interesting history of technical innovation in ships and naval equipment designed to meet operational requirements. While these have satisfied what may be sometimes described as uniquely Canadian circumstances, many of our home-grown advancements have had more universal applicability to other navies. Working in support of Department of National Defence naval researchers in the Directorate of History and Heritage (DHH), the all-volunteer CNTHA works to document these major developments in Canada's naval technical history while the people who have close knowledge of the various programs are still around to tell their stories.

Through our oral history project and written summaries on various naval engineering disciplines, the CNTHA has documented many notable reminiscences by naval, government, and industry personnel, and made them available on our CNTHA.ca website. Bit by bit, we are gradually filling in the broader story of Canada's naval developmental activity in such areas as ship procurement, construction and upgrade projects, equipment design and support activities, and the effect this has all had on Canada's defence industrial base. By tapping into the body of knowledge we have collected, working members of the naval technical community and other interested researchers are able to study the lessons of the past, and see how they might apply to current or emerging technology projects.

The information showcased on our website is a rich and unique resource of source material for presentations, articles, training courses – you name it – pertaining to the technical activity of the RCN. To ensure the ongoing relevance of what the CNTHA has begun, the people who play active roles in the naval technical support community, and those who work in the marine technical industry, including shipyards, design offices and naval equipment suppliers, must be encouraged to contribute their knowledge to the base we have built.

By getting our message out to the engineering, technical and logistics support personnel, both military and civilian, who are managing the technical resources of the Navy right now, we are hoping to foster a culture whereby the teams of today will take responsibility for preserving the record of Canada's naval technical history for future generations. We invite you to join us in supporting this worthwhile effort.

We are always looking for new people to get involved with the important work of the CNTHA, and we invite you to contact us at info@cntha.ca to learn more about how you can contribute.