National Defence
Défense nationale

Maritime Engineering Journal

91
Since 1982
Fall 2019

Canada's Naval Technical Forum

CNTHA News Inside!

Special Feature

The Enduring Legacy of the 1969 HMCS *Kootenay* Explosion

Canada

Safety Aloft

HMCS *Halifax* radar technician **LS Erik Christensen** investigates enhanced safety equipment and training for work and rescue aloft.

see page 14

Maritime Engineering Journal

91

(*Established 1982*)
Fall 2019

Director General Maritime Equipment Program Management

Commodore
Christopher Earl, CD

Senior Editor
Capt(N) Sebastien Richard
Chief of Staff MEPM

NCM Editorial Advisors
CPO1 Gerald Doutre
DGMEPM Unit Chief

CPO1 Monika Quillan
DNPS 3-3-4, DGMEPM

Project Manager
Lt(N) Shane Kavanagh

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

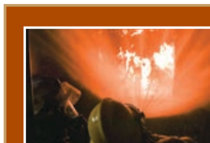
Commodore's Corner

Forum

Feature Articles

News Briefs

CNTHA News



Reservists from HMCS *D'Iberville* (Rimouski, Quebec) during firefighting training at Damage Control Training Facility Kootenay near Halifax.

(Photo courtesy Sgt Yannick Bédard, HMCS *D'Iberville*)

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

The *Maritime Engineering Journal* (ISSN 0713-0058) is an unofficial publication of the Canadian Armed Forces published by the Director General Maritime Equipment Program Management. Views expressed are those of the writers and do not necessarily reflect official opinion or policy. Mail and requests for free subscriptions may be sent to: **The Editor, Maritime Engineering Journal, DGMEPM, NDHQ, 101 Colonel By Drive, Ottawa, Ontario, Canada, K1A 0K2. Unless otherwise stated, *Journal* articles may be reprinted with proper credit. A courtesy copy of the reprinted article would be appreciated.**

COMMODORE'S CORNER

Remembering why Naval Materiel Assurance is important to the work we do every day

By Commodore Christopher Earl, CD

Photo by Royal Canadian Navy.

Every time I read, or re-read, the fine articles in our *Maritime Engineering Journal*, I am inspired by the ingenuity, grit, and sheer talent that are routinely displayed by the Royal Canadian Navy's technical branch in overcoming some fairly complex challenges. While we always strive for perfection in delivering fit-for-purpose, safe, and environmentally compliant ships and submarines, our cover feature acknowledges that we don't always get it right. The explosion aboard HMCS *Kootenay* (DDE-258) on the morning of October 23, 1969 affected many lives, and 50 years on, this tragic event remains an important reminder of what can happen in the unforgiving environment in which we operate.

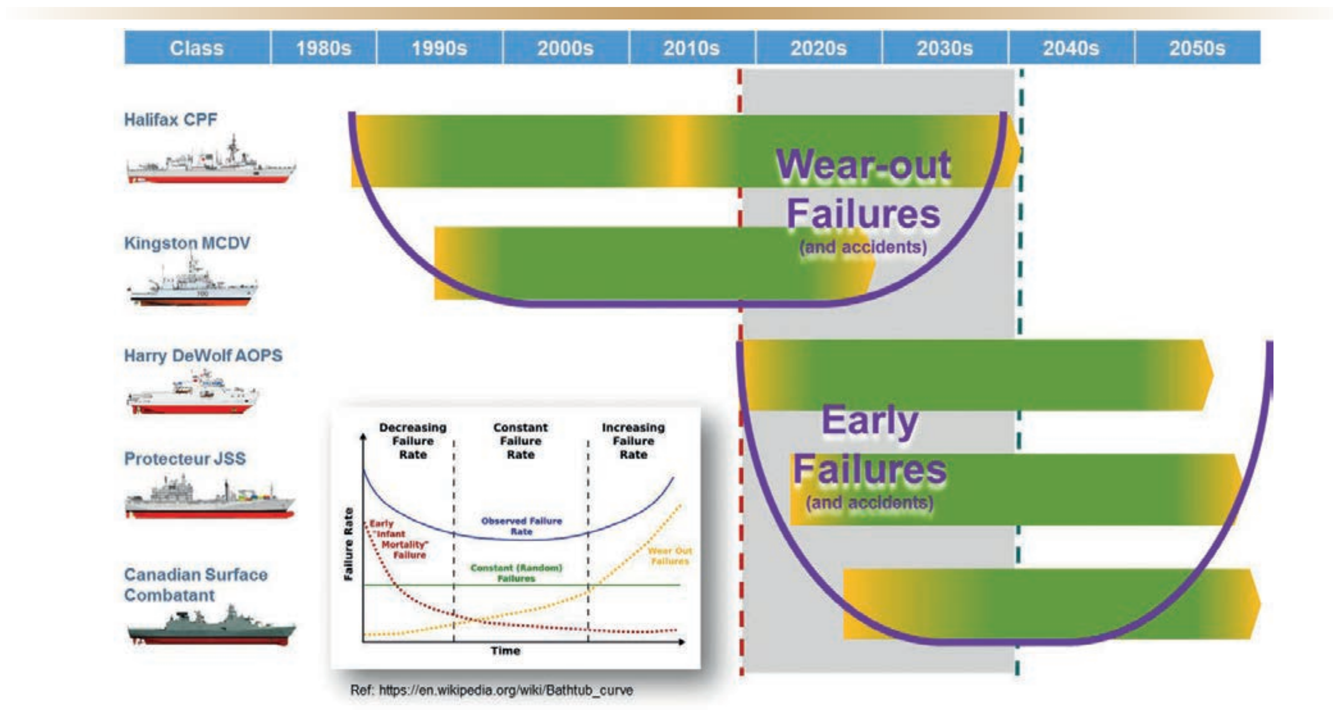
The lessons that would be learned following this catastrophic incident fundamentally changed the way our Navy approaches engineering watchkeeping, the selection of shipboard materials, and the repair and overhaul of equipment. These would become the new standards to which we hold ourselves accountable, and the catastrophe really laid the groundwork for the adoption of modernized shipboard firefighting procedures. As I review the details of what happened to *Kootenay* and her crew on that fateful day and in its aftermath, I can't help but think how these lessons probably saved many lives during my own time in the

Navy. I wonder whether the outcomes of the fires aboard HMCS *Ottawa* (2003), HMCS *Chicoutimi* (2004) and HMCS *Protecteur* (2014) might have been dramatically different and fundamentally worse than they were.

There is no doubt that the *Kootenay* explosion and many of the major accidents/incidents that followed have shaped both how we currently think about Naval Materiel Assurance (NMA), and the path we now follow as a Navy with respect to safety and the assurance of our ships and systems. As was reported back in the 30th anniversary issue of the *Journal*, NMA was developed to address the reality that we had only limited engineering resources to handle an increasing number of engineering demands. NMA would give us the rigorous structure we needed to provide appropriate technical support at all stages of a ship's life from its design though to its period of in-service operations and maintenance. The experience of *Kootenay* remains a poignant reminder of why NMA is important to the work we do each and every day, especially in our current context of managing a fleet in transition.

The progressive replacement of the RCN's large surface combatant and non-combatant vessels will begin later this year with the delivery of the Arctic and offshore patrol vessel HMCS *Harry DeWolf* (AOPV-430). While the imminent arrival of a new ship and the new capabilities it will bring to the Navy is exciting, it also represents a time of increased risk as we learn how to safely operate the vessel, discover if the design and its inherent systems operate as expected, and deal with the inevitable early failures. In reliability engineering this period of increased risk is often represented as a bathtub curve, and when the introduction of new vessels is considered in conjunction with the fact that we will be operating the existing fleet well beyond what was envisioned when the vessels were designed, NMA has never been more important.

As a community, we must all remain vigilant and aware of the risks on any given day. The natural desire of the Navy is to lean forward, operate at or near limits to confirm capability, and to test and trial the equipment in support of these objectives. While this must occur to operationalize the new capabilities, I ask that you remember the lessons of the past, abide by the principles of NMA, and raise your hand when something doesn't appear to be right. Working together, I have the utmost confidence that we can successfully navigate this period of transition, and continue to assure that the vessels of the Royal Canadian Navy remain fit-for-purpose, environmentally compliant, and safe.



Royal Canadian Navy Fleet during transition period

FORUM

2019 Maritime Engineering Journal Readership Survey Results

Analysis prepared by Lt(N) Shane Kavanagh and Brian McCullough

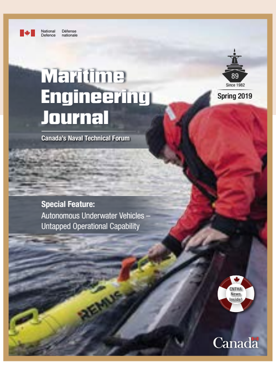
Earlier this year, we posted an online survey seeking your feedback regarding the effectiveness of the design and content of the *Maritime Engineering Journal*. This was the third such survey in the *Journal*'s 37-year history, and once again we were encouraged and informed by what we heard back from you.

