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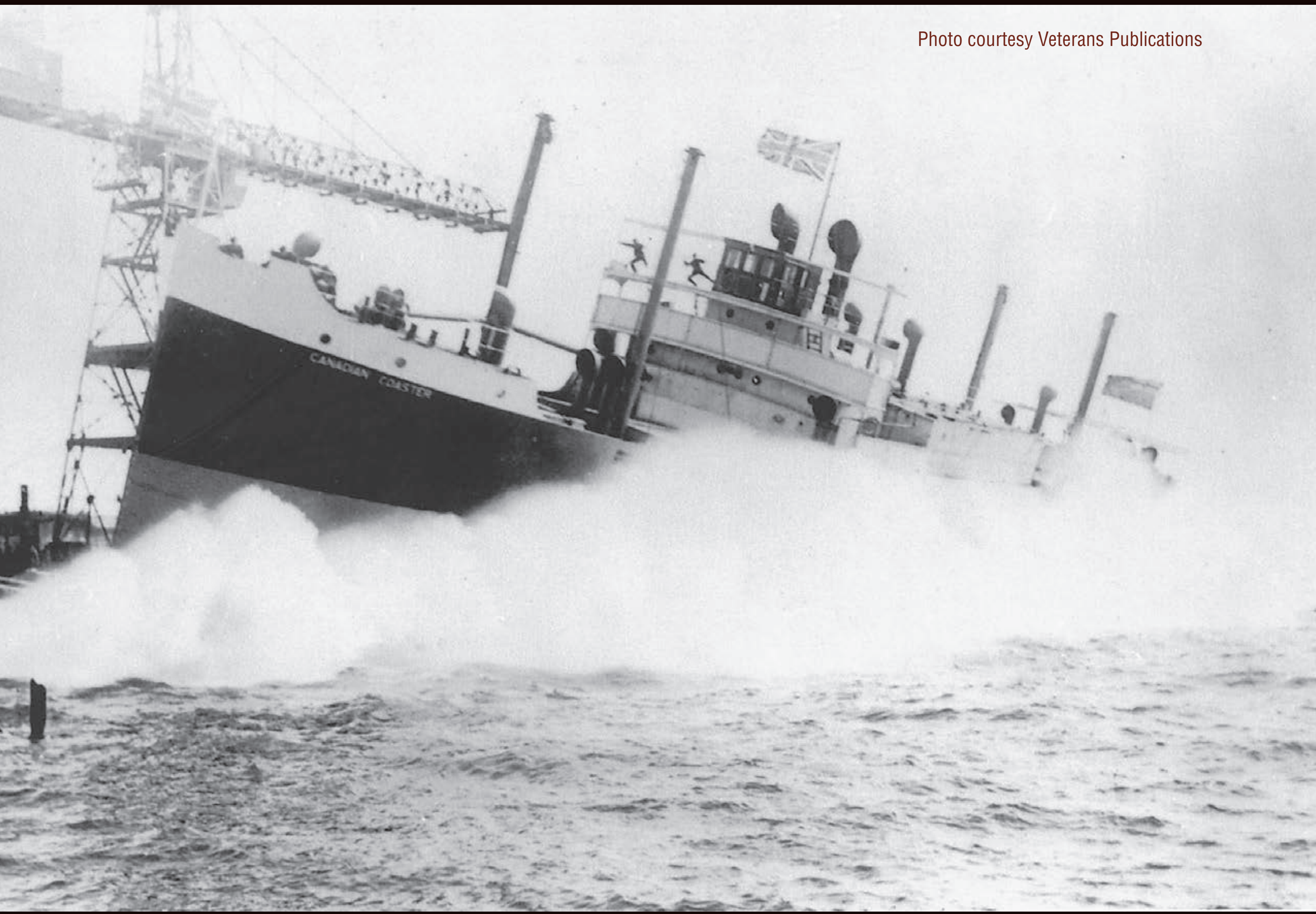

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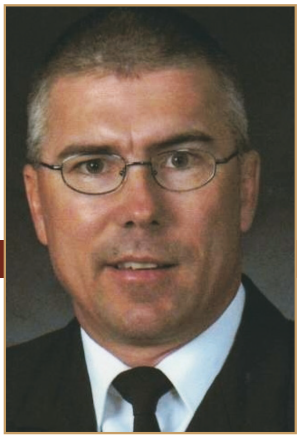

Director General Maritime Equipment Program Management

Commodore Marcel Hallé, OMM, CD

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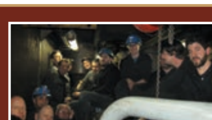

A combined team from FMF Cape Breton and MAN Diesel & Turbo worked together to complete the 24,000-hour Pielstick diesel engine overhaul ahead of HMCS *Regina*'s mid-life refit.
Photo courtesy: Randy Fairbank, FMF Cape Breton

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Commodore's Corner

By Commodore Marcel Hallé, OMM, CD

A Retrospective

(Cmdre Hallé has been appointed Assistant Chief of Staff J4 (Logistics), Supreme Headquarters Allied Powers Europe in Belgium.)

As you read this edition of the Commodore's Corner I will have already turned over the Maritime Equipment and Program Management (MEPM) division, and the role as the Navy's Chief Engineer, to Commodore Simon Page. To begin, I extend my congratulations to Simon for a well-deserved promotion and appointment. The leadership of the naval materiel enterprise is in very good hands and I wish him all the best as he navigates the materiel acquisition and support challenges to ensure that the fleets are fit for purpose, safe, and environmentally compliant. This forum also gives me an opportunity to publicly thank him for his great leadership and dedication when he was triple-hatted as MEPM's Chief of Staff, Director of Maritime Management and Support, and Branch Advisor for all Naval Technical occupations– each in their own right a full-time job. Thanks Simon.

Times like this are cause for reflection. As I look back on the three years spent in my appointment as DGMEPM, I cannot help but be impressed and proud because of what each of you has done in supporting and advancing the capabilities of our Navy. As an integrated team, all of you in industry, the public servants in Defence and other government departments, and our people in uniform make up the triumvirate that has delivered time and again on the complex machinery that comprises the naval materiel enterprise. You all represent the "engine room" that Admiral Jellicoe referred to in his famous quote from the Battle of Jutland in 1916.

As we take stock, five of the 12 *Halifax*-class frigates have been modernized and delivered back to the Navy. This $4.3B effort represents the most complex program in the department that has consistently remained on time, on budget and under the radar due to the solid leadership from its project manager and its respective leaders in industry and government. At the end of 2014 the submarine program achieved steady state, which marked a long-awaited and key milestone for this strategic capability for Canada. In September, steel will be cut for the *Harry DeWolf*-class Arctic and Offshore Patrol Ships, setting us on a tangible course of fleet renewal, with the *Queenston*-class Joint Support Ships and Canadian Surface Combatant vessels to follow. This could only happen due to the outstanding professionalism, support, and commitment of the triumvirate, and for that I thank you.

As we look forward, we are doing things differently because we must. Significant advances in technology and our changing environment have demanded that each of us be that much more innovative. One such area where innovation is at its best is the work of the maritime environment in leading the way for the Canadian Armed Forces in revamping the domain of information technology security. I would submit that we are adapting well in all areas. Our change management programs, for instance, have resulted in the establishment of a more robust and risk-based naval materiel assurance program. And as we look over the horizon, the in-service support domain is being shaped early to ensure we optimize the limited resources to maximize supportability for our current and future fleets. Holistically, the interaction between the people working the in-service support initiative and those in the project management offices will ensure that design for supportability is factored in from the outset to balance the competing pressures of design and build against those of through-life support.

I can only describe my time as DGMEPM and Chief Engineer of the Navy as having been a tremendous and rewarding journey. Despite the phenomenal advances in technology, what has impressed me most and what makes us great is your individual commitment within the teams that deliver reliably day in and day out. Challenges abound, and always will, but the manner in which you recognize, prioritize and tackle these challenges head-on ensures that the primacy of Operations prevails. You epitomize the Navy's motto of "Ready Aye Ready." I am proud of what each of you has done in support of fleet readiness, and I leave full of pride – appreciative and thankful to each of you who do the heavy lifting in making the naval materiel enterprise a success, which in turn results in effective operational readiness in Canada's maritime domain.

