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Maritime Engineering Journal

Canada's Naval Technical Forum



Fall 2026



Featured Content

**Maritime Equipment Program Management Adventure
Training Expedition: Building Leadership and Resilience**



Canada



Photo by Neil Clarkson, Formation Imaging Services Halifax

Inside the Lunenburg Foundry, aspiring Royal Canadian Navy Machinist Specialists from Naval Fleet School (Atlantic) spent two days casting machine parts from molten metal.

See page 21



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Commodore's Corner

Year in Review

by *Commodore Michel Thibault* 2

Forum

Letter to the Editor 3

Opinion: Is the CAF Prepared to Adapt and Overcome on a Modern Battlefield?

by *S1 Emlyn R. Parker* 4

Red Flags, Not Red Tape

by *Jonathan Shriqui* 7

Feature Articles

MEPM Adventure Training Expedition: Building Leadership and Resilience

by *Capt(N) Patrick Larose* 12

Advancing Shipboard Welding Below the Waterline for RCN Surface Ship Repairs

by *Darren Begg* 14

What's on Your Radar?

Featuring: *Sailor 1st Class Brian Bruyere* 19

News Briefs

Change of Commands 3

CFMETR Humpback Whale Rescue 6

Welcome MEPM Unit Chief 11

Sailor of the Quarter 20

Launch of Trilateral Cooperation 20

Foundry Training Helps Keep Rare RCN Machinist Trade Alive 21

CNTHA NEWS

HMCS Labrador (AW 50) — The RCN's Cold War Icebreaker

by *LCdr (Ret'd) Brian McCullough* 22



A moment of respite on Mont des Morios after an arduous climb.

Photo by Lt(N) John McConkey

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COMMODORE'S CORNER

Year in Review

By Commodore Michel Thibault, CD

Dear members of the Naval Engineering and Maintenance (NEM) Enterprise. It's with humility and a profound sense of duty that I step into this second year of my tenure as DGMEPM and Chief Engineer for the Royal Canadian Navy. Together over the past year, we've joined forces more unified than ever and focussed on implementing the new direction that has been chartered for the Department of National Defence (DND), the Canadian Armed Forces (CAF) and Royal Canadian Navy (RCN). I think you'll all agree that last year was marked by a mixture of excitement from the historical support and level of resources provided to DND, as well as challenges for all of us to affect the necessary pivot, and accelerate the delivery of materiel readiness for the RCN. I had numerous opportunities to communicate my challenges and priorities, as well as exchange ideas on how to capitalize on the opportunities we have in front of us. Therefore, some of what follows shouldn't be much of a surprise. Our objective is now clearly codified in the Defence Industrial Strategy published earlier this winter and consists in delivering 75% serviceability for all RCN classes within 10 years.

My focus over the past year has been to tackle as many of the "low-hanging" fruit that we could in order to quickly generate tangible benefits, all the while establishing a foundation for the structural changes and reform required to ensure long-term success and viability of our Enterprise. Together, we increased the quantity of spare parts and materiel held by the RCN for all classes, initiated some much-needed procurement to help address obsolescence or capability deficiencies, and significantly increased our support and resources towards the sustainment of the *Halifax*-class, *Harry DeWolf*-class and preparation towards the acceptance of the *Protecteur*-class. These areas of focus will remain extent as long as required to ensure we achieve the desired level of materiel readiness.

I am also pleased to report that some progress was made in streamlining our business. From a policy perspective, we now have access to more options and tools to obtain the necessary authorities from government to shorten the overall procurement timeline. Through the *Halifax*-Class Life Extension Initiative (HCLI), we are tackling some fundamental and structural issues to assist with increasing the efficiencies of Docking Work Periods (DWPs) and decreasing their durations. But, perhaps the single most consequential change for DND, is the de-projectization of our business. This will affect most non-capital procurement and enable the replacement of "like-for-like" capabilities from systems to complete platforms, without the associated higher-level governance of standard projects. This change is expected to positively impact over 30% of our program, by enabling faster procurement initiation.

Once fully realized, these changes are expected to help reduce the procurement timeline within DND, and if not carefully orchestrated with industry partners, may create or amplify existing capacity gaps. As usual, opportunities to openly communicate with industry will be key in ensuring our collective preparedness to fully capitalize on these important changes.

I look forward to working with all of you this year again in delivering more readiness and ensuring that we establish the foundation to successfully achieve our collective objective of providing the RCN with 75% serviceability on all classes!

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 at MEJ.Submissions@gmail.com.

FORUM

Letter to the Editor

Dear Editor,

I just saw the article on **Roger Heimpel**, “Remembering Commander (Ret’d) Roger Heimpel: The Engineer with the Red Hat and a Big Heart” (*MEJ* 114). One thing completely omitted was his participation in the 3rd Marine Engineering Technical Training Plan (METTP) serial which started in 1982. I was a student with Roger, who was

a ‘fleet’ candidate, and many other reprobates who I came to respect and admire later in my career. It is too bad that was missed as his Tech paper was about an automated pig farm!...Just one of many surprises and a story unto itself!!!

Thanx Roger.

Pat Devenish, CPO1 (Ret’d), CD2



Change of Commands

Naval Engineering Test Establishment

On July 31, 2026, **Cdr Darryl Gervis** formally relinquished command of the Naval Engineering Test Establishment (NETE) in Montréal to incoming Commanding Officer, **Cdr Yohan Desjardins**. The Change of Command ceremony was presided over by **Cmdre Michel Thibault**, Director General Maritime Equipment Program Management and Chief Engineer of the Royal Canadian Navy.