This does not mean that things will remain static. While the majority of the 120 respondents indicated we are definitely on the right track, we have identified several areas that require more focused attention. Chief among these is the need to include more content that is of direct interest to non-commissioned members (NCMs) in the RCN's technical branch. We are pleased to report that efforts are already underway to produce new features that will address this shortcoming.

We thank all of you who took the time to participate in our survey. Your suggestions and other feedback will go a long way toward helping us continue to produce an engaging 'general technical' publication in support of Canada's naval technical community. While the majority of our content is driven by submissions, we will continue to explore other avenues so that we can bring you the best possible mix of articles and items of interest. We thank you for your ongoing support.

Key Survey Objectives — A Snapshot

- Identify *Journal* readership;
- Assess product satisfaction;
- Assess content satisfaction;
- Assess delivery formats; and
- Identify areas for improvement.



Journal Readership

Analysis

- 85% of the respondents identified themselves as military/civilian personnel within Canada's Department of National Defence.
- The majority of respondents were Naval Technical Officers.

Actions

- The *Journal*'s editorial team is investigating opportunities to enhance interest in the publication among NCMs.
- A new Senior NCM Advisor position has been added to the editorial team.

Overall Product Satisfaction

Analysis

- Approximately 80% of respondents said they agreed that the *Journal* meets a satisfactory standard, and that the current format is effective.
- 95% of respondents indicated that articles are a suitable length.

Actions

- No major format changes are required.

Content Satisfaction

Analysis

- The technical content of the *Journal* was deemed interesting and appropriate by 72% of the respondents, with less than 10% disagreeing.
- While 55% of those responding indicated satisfaction with the non-technical content, it has been noted that about 15% of the survey responders said they would like to see a decrease in the quantity of non-technical articles.

Actions

- The depth of *Journal* technical content will remain at or about the same level.
- There will be a slight decrease in the amount of non-technical content in favour of a small increase in technical coverage.
- The *Journal* will continue to include articles focusing on past and present members of the military and civilian naval technical community.

Delivery Format

Analysis

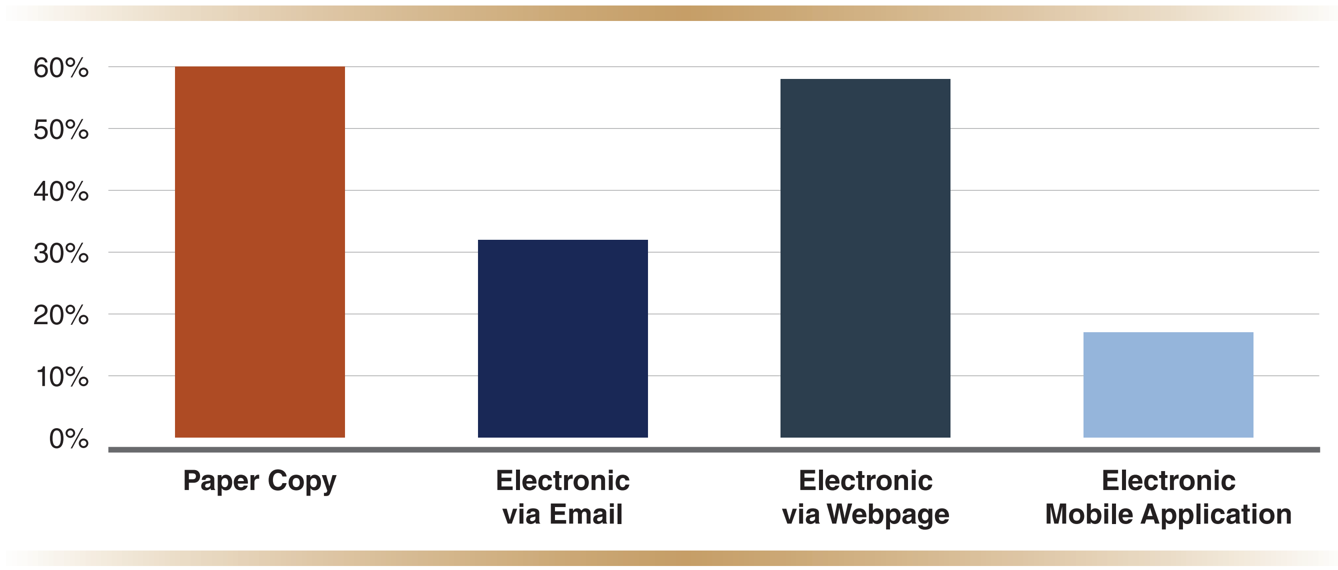
- Continuation of a printed version of the publication was the preferred choice of 60% of those who took the survey.
- Access to the *Journal* by means of an external web page was advocated by 57% of respondents, while 34% said they would like electronic access via e-mail.
- A mobile application was of interest to only 11% of the survey participants.

Results

- The *Journal* will soon be universally available via the Internet on **Canada.ca**.
- With 60% of respondents indicating that a printed version is desirable – especially for those accessing the publication at sea – this popular format will continue.

Overall Areas to Improve

- Increase appeal to NCMs;
- Increase fleet participation;
- Slightly increase technical content;
- Balance marine and combat systems related content as much as possible; and
- Develop and maintain an external facing web page.



Results from Question 9 – Indicate which of the following publication formats you are interested in.

FORUM

Finding Work/Life Balance out on Mahone Bay, Nova Scotia

By LCdr Jesleine Baker

The Baker siblings aboard their J/30 at Royal Nova Scotia Yacht Squadron in Halifax.

Winning the Distance 4 Class title during Helly Hansen Chester Race Week 2019 – Canada's largest annual keelboat regatta – three years in a row certainly gets you your share of attention. Having a couple of articles about you appear in the local newspaper is one thing, but now I find myself writing about the experience for the *Maritime Engineering Journal*!

First of all, the sport of sailing certainly has its fair share of technical aspects, so having a technical background absolutely helps in understanding how concepts such as drag, lift, and buoyancy, among other things, lead to maximizing boat speed. Like most things, top performance also requires dedication, patience, and a lot of teamwork. I suppose one of the reasons for the close cooperation among our sailboat's crew of 10 is that I've known three of these sailors for pretty much my entire life – they are my brothers!

I grew up in Halifax, and was fortunate to have a family that had a real passion for sailing. Our summers were spent out on the Northwest Arm, taking sailing lessons and racing against one another. I'll admit that during my teenage years it was much more fun racing against my brothers than being on the same boat with them, and it took us about two decades to realize that we just might be better off combining our effort and skills, and race together on our own boat.

Six years ago, Philip, Jim, David, and I did just that by buying a J/30 boat named *Just Add Water*, and I quickly learned that there is nothing better than a boatful of Bakers! It took a number of years to hone our skills, get used to the boat, train other positions of our crew, and update equipment and sails, but we started to see some real results from our efforts with our first Helly Hansen Chester Race Week Distance Class win in 2017. Contrast that with our very first Chester Race Week in 2013 where we didn't even finish a single race (out of 12), so we obviously made some headway.

I always knew I wanted a career that would keep me connected to the ocean – which was one of the main reasons why I joined the Royal Canadian Navy. I really enjoyed my time at sea as a marine systems engineering trainee, and had a very rewarding deployment as the marine systems engineer of HMCS *Charlottetown* in 2010. Later, during my Halifax shore postings at Fleet Maintenance Facility Cape Scott, Naval Fleet School (Atlantic), and Maritime Forces Atlantic Headquarters, I was able to really get back to my sailing roots in my spare time.

After buying our boat, I naturally fell into the role of "Chief Engineer." The craft has an inboard 14-hp YANMAR diesel engine to maintain after all. But whether I was changing the oil in the engine, or putting a coat of varnish on the brightwork, like any good pastime, it really was about finding a good work/life balance. Most of all, buying the boat really helped me connect with my brothers on a whole new level, and having that family support is invaluable when it comes to staying mentally and physically fit.

As the largest annual keelboat regatta in Canada – with recorded roots back to 1856, and more than 120 boats competing – Helly Hansen Chester Race Week on Mahone Bay brings a whole new level of competition, and is one of the reasons why the Bakers and many other families make it a priority to participate every year. This year did not disappoint, as great conditions, stiff competition, and close racing kept us on our toes for the full four days. Going into the last day we were only ahead by one point, which meant we needed to finish at least in the top three, and also beat one specific rival. We ended up beating that boat by only about 20 seconds, which isn't much leeway during a three-hour distance race.