FORUM

The Future of In-Service Support – Evolution to Flexible and Innovative Ship Support

By Alanna Jorgensen

Photo by Brian McCullough

The RCN is ushering in a new era of comprehensive naval materiel in-service support to meet the needs of Canada's current and future fleets.

By now many of you have already heard about a strategic initiative called the Future of In-Service Support (FISS). Its stated goal is to define and establish a comprehensive naval materiel in-service support system, as a subsystem of the Naval Materiel Management System (NaMMS), to meet the needs of the future fleet in 2018 and beyond. Even as things stand with the current fleet there is more demand for in-service support work than our resources can meet. Something had to change.

FISS was originally called the In-Service Support Contracting Framework (ISSCF), and its goal was to respond to the shortcomings of the wider CAF policy on ISSCF in meeting the needs of the RCN in the most effective and efficient manner. Time marched on, and the ISSCF policy was rescinded under the Defence Renewal Sustainment Initiative, but the underlying issue of having too few resources to satisfy the in-service support requirements of the current fleet remained. The impact of this is evident in maintenance completion rates as low as 20 percent in some ships, and life-cycle materiel managers so busy dealing with sourcing obsolete parts that more strategic issues cannot be addressed.

We know how to conduct our life-cycle materiel management (LCMM) at the system and equipment level very well, but we have neither the capacity nor always the funding to do this properly all the time. This translates into engineering change decisions being taken *after* a crisis instead of managing them proactively. We don't work our LCMM activity from a whole ship perspective. We manage margins, we integrate systems and we conduct third-line maintenance activities, but we don't manage the entire ship as a single system. We get our ships to sea to meet the operational requirements of the day, but we accomplish this due to the "can do" attitude of everyone – primarily by the ship's staffs and the people in the Fleet Maintenance Facilities. We get the ships and submarines to sea and we move on to the next crisis, but we aren't using our resources optimally. The outcome-based structure of the FISS system should correct this.

ISS Analysis

The approach of the FISS team was to take a step back and look at the entirety of in-service support, and not just "tunnel vision" directly to ISS contracts. This analysis would require a disciplined systems engineering approach by a diverse team from MEPM, the coastal engineering organizations, and the operational and logistics communities.

The first step was to baseline and understand the current in-service support system, because you can't improve upon something if you have no idea of where you currently are. This was coined the "Get Smart" phase, during which we would develop a description of the in-service support system based on current practice, and on alignment to the larger Naval Materiel Management System within which the in-service support system operates. The system description was then used as the base reference for the in-service support system analysis.

The analysis involved a review of current materiel acquisition and support policies for their applicability and for their impact on FISS. Current ISS contracts were reviewed to identify best practices, and to learn lessons for application to the future system. Performance metrics were pulled to identify and quantify opportunities for improvement, as well as to establish a baseline for improvements. The current system was reviewed and areas for improvement were identified, taking into account the constraints, risks and opportunities in the near- and mid-term environments.

> *"We have an excellent enterprise system in the Defence Resource Management Information System (DRMIS), but have yet to fully leverage this enabler to optimize our in-service support performance."*

In addition, the team analyzed the strategic capabilities and outputs of the RCN's two Fleet Maintenance Facilities, and also sought the advice of the Royal Navy, the Royal Australian Navy, and our own Land and Air equipment program management sister organizations regarding their lessons learned on ISS. From this analysis we were able to develop a set of in-service support system requirements to meet our future needs.

The analysis reaffirmed the MEPM program management structure whereby the class program managers not only perform all of the old "class desk" functions, but also prioritize and fund all projects that impact their class. The role of ship-level, life-cycle materiel management needs to be developed within these new organizations. The class program managers are now also the design authority for their particular in-service class, and are charged with ensuring that the class and each platform of the class remain within design intent.

The design intent of a ship or submarine is not a well-understood concept. Essentially it is the body of knowledge that states the purpose and performance of the platform, and how it is intended to be operated and maintained to satisfy the stated purpose. This means that documents such as the statement of requirement, the concept of operations, the concept of support, all of the technical data package, and much more form the design intent. Maintenance of the design intent isn't something that we've necessarily done well in the past. In order to support naval materiel assurance and to optimize the in-service support for a class, we all need to understand the design intent of the various classes.

We have an excellent enterprise system in the Defence Resource Management Information System (DRMIS), but have yet to fully leverage this enabler to optimize our in-service support performance. Some classes of ships are not managed in DRMIS, while others seem to use the tool as little as possible. DRMIS, when fully utilized, allows for performance management of class- and ship-level in-service support, and ensures continuous improvement. DRMIS also allows the operational and design authorities to determine the materiel state of a specific ship or an entire class, thus enabling effective and efficient naval materiel assurance. When we contract in-service support activities to service providers we need to ensure that we understand how best to integrate their data into DRMIS so that we don't lose this enabler.

Establishing in-service support contracts (ISSCs) to enable MEPM to meet core accountabilities, responsibilities, and authorities is important. How else can MEPM meet naval materiel assurance requirements, class program management and design authority requirements, and do proper safety and environmental management and NaMMS management unless we shed some of the workload?

The approach to ISSCs must be done such that we retain our ability to be an "intelligent client" for our contractors and the RCN. We cannot blindly enter into contracts thinking they will be our panacea; the contracts of the future need to be longer-term, performance-based, and flexible enough to allow a progressive application of scope within a team approach. These advanced contracting frameworks will require hard work with active contract management, but will evolve our current model of "time and materiel contracting" to a more strategic relationship with our industry partners. Since we will have to ensure that each new contract that leaves MEPM is in alignment with the FISS system requirements, the coordination of contractors on the coasts will be even more important than in the past to ensure that technical scheduling issues do not delay ships' programs.

> *"We cannot blindly enter into contracts thinking they will be our panacea; the contracts of the future need to be longer-term, performance-based, and flexible enough to allow a progressive application of scope within a team approach."*

In an environment where a large amount of the in-service support is contracted out, it is important that we provide our ships with the appropriate tools to safeguard their days at sea. Engineering officers will need to understand the contract environment when accepting work from a contractor, and their departments will have to maintain skills sets in fault-finding and some second-line activities. Full reliance on a contractor in an operational environment is never an optimal situation, so the ISSCs will need to ensure that we safeguard our sailors' competencies through industry secondments or enhanced OEM-style training.

Where do we go from here?

The FISS team has a lot of work ahead of it to progress the various continuous improvement projects within each class. The class program managers will lead their own continuous improvement projects for better managing their work, which in turn will assist in developing portions of the in-service support system. The first to start on the road to aligning with FISS will be the *Victoria*-class program manager, as the submarines already have a "whole of platform" ISSC in place and are in an ideal position to better optimize that contract. The contractor will be looking at how it can assist the class program manager/design authority to perform the ship-level LCMM function. The submarine enterprise team will also determine if an integrated project team can be implemented within the enterprise, either in MEPM or on the coasts.

The Minor War Vessels and Auxiliaries class program manager/design authority will also be determining how to best institute ship-level LCMM functions and integrated project teams with the extant contractor. Their continuous improvement project will be to better align the contractor into the technical schedule management process on the coasts.

The *Halifax* class has been doing outstanding work in determining how much of the FISS system can realistically be implemented for the frigates given the amount of time left in the life of the class. Their goal will be to bundle their system- and equipment-level LCMM functions in the best way possible.

The fourth project will be the ISSC that is currently being developed by the National Shipbuilding Procurement Office of Director General Major Project Development (Land & Sea) for the upcoming Arctic/Offshore Patrol Ships (AOPS) and Joint Support Ships. This project has been ongoing for quite some time and will ensure continual alignment between the major capital projects and FISS. The project will also ensure that the coasts and the class program management organizations are prepared for the arrival of the first of the AOPS, HMCS *Harry DeWolf*, in mid-2018.