Photo by Corporal Étienne Lafamme

Naval Fleet School (Pacific)

On August 7, 2026, **Cdr Calley Gray** assumed command of Naval Fleet School (Pacific) from **Cdr Meryl Sponder** during a Change of Command ceremony held at His Majesty’s Canadian Dockyard in Esquimalt, British Columbia. **Captain(N) Mike Stefanson** officiated as the Change of Command ceremony Reviewing Officer.



Photo by Pte John Mackay, Maritime Forces Pacific Imaging Services

Fleet Maintenance Facility Cape Scott

On 18 August 2026, **Capt(N) Iain Meredith** assumed command of FMFCS from outgoing Commanding Officer **Capt(N) Eric McCallum** during a ceremony held at His Majesty’s Canadian Ship *Scotian* in Halifax, Nova Scotia. **RAdm Pascal Belhumeur**, Commander Maritime Forces Atlantic, presided over the ceremony.



Photo by Cpl Brendan Gamache, Formation Imaging Services Halifax

FORUM

Opinion: Is the CAF Prepared to Adapt and Overcome on a Modern Battlefield?

By S1 Emlyn R. Parker

For a while now, I have been hearing fellow military members say that we have become obsolete as a military force, or that the state of our equipment is embarrassing. That wasn't always the case though. The Canadian Armed Forces (CAF) has a storied history and was considered a competent ally on the world stage for over a century - from the fighting force of the First World War leading to Canada being independently recognized in the treaty of Versailles, despite it being a British Dominion at the time, to the country having one of the largest navies in the world by the end of the Second World War. More recently, Canada again proved itself as a competent ally in a conflict on the world stage in Afghanistan from 2001 to 2014, when Canada stepped up and showed its capabilities in joining the United States led, and United Nations sanctioned, coalition.

In recent years however; it has been claimed that Canada has drastically fallen behind in regard to its military capabilities. The BBC and CBC have published articles about the struggles Canada has faced with the CAF, including keeping up with NATO spending targets, procurement delays, workforce shortages, and on Canada's short comings with regards to surveillance and security in the Arctic. It isn't just the media that has made these claims however; on July 18th, 2024, the Chief of Defense Staff had a sobering message for Canadians when she was interviewed by the CBC: "We are much more open now to both conventional threats and unconventional threats, all at the same time. So, I think that Canadians need to understand that if we are not ready, we might not be able to react appropriately in defense of them, I say we have about five years to get us close enough to be ready to counter those long-range type of threats."¹

It wasn't just Canada who felt the risk of potential looming threats. Recently, the American public broadcast-



RCN photo

S1 Parker on board HMCS *St. John's* during Op REASSURANCE 2025.

er, National Public Radio (NPR), reported that the world was seeing the highest number of ongoing conflicts since the conclusion of the Second World War. This was based on data from the Uppsala Conflict Data Program, which has been tracking a rise in global conflicts. It was actively tracing 65 in June 2026.² European leaders were sounding alarm bells as well, according to the Atlantic Council, European intelligence services estimate that evolving drone warfare tactics could test NATO's Baltic members within the next three to five years. Andrius Kubilius, the European Union's first ever commissioner for defense and space, said in an interview with Atlantic Council in the same article, "We are not ready, Day X is coming, and we need to see the picture clearly."³

1. Burke, A. "New Chief of Defence Staff says Canada has 5 years to prepare for emerging threats". CBC News. 18 July 2024. www.cbc.ca/news/politics/new-chief-of-defence-staff-change-in-command-ceremony-1.7266382

2. Bartlett, K.. "Conflicts are on the rise globally, at the highest level since WWII, data shows". NPR. 9 June 2026. www.npr.org/2026/06/09/nx-s1-5850355/data-highest-conflicts-iran-israel-ukraine-russia-world-war-ii

3. Kempe, F. "Europe is 'not ready' for the Russian threat. At least it now has a plan". Atlantic Council. 28 July 2026. www.atlanticcouncil.org/content-series/inflection-points/europe-is-not-ready-for-the-russian-threat-at-least-it-now-has-a-plan/.

It's not all bad news however; recently measures have been taken to prepare us for the new reality of a modern battlefield. Recently Canada, and our allies, have stepped up finding and fixing shortcomings in our defence communities. In 2025 every member of NATO hit its defense spending target of two percent Gross Domestic Product (GDP), this is the first time Canada has hit that benchmark since the fall of the Berlin Wall.⁴ Canada and all NATO nations agreed to a new Defence Investment Pledge to increase defense spending to five percent GDP by 2035. NATO is even looking to set up a multinational Defence, Security and Resilience Bank which will have its headquarters in Canada.⁵ The European Union (EU) has established the Security Action for Europe (SAFE) Program and has entered into a Canada – EU Security and Defence Partnership.⁶ NATO has announced it is executing a sweeping multibillion dollar modernization of global surveillance and intelligence networks, creating a “system of systems” linking together air, land, maritime, space, and cyber assets to a unified intelligence system.⁷

Canada was already in the process of modernizing its Armed Forces, but that process was greatly improved in 2025 with the creation of the Defence Investment Agency (DIA) to accelerate procurement processes and to greatly expand its capabilities.⁸ This is being done through programs including but not limited to: the Canada ship building strategy, the Canadian patrol submarine project, the aircraft procurement strategy (which is currently under review), the establishment of the Drone Innovation Hub, the DND/CAF Artificial Intelligence Strategy, the Indirect Fires Modernization, and the Sovereign Ammunition Production strategy. Plans for the CAF don't end at modernizing the current generation of weapons technology. Right now, Canada is working with partners and allies to help develop the future generations of warfighting capabilities. Canada has entered a development and production partnership with Ukraine to improve drone



Photo courtesy S1 Emyln R. Parker

S1 Parker at Vimy Ridge, November 11, 2025.

tech and tactics.⁹ Canada has recently joined the Global Combat Air Programme as an observer partner in a joint project to develop a brand new sixth generation fighter jet. Canada is also one of 12 countries continuing to develop the Evolved Sea Sparrow Missile (ESSM) to improve anti air defenses.