Photo © 2019 Tim Wilkes / www.timwilkes.com

Whether we had won or lost this year, the thing I am always thankful for is the opportunity to be out on the water with my brothers and reconnect with family and the local sailing community. But I have to say that after spending the week getting burned by wind and sun, it was also nice to return to my current desk job in Ottawa. That's the kind of work/life balance we all need in our careers, and I'm grateful that no matter what's going on at work (and it gets busy), I have always had the support of my supervisors and subordinates to be able to book off for Helly Hansen Chester Race Week to get my fix of salt air.

If you ask me what the secret recipe is for our success, it would be: *Just Add* (a little bit of) *Water*, a pinch of salt, and a family of Bakers!

LCdr Baker is Executive Assistant to the Director General Maritime Equipment Program Management.

Editor's footnote – Jesleine was planning another regatta outing in Halifax with her brothers in early September, but says the event was postponed due to inclement weather: "Hurricane Dorian was quite the event! My brothers had to remove the sails and everything on the upper deck to lower the wind drag, and double up all lines, but *Just Add Water* and the rest of the Royal Nova Scotia Yacht Squadron fared well overall, with no significant damage."

Thanks to LCdr Brent Bowdridge at FMF Cape Scott for recommending this story.

Breaking news!

Jesleine Baker of the Royal Nova Scotia Yacht Squadron has been named Sail Nova Scotia's 2019 Female Sailor of the Year. The citation notes in part her incredible accomplishment of winning against a very competitive fleet in Chester, NS for the third year in a row.

Bravo Zulu, Jess!

SPECIAL FEATURE

Fifty years on: The enduring legacy of the 1969 HMCS *Kootenay* explosion

Engineering Accuracy – The Key Lesson from the HMCS *Kootenay* Gearbox Explosion

By Claude Tremblay

It has been 50 years since a devastating gearbox explosion occurred on board the *Restigouche*-class destroyer escort HMCS *Kootenay* (DDE-258) on October 23, 1969 – 50 years of remembrance, 50 years of technological evolution, and 50 years of vigilance to prevent a recurrence. To a non-specialist, today's gearboxes look quite similar to the ones we operated in our ships half a century ago (Figures 1 and 2), but there are many differences. The design and manufacturing technologies have changed, and the materials used are different and include more precisely controlled surface-hardening techniques.

Something that has not changed following the incident, however, is the importance of the key lesson that was learned from the *Kootenay* disaster – vigilance by ship's staff and technical support teams ashore to assure the "engineering accuracy" of naval technical equipment during its manufacture, during its assembly or reassembly for maintenance, and most importantly, during its operation at sea.

The main cause of the explosion is well known – a wrong assembly of journal bearings inside the gearbox (see MEJ issues 34 and 65). To reduce the number of spares that had to be carried on board, the bearing shells were designed to be used for both the port and starboard gearboxes. Unfortunately, with the two gearboxes turning in opposite directions, the bearing shells had to be put together in a specific way for each gearbox. If they were installed back-to-front, an easy thing to do, the supply of lubricating oil would be blocked from reaching the surface of the bearings. An accident was inevitable.

In *Kootenay*'s case, the bearings had been installed incorrectly four-and-a-half years earlier, which means they had experienced many high-speed operations during that period without causing oil ignition. As the journal bearing surfaces wore down, however, the ability of the thrust labyrinth rings to maintain flooded lubrication in the thrust chamber was affected. The thrust bearing, located next to

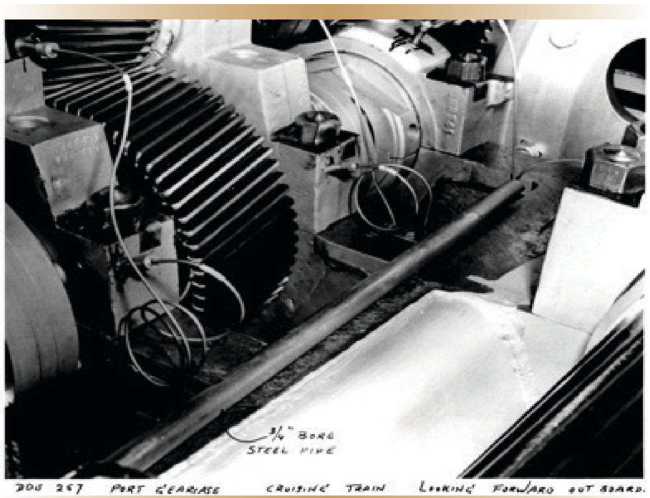


Figure 1. HMCS *Restigouche*'s gearbox in 1960, showing thermocouple sensors connected to the journal bearings during trials.

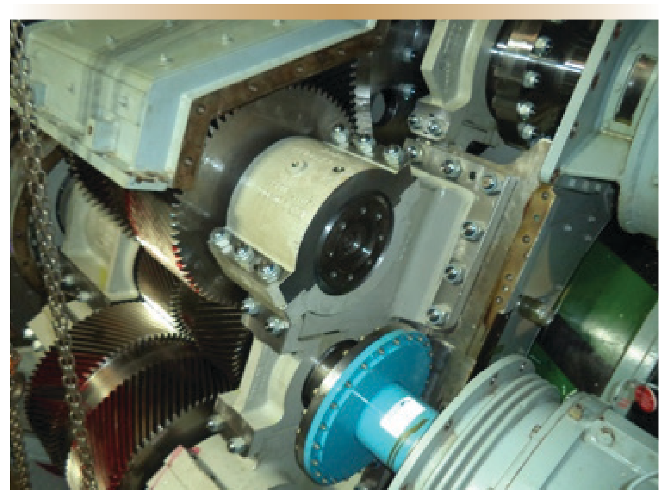


Figure 2. HMCS *Montreal*'s starboard gearbox in 2017.

the pinion journal bearing, was installed to prevent any axial movement induced by the single-helical gear design. By failing, the labyrinth rings allowed the oil to drain from the chamber, leaving the thrust pads without lubrication, leading to severe steel-on-steel friction. It is estimated that the friction power loss reached 8,300 hp (6.2 MW). The heat generated increased the surface temperatures to as much as 1,800° F (980° C). Since the failure of the thrust bearing happened after the ship reached full power, the release of the enormous heat buildup was immediate, and caused the gearbox atmosphere to explode with tremendous violence (Figure 3).

Kootenay was not the only ship to experience problems, as bearings were found to be incorrectly installed in other gearboxes in the fleet. Within two years, four other incidents, including fires, had occurred in four other ships' gearboxes. Although immediate verifications had been ordered following the explosion on board *Kootenay*, the same mistakes were still being made. The likelihood of this same type of error happening today is extremely low, but engineering vigilance is still important to ensure that no new design allows the bearings to be assembled incorrectly, and also to guard against the possibility of human error at any point.

Continuous monitoring of gearbox health is the main tool we use to ensure safety. Any problem in the manufacture or assembly of the bearings, or interruption in the supply of lubricating oil, will impact the operating surface temperature. Oil pressure to the gearbox has always been monitored, but bearing surface temperature monitoring was not necessarily common in the 1950s and 60s. While the technology of thermocouples, or resistance temperature detectors (RTDs), was reliable 50 years ago, the monitoring equipment simply displayed the temperatures, and triggered alarms when the set points were exceeded. In August 1958, more than a decade prior to the explosion, the Royal Canadian Navy's engineer-in-chief had sought to install thermocouples in all 14 ships of the DDE-205 and 257 classes, but this was approved for only two installations in the first-of-class ships, HMCS *Saint Laurent* and HMCS *Restigouche*. Thermocouple installations were denied for the remaining ships on the basis of cost. Of note, the newer ships at the time, the *Mackenzie* (DDE-261) and *Annapolis* (DDH-265) classes, were fitted with the monitoring equipment when they were built.

Following the *Kootenay* incident, however, all ships were equipped with a 40-point bearing temperature monitoring system, but it took three years to achieve the full fleet

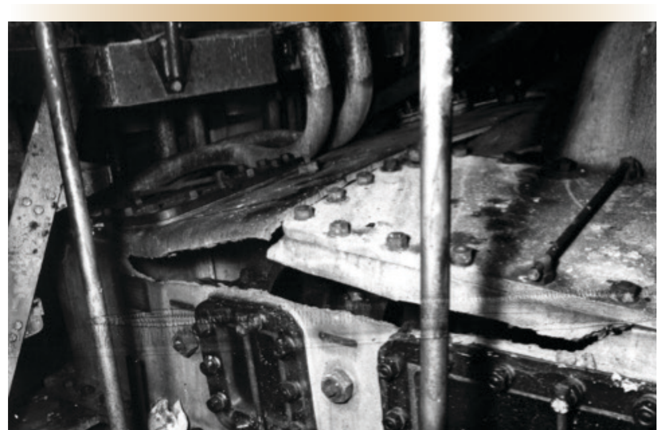


Figure 3. The explosion ripped open the aluminum casing of *Kootenay*'s starboard gearbox.

installation. During a presentation to ships' engineering officers in 1975, Don Nicholson, then head of the power transmission section in the Directorate of Marine and Electrical Engineering, and principal investigator of the *Kootenay* explosion stated: "None of the incidents experienced could have advanced undetected to cause dangerous major failures had there been a full installation of monitored thermocouples in all bearings."