Alanna Jorgensen is the DGMEPM champion for the Future of In-Service Support initiative at National Defence Headquarters in Ottawa. She is also the class program manager for Minor War Vessels and Auxiliaries, and is the designate CPM for AOPS and JSS.

Letters to the Editor

(In response to author Cdr A.J. March's article: *Deeply Complicated: Canadian Submarine Procurement Options (Part One - Design Options)* [MEJ 76])

Sir,

I am on duty and just read your article, which I think is one of the best reads on the Canadian submarine program so far. I like how you tackled the difficulty of building subs domestically, and highlighted the enormous engineering manpower required to effectively design and build such craft. It is on par with building a spaceship, and not something to be taken lightly. This may force the government to rethink any policies on strictly domestic shipbuilding.

Another great point you made is that there is no *Victoria*-class replacement in the National Shipbuilding Procurement Strategy. The navy is fighting hard to maintain our underwater capability, yet the first of our ex-*Upholders* started service with the RN in 1990. It would appear from the layman's point of view that when the *Victorias* do finally get phased out we will be back to where we started.

Thank you for writing a challenging article. I am looking forward to reading Part Two.

Respectfully,

Master Seaman Erik Lindholm,
Engineering Officer of the Watch,
HMCS *Yellowknife*

Sir,

I am keen to continue reading the *Maritime Engineering Journal*, especially the *CNTHA News* section.

As a one-time civilian engineer employed in naval headquarters near the beginning of my career many years ago, I fondly remember working on programs such as the degaussing problems of the original MCB-143 Bay-class all-aluminum minesweepers*, and subsequently on the first naval computer-based command and control system, DATAR (Digital Automated Tracking and Resolving), which was a Canadian idea.

My boss at DATAR, the late Stanley Knights, conceived and supervised the system trials on Lake Ontario with a shore station located on the Scarborough Bluffs. He also introduced many military and civilian engineers to the world of digital computation, and out of DATAR came the Naval Tactical Data System for the US Navy and NATO. This was the forerunner of SHINPADS, and to a lesser extent SHINMACS and SHINCOM**.

I really enjoy reading about earlier RCN technical advances and I encourage the editors to continue writing about these old systems.

— Alan Rackow, Ottawa

[*The Bay-class minesweeper "woodpecker fleet" had wooden hulls, of course, but were extensively constructed from aluminum to lower magnetic signature.

**The "SHIN" series of products were digital shipboard integrated systems for processing & display, machinery control, and interior communication. – Ed.]

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.

FEATURE ARTICLE

Partnering with Industry – the Pielstick Diesel Engine 24,000-hour Overhaul

By Cdr Trevor Scurlock and Brian Cox

Photo courtesy Randy Fairbank, FMF Cape Breton

A significant pre-refit maintenance activity ahead of the *Halifax*-class frigate mid-life refit (MLR) is the 24,000-hour overhaul of the ship's SEMT Pielstick diesel engine (PDE). The 24,000-hour overhaul is the most comprehensive preventive maintenance routine performed during the PDE's life cycle, and involves a complete strip-down and re-baselining of the engine and controls system.

Due to the size of the PDE this routine is normally conducted *in situ*, as a replacement of the full engine would require docking and extensive removals through the underwater hull. Components are swapped out for maintenance-by-exchange. This *pre-MLR* work item has now been successfully completed on six of Canada's 12 patrol frigates during their mid-life refit programs, with a seventh PDE overhaul now underway for HMCS *Toronto*. The five remaining PDEs in the frigate fleet will have insufficient operating hours on them at MLR, so their 24,000-hour overhauls will be scheduled as hours accumulate and dockyard alongside opportunities arise.

Background

The first two of these overhauls – HMCS *Fredericton* from April to December 2011, and HMCS *Montréal* from January to May 2012 – were managed by the repair and overhaul contractor at the time, Jaymar Diesel Ltd. of Halifax NS, with factory service support from the original equipment manufacturer (OEM), MAN Diesel & Turbo of St. Nazaire, France. The bulk of the hands-on work was conducted alongside the Halifax naval dockyard, with the Halifax Class Modernization - Frigate Life Extension project management detachment office in Halifax providing most of the on-site management, spares marshalling support, and office facilities. Fleet Maintenance Facility Cape Scott (FMFCS) was keenly interested in playing a key role in these two overhauls, but their services were limited mainly to Designated Engineering Authority support and co-ordination with other pre-MLR activity going on in the ships.

Shortly after completion of the *Montréal* overhaul, and due to MAN world-wide corporate restructuring, the service license for the PDE was withdrawn from Jaymar Diesel and assigned to MAN Diesel & Turbo Canada Ltd., headquartered in Oakville, Ontario, with a service centre in Halifax, Nova Scotia. Since contractual terms and conditions could not be finalized in time for the third overhaul, HMCS *Charlottetown* from November 2012 to March 2013, FMFCS conducted the entire overhaul with only FSR oversight and specialized block machining by the OEM.

As FMFCS had already conducted most of the 12,000-hour PDE overhauls for Maritime Forces Atlantic, this work was not new to them. The overhaul was completed successfully and in a very timely manner.

The contractual issues with MAN Diesel & Turbo Canada were resolved for the fourth overhaul, conducted on board HMCS *St. John's* from June to December 2013. At this time DNPS 3 was developing the Halifax Class Diesel Generator Replacement and In-Service Support work statements, and recognized that a mix of OEM and FMF maintenance support would be the way of the future in keeping with the Future of In-Service Support initiative, and with the Defence Procurement Strategy (one aspect of which is to create key industrial capabilities within the Canadian industrial base). It was therefore considered valuable experience for all parties to introduce such a work share program for the remaining PDE 24,000-hour overhauls.

Work-split Arrangement

The *St. John's* work was split approximately 50/50 between MAN Diesel and FMFCS, with FSR oversight and overall responsibility still with MAN Diesel & Turbo Canada. The diesel mechanic work teams were integrated, with FMF and FSR mechanics working side-by-side on each work shift for the disassembly and reassembly of the engine. FMFCS also supplied rigging and electrical expertise. During this overhaul MAN & Turbo Canada took on more of the work that the OEM FSRs from France had previously conducted.

When the third-line work on individual components was being divided between FMFCS and MAN Diesel after the engine was disassembled, the aim was to make the best use of the available FMF shop capabilities, and have some of the more specialized third-line overhaul work done in the OEM's facilities. Work such as inspection and overhaul of switches, hoses and valves, painting of components and nondestructive testing was done by FMF, while typical third-line work such as cleaning and inspection of the pistons, conrods, and liners, and other more specialized work, was done by MAN Diesel at their facilities.

This arrangement gave the FMF shops new work opportunities in "core capability" third-line preventive maintenance routines that would typically be done by the OEM, but which are still important skill sets to maintain for the day-to-day support that FMF provides to the fleet. Additionally, the integrated FMF/FSR teams allowed for valuable knowledge sharing between the diesel mechanics, which can only benefit the fleet as the more in-depth knowledge will help in troubleshooting any future problems.

Overall this proved to be an excellent learning experience by all parties, especially for MAN Canada which was endeavoring to bolster its Canadian maintenance support capability. The inevitable wrinkles were ironed out along the way. The fifth overhaul, HMCS *Ville de Québec* from April to August 2014, was conducted with the same work share arrangement. Thanks to lessons learned from the previous overhaul, the job was completed smoothly.

Photos by Randy Fairbank, FMF Cape Breton

The way of the future. Combined teams of DND and industry personnel from FMF Cape Breton and MAN Diesel & Turbo pool their skills as they measure and reinstall the pistons for a Pielstick diesel engine.