So why is all of this investment coming now? Why is this suddenly a priority? People have referred to the current, post-cold war era, as being an unprecedented period of general peace and prosperity. Due largely to that peace, Canadian opinion of defense spending has generally favoured maintaining spending levels at around one percent GDP, with public opinion showing that in general, the people did not want to spend large sums of money on new defense technologies through the 2010's. Nano research's polling shows that the trend in public opinion shifted heavily

(Continues next page...)

4. Brewster, M. “Canada clears NATO's 2% bar – after years of lagging and a last-minute lift”. CBC News. 26 March 2026. www.cbc.ca/news/politics/canada-anto-defence-spending-9.7142615.

5. Department of Finance Canada. “Canada welcomes progress towards the establishment of the Defence, Security and Resilience Bank and hosting its headquarters”. Government of Canada. 29 April 2026. www.canada.ca/en/departement-finance/news/2026/04/canada-welcomes-progress-towards-the-establishment-of-the-defence-security-and-resilience-bank-and-hosting-its-headquarters.html

6. “Agreement between the European Union and Canada concerning participation under the SAFE Instrument”. Government of Canada. 24 February 2026. https://www.international.gc.ca/world-monde/international_relations-elations_internationales/eu-ue/agreement-accord.aspx?lang=eng

7. NATO. “NATO ramps up development of Future Surveillance Capability”. 26 February 2026. www.nato.int/en/news-and-events/articles/news/2026/02/26/nato-ramps-up-development-of-future-surveillance-capability.

8. Defence Investment Agency. “Defence Investment Agency About us”. Government of Canada. 2026. www.canada.ca/en/defence-investment-agency/corporate/about.html.

9. National Research Council Canada. “New programs to support Canada's Defence Industrial Strategy. Government of Canada”. 09 March 2026. www.canada.ca/en/national-research-council/news/2026/03/new-programs-to-support-canadas-defence-industrial-strategy.html.

in the 2020's. In 2025 52% of Canadians wanted two percent GDP on defense spending, and an additional 31.7% wanted to see Canada up to five percent GDP.¹⁰

Modern conflicts have shown that the tried-and-true technologies of the Twentieth Century are no longer adequate on the modern battlefield. We have seen that ingenuity in the civilian sector has led to the development of technologies that have allowed cheap, easy to use products, to catch up to technical capabilities of older systems that were once considered advanced in their time. With the advent of autonomous, uncrewed robotics, there has been a drastic shift of how intelligence and combat operations are being conducted.¹¹ Unbeknownst to us, we have stumbled into a new era of warfare, out of a prolonged relative peace that allowed most Canadians to feel satisfied with the state of our national defences. This new tech has not simply shifted how we conduct warfare, but drastically

changed what is seen as an effective military on the world stage. I believe we were fortunate, in that we were able to witness this change on distant battlefields, through the sharing of allies' intelligence and experiences, rather than having been hit by an adversary using these modern methods against us at home. Now it's time to catch up, and raise ourselves once again, to a point where we are able to protect our people, our allies, and our interests, as a nation.



Sailor First Class Emlyn R. Parker, a member of the Combat Systems Engineering Department, is currently a Junior Fire Control Maintainer on HMCS Halifax.

10. Nanos Research. "Appetite for Canada to increase defense spending on the rise". Submission 2025-2859. CTV News.

<https://nanos.co/wp-content/uploads/2025/07/2025-2859-CTV-June-Populated-Report-Defence.pdf>

11. Walsh, N.. "Robots are redefining the war in Ukraine – and forcing Russia onto the back foot". CNN World. 30 May 2026.

www.cnn.com/2026/05/30/europe/ukraine-robots-drones-russia-war-intl.

News Brief

CFMETR Humpback Whale Rescue

(Courtesy DND LinkedIn)

When a humpback whale became entangled in fishing gear in the Strait of Georgia off the east coast of Vancouver Island on June 11, quick action and strong collaboration helped set the stage for a successful rescue.

The Canadian Forces Maritime Experimental and Test Ranges (CFMETR) crew members aboard the Canadian Forces Auxiliary Vessel (CFAV) *Stikine* (YTP 613) first identified the entangled whale, which they later learned was named Artemis. The CFMETR team then worked with employees from Fisheries and Oceans Canada to locate, assess, and track the animal. Their coordinated efforts enabled DFO rescue teams to safely continue disentanglement operations over the following days.

On June 14, Artemis was successfully freed from all remaining ropes.



This operation highlights the importance of environmental stewardship, vigilance on the water, and strong partnerships in protecting marine wildlife (*MEJ* 111). Thank you to everyone involved for their dedication and commitment to safeguarding Canada's marine environment!