Shortly after the *Kootenay* explosion, a Gearbox Explosion Working Party was set up in the UK by the Director of Engineering for the Royal Navy (RN), and met for the first time in Bath, England on July 31, 1970. There had been other gearbox explosions at the time in the UK, but none as large as *Kootenay*'s. The working party was tasked to collect evidence, investigate all aspects of gearboxes such as materials, lubricating oil characteristics, and ventilation arrangements, then assess the explosion hazards and make recommendations to reduce future risk of explosion in a gearbox. The members of the working party included representatives from the major gearing manufacturers in the UK at the time, in addition to the engineering experts of the RN. Canada's subject matter expert, Don Nicholson, met with the working party in London in October 1971.

The UK working party met almost every month until May 1972, then released an interim report in July 1973, and a final one in 1979. Twenty cases of incidents in merchant, navy, and industrial gearings were reviewed. Their recommendations included a prohibition on the use of aluminum for gear casings, and a method for locating bearing shells, either on initial build or during maintenance, to ensure that bearings cannot be assembled incorrectly. The main recommendation, though, was that a gearbox health monitoring system should be developed and maintained. During design, the bearing instrumentation was to be "carefully reviewed in view of location of the thermocouples or other detection system to cover major modes of operation in loaded and unloaded systems, and methods of attachment to bearings and circuitry."

Following the working party's report, the UK Naval Engineering Standards, now Defense Standards, were updated to include the recommendations, as were the Canadian standards. Most of the classification societies now include the recommendations, although for some reason Lloyd's Register is still not asking for more bearing monitoring than *Kootenay* had (i.e. none).

In today's *Halifax*-class frigates, all bearing surface temperatures are closely monitored. In the cross-connect gearboxes, where the loading of the bearings depends on the drive mode (power could be coming from the port side, starboard side, or both), there are two sensors to cover the different loading point locations. Each individual bearing has its own set points in the control system for warning and alarm levels to allow for the small variances in construction from ship to ship. The idea is to identify any malfunction as early as possible to allow ship's staff to take appropriate corrective action.

In recent years, with the installation of the new Integrated Platform Management System (IPMS) controls, there is an additional capability to record all engineering data on a continuous basis. This data is transferred to headquarters every month for analysis, which provides a valuable picture of the actual operation profile of each bearing in a ship. Figure 4 shows the temperature profile for bearing sensor number 20 on board HMCS *Fredericton*. Each line represents average temperatures in all four drive modes throughout the speed range. Since the bearing is located in the cross-connect gearbox, the load will be applied to different locations depending on which drive mode is engaged.

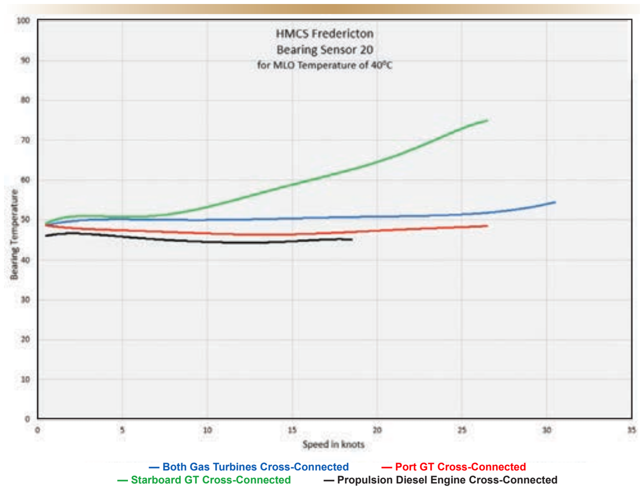


Figure 4. Bearing surface temperatures versus ship speeds in all four drive modes.

Understanding the actual behaviour of the bearings at all speeds will improve the monitoring and health analysis of the installation in order to increase the level of safety in the fleet. In the end, the key lesson learned from the *Kootenay* disaster could be summarized as being the very essence of modern engineering – vigilance in assuring accuracy in the design and manufacture of naval technical equipment, and accuracy throughout its operation and maintenance life cycle. When accuracy is respected in all aspects, engineering can produce great achievements, but when it is allowed to be neglected, there are few margins to prevent failure, if not certain disaster.

Claude Tremblay is the Transmission Systems Engineer with the Major Surface Combatant MSC 3-2-3 in DGMEPM.

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 Brian McCullough. Contact information may be found on page 1. Letters are always welcome, but only signed correspondence will be considered for publication.

HMCS *Kootenay* – Lessons Learned

By LCdr (Ret'd) Brian Howie

Photo courtesy Sgt Yannick Bédard, HMCS *D'Iberville.*

Reservists from HMCS *D'Iberville* (Rimouski, Quebec) during firefighting training at Damage Control Training Facility Kootenay near Halifax.

An inherent danger in combatting a serious machinery space fire is the unknown – not knowing what you don't know. There is the assumption that current training and equipment will suffice, if and when the requirement arises. Stark realization that this might be insufficient only heightens the fear when you are forced to fight a fire in a space that is compromised by the presence of fuels, oils, and ineffective materials used in ship design. In 1969, *Kootenay*'s sailors endured this fear as they fought with whatever tools they could find after much of the equipment they had been trained to use became unavailable, or was expended.

The explosion and fire aboard HMCS *Kootenay* stands as the worst peacetime disaster in Royal Canadian Navy (RCN) history. Nine crew members lost their lives, and 53 others were seriously injured during the event. There were many lessons learned from the subsequent *Kootenay* Board of Inquiry, and from the teachings of others who were there that day as they continued their careers in the Navy. Some of these lessons resulted in:

1. The use of steel in the manufacture of ladders, handrails and deck gratings in place of aluminum – which easily fails under intense heat;
2. Improved methods of smoke control to limit smoke egress and contamination throughout the ship;
3. More frequent damage control training, and training conducted as a prerequisite to standing duty watches;
4. Increased number of sailors trained in first aid, with training focused on the most common injuries found aboard ship;
5. An increased number of CHEMOX sets, from six to 21 units;
6. Redistribution of firefighting equipment throughout the ship; today this equipment and its location is tracked by a document referred to as the DC Key Plan; and
7. Identifying the need for more escape hatches and egress routes from engine spaces.

On October. 23, 2002, a state-of-the-art Damage Control Training Facility (DCTF) was commissioned in Halifax, and named "Kootenay" in honour of the memory of the sacrifices of the crew, and the importance of this ship's contribution to modern-day shipboard damage control. Here, the lessons of *Kootenay* remain front and centre as all new sailors undergo rigorous firefighting and damage control training as part of their Naval Environmental Training Program. In addition to fire, flood, and attack team leader training, which is currently a refresher every two years, each ship undergoes damage control team training to develop the skills necessary to fight multiple scenarios at one time. Prior to deployment, ships undergo additional training and assessment by Sea Training to ensure all training requirements are met.

The RCN continues to regularly track damage control practices, equipment, and class-specific requirements through the Internal Battle Working Group. The group is chaired by the Director of Naval Force Readiness, and is comprised of representation from Naval Personnel and Training Group, Damage Control Divisions, and Sea Training, with support from other organizations. Through this annual forum, RCN damage control practices, procedures, and technologies are discussed, along with protocols from other navies that could be adopted.

It is important to note there have been other fires in RCN ships since 1969, but through the training and equipment advances implemented following the *Kootenay* explosion, the RCN has been fortunate not to relive the devastating 1969 experience. In many ways, *Kootenay*'s sailors were pioneers in improving safety and sailor confidence in RCN damage control practices and training. Their efforts on that fateful day, as they fought to save their ship and shipmates, initiated engineering changes and training amendments that continue to this day. Fifty years on, the spirit of the ship's motto, "We Are As One," lives on in the work we do to keep our sailors safe at sea.

LCdr (Ret'd) D. Brian Howie retired from the RCN in September as Damage Control Division Commander with Naval Fleet School (Atlantic) in Halifax.

Photo by Brian McCullough

Photo by Patti Christie

Survivors during the HMCS *Kootenay* commemoration in Halifax on Oct. 23, 2019 – the 50th anniversary of the explosion. Some of AB Bell's memorabilia on display (top) at the Naval Museum of Halifax.

‘Dinger’ Bell’s Trial by Fire

By Brian McCullough
Production Editor, Maritime Engineering Journal

Allan ‘Dinger’ Bell’s story is tough to listen to. Even now, nearly six months after interviewing the 71-year-old *Kootenay* survivor in Halifax, I can barely bring myself to play the tape. Our scheduled hour-long chat took more than two-and-a-half hours to unfold, and included several tactical pauses to catch our breath. It was tough.