The sixth overhaul, for HMCS *Regina* from November 2014 to March 2015, was conducted in a similar manner as that for *Ville de Québec* and *St. John's*, except that this time it was FMF Cape Breton in Esquimalt, British Columbia that was supplying the FMF workforce. While this was the first 24,000-hour PDE overhaul on the West Coast, FMFCB had already conducted most of the 12,000-hour overhauls for Maritime Forces Pacific, and the *Regina* overhaul progressed equally well.

Randy Fairbank, FMFCB's Diesel Shop (132) shop supervisor commented, "Our partnership has been working almost flawlessly. The diesel shop is enjoying the work and the opportunity to learn from the factory trained service reps, and I believe that the FSR is very satisfied with our work ethic and knowledge of the engine and accompanying systems. I would like to acknowledge Diesel Shop (132) for their hard work and commitment to the job, and for stepping up and showing we can adapt when partnered with outside industry. Good job!"

Conclusion

All of this is good news for the 24,000-hour overhaul and the continuing evolution of the in-service support construct for the RCN. The seventh overhaul, currently underway on the East Coast for HMCS *Toronto*, is being conducted in the same manner as these recent overhauls and is expected to continue the trend of improvement in the process and working relationships seen to date.

The FMF/OEM work share agreement has been extremely beneficial and successful for both parties, and demonstrates how such an arrangement can be successfully instituted for future work such as the Halifax Class DG Replacement and In-Service Support and the lessons learned have been used to work with the FMFs in developing a framework for that kind of long term system level work sharing agreement

As Commodore Hallé mentioned in his Commodore's Corner for the 74th edition of the *Maritime Engineering Journal*, "FISS (Future of In-Service Support) will also play an important part in shaping what the FMFs look like – ensuring critical capabilities are retained within the RCN, as well as enabling the establishment of strategic relationships that leverage the integration of skill sets and infrastructure between Crown and industry."

A key component of the FISS initiative is to gain a better understanding of how to integrate contractors and DND employees on future platform-level in-Service support contracts (ISSCs). The experience from the PDE 24,000-hour overhaul work-sharing arrangement provides a lot of lessons learned and reassurance that an increased reliance on ISSCs for future platforms will still allow the materiel requirements to meet the needs of the RCN. It also clearly demonstrates the benefits of using combined DND/contractor teams to conduct complex maintenance routines, and can be used as a model for future work to ensure the FMF capabilities are maximized when new support solutions are being implemented for the existing and future fleet.

Cdr Trevor Scurlock is the DGMEPM section head for Marine Propulsion, Electrical and Control Systems in the Directorate of Naval Platform Systems.

Brian Cox is a Marine Diesel Systems Engineer working in DNPS 3 in the Directorate of Naval Platform Systems.

Postscript –

The work described in this article shows but one of the elements that the Future of In-Service Support (FISS) is striving to enable. Under FISS, we are looking at innovative ways to improve how we support the fleet and develop strategic relationships that will endure into the future. The diesel-generator replacement contract leverages the best of both worlds in industry and the Fleet Maintenance Facilities. The FMFs are able to further fine-tune and grow the specific diesel-generator skill sets, and industry is better able to understand and respect the skill sets and resident professionalism in the FMFs.

This contract is innovative and is considered a 'pilot' for FISS in that it is looking at how we can load-level and transfer second- and third-level work between industry and the FMFs seamlessly, and how we can capitalize on the current dockyard infrastructure to the benefit of all service providers, both in industry and in the FMFs.

– Alanna Jorgensen
DGMEPM Future of In-Service Support champion

FEATURE ARTICLE

Deeply Complicated: Canadian Submarine Procurement Options • Part Two – Build Options •

By Cdr A.J. March

Photo by PO1 Makoto Maeda

HMCS *Victoria* (SSK-876) at sea during Exercise RIMPAC 2014.

[Editor's Note: Part One of this article appeared in the *Journal's* spring edition (no. 76). In this second of two parts, Cdr March offers an overview of the various **build** options the RCN could consider for its next-generation submarine requirements, along with a rationale for a course of action he recommends.]

Build Considerations

Once a design has been settled upon, the next step is the build. This can take two principal forms – an offshore build by an experienced design-agent shipyard, or domestic construction in Canada. Research by the author on Western post-war submarine projects does not feature a single example of a nation developing an indigenous design and then commencing indigenous construction without either having previous submarine construction experience, going through the intermediate step of either licenced production of an offshore design, or having significant technical assistance from abroad to help develop the capability.

This section thus focuses on contrasting the production under licence of a foreign design with construction at an original equipment manufacturer's (OEM) shipyard. Licenced production has been common in industry, with the OEM typically supplying production drawings and procedures, material component packages, and on-site technical assistance. The range of OEM involvement in these arrangements varies from the building nation requiring significant assistance from the OEM (effectively only 'assembling' a foreign design), to a scenario where more subsystems from the building nation are incorporated. A graduated approach has also been employed, whereby the first of class, and/or completed sections are built in the OEM shipyard, and follow-on vessels are constructed in the purchasing nation. Pakistan, Greece, Turkey, and South Korea are all examples of this approach.

In order to explore build considerations further, it is helpful to determine a baseline. France, Germany, and Japan are good examples, being Western nations with proven, in-service designs. After re-establishing a domestic submarine industry in the late 1950s, Japan has maintained a robust national design-and-build capability and a regular submarine production drumbeat. In the 51 years between 1963 and 2014 a new submarine has been laid down each year, except in 1973 and 2010, with finished submarines being delivered reliably four years after keel-laying. The most recent *Souryu* class, ordered in 2013, had a unit cost of USD 505 million. This offers capability value when compared with military off-the-shelf (MOTS) options such as the *Dolphin* Batch II at USD 700 million.

However, while demonstrating what a capable industrial base can do, Japanese designs are not exported or licence-produced, so it is difficult to draw comparisons. The French *Scorpène* has been directly exported to Chile and Malaysia, and is also being licence-produced in Brazil and India. In the most recent direct export case, the time elapsed from contract signature to first delivery was 6.7 years. In contrast, India signed a licence production contract in 2005 with first delivery planned for 2012. No submarine has yet been delivered and the project is at least three years delayed. Brazil ordered *Scorpène* in December 2008, with the forward section of the first boat being built in France. Delivery of the first of class is not anticipated until 2017, over eight years after contract award. HDW has demonstrated better direct exporting performance. Portugal ordered two Type 214s in 2005 with the first delivered 6.2 years after contract award. Similarly Israel took delivery of its first *Dolphin* Batch II 5.8 years after contract award. In summary, these international examples of licenced production of various MOTS designs show a two-to-four-year increase in construction timelines for inexperienced builders.

The Australian experience provides another example. The *Collins* class, which is a Swedish design, took 9.1 years from contract award to first delivery, which was only achieved with a degraded combat system that was not rectified until a number of years later. The average build time was 7.3 years which, contrary to what would be expected in an industrial process, increased over the life of the program as work began to backlog. Although *Collins* is a larger submarine than the *Scorpène* or Type 214, it is smaller than contemporary Japanese designs. Corrected for inflation, and accounting for design costs as specified earlier, the *Collins*-class unit production cost was approximately USD 900 million to USD 1 billion. In comparisons to the larger Japanese *Souryu* class, both costs and production time were almost double.

Photo courtesy ThyssenKrupp Marine Systems

A German HDW *Dolphin*-class submarine.

Not all licenced production has resulted in increases in construction timelines. South Korea and Turkey have both produced HDW designs at rates matching the OEM. However, in both cases there is a long history of licenced production. Additionally, South Korea is a world leader in ship manufacturing, limiting this example's wider applicability. However, licenced production does offer benefits, particularly regarding employment and a stronger domestic industrial base that can support long-term in-service support through maintenance and refit activities. This was one of the factors that led Australia to build the *Collins* class domestically. Additionally, there is a significant direct labour-hour contribution to industry, with submarines taking several million labour hours to build. However, along with these economic benefits come costs.