FORUM

Red Flags, Not Red Tape

Earned Value Management System: The Missing System of Canadian Defence Procurement

By Jonathan Shriqui, PMP

Canada is about to push an unprecedented volume of public money through its defence procurement system, driven by the need to meet its NATO spending commitments and rapidly invest in capability. Budget 2025 committed \$81.8 billion in additional defence funding over five years, as Canada accelerates defence spending toward its new commitment to reach 5% of GDP by 2035.¹ To support these investments, the newly established Defence Investment Agency (DIA) has been tasked with fast-tracking a portfolio of major projects simultaneously accelerating approvals, reducing bureaucratic friction, and compressing decision cycles that have historically taken years.

The intent is right. But fast-tracking approvals is not the same as fast-tracking control. As the DIA moves a growing portfolio of large, complex projects through the system at speed, the question is not just whether each project gets approved faster, it's whether anyone can see, in real time, how each project is actually performing once the money starts moving. In my opinion, project controls have not evolved at the same pace as approval timelines. That gap matters more on a portfolio than on any single project, because defence funding sits in one finite envelope. An acquisition cost overrun on one project doesn't stay contained to that project — it competes for the same dollars as In-Service Support (ISS) funding for fleets already in service, and it can quietly erode the future ISS funding the new capability itself will need once it transitions into operation.

Without timely, credible cost performance data, DND cannot make the decisions a fast-moving portfolio demands, whether to: proceed with a future procurement as planned, select a less costly alternative, or rescope projects already in flight to protect their own paths to adequate sustainment funding. Alan Williams, former Assistant

Deputy Minister (Materiel) put it plainly in the Canadian Defence Review in March 2026, "system-wide performance measures must be introduced. Without performance measures open to public scrutiny, performance suffers. We need indicators that, at a minimum, measure cost and timeliness. If costs are rising, why are they rising? If delays are occurring, where in the process are the bottlenecks? It's impossible to make improvements, if we don't have a clear understanding as to where the problems lie."²

Speed without visibility doesn't just risk individual project failure, it risks the financial integrity of the entire capability portfolio, acquisition and sustainment alike.

This is the gap that an Earned Value Management System (EVMS), a performance methodology, is built to close. The purpose of this system is the creditable and auditable assessment of project performance and progress through the use of a series of standardized, objective metrics that are set against an integrated cost and schedule baseline, known as the Performance Measurement Baseline, to objectively support transparent decision-making (*MEJ* 108). It is worth noting that the implementation of an EVMS is not merely an industry best practice. Under the United States Defense Federal Acquisition Regulation Supplement (DFARS) Subpart 234.2, contractors performing cost or incentive contracts and subcontracts \$100 million USD or more are required to undergo an EVMS government EIA-748 compliance review.

In its December 2025 "Evaluation of Capability Acquisition Modernization" report, DND's ADM (Review Services) highlighted the implementation of Earned Value Management (EVM) as a key departmental achievement, noting that it supports "reduced processing times, improved schedule tracking, and informed decision making."³

(Continues next page...)

1. Canada. "Budget 2025: Our Plan: Build Canada Strong". <https://budget.canada.ca/2025/report-rapport/intro-en.html>
2. Careless, James. "Defence Procurement: What It is, What the Expert Think". *Canadian Defence Review*. 19 March 2026. <https://canadiandefencereview.com/defence-procurement-defence-investment-agency/>
3. Canada. "Evaluation of Capability Acquisition Modernization". December 2025. <https://www.canada.ca/en/department-national-defence/corporate/reports-publications/audit-evaluation/eval-capability-acquisition-modernization.html>

EVM provides exactly the kind of objective, real-time cost and schedule performance data that portfolio-level decision-making requires. The complication is that Canada's defence contracts tend to employ fixed-price structure—a payment structure that, on its face, appears to make this visibility unnecessary. It does not.

It is important to understand what is defined as control within a complex procurement framework. It is not the certainty of achieving a capability “on time, and on cost”. It is the implementation of a dynamic management system enabling timely decision to minimize or mitigate the impact of risks and amplify the benefits of opportunities.

The Oversight Gap: What Firm-Fixed-Price Hides

A common industry criticism of Canadian defence procurements is that the Crown tends to be risk adverse. Consequently, it is not surprising that Fixed-Firm-Price (FFP) milestone-based payments are favoured. On the surface this appears to transfer risk to the contractor: the government pays a fixed amount at each milestone, and the contractor bears the cost risk in between. However, the words defence, complex, and fixed-price are rarely complementary in a Canadian procurement context.

When schedules slip, it is apparent to all stakeholders that milestones are binary, and delays are visible. What no one can see on an FFP contract is the cost impact of that slippage. The assumption is that cost overruns are the contractor's problem. Yet, when schedules slip, contractor costs increase. When costs increase beyond what the contractor can absorb, one of two things happens: they come to the government for relief—and the government has no objective data to evaluate the claim—or they begin cutting corners on quality and scope to protect their margin. Either way, the government loses.

The cash flow consequences are equally real. Delayed milestones mean delayed payments. On the government side, that can trigger lapsed funding, re-profiling of cash flows, and Treasury Board submissions—bureaucratic churn that further delays capability. On the contractor side, cash crunches ripple through supply chains and the workforce. Time is money, and without cost visibility, the full impact remains hidden until it becomes a crisis.