Bell was a 21-year-old AB stoker aboard the doomed Canadian destroyer escort on the morning of Oct. 23, 1969 when an improperly assembled bearing caused the starboard gearbox to overheat and explode during a full-power trial off the south coast of England. The ensuing fire killed nine men and injured 53. In the months that followed, others who were tormented by the experience would become casualties in various ways.

Bell was one of only three men able to escape the inferno in the engine room, along with PO1 John MacKinnon and Engineering Officer Lt(N) Al Kennedy, and even leaving out many of the specifics, the scene he described is horrific:

“Things were happening so fast, it felt like time had stopped,” he said. “The oil mist was blowing onto us and lighting us on fire. I tried to get up the ladder, but bodies were falling on top of me and dragging me down. My mind said I was going to die, and then everything went calm and I went to my quiet place. I started up the ladder again, using my forearms because my hands were burnt that bad, and I got out of the engine room.”

Bell suffered third-degree burns from the waist up, and was evacuated to a hospital burn unit in the UK where he would spend the next two months undergoing agonizing skin debriding procedures. Once repatriated to Canada, he would face another 20 months of treatment and surgeries before being discharged from hospital in the fall of 1971.

“I had other problems, but no one wanted to acknowledge them,” Bell said, referring to his diagnosed psychological trauma that went largely untreated. “While I was in hospital, I went AWOL 26 times, and got into alcohol. I got married, but that only lasted three weeks before I walked out. I lost everything, and up until five years ago, alcohol ruled my life.”

Photo by Bill Gard

Kootenay survivor Allan 'Dinger' Bell received the Wound Stripe earlier this year from former RCN Commander VAdm Ron Lloyd.

Bell went back to sea in 1972, in submarines this time, and served until his release in 1983. He took employment as a civilian dockyard worker, and spent the next several decades lost in his own “out of body” world before finally being able to access help and benefits through Veterans Affairs Canada. Today, remarried, he is a familiar figure along the Halifax waterfront, a fierce advocate for the welfare of other members of the extended ‘*Kootenay* Family,’ as well as for the families of Canadian sailors who died during the Cold War without proper recognition of their service.

“It consumes me, but I have to do this,” Bell said. “Helping people is the only thing that keeps me sane.”

The physical and emotional effects of Dinger Bell’s ordeal continue to dog him half a century later. He suffers nightmares so vivid that he sometimes throws himself out of bed. He said that his wife Barbara “understands for the most part, and tolerates what she doesn’t understand.”

As ever, his thoughts return to the sailors of the Royal Canadian Navy whose business it is to take their warships to sea.

“When things start to go wrong, they go wrong fast,” he said. “With *Kootenay*, everything that could go wrong went wrong. My message to you is, you’d better know your ship, because I am still trying to get out of that engine room.”

FEATURE ARTICLE

Safety Aloft Aboard HMC Ships

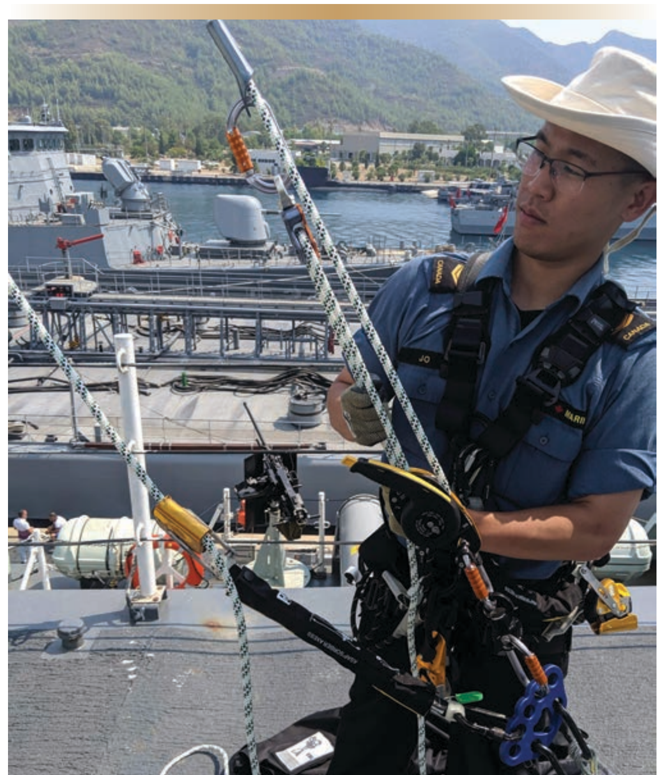
By LS Erik Christensen, HMCS *Halifax*

In late 2018, HMCS *Halifax* (FFH-330) identified a gap in the capability of ship's staff to safely reach certain pieces of equipment at the extremities of the mast to perform maintenance or repair without the use of a crane and bucket, or scaffolding. The fall-arrest gear that is currently used aboard Royal Canadian Navy (RCN) ships is a great system that definitely has its place while working at height, but it has its limitations. For one thing, a worker aloft needs to have a safe, clear fall distance to allow the shock-absorbing lanyard and safety harness to function effectively, and there is also no simple procedure for recovering a suspended worker who might require assistance in safely reaching the deck.

As a matter of professional interest, I decided to see what other options might be available outside the Navy, and began by reaching out to one of my cousins who used to work for a Halifax-based company that specializes in industrial rope access work. She told me stories of how their techs could place a worker almost anywhere on a job site safely and easily. So I then contacted one of her former co-workers who now runs a worker-positioning training centre in Halifax. After a long discussion with him, and some follow-up research, I came to the conclusion that the Industrial Rope Access Trade Association (IRATA) had an internationally recognized system that might be useful to the RCN.

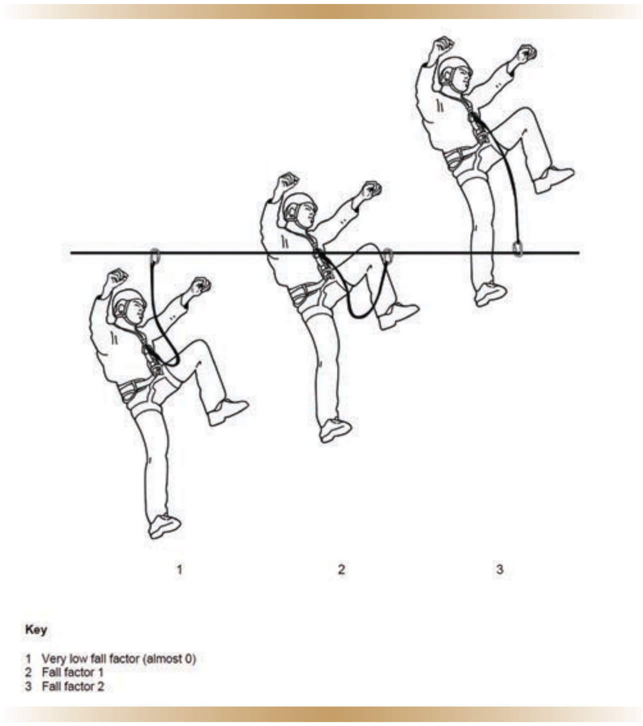
Both the Navy's current fall-arrest system and the IRATA system contemplate the potential for a person working aloft to fall. Within the fall-arrest system, the height required to safely fall and have the shock absorption system take full effect to protect a person is typically five metres of total drop. With the IRATA system, the total drop is kept to less then 60 cm, which means there is less chance of a person free-falling any significant distance, or hitting something or someone below.

Fall-arrest systems assume there is a good anchor point above your head, and a clear path below you – an ideal situation that is seldom present aboard ship. It should also be noted that if a person in a fall-arrest harness drops far enough for the shock-absorbing lanyard to deploy, both the harness and the lanyard must be removed from service and inspected.



LS Yeijun Jo demonstrates the IRATA rope access gear.

The IRATA system works anywhere you can rig a rope to pull your weight against, and uses a series of fall factors to assess the safety risk (Figure 1). Any fall factor less than 1 is the normal safe working condition for IRATA as it provides very little stress on the human body, and leaves the gear usable afterward. Mitigation should be employed to keep the fall factor below level 1. While a fall factor up to level 2 is not fatal, the gear now needs to be inspected and potentially removed from service, and anything higher would require that the worker seek medical assessment. Maybe the largest advantage of the IRATA method is its use of the buddy system while work is being conducted aloft, and for rescue operations. Rescue training is offered as part of every IRATA member certification, which offers a huge benefit to the Navy in that the "buddy" keeping an eye on the worker is trained and ready to initiate a rescue should something happen.



Courtesy IRATA International, from IRATA Code of Practice for Industrial Rope Access.