While is it difficult to make precise comparisons due to a large number of complicating factors, including the variance in purchasing nations' industrial and workforce capabilities and what costs are included, some broad conclusions can be made. It is safe to say that licenced production of submarines increases the overall cost and time required relative to direct purchase from the OEM. HDW in Germany has consistently demonstrated the ability to deliver submarines within six years of contract award, with DCNS not far behind. International examples of licenced production by inexperienced builders show timelines approximately one-third longer – with increased risk of unplanned cost overruns and schedule delays. There are benefits to domestic industry arising from licenced production, but they do not come without risk.

Canadian Context

We have examined the issues associated with MOTS options, the design of a made-to-order submarine, and domestic versus offshore production. We will now synthesize these themes in the Canadian context, first addressing design, and then the build considerations.

Defence procurement is in a period of change in Canada, particularly in naval shipbuilding. The 2010 National Shipbuilding Procurement Strategy (NSPS) clearly positioned Canada as a domestic builder of government vessels. In 2013, the Canadian government commissioned successful businessman Thomas Jenkins to report on how to best leverage defence procurement for domestic economic benefit. The resulting Jenkins Report identified that shipbuilding and in-service support of military platforms are both proposed 'key industrial capabilities.' However, it should be noted that neither the NSPS, nor the Jenkins Report, nor the Canadian Association of Defence and Security Industries (CADSI – the largest national industry association) identified vessel *design* as a national capability. As noted in Part One of this article, submarine design is a specialized, complicated, and risky endeavour in which Canada does not have expertise.

Illustrating the complexity and difficulty of such an endeavour, the Australian government revisited a decision articulated in their 2013 White Paper that discarded MOTS designs in favour of an indigenous solution and is now intending to use an experienced foreign designer. In the Canadian context, a domestic design is not a realistic option. In addition to the *minimum* several-hundred-million-dollar cost increase a domestic design would entail, Canada, as mentioned, lacks the required design expertise. More importantly, the specialized nature of submarine design, combined with the lengthy time intervals between submarine programs, make any effort to develop this capability a high-cost, single-use activity. With NSPS focusing on production, an expensive and risky domestic submarine design does not align with government policy.

Build considerations are less clear-cut. NSPS is best described as a means for industry to produce a selected design. However, the question remains as to whether the NSPS is the best means to build submarines. Nowhere in the NSPS is a submarine construction program mentioned. This is not surprising, given that there is no program of record for the replacement of the *Victoria* class. This seems to open the door to a potential offshore build. However, despite the complexities and risks associated with submarine construction, it is reasonable to assume that selection of an international supplier for such a major procurement would still be met with opposition from domestic industry. Still, submarine construction is a different, more complicated endeavour than building surface ships. Internationally, the trend is towards specialized submarine builders. Australia built a shipyard virtually from scratch specifically for the *Collins* class, despite having existing shipbuilding facilities. HDW in Germany, BAE Systems in the UK, and GDEB in the US are all specialized submarine-building shipyards. Even Australia, having already gone through a domestic submarine build program, is seriously examining the economic and defence merits of domestic build for its Future Submarine Programme. In a speech to the Australian Strategic Policy Institute, Minister of Defence David Johnston stated:

> As a government we want to give Australian industry every chance of success, but let me be clear our primary and dominant purpose is to ensure that we provide Navy [sic] with a submarine which meets its requirements. A submarine is not industrial or regional policy by other means or another name. Industry must demonstrate an ongoing capacity to meet international benchmarks with respect to productivity, cost and schedule. Furthermore, we see military shipbuilding as a strategically important industry and certainly it is desirable that the new submarine would be built in Australia but it is not a blank cheque.[1]

Photo courtesy ThyssenKrupp Marine Systems

German HDW Type 214

1. David Johnston, "Address for the ASPI Conference: The Submarine Choice, 9 April 2014," Australian Strategic Policy Institute, https://www.aspi.org.au/__data/assets/pdf_file/0011/20720/Johnston-Speech.pdf (accessed May 6th, 2014).

The French *Sorpène* from DCNS.

For a country with a greater commitment to a submarine capability than Canada and a pre-existing domestic production capacity to be seriously considering offshore build should serve as a warning. Canada has not built a submarine since 1914, nor a major surface combatant since 1996. Outside of the Canadian Patrol Frigate Project and the nascent NSPS, Canada has not undertaken the domestic design and build option for any major military platform over the last 50 years. The last time domestic production was contemplated in 1988, a House of Commons report indicated that Canadian inexperience with submarine construction would likely lead to cost overruns.

Building in Canada would result in increased risk and thus increased probability that the project would require repeated approvals for greater funding. Such repeated approvals, not uncommon in Canada, inject a separate source of programmatic delay in the procurement process. Schedule slippage, both programmatic and construction, inevitably lead to cost growth. While appropriate risk management techniques such as assigning an appropriate contingency and having risk held by the appropriate stakeholders can help manage this, the fact remains that domestic production is an inherently riskier activity than purchasing from an established OEM. This factor is exacerbated by the fact that these risks tend to be systematically underestimated in new submarine projects.

Schedule is also of concern. As amply demonstrated, the time from contract award to initial delivery can reach over nine years for a licence-built submarine. In Canada, where the timeline to first reach contract award is already lengthy, this places further stresses and costs on the project. Furthermore, with the objective timeline from contract award to initial delivery being five years, only an offshore build can come close to meeting this goal. Offshore build of a MOTS solution provides a higher-fidelity initial cost estimate, shorter build time, and increases the probability that a single contract and approval process will lead to an operational submarine in the shortest amount of time. This reduction in overall program cost and schedule risk is a significant consideration in the Canadian domestic political context where delayed procurement projects such as the Maritime Helicopter and Next Generation Fighter Capability have been politically embarrassing.

However, despite these risks, the NSPS indicates that Government sees domestic shipbuilding as important, and that any military procurement needs to demonstrate reasonable industrial benefits. In the context of a Canadian submarine project, in-service support (ISS) provides an excellent means to achieve these benefits. ISS incorporates not only repair and maintenance, but also the development and maintenance of an overall strategy to support the platform in the most effective manner over the entire life cycle. Typical work includes not only routine repair and maintenance, but also high-value work such as engineering support and the development and management of a holistic technical and logistical support strategy. ISS is identified as one of the six key industrial capability clusters in the Jenkins Report, and CADSI has also identified naval platform ISS activities (including integrated logistic support, maintenance, and repair and overhaul) as domestic Canadian capabilities.

ISS activities are spread over the 30-year project life cycle and can be four or five times the platform unit cost. Canada is demonstrating submarine ISS capabilities through the 15-year, CAD 1.5 billion *Victoria*-class ISS Contract (VISSC) signed in 2008. The VISSC is the primary means for the materiel support of Canada's current fleet of submarines, with HMCS *Chicoutimi* being the first platform to undergo a VISSC refit. This activity completed 18 months faster than previous refits in government dockyards. Through a similar mechanism, the industrial and regional benefits of a future Canadian submarine procurement can be realized in a manner consistent with national objectives.

Military procurement in Canada is a complex process with many stakeholders. The inherent complexity and increased risk associated with submarines exacerbates these challenges. Canada lacks a domestic design base and has only a nascent shipbuilding base. While the temptation to use this for licenced production to facilitate domestic economic benefits is strong, there are significant cost, schedule, and programmatic risks to this approach. Canada does however have an ISS capability that can be leveraged to provide lower-risk, yet still high-value benefits.

Conclusion

This discussion has explored the issues surrounding a notional future Canadian submarine procurement. Historically, Canada has sought long-range, high-endurance submarines for expeditionary operations. The current MOTS marketplace does not have a clearly identified fit for these demanding requirements. However, the difference in capability is not large and suitable MOTS options do exist. The optimal submarine capability for Canada may not be the one that offers the best cost-capability balance, but the one that is affordable and offers a tolerable level of risk. This risk space is bounded by the significant resources and time required to enable a new submarine design that takes approximately seven years to complete, costs hundreds of millions of dollars, and needs several million labour hours using specialized skill sets not currently available in Canada. This is occurring in an international environment where experienced players are retrenching and having difficulty maintaining their own capacity.