EVMS fills precisely this blind spot. The logical extension is that FFP contracts on major defence projects should include a requirement for full at-cost EVM reporting. Fixed



price may limit the government's contractual liability, but it does not eliminate the government's exposure to programme risk. A contractor experiencing significant cost pressure can trigger schedule delays, requests for relief, quality concerns, supply-chain instability, or affordability pressures that ultimately affect capability delivery. Independent visibility into those emerging pressures is therefore essential, not because the Crown pays every dollar of contractor overrun, but because the Crown bears the consequences when major procurements fail to perform as planned. Without cost visibility alongside schedule performance, slippage remains a symptom without a diagnosis—and the essential question goes unanswered: are public funds producing the value we expected, at the rate we expected?

Typically, large and complex procurement which are ratified on a FFP structure contain a discretion audit clause. However, the clause is typically reserved for when problems arise, and rarely has a set periodicity. To push a portfolio of

defence procurement at unprecedented speed while not jeopardizing their sustainment, cost insight, regardless of payment structure, is fundamental to success. While the contractor may be financially liable on FFP, the Crown – always – retains cost risk.

Defense procurement risk is fundamentally asymmetrical, especially now with procurement urgency. While contracts are equipped with contractual exits for poor performance, the reality is that it is typically not beneficial for Canada to exercise such right, as doing so would not only increase cost, but significantly delay bringing the required capability to those who have answered the call to service.

The Incremental Cost Argument

The inevitable objection to EVM which many raise with haste is cost: EVM adds burden to the contractor, and consequently, increases the price of acquisition. But does it really do so? Consider what every contractor on a major defence project is already doing. They are performing schedule management, cost management, risk management, resource planning, and progress reporting. In reality an organization cannot run a major project without these functions.

What EVM actually adds is the integration and transparency layer across disciplines that the contractor is already performing. It connects schedule to cost to scope in a single coherent framework and makes the outputs visible to the government. The incremental cost is minimal—you are not asking for new work, you are asking the contractor to connect existing work and report it in a structured way. Measured against a schedule slip that no one saw coming or a series of milestone failures that trigger a Treasury Board re-profiling exercise, the value for money is overwhelming. An EVMS is not red tape. It is the mechanism that makes the red flags visible before they become crises.

EVMS is a System

The first step toward effective implementation is recognising what an EVMS actually is. It is not a spreadsheet. It is not a monthly report. It is a *system*, and like any engineered system, it has requirements, a design, an integration challenge, and a lifecycle that includes implementation, operation, and sustainment. The EIA-748 Standard defines 27 guidelines organised into five process categories: Organisation; Planning, Scheduling, and Budgeting; Accounting Considerations; Analysis and Management Reports; and Revisions

and Data Maintenance. As the NDIA's Intent Guide makes clear, these guidelines describe an integrated management system with interdependent components that must be designed, documented, validated, and maintained.⁴ The five categories suggest a natural build sequence, you cannot perform meaningful analysis without first establishing the organisational structure and the planning and budgeting baseline. The system must be built up deliberately, just as any technical system would be. No one would accept a combat management system thrown together without a design review process. The same standard should apply to the management system governing the project.

Engineering the Management System: A Gate-Based Maturity Model

Since EVMS is a system, its implementation should be subject to the same review gates that govern the technical system. The standard systems engineering reviews—SRR, PDR, CDR—map directly onto the maturity stages of an EVMS implementation. This is not red tape layered on top of technical reviews, it is the mechanism that generates red flags at the right time, ensuring problems surface when they can still be solved.

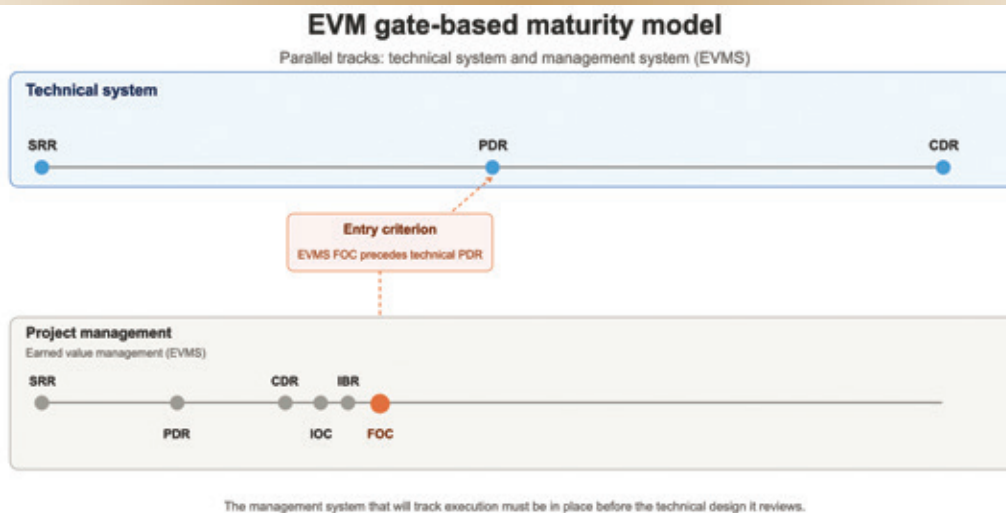
System Requirements Review (SRR) for EVMS. The review of the project's management requirements: what does the contract demand, what standard applies, what are the government's expectations for reporting, Work Breakdown Structure (WBS), data deliverables, and cost and schedule variance thresholds. At SRR, both parties confirm what the management system needs to do, precisely as they confirm what the technical system needs to do.