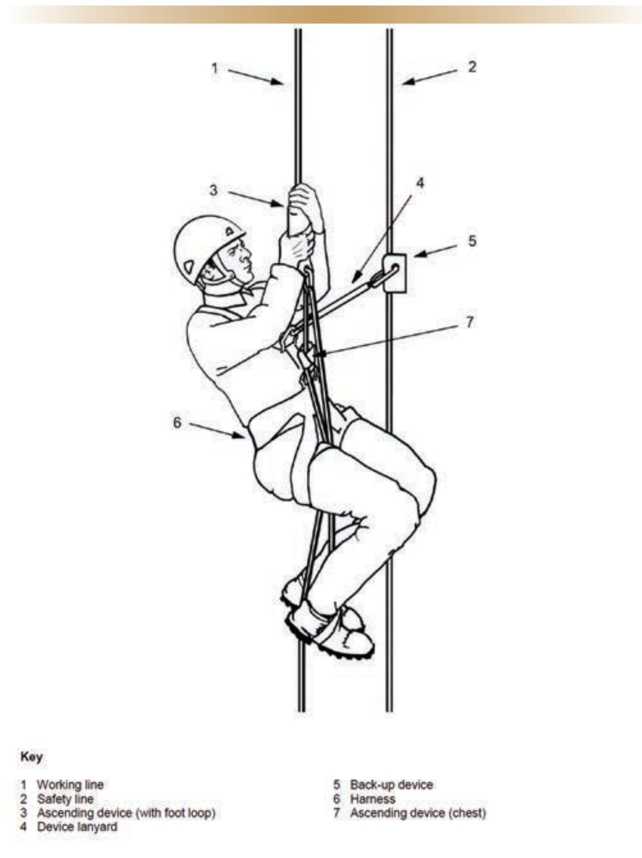
Figure 1. IRATA diagram showing different fall factors.

The Navy's fall-arrest gear would still have a significant place within the naval environment, as it could be used in conjunction with the IRATA system to get to and from a job site while not working suspended from ropes. Fall-arrest should be seen as a basic system that can be added onto with things like IRATA, or other procedures and training.

Once I had learned the definite benefits of the IRATA system over fall-arrest, it was my goal to get one other person in addition to myself trained so that we could safely complete repair and maintenance during HMCS *Halifax*'s upcoming NATO deployment. To this end, I completed the appropriate paperwork through the ship to have fellow radar tech Leading Seaman Yeijun Jo and me loaded on an IRATA Level 1 course in Halifax. Over the six-day course we learned the basics of how to safely use the IRATA equipment (Figure 2), and the different situations and environments it can be used in. The course was difficult, and challenged us physically and mentally in ways we hadn't been pushed since basic training. It was an amazing experience that gave us unique insight into how we could use the IRATA techniques and equipment to safely and efficiently handle jobs that we had struggled to complete in the past. Later on, taking all aspects into account, it struck me that while the IRATA system has much to offer, the complexity of the training might preclude it from being the RCN's best overall option. However, we feel the training was extremely worthwhile, and suggest the system could be considered as one possible solution going forward.

With certifications and log books in hand, we headed back to apply our new knowledge to our situation aboard ship. We invited the head instructor, an IRATA equipment distributor, to come to our ship and look at the challenges we faced while working aloft on the mast and other areas. He helped us identify several different methods for placing people out to work on the hard-to-reach equipment, and how to potentially rescue them using IRATA equipment. To ensure we were complying with RCN standards, we also had the MARLANT Safety and Environment Technician come down to the ship to certify our new IRATA gear the same way we do with our fall-arrest gear. This was all done before HMCS *Halifax* deployed on July 6.

Some time after we sailed, the ship received its regular annual Formation Safety and Environment Verification which, not surprisingly, identified that the ship had no



Courtesy IRATA International, from IRATA Code of Practice for Industrial Rope Access.

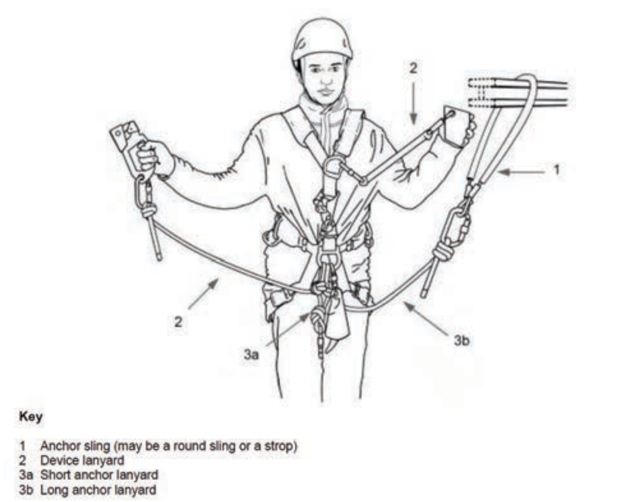
Figure 2. Typical method of ascending in an IRATA rope access system.

high-angle rescue plan in place. Knowing that LS Jo and I had recently become qualified to handle rescues aloft, our Combat Systems Engineering Chief put our names forward to help rectify the problem. When the ship stopped at Naval Station Rota in Spain, LS Jo and I started work on a functional high-angle rescue plan following IRATA guidelines for a safe working environment. This effort involved:

1. Developing a risk assessment for working aloft on the ship
2. Developing the rescue plan
3. Ensuring we had all the proper equipment for the plan
4. Practising the plan, and
5. Getting the plan approved by the chain of command

We identified 16 different areas of risk, and ways to mitigate them. To develop our rescue plan, it had to be established that the goal was to be able to rescue someone wearing either an IRATA harness or a fall-arrest harness. Since the two systems connect to the ship's superstructure quite differently, and have different attachment arrangements on the harnesses, it was important to understand how everything works. The standard man aloft harness has a single D-ring connection between the shoulder blades. The IRATA harness (Figure 3) has a D-ring in the back to attach a fall-arrest lanyard, but also has ventral and sternal rings on the front for working on the ropes, as well as a ring on each hip to attach workplace positioning lines. With adjustments at the neck, back, hips, thighs, and buttocks, a variety of body types can be fitted into the harness properly. The ability of the IRATA harness to be utilized in many different configurations allows for a far greater scope of work to be accomplished with only slight modification to a standard setup.

The adaptability of the harness when rescuing someone is situation-dependent. If the casualty is in an IRATA harness (Figure 4) there are steps to follow, and no matter how complicated the rescue you can always build on these steps to accomplish the rescue. You start by always maintaining two points of contact between yourself, the casualty, and your working ropes. The goal is to keep the casualty in as natural a position as possible, and get the person down as fast as possible to minimize the risk of suspension intolerance – a loss of consciousness or worse brought on by blood pooling in the lower extremities when a person is suspended upright with limited ability to move for some length of time. Once you have reached the casualty aloft, you can do things to slow down suspension intolerance, such as rigging a line to pull the casualty's knees up to a sitting posture to give the rescuer more time to complete a complex rescue.



Courtesy IRATA International, from IRATA Code of Practice for Industrial Rope Access.

Figure 3. Example of an IRATA system anchor sling and different types of lanyard.

Additional challenges arise when a casualty is wearing a standard fall-arrest harness. There are minimal connection points to hook on to, the casualty has potentially fallen up to five metres, their lanyard is taut, and there is no easy way to remove the tension. In this situation, the casualty's weight must be transferred to a rescuer's IRATA harness, or to a rig-to-rescue system such as the Petzl JAG Rescue Kit that is designed to pick off and lower the person to safety. The big benefit to this rig-to-rescue system is that it can be easily taught to personnel, needs only one anchor point, and has a built-in lifting device. However, the rescuer must be able to reach the casualty's harness to use this system. The rescuer hooks the upper attachment to a suitable anchor point, then attaches the lower point to the casualty's harness so that the lifting device can take the weight off the casualty's lanyard before disconnecting the lanyard and lowering the casualty to the deck with the mechanical assistance of the built-in lift/descent device.

On board *Halifax* at the moment, we have IRATA gear to handle most situations that might arise with the type of work we do, but a better, more permanent solution is required to meet the needs of the entire fleet.

Conducting high-angle rescues and working aloft are inherently dangerous activities. As radar technicians, it is our job to go aloft to maintain the ship's radar and electronic warfare equipment that is located in poorly accessible positions at height. On board *Halifax*, LS Jo and I are in the process of writing a standard operating procedure for our high-angle rescue plan that would be implemented by us for the time being, given our specialized training. But this raises a couple of questions: What exactly should other techs be trained to do, and how should this training be delivered so that new techs arriving on board are properly trained? While the IRATA training is fantastic, and has given LS Jo and me an amazing opportunity to expand our knowledge and scope of work, the training is complex, and probably not for everyone. There has to be a simpler way ahead.

In my opinion a system like a rig-to-rescue bag that contains an appropriate, class-specific length of rope and lifting device offers us the best way forward. If a simple plan were made up for each class of ship, then a trainer could lead ship-specific training so that people on each crew could act as the high-angle rescue team. With some rig-to-rescue kits priced under $1000 (e.g. from Keltic Falcon in Dartmouth), a plan could be implemented cost-effectively and quickly. While there is no ideal system, this likely is the best solution for a high-turnover organization like the RCN. HMCS *Halifax* does not have this product, but has all the separate equipment – so an IRATA technician could assemble one and use it in the same way.