With all of these factors considered, designing a submarine indigenously is simply unrealistic for Canada. When it comes to submarine construction, the millions of labour hours required represent a potential domestic economic windfall. However, international experience with licenced production indicates potential cost overruns of hundreds of millions of dollars and possible delays measured in years. Additionally, when compared with buying offshore, building domestically is more expensive and takes longer. While building surface vessels is seen as different and Canada has historically been willing to accept the results of domestic production, submarine construction is a further specialized field, with international best practices seeing dedicated submarine builders become the norm.

In countries where licenced production has been successful, there is either a history of licenced production across multiple programs, a world-class national shipbuilding capability, or both. Canada has neither. What Canada can offer is the already-existing capability to maintain submarines in service, unlocking the high-value ISS work that lasts over the life of the platform, exceeds the initial unit procurement cost several times over, and dominates the total through-life cost. Military procurement is about the trade-off between risk, domestic industrial benefit, and operational capability. The calculus of this trade-off is fundamentally different for submarines. A MOTS submarine, built overseas but maintained in Canada, is the lowest-risk, lower-cost option that will deliver an operationally relevant future submarine capability.

Cdr Anthony March is a naval engineer and submariner. He is currently employed as DNPS 2 in DGMEPM.

Reference

LCdr A.J. March, "Deeply Complicated: Canadian Submarine Procurement Options," Canadian Forces College, May 26, 2014.

FEATURE ARTICLE

Halifax-class Link-11 Legacy System Acceptance Trial

By Ken Berry, Fleet Maintenance Facility Cape Scott
Illustrations courtesy the author

A stand-alone, ruggedized, portable link display system (PLDS) workstation and HF radio subsystem.

The Project Management Office of the *Halifax*-class Modernization Project and Lockheed Martin Canada are responsible for upgrading the majority of the combat systems equipment on board the *Halifax*-class ships following their mid-life refits. However, a number of vital legacy components still remain that have to be integrated into the new CMS-330 combat management system by Lockheed Martin. Fleet Maintenance Facility Cape Scott (FMFCS) in Halifax, NS, and FMF Cape Breton (FMFCB) in Esquimalt, BC were tasked to reactivate and prove these legacy systems prior to the start of integration testing.

One of these systems is the Link-11 shipboard tactical data link that has been in use with the Royal Canadian Navy since 1974. Link 11 will eventually be replaced by Link-22, but is scheduled to remain in service in Canada until 2025 because of costs and its extensive use by all branches of allied forces.

Reactivation for the Link-11 was a combined FMFCS Production and Engineering task that was complicated by missing cables and the lack of drawings. A very important lesson was learned during this process – when you update equipment, not all drawings and cable-run sheets should be superseded. The earlier upgrade of the *Halifax*-class Link-11 system from the USQ-76 to the USQ-125 data terminal set should have retained the cable-run sheets and rack layout drawings as the rack, along with many of the system cables, were re-used by the new installation. The reactivation process was temporarily delayed by these problems, but was finally achieved through cooperation and teamwork.

The next step in the process was to prove the legacy equipment, but without a connection to a link processor the proof of the legacy equipment would be limited to built-in tests or to a self-check that could only be done on the individual pieces of equipment, not on the legacy

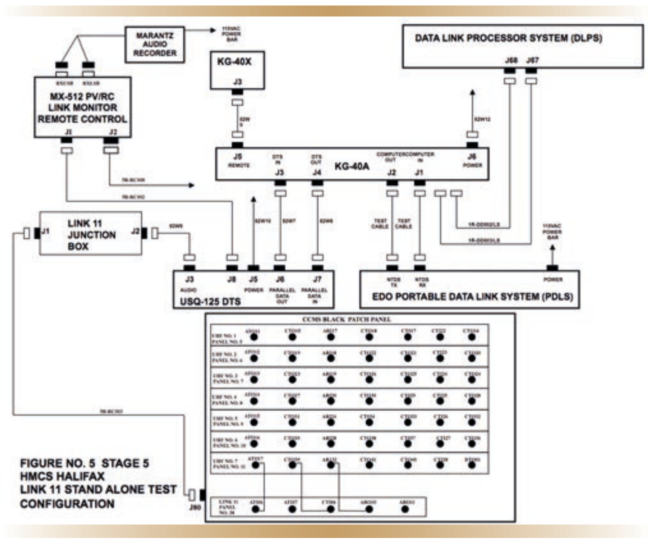


FIGURE NO. 5 STAGE 5
HMCS HALIFAX
LINK 11 STAND ALONE TEST CONFIGURATION

Link-11 as a system. There clearly existed a need to prove data flow through the USQ-125 Link-11 data terminal set, KG-40A crypto, and associated legacy cabling prior to it being connected to the CMS-330 system. To achieve a system test, the FMFCS Command and Control Systems Engineering (CCSE) section would need access to a Link-11 display/processing workstation.

It turned out that we had the required solution at hand in the form of a portable workstation. How it came to be acquired requires a brief history lesson about its origins.

In the late 1990s the EDO Corporation (now part of Northup Grumman) built the Link-11 radar display system (LRDS) for the Royal Canadian Navy's fleet auxiliary vessels. The LRDS is a single console that provides an integrated tactical picture of Link-11 and radar sensor data, allowing better tactical communication and control when tracking air and surface targets. The LRDS was only fitted on board the *Protecteur*-class ships, but had also been temporarily installed on board other vessels such as the minesweeper auxiliary HMCS *Moresby* (MSA-112).

In the same time period, the RCN and the Canadian Army had purchased from EDO Corporation a number of *portable* link display systems (PLDS) and a single training/desktop Link-11 display system (TLDS). The PLDS was a ruggedized workstation and HF radio subsystem that together provided a self-contained and field-deployable stand-alone Link-11 system. The PLDS and TLDS systems were designed to work with, test and provide training for the LRDS systems.

By 2012, the LRDS, PLDS and TLDS were considered obsolete technology by the original equipment manufacturer, but FMFCS still had an LRDS and two PLDS units in inventory, primarily in support of the equipment still on board HMCS *Preserver* (AOR-510). This proved useful when the supply ship's own LRDS became unserviceable and could not be repaired in time for her deployment on Operation Caribbe in early 2012. The FMFCS PLDS workstation that was temporarily installed on board *Preserver* allowed the ship to participate in the task group Link-11 network and contribute to the "recognized maritime picture" for the deployment. This was an example of finding a solution by utilizing the material available.

The valuable experience and "knowledge refresh" of the EDO systems that were gained on board *Preserver* clearly demonstrated to the CCSE staff the usefulness of the PLDS. It could be used for the testing and verification of the Link-11 data terminal set with the KG-40A crypto and the associated legacy cabling as a stand-alone system.

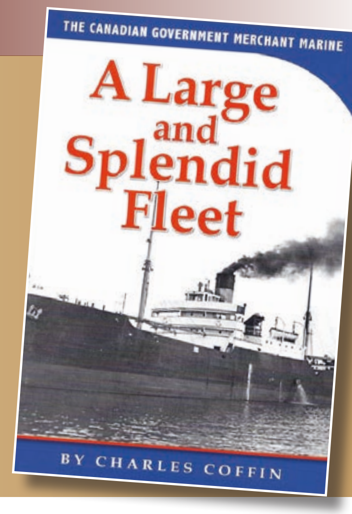
A simulation test bed was built at FMFCS as proof of the concept, and an internal trial agenda was written afterward by FMFCS CCSE. The next hurdle became the certification paperwork for the HP UNIX-based SPARC processor and other associated test equipment so that it could be used on board HMCS *Halifax* (FFH-330). This challenge was overcome and the test method was accepted by both fleet technical authority and PMO-HCM. As seen in the simplified block diagram, the connection of the PLDS by two test cables allowed the legacy system to interface with a link processor.