Preliminary Design Review (PDR) for EVMS. Acceptance of the management system design: the Project Management Plan and all subordinate plans including schedule management, cost management, risk management, communications, and others. The contractor's approach is confirmed as sound and compliant with the requirements established at SRR. In essence, is the proposed management system architecture sound and capable of supporting decision making.

Critical Design Review (CDR) for EVMS. Acceptance of the detailed build: the EVM plan itself, the integrated baseline, control accounts, work packages, and the earned value techniques assigned to each. The management system is confirmed as ready for operation.

(Continues next page...)

4. The American National Defense Industrial Association (NDIA) Integrated Program Management Division (IPMD) creates the Intent Guide to provide further guidelines to the EVMS. The NDIA is a non-partisan, non-profit educational association. www.NDIA.org



The practical implication is clear: the EVMS should achieve its own FOC—baseline jointly validated through IBR, EVM data authoritative and decision-grade—as an entry criterion for the technical PDR. By the time the government is reviewing the design of the technical system, the management system that will track its execution must already be in place. To enter technical PDR without it is to commit to a project's direction without the means to know whether it stays on course.

Project Management Configuration Management and Validation & Verification

Two systems engineering disciplines underpin EVMS integrity and are routinely underdeveloped in implementation: Configuration Management (CM) and Verification and Validation (V&V). The parallel to the technical domain is direct and intentional.

CM keeps the Performance Measurement Baseline (PMB) honest. Without formal configuration control applied to the PMB — governing how changes are identified, evaluated, approved, and recorded — baseline manipulation is straightforward. Contractors under cost and schedule pressure can re-baseline quietly, absorbing variances into a revised plan rather than surfacing them as performance problems. Just as a technical system's design baseline must be under configuration control to ensure what is built matches what was approved, the programme's management baseline must be equally disciplined. An EVMS without CM is not providing objective performance data, it is providing managed performance data.

V&V confirms the system is generating credible outputs. Verification asks whether the EVMS is operating correctly against EIA-748 and thus producing accurate, timely, consistent data. Validation, conducted through the Inte-

grated Baseline Review (IBR), asks whether the baseline actually reflects an achievable plan to deliver the contracted capability. The IBR is the operational acceptance test of the management system. Until it is complete and the baseline jointly accepted, EVM data is indicative. After a successful IBR, the data is decision-grade. That transition — from indicative to authoritative — is what makes EVM genuinely useful rather than merely compliant.

From Acceptance to Operation: IOC, IBR, and FOC

Passing CDR does not mean the system is operational, there is still integration, testing, and proving out. The gate-based model extends into operational readiness through three further milestones.

Initial Operating Capability (IOC). The EVMS is stood up and generating data. The baseline is loaded, control accounts are active, earned value techniques are assigned, and the system is producing its first outputs. It is functioning, but it has not yet been jointly validated by the government.

An important practical point: until the IBR is conducted and the baseline is formally accepted, the project schedule as submitted during the competitive bid serves as the informal baseline, and EVM reporting should begin against it. Unless there is a major change in required capability or a significant divergence in strategy from what Canada solicited, the proposed schedule is the baseline schedule. Circumstances will inevitably shift between the Request For Proposals and contract award, but like any system, the schedule baseline must be placed under configuration control from the outset. Allowing it to drift without discipline before the IBR undermines the very foundation the IBR is meant to validate.

Integrated Baseline Review (IBR). The IBR is the operational acceptance test. Government and contractor walk the baseline together, confirm the planning is adequate, the resources realistic, the risks captured, and the management control system credible. This is the event that transitions the EVMS from IOC to full operational status—reframing the IBR from the ambiguous checkpoint it is often treated as into what it should be: a validation of a system that is already working.

Full Operating Capability (FOC). FOC is the state after a successful IBR. The baseline is jointly accepted, the management system is trusted, and from this point forward the EVM data is authoritative and decision-grade. Variance analysis is meaningful, Estimates at Completion are reliable, and the system is genuinely driving project decision-making—not merely producing reports.

Custodians of the Public Purse

The argument for EVMS is not ultimately about metrics: CPI, SPI, VAC, and TCPI are important, but they are outputs, not the objective. The objective is governance. Public servants managing defence projects are custodians of public funds. That custodial responsibility demands transparency—not just within the project team, but across every layer of government that has a stake in the outcome. On a major defence procurement, that means DND project managers, Public Service and Procurement Canada (PSPC) and DIA contracting authorities, departmental senior leadership, and Treasury Board. A properly implemented EVMS becomes the common, objective language across all of those layers—the same credible, data-driven picture, whether you are an account manager or a Treasury Board analyst.

This objectivity ensures the right stakeholders are having the right conversations at the right time, grounded in credible data rather than optimistic briefing slides. Problems are visible early, informed decisions are made before small issues become programme-threatening ones. No single layer of government can claim they did not have visibility. That is how you discharge a custodial obligation to the public purse.

Conclusion: Enabling Speed Through Discipline

The Canadian Armed Forces (CAF) need capabilities, and they need them faster than the current system has historically delivered. The traditional government posture has been risk aversion with slow approvals, rigid payment structures, and multiple oversight layers. Ironically, that risk aversion has become one of the greatest risks to capability delivery. To get capabilities into the hands of the CAF faster, cash flows need to be more flexible. But no Treasury Board, no DIA, no DND senior leader will approve that flexibility without a credible mechanism confirming it is safe to do so.