With the continually improving environment when it comes to personnel safety in the Navy, and as modern sensors and weapons become smaller and more abundant on our vessels, the issue of working safely at height is only going to become more apparent. It is my feeling that the time has come to change the way the Navy works aloft. Systems like the IRATA can be a valuable tool when properly put in place and managed over an entire organization, but there are always options to explore. In conclusion I believe there is a lot the RCN could learn from IRATA so that we do not try to reinvent the wheel. There are many organizations in the world that operate in similar environments as we do, and could teach us some of the skills we are missing.

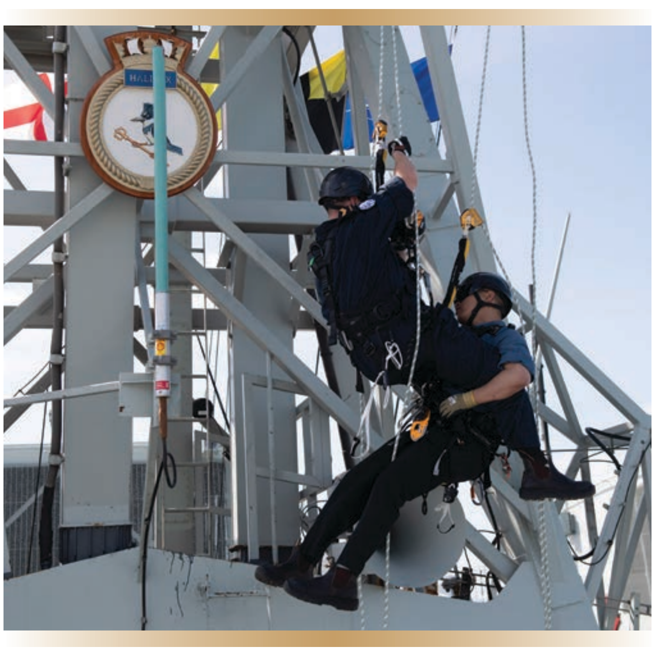


Figure 4. A standard IRATA high-angle rescue with both casualty and rescuer wearing IRATA-system harnesses.

Leading Seaman Erik Christensen is a Weapons Engineering Radar Technician on board HMCS Halifax.

Editor's Note: In his support and praise for the initiative of both LS Christensen and LS Jo, Lt(N) Kevin Pallard, the Assistant Combat Systems Engineering Officer on board HMCS *Halifax*, points out that when the RCN stopped carrying Royal Canadian Air Force firefighters on board HMC ships several years ago, the Navy lost its high-angle rescue capability – an issue that the MARLANT Fleet Safety and Environment Management Committee has been struggling to address ever since. Lt(N) Pallard adds that the benefits of the IRATA training were obvious during HMCS *Halifax*'s deployment. Ship's staff were able to complete corrective maintenance that, were it not for this training, would have required the ship to hire a crane-and-bucket in a foreign port. Thus, he says, the progress made by LS Christensen and LS Jo is significant, and is a wonderful example of how the Navy can empower junior personnel to solve a problem.

FEATURE ARTICLE

Naval Remote Weapon Station System — The Road to IOC

By Brian Bassit

A momentous milestone in all equipment acquisition projects is Initial Operational Capability (IOC). By National Defence's definition, it is the first attainment of the minimum ability to employ a new or improved capability, for which adequate infrastructure, training, staffing, and support are in place[1]. IOC is a unique, event-driven milestone, that certifies a system can meet the operational capabilities for a user's stated need.

Summer 2019 marked the first time the Naval Remote Weapon Station (NRWS) replacement for the manually-fired heavy machine gun (HMG) mounts currently in service was effectively employed by the Royal Canadian Navy (RCN). As a result, the NRWS project is well on its way to achieving official IOC status. The road to IOC has been an extensive journey, and has encompassed a significant level of effort from project resources in engineering solutions, engaging stakeholders, and executing plans over several years.

The Navy's .50-calibre HMG

The RCN currently uses a layered defence methodology on board its 12 *Halifax*-class patrol frigates, with the close-range fitted weapons being the Phalanx close-in weapon system, the Bofors 57-mm Mk 3 naval artillery gun, and the manually operated M2 .50-calibre heavy machine gun (Figure 1). More frequent naval operations in navigationally challenging and high-traffic littoral waters have placed greater importance and responsibility on the close-range weapons to handle all potential threats against RCN frigates.

The .50-calibre HMG has been relied on since the Second World War, being used extensively for short-range surface engagements, and limited air defence. The need to minimize collateral damage, the short detect-to-engage sequence, the difficulties of determining intent at range, and the weapon's practical rate of fire often leave the .50-calibre HMG as the only fitted weapon available for use against fast inshore attack craft (FIAC) and low, slow flyers. The air-cooled, 550-round-per-minute, low-maintenance weapon is fitted on board ship for fire support and force protection in a variety of seamanship evolutions, such as drug interdiction and naval boarding operations.

Figure 1. The current hard-pintle M2 .50-calibre HMG in use by the RCN.[2]

The Deficiency

In October 2003, the Canadian Forces Maritime Warfare Centre (CFMWC) conducted a FIAC operational test, which demonstrated that the accuracy and resulting effectiveness of the long-used .50-calibre HMGs was unsatisfactory. The low probability of hit revealed that the frigates were vulnerable to attack by a single FIAC, and highly susceptible to swarm attacks.

A deficiency in capability for the .50-calibre HMGs was declared based on a number of factors. The hard pintles that support the guns do not effectively provide the ability to control recoil during sustained firing, raising the risk of unintentional collateral damage. As well, the HMGs left blind arcs in specific zones due to pintle locations and the inability to depress the weapons far enough. Furthermore, the inability to recognize threats in poor visibility, the degraded command and control communications with the use of exposed SHINCOM equipment, and the vulnerability of HMG operators on the ship's upper decks all contributed to declaring the capability deficiency.

Project Creation

In 2005, the Remote Control Heavy Machine Gun (RCHMG) project was initiated to procure operationally proven and tested military off-the-shelf equipment. The project took advantage of two evaluations conducted by CFMWC: an operational evaluation for an upgraded .50-calibre pintle and sight in 2005, and a lease-and-try operational evaluation for a remote-controlled HMG in 2006. The lease-and-try OTO Melara naval turret (Figure 2) installed on board HMCS *Summerside* (MM-711), demonstrated that the technology associated with combining electro-optical sights, an operator station, and a remote-controlled weapon was reliable, competitively available from industry, and able to address the RCN's .50-calibre HMG capability deficiency.

In 2007, the RCHMG project was renamed to Defence Against Small Boat Threats (DASBT), with the goal to acquire a reliable capability to defend all major surface warships of the RCN against small-boat threats. Options analysis was completed in 2008, which concluded that it was more beneficial to acquire a .50-calibre HMG remote-control stabilized system instead of a new gun system, a new missile system, or new pintle and sight equipment. Project approval was granted in August 2010, which expanded the scope to include equipment delivery for two *Protecteur*-class joint support ships (JSS). In July 2011, the project name was further changed from DASBT to NRWS to better reflect industry nomenclature.

In January 2016, the acquisition contract was awarded to Raytheon Canada Limited (RCL) for delivery of 58 NRWS mounts – 48 for the *Halifax*-class frigates, eight for two future *Protecteur*-class ships, and two for training at the coastal fleet schools. RCL partnered up with Israeli defence company Rafael Advanced Defence Systems, which engineers and builds most components of the NRWS system. In December 2017, a factory acceptance test demonstration was conducted on board a test ship in Israeli waters. Even though the chosen system was proven and is in service by multiple navies, there were a series of features developed specifically for the RCN that integrated multiple mounts. The test demonstration showed that these new features functioned as expected, and proved that the RCN would have a smooth transition once the mounts were integrated on board the frigates.

NRWS System Capabilities

Each NRWS system installed on board a *Halifax*-class ship consists of four remotely operated weapon mounts, sensor suites, and operator consoles that are fully integrated with one another. With two mounts located on the extended bridge wings, and two on the quarterdeck, the system provides 360-degree ship coverage (Figure 3).

Figure 2. A lease-and-try OTO Melara naval turret installed on HMCS *Summerside*.[3]

Figure 3. NRWS locations on board *Halifax*-class frigates.

Each weapon mount (Figure 4) consists of a pedestal, cradle, ammunition box, and electro-optical surveillance suite (EOSS). The pedestal, comprised of an aluminum base secured to the ship's deck, supports the weapon cradle, which, in turn, supports the gun, ammunition box, and EOSS. The cradle is stabilized by two internal gyros, with the gun's lead and super elevation angles calculated and fed into the system by its own fire-control processor.