The legacy testing proved that the crypto equipment was not working properly and allowed FMFCS Production to repair a number of problems that would have severely delayed the Lockheed Martin Canada integration trials. Afterward, the PLDS and the *Halifax* legacy Link-11 equipment successfully conducted a complete unit equipment readiness check (UERC) with the Multiple Unit Link Testing and Operational Training System (MULTOTS).

The same legacy testing was conducted on board HMCS *Fredericton* (FFH-337) in the fall of 2013. This time the test proved the system was working properly without any problems being encountered.

Petty Officer First Class Ken Berry, RCN (ret.), is a Command and Control and Link Systems technologist at Fleet Maintenance Facility Cape Scott.

Book Review



A Large and Splendid Fleet: The Canadian Government Merchant Marine

Reviewed by Tom Douglas

A Large and Splendid Fleet: The Canadian Government Merchant Marine
Charles Coffin © 2014
Veterans Publications
Box 223, Kemptville ON K0G 1J0
Editor: Ivan Fenton (613) 258-0098
ISBN 978-0-9784037-8-2 202 pages; illus; appendices; $20 ($6 shipping)
142 pages; illus; appendices; glossary; endnotes; bibliography and index

The Canadian Government Merchant Marine (CGMM) was created by the federal government in defiance of a naïve edict by Great Britain that United Kingdom shipyards could handle all construction of vessels required to supply the Allies with materiel and food supplies during the First World War.

As the loss of ships mounted, Prime Minister Robert Borden set the wheels in motion for the construction of six categories of freighters that could transport Canada's natural resources and manufactured products across the hostile Atlantic and, post-war, to markets around the world.

While this engaging account of the 63 ships launched by the Canadian Government between 1918 and 1936 is a maritime historian's goldmine, its publishing history is a poignant love story.

Author Charles Coffin inherited a love of ships from his great uncle Captain Thomas Roy Coffin, master of four merchant marine vessels, and his father George, who served on two merchant ships. Inspired by his forebears, Charles served 21 years with the Royal Canadian Navy.

During his post-retirement career as an electronic systems technologist, Charles conducted exhaustive research into the untold story of the CGMM. Tragically, he died in August 2008, and that's where the rest of this "love story" begins. His wife Antoinette assured him his efforts would see the light of day.

"Charles pursued his dream of writing this book even after being diagnosed with terminal cancer, but he was devastated to realize he would not be able to complete his vision," she writes in the book's dedication to him. "I promised him that I would see his dream realized, and I think that afforded him a measure of peace."

A friend, retired RCR major-general Ivan Fenton, OMM, CD, stepped in and took the project on as a labour of love. Fenton organized Coffin's work into three sections: The first presents the vision, creation and aggressive marketing of the CGMM, along with its eventual demise during the Great Depression. It also outlines the challenges faced by the 15 participating shipyards.

"The second section profiles the 63 ships from launch to sinking or breakup at the end of their days," says Fenton. "Coffin provides ship specifications, and details the cargoes and voyages of each ship. Tragedy stalked many ships. Some, like *Canadian Trader* in 1928, disappeared with their entire crew. Thirteen ships bought or captured by Japan were sunk during World War Two by American submarines or aircraft."

The third section consists of appendices, including a list of ship masters, sample rates of pay, the market values for the ships, and Cabinet decisions on selling off vessels of the fleet. It is a wonderful piece of work.

Coffin's writing style and Fenton's organizational skills make this book a must-read for maritime historians, and for anyone else interested in a "riveting" piece of Canadiana. Charles Coffin may not have lived to see his work published, but thanks to the efforts of his wife Antoinette, his friend Ivan Fenton and Veterans Publications this story of the Canadian Government Merchant Marine will live on indefinitely.

Tom Douglas is the associate editor of the Maritime Engineering Journal.

2014 NAVAL TECHNICAL OFFICER AWARDS

Halifax photographs by SLt Christopher Chang
Notes courtesy Lt(N) Christopher De Castro

Naval Association of Canada (NAC) Award

SLt Patrick Cousineau
Highest standing, professional achievement and officer-like qualities during Naval Engineering Indoctrination *(With Cmdre Mike Cooper, RCN (Ret.))*

Mexican Navy Award

SLt John J. Lee
Top student, Naval Combat Systems Engineering Applications Course *(With Mexican Naval Attaché Capt(N) Marco Antonio Bandala López)*

L-3 MAPPS – Saunders Memorial Award

SLt Robert Desaulnier
Top student, Marine Systems Engineering Applications Course *(With Gwen Manderville and Michael Babec)*

MacDonald Dettwiler and Associates Award

Lt(N) Michael Michaud
Top NTO candidate to achieve Head of Department qualification *(With Richard Billard)*

2014 NAVAL TECHNICAL OFFICER AWARDS (continued)

Weir Canada Award

Photo by Lt(N) Peter O'Hagan

Lt(N) David Weatherall
Top Marine Systems Engineering Phase VI candidate
(With Serge Lamirande)

Lockheed Martin Canada Award

Lt(N) Jeremy Hamilton
Top Combat Systems Engineering Phase VI candidate
(With Cdr Stephen Peters, RCN (Ret.))

Royal Military College of Canada Carruthers Naval Engineering Sword

Photo courtesy e-Veritas

NCdt Matthew Golding
For academic achievement and exemplary performance
(With Capt(N) Jim Carruthers, RCN (Ret.))

News Briefs

1945 Bedford Magazine explosion

An ammunition barge fire at the Bedford Magazine near Halifax on July 18, 1945 resulted in a series of explosions that lasted until the following day. One person was killed, several others received minor injuries, and buildings in Halifax sustained shattered windows and cracked plaster. Voluntary firefighting by naval personnel at the ammunition depot was credited with helping to prevent an even greater disaster. A sailor aboard HMCS *Iroquois* photographed part of the action.

Photo: Bedford Magazine Explosion, 1945 - CWM 20020039-001_p53d, George Metcalf Archival Collection, Canadian War Museum

Bravo Zulu to MS Ghislain Cyr!

Marine Engineering Technician MS Ghislain Cyr made a big splash this spring with his temporary shipmates on board HMCS *Fredericton* (FFH-337). MS Cyr, who works in the Diesel Inspection section of FMF Cape Scott, volunteered to deploy aboard the frigate from March 1 to 16 so that fellow marine engineers deployed on Operation Reassurance in the Black Sea could get home on leave.

MS Cyr was awarded the commanding officer's "Bravo Zulu" coin for his "outstanding dedication and subject matter expertise" during his time on board. The stoker turned down opportunities to go ashore, spending much of his off-watch time instead up to his elbows with repairs on the ship's diesel generators and other equipment. The ship made special mention of MS Cyr's mentorship of junior personnel while conducting critical repairs, adding that "he was instrumental in helping the MSE department maintain...a high state of technical readiness."

Photo by Maritime Task Force – Op Reassurance

News Briefs (continued)

Submarine on the surface at Port Burwell

Melissa Raven never served a day aboard HMCS *Ojibwa* while the boat was operational, but she is making up for that now. As we reported in MEJ no. 74, Raven is the director of communications for the Museum of Naval History at Port Burwell, ON, a "sub" station of the not-for-profit Elgin Military Museum in St. Thomas, where this long-retired *Oberon*-class Cold Warrior is now on display.

What she knows about this submarine and its service in the RCN is nothing short of astounding. Whether she is talking about the fascinating story behind the boat's official crest, *Ojibwa*'s involvement in the development of standardized hatch couplings for undersea submarine rescue, or the ingredients that make up the distinctive scent known as "*Eau de Submariner,*" she clearly has been listening carefully to the "Dolphin crowd" who visit and continue to support this extraordinary naval exhibit.

To learn more about the various tour options, including booking requirements and age restrictions, go to www.projectojibwa.ca. Regular inside tours last one hour, but old hands might want to take advantage of a three-hour evening Greater Depths Tour that includes a meal on board. Guided by a qualified submariner, visitors on this extended tour see parts of the boat that are normally off limits.