EVMS is that mechanism. It provides continuous, objective data that gives decision-makers the confidence to enable flexible cash flow because they can see, in real time, whether productivity justifies it. And when it does not, the same data provides the basis to course correct early, before problems compound. If cash flows, so should productivity—and EVMS is the tool that makes that relationship visible and accountable.

EVMS does not add red tape to the procurement process. It raises red flags—early, objective, and actionable—so that decision-makers can course correct before problems become crises. It is the system integrator of the project management domain, bringing together cost, schedule, scope, risk, and reporting into a coherent, functioning whole, just as systems engineering integrates the technical domain.

As Canada prepares to push an historic volume of investment through its defence procurement system, the missing system is the one that ensures every dollar delivers capability. It is time to put it fully in place.



Jonathan Shriqui is the Project Control Officer with the Future Aircrew Training (FAcT) Program, Directorate Air Simulation & Training in Ottawa.

News Brief

Welcome MEPM Unit Chief

Chief Petty Officer First Class Mike Umbach joined the team in June 2026. He enrolled in 1992 from Calgary, Alberta as a Naval Electronics Technician. His previous position was Coxswain onboard HMCS *Max Bernays* (AOPV 432), where CPO1 Umbach successfully completed Operation LATITUDE to the Arctic Region.

CPO1 Umbach as Coxswain onboard HMCS *Max Bernays* during Op LATITUDE in 2025 where the ship transited to 81 degrees North – the farthest north any RCN vessel has travelled.



Photo by CPO1 Mike Umbach

FEATURE ARTICLE

MEPM Adventure Training Expedition: Building Leadership and Resilience

By Capt(N) Patrick Larose P.Eng. MSustMgt, MSysEng, MDS



Photos by Lt(N) John McConkey

Quick O Group and celebration before the descent back into the forest.

Strengthening esprit de corps and leadership amongst participants was the goal of the recent adventure training expedition organized for the Maritime Equipment Program Management (MEPM) community. Designed as a unique and demanding excursion through Canada's semi-boreal forest, the activity provided Canadian Armed Forces (CAF) members with an opportunity to challenge themselves in an austere and unpredictable environment.

Adventure training inherently involves exposure to risk, requiring participants to demonstrate physical fitness, moral courage, initiative and endurance—qualities that were consistently demonstrated throughout the expedition.

The five-day expedition followed the Traversée de Charlevoix trail in Québec, initially planned as a 92 to 105 km continuous through-hike. However, the team quickly encountered harsher-than-expected conditions, including deep unbroken snow, cold temperatures and wet terrain,

which significantly increased the difficulty of travel. Exercising sound judgment, the group adapted the plan to a shorter out-and-back route, ultimately completing approximately 75 km. This decision demonstrated effective leadership, risk awareness and adaptability in a dynamic environment.

Beyond the physical challenge

Prior to execution, a Gender-Based Analysis Plus (GBA+) review informed important adjustments to the plan. These included enhanced mentorship from experienced personnel, reduced individual gear requirements and more flexible dietary options, ensuring broader inclusivity and accessibility for all participants.

Participants described the experience as both physically exhausting and mentally demanding. Deep snow travel, long distances, fatigue and physical strain were among the primary challenges. Despite these hardships, strong team

cohesion emerged as a defining feature of the expedition. Members supported one another through load sharing, mutual encouragement and maintaining morale during difficult periods.

Overall, the training was regarded as highly successful and deeply rewarding. It enhanced resilience, confidence and trust within the team, while reinforcing the importance of preparation, adaptability and appropriate equipment. Most importantly, the expedition demonstrated the critical role of teamwork and leadership in overcoming adversity, achieving the objective of developing capable, cohesive and resilient personnel in a real-world setting.

Participant reflections:

“Everyone brought something different to the team, and we covered for each other's weaknesses. It was also nice to do some traditional Navy bonding without it being centered around alcohol.”

“The training was amazing. I experienced equal amounts of frustration and elation during the hike and view the trek as an amazing experience to have had. The team was excellent and maintained a positive attitude throughout, despite the exceptionally challenging experience. I would feel honoured to do another serial with MEPM in the future.”

“Overall, this was one of the most difficult experiences I have faced both physically and mentally, but it was also one of the most rewarding. There were multiple moments during the exercise where I questioned whether I would be able to finish, yet overcoming those moments made me realize I am capable of more than I thought.”



“I feel lucky to have met these smart and personable people because I am new to Ottawa, and now I have real friends in MEPM.”

“Adventure training is tough, wasn't meant to be easy and I'm glad it wasn't.”

“Adventure training keeps us sharp. It gives us experience and perspective to reflect upon. Leaders must have courage and resilience, and a sense of fighting spirit. I would sign up for another one of these trips in a heartbeat.”



Capt(N) Patrick Larose is the Senior Editor for the Maritime Engineering Journal and Director Maritime Equipment Program Management (Submarines).



FEATURE ARTICLE

Advancing Shipboard Welding Below the Waterline for RCN Surface Ship Repairs

By Darren Begg, BMT

Background

Royal Canadian Navy (RCN) surface ships occasionally require weld repairs to internal steel structures located close to, at, or below the vessel waterline. These repairs can include build-up or resurfacing of hull plating affected by corrosion or metal loss, as well as repairs to fillet welds where internal stiffeners, frames, longitudinals, decks, and other structural members attach to the inside of the outer hull.