With a weapon changeover kit, the cradle is configurable for either the .50-calibre HMG, or the smaller C6 general-purpose machine gun. The flexibility with either weapon was a key requirement, and allows the RCN to minimize the risk of collateral damage when using the C6 7.62-mm calibre round. The ammunition box has the capacity to store 200 rounds of .50-calibre ammo, or 400 rounds of 7.62-mm ammo, and has a catch basin found below on the pedestal for collecting spent links and casings.

Each mount's EOSS brings new capability in the form of threat identification, acquisition and tracking in all conditions of visibility. The EOSS consists of a laser range-finder, a charged couple device camera for day/low-light operation, and an infrared camera for night and poor weather operation. The threat detection range of both cameras is greater than five kilometres, with the identification ranges being 1.8 km for the day camera, and 1.1 km for the infrared. The EOSS has its own dedicated jet-wash system, which comprises a heated nozzle to spray away dust and salt buildup, and de-ice it in colder conditions.

Figure 4. HMCS *Fredericton*'s starboard forward NRWS.

Figure 5. The aft remote operator consoles aboard HMCS *Winnipeg*.

Controlling the NRWS System

The NRWS system is controlled by four remote operator consoles (Figure 5) safely co-located within the ship citadel in fire-control equipment room no. 3 (FCER3). Boatswains are the primary operators, and are able to control each mount individually using its respective display unit and main control panel. The ship's weapons engineering technicians are responsible for all required maintenance. To save on personnel resources, the system does have a cross-operation feature – the ability for operators to slave same-side mounts on one operator console, thereby reducing manning to two crew members from four.

The NRWS system includes target sharing and target handover capability between mounts, allowing mounts adjacent to the primary tracking mount to automatically slew and track the same target if it enters its designated arc of coverage. There is overlap in arcs of coverage between adjacent mounts, which ensures that boundaries have double coverage, and reduces risk of lost tracking if a threat is circling. As well, each operator console includes an embedded trainer program where customizable scenarios can be loaded on-screen to ensure that operators can practise and remain competent with the system.

There are multiple mechanical and electrical safety mechanisms in place to ensure unintentional firing does not occur. The fire enable key, the gun enable switch, and the state selector switch are all required to allow an NRWS to fire. Veto switches located in the operations room and on the bridge can disable and prevent remote firing of all four NRWS mounts. As well, a manual override switch exists at each mount location to cut its electrical power and prevent remote control. In emergency cases, such as a power loss on board, ship's crew can locally disengage a mount's motors and manually train and fire the weapon.

Project Status

As of October 2019, two *Halifax*-class frigates have been fully outfitted with the NRWS system, while two more are in the installation process. Each full-ship NRWS system installation requires more than 10,000 hours of work by the contracted shipyards as there are significant structural modifications being made to extend the bridge wings. Two to three ship installations will occur per year until the entire fleet is equipped. As well, delivery of weapon mounts to coastal naval fleet schools, and the initial cadre training for operators and maintainers has been completed.

In June 2019, the NRWS project successfully conducted its first article sea acceptance trial on board HMCS *Fredericton*. During the trial, the NRWS system validated its firing requirements by accurately engaging small boat targets (Figure 6) and sinking a Hammerhead unmanned surface vehicle (Figure 7). This trial was the first time the NRWS capability was effectively employed by the RCN. The second sea acceptance trial was also successfully conducted on HMCS *Winnipeg* in October 2019.

Figure 6. Small boat targets being engaged during sea acceptance trials.

Looking ahead, in addition to completing the frigate installations, the NRWS project will deliver eight mounts for use on board two *Protecteur*-class joint support ships (JSS). The project is expected to attain IOC imminently, and is on track for full operational capability in 2024. Along with enhanced weapon effectiveness and fire control, further time and use in naval operations with the NRWS will improve crew protection, communications, and threat detection and engagement for the RCN.

Brian Bassit is the NRWS Project Engineer working under Major Surface Combatant directorate in Ottawa.

Figure 7. A Hammerhead surface target burning during sea acceptance trials.

Acknowledgment

The professional feedback from colleagues Myna Moharib (NRWS Project Manager), and Darren Lemieux (NRWS Life Cycle Material Manager), in the preparation of this article was greatly appreciated.

References

[1] Initial Operational Capability Certificate. Assistant Deputy Minister Materiel. National Defence. Available from: http://materiel.mil.ca/en/business-functions-project-management/initial-operational-capability-certificate.page. Accessed Aug. 23, 2019.

[2] Frigates – Tech Data. Royal Canadian Navy, Government of Canada. Available from: http://www.navy-marine.forces.gc.ca/en/fleet-units/frigates-tech.page. Accessed: Aug. 8, 2019.

[3] Final Report – Remote Control Heavy Machine Gun-OTO Melara Naval Turret Operational Evaluation, Canadian Forces Maritime Warfare Centre, dated Feb. 19, 2007.

NEWS BRIEFS

Photo by LS Mike Goluboff, MARPAC Imaging Services.

Fleet Maintenance Facility Cape Breton in Esquimalt, BC saw a change of command this past summer when acting CO **Cdr Amit Bagga** (at left) turned over the watch to incoming commanding officer **Capt(N) Martin Drews** (at right). **RAdm Bob Auchterlonie** (Commander Maritime Forces Pacific) and **Cmdre Chris Earl** (Director General Maritime Equipment Program Management) officiated at the handover ceremony.

AWARDS

2019 Rheinmetall Award

LS Evan Lawrence
Top Weapons Engineering Technician exhibiting outstanding performance and conduct in trade
(With Luis de Sousa)

2019 Lockheed Martin Canada Award

Lt(N) Andrew Torchia
Top Combat Systems Engineering Phase VI candidate
(With Patrick St-Denis)

Naval Association of Canada Shield

SLt Courtney Williams
Highest standing, professional achievement and officer-like qualities during Naval Engineering Indoctrination
(With Dave Craig)

MacDonald Dettwiler Award

Lt(N) Nathan Schnarr
Top NTO candidate to achieve Head of Department qualification
(With John Turner)

Mexican Navy Award

SLt Charles Grimshaw
Top student, Naval Combat Systems Engineering Applications Course
(With Cdr Erick Zendejas Hinestrosa, Mexican Navy)

Photos by Brian McCullough

PRESERVING CANADA'S NAVAL TECHNICAL HERITAGE

CNTHA

NEWS

Canadian Naval Technical History Association

DDH-280 Sea Sparrow Trials

By Pat Barnhouse

Our 2018 interview with retired **Captain(N) Norm Smyth** revisited his time as trials director for the testing and evaluation of the Sea Sparrow missile system fitted in the four DDH-280 ships in the early 1970s. The following excerpts from the interview have been abridged and edited:

"What existed in the world at that time was basically an air-to-air missile that was adapted for a surface-to-air role by the US Navy. Reloading the four-, or eight-cell box launcher was a time-consuming operation that took hours, and Canada wanted a faster response system for the Raytheon missile and launcher. Raytheon Canada developed a unique launcher concept that could reload in a minute. It entailed a fairly large enclosure at the front end of the ship to house a pair of four-missile launchers that could emerge port and starboard on a rotating arm to launch missiles in the direction of the intercept point. The missiles could fly around a corner if the intercept point was beyond the arc of motion of the launcher, up to something like 45 degrees, so if a target was coming in from somewhere ahead, both launchers could engage simultaneously. If the target was coming in from abeam or abaft the beam, that side's launcher could engage. With the box launcher, you'd need a couple of boxes fore and aft to cover this off...

"Running a missile launcher project is pretty straightforward – you get smart, you develop a relationship with industry, and you do your thing. But when, all of a sudden, the equipment is turned over to the Navy, you have to look around for the talent to evaluate it. What saved the day for us was a bunch of can-do people at Defence Research Establishment Suffield who we engaged to do blast trials on the DDH-280. When we launched these missiles, we needed to know what effect the rocket motors would have on the

DND image of a fully loaded DDH-280 Sea Sparrow missile launcher from the documentary film, Sisters of the Space Age.

structure of the ship, and on the launchers themselves, and what would happen if a missile got locked up and never released. We also had to figure out how we were going to test that the electromagnetic radiation we were providing as a rear reference signal for the missile was in fact getting out to 20,000-30,000 yards from the ship...

"We ended up running a year-long technical evaluation program that could not have occurred without the instrumentation that the guys at Suffield designed for us, nor without the willingness of those people to help our engineers develop a trials program. Industry had done their part in delivering the launcher system, and now we needed to kick the hell out of it and understand it. It was a very complicated system, and we had to make sure that the fire-control radar was working to the extent of its capability, that the illuminations were getting out there, that the missile was responding, that the launcher was tracking, that the computations for the intercept point were correct – everything. At the end of the day we had fantastic success with HMCS *Athabaskan* on the missile range at Puerto Rico, and it astounded all of us how well the system performed."

HMCS *Athabaskan* on the missile range.