The submarine's crest illustrates the story of the Ojibwa First Nation's early migration from the East Coast to Ontario. The Submariners Association of Canada continues to actively support HMCS *Ojibwa* at Port Burwell.

Photos by Brian McCullough

Communications director Melissa Raven in *Ojibwa*'s forward torpedo room.

News Briefs (continued)

Project Management Certifications

Photo courtesy PMCD

Congratulations to the MEPM employees who were awarded various levels of qualification as project managers during a PM seminar conducted through the Project Management Competency Development (PMCD) program last February.

The program was conceived by ADM (Materiel) in 2007 to demonstrate to Treasury Board Secretariat that DND and the Canadian Armed Forces possess suitably qualified personnel and the capacity to manage projects of various complexity and risk.

The Department's PMCD initiative, spearheaded by ADM (Mat) through Director General Major Project Delivery (Land & Sea), has achieved some major milestones including an updated DND standard for project manager competencies, validation of a methodology for developing PM competencies and addressing any gaps, and development of a PM qualification process.

Pictured in the photo with Commodore Marcel Hallé (DGMEPM) are: (Back row) Simon Dupont, Ron Cormier, Cdr Kirby McBurney, David Maule, LCdr Stephen Parker, Lt(N) Dhilip Kanagarajah, Darren Gould, LCdr Philip Harris, David St-Cyr, and Terry Bisson. (Front row) Dan Powell, Thanushian Pathmalingam, Ahmed Bashir, Francois Costisella, LCdr Peter Duffley, Chiku Mlonja, Diogo Brandao, Serge Cote, and Cambwell Fung.

Photo courtesy Staff Officer, ADM (Mat)

Patrick T. Finn

New Assistant Deputy Minister (Materiel)

Former Navy Chief Engineer RAdm Patrick T. Finn has retired from the RCN and taken up a new appointment as Assistant Deputy Minister (Materiel). During his 35-year career in the Canadian Armed Forces Pat Finn developed expertise in leadership and management in the domain of materiel readiness for operations, and in complex project management. His last military appointment was as Chief of Staff for the Materiel Group where he provided oversight for projects in all branches of Canada's military.

PRESERVING CANADA'S NAVAL TECHNICAL HERITAGE

NEWS

Canadian Naval Technical History Association

An Insider's Look Back at the DDH-280 Destroyer Program*

By Gordon Smith

CNTHA News *Est. 1997*

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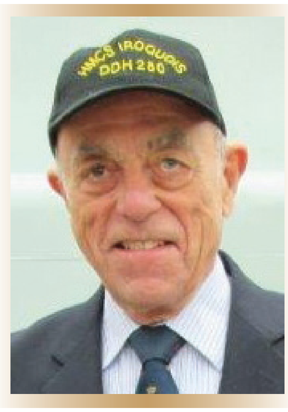
Views expressed are those of the writers and do not necessarily reflect official DND opinion or policy. The editor reserves the right to edit or reject any editorial material.

www.cntha.ca

My relationship with the DDH-280 Tribal-class destroyer program runs from ship's conception until the present time. I recall historical events related to the design, construction and contract activities that took place, and the effects this program had on Canada's defence industry. Of the four ships built for the DDH-280 destroyer program – *Iroquois*, *Huron*, *Athabaskan* and *Algonquin* – only *Athabaskan* remains in service.

When I was in Director General Ships (Preliminary Design) in naval headquarters in 1964, I was the marine engineer on a team of about six people responsible for designing ships to satisfy the various staff requirements. I had just arrived back from the Advanced Marine Engineering (Dagger) Course at the Royal Naval College, Greenwich, England, and the Preliminary Design section was given the task of designing a new destroyer to replace the General Purpose (GP) Frigate design that was cancelled in 1963.

In order to give the new ship enough deck space for missiles it was decided to lengthen the *Annapolis* design by 25 feet, but this meant that the power of the 30,000-s.h.p. [shaft horsepower] propulsion system could no longer meet the ship's speed requirements. The Royal Navy (RN) had no steam plants over 30,000 s.h.p., and the only proven steam plant we could find that was powerful enough was a U.S. Navy propulsion system of about 75,000 s.h.p. Unfortunately, this design had very high operating temperatures and pressures, with their inherent problems, and the shaft horsepower was too high. So we thought, "Why not go for a gas-turbine propulsion system of about 50,000 s.h.p. that the naval architects wanted?" The Directorate of Marine and Electrical Engineering in Ottawa, the Naval Engineering Design Investigation Team in Montreal and others looked at the various arrangements of



combined diesel, steam, and gas turbines. It appeared the most logical choice was an all-gas-turbine arrangement with two main gas turbines of 25,000 s.h.p. each, and two smaller gas turbines of about 3,700 s.h.p. each for cruise power.

We eventually came up with a suitable design to satisfy the staff requirements, which was sent to the Naval Board for approval. The board made the final decision to build four DDH-280 destroyers. I remember one of VAdm R.P. Welland's major considerations (as vice chief of the naval staff) was whether the ships should have gas-turbine or diesel alternators. After some deliberating it was decided to go all-gas-turbine alternators with one diesel alternator for emergency and harbour use. Once Naval Board approval had been obtained, the DDH-280 project moved to DGMEM Contract Design, and I went on to participate in other studies such as the replacement of HMCS *Bonaventure*.

I left the navy in 1969 and joined the Industrial and Marine Division of United Aircraft Ltd. to market gas-turbine propulsion systems to other navies and the Canadian Coast Guard. Two years later, I went to German & Milne, Naval Architects & Marine Engineering consultants in Montreal. In 1972 German & Milne received a contract from United Aircraft to supply members to the Machinery Operating Team for the DDH-280s, and I thus became the first chief engineer responsible for set-to-work and trials of HMCS *Iroquois* and HMCS *Huron* in Sorel, Quebec. Once the ships were successfully trialed and

CNTHA News – Continued

commissioned, I turned over to the new engineering officer, and my assistant, the late Jack Phillips, turned over to the new chief ERA. Jack had been my C1ER in HMCS *Provider*. My experience with the DDH-280s actually landed me a contract as a consultant to Bath Iron Works in Bath, Maine on the *Perry*-class destroyer program.

The next time I became involved with the DDH-280s was in 1978 when I became resident naval overseer for the Machinery Design & Drawing Office at Canadian Vickers. Vickers had the contract to do the working drawings, shipalts, and so forth for the DDH-280s. Around 1981, the MDDO was moved to Ottawa and there was no more need for an RNO in Montreal, but in 1989 I received a contract from Litton in Toronto to be the resident overseer for their contract with Pratt & Whitney for the Tribal-class Update and Modernization Project (TRUMP). The cruise engines, machinery control systems, and other machinery items were changed during this successful program.

Many years have passed since I last worked on the DDH-280s, but on May 1, 2015 I was honoured to be among the hundreds of people who shared in the decommissioning ceremony for HMCS *Iroquois*, a great ship that gave the Navy great service for more than 40 years. *Athabaskan* will soon be retired, and with her will pass the end of an era.

*(*This was an edited excerpt from a CNTHA Oral History Interview conducted on Feb. 27, 2006. To read Gord Smith's full interview, go to http://www.cntha.ca/images/oral_histories/g.smith-2.pdf.)*

Photo by Brian McCullough (Courtesy HMCS *Scotian*)

CNTHA online – insight through hindsight

Since going live in 2004 the CNTHA website (www.cntha.ca) has gone through a number of updates to improve how we inform and serve our visitors online. We are always keen to hear from anyone who might have ideas for added features, or content that will help us in our primary mission of preserving Canada's naval technical heritage for future generations.

Much of what you see has been developed by retired members of the naval technical support community who were once actively involved in Canada's various naval ship and equipment development programs. For young professionals in active career mode today, there is much to be learned from their insights.

We encourage all of you, young and old alike, to take an active role in contributing to the discussion through the CNTHA's oral and written history program, and through your letters to the publication you are reading now. We look forward to hearing from you at info@cntha.ca.