Historically, repairs in these regions have been treated with caution. When welding is performed on a structure backed by seawater, the surrounding water can act as a significant heat sink. This can increase the weld cooling rate, which in turn can increase Heat Affected Zone (HAZ) hardness and the risk of hydrogen-assisted cold cracking. To avoid this risk, below-waterline welding has typically required drydocking, external cofferdams, or other measures to remove or isolate the water-backed condition. While effective, these approaches can be costly, schedule-intensive, and operationally disruptive.

BMT has been conducting a phased research program to better understand whether some internal weld repairs on RCN surface ships can be safely performed without drydocking the vessel.¹ The work has focused on quantifying the effect of water backing on weld cooling, identifying locations most affected by high heat sink conditions, developing practical heat sink capacity testing methods, and evaluating welding strategies that can reduce HAZ hardness below commonly accepted hydrogen cracking susceptibility thresholds.

Across the first four phases, the program has progressed from laboratory-scale weld trials and numerical modelling to scaled ship-structure testing, instrumented weld trials, hydrogen diffusion modelling, temper bead evaluation, and preliminary procedural guidance. The objective has not been to broadly authorize all below-waterline welding, but to develop an evidence-based method for assessing when and how specific repairs may be completed safely.

Objectives

The overall objective of the work has been to develop the technical basis for welding procedures and assessment methods that support weld repairs on internal RCN ship structures located close to or below the waterline.

The principal technical objectives have included:

1. determining how water backing affects weld cooling rates and HAZ hardness;
2. identifying ship structure locations most influenced by high heat sink effects;
3. developing and validating numerical thermal models capable of predicting weld cooling behaviour;
4. applying heat sink capacity testing (derived from the pipeline industry for welding on in-service pipelines) to assess local cooling severity on representative ship structures;
5. evaluating weld tempering methods to reduce peak HAZ hardness;
6. developing hydrogen diffusion and inspection delay-time models; and
7. preparing the technical basis for future Canadian Forces Technical Order (CFTO) guidance.

A key acceptance consideration throughout the work has been the relationship between weld cooling rate, heat input, predicted or measured HAZ hardness, and hydrogen cracking susceptibility. The program has used the industry widely accepted 350 Hv hardness threshold as a practical screening criterion for identifying welds that may present elevated hydrogen cracking risk. Where single-pass welds or high heat sink conditions produced hardness values of concern, the work examined whether temper weld bead strategies or other mitigation methods could reduce hardness to acceptable levels.

1. BMT is an international maritime engineering and technology consultancy group. BMT has offices in Canada, USA, UK, Australia and Europe. www.BMT.org

Approach

The research was structured as a progressive series of phases. The early work established the fundamental problem. Laboratory test vessels and weld trials were used to compare bead-on-plate and fillet welds made above, at, and below the waterline, using the gas shielded Flux Cored Arc Welding (FCAW) process. These trials were instrumented with thermocouples to measure weld cooling behaviour and were sectioned for macro examination and Vickers hardness testing. The data was used to correlate cooling rate with HAZ hardness and to support development of BMT's hydrogen modelling approach.

Numerical modelling was then introduced to represent typical RCN hull structural repair zones. These models examined how proximity to the side shell and waterline influenced cooling behaviour. The modelling work was used to help identify which structural regions were likely to experience the most significant heat sink effects and to inform the design of a larger physical trial structure.

Subsequent phases used a to-scale ship hull structure fabricated from DND furnished drawings and materials, that represented typical weld repair regions of interest. The structure was fitted with a water tank so that controlled waterline conditions could be reproduced. This allowed Heat Sink Capacity Tests (HSCTs) and instrumented weld trials to be conducted at representative structural repair locations and distances from the waterline.

The materials used to fabricate the to-scale ship structure, along with their calculated carbon equivalents, are shown in Table 1.

The final fabricated to-scale test rig to perform the welding trials and HSCT's is shown in Figure 1. Note the water nozzles installed into the side of the water tank to

control the waterline to specific levels (with an identical nozzle configuration installed on the opposite inlet side).

Testing examined locations such as the side shell above, at, and below the waterline; longitudinals and shell frames connected to water-backed plating; deck-to-side-shell regions; and other structural details where geometry could influence heat flow. Regions of high and low heat sink were established through HSCT's and thermal modelling, to establish a matrix for locations of weld trials. Instrumented welds were deposited at selected locations, and resulting welds were evaluated using thermocouple data, macro examination, and hardness traverses.

The later phases added further focus on mitigation. Temper bead and related weld sequencing methods were examined for welds in locations identified as most critically affected by water backing, including the side shell at and below the waterline and the immediate deck-to-side-shell region. The purpose was to determine whether controlled

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Photo by Zoe Slumkoski

Figure 1. To-Scale Ship Structure Test Rig

Table 1: Structural Materials for Ship Structure Test Rig

Section	Grade	C	Mn	S	P	Si	Cr	Ni	Cu	Mo	Cb	V	Ti	B	Al	CE*
Side Shell (Upper)	ASTM A572-50 / A709-50, A131 AH/DH36; CSA G40.21 50WT-CAT3	0.17	1.04	0.00	0.01	0.19	0.12	0.14	0.25	0.04	0.00	0.03	0.00	0.00	0.03	0.41
Side Shell (Lower)	HSLA CSA STD G40.21 350WT	0.09	1.25	0.01	0.01	0.21	0.05	0.05	0.05	0.00	0.03	0.04	0.00	0.00	0.00	0.32
Shell Frames	CSA G40.21 50WT/ 350WT- CAT5	0.05	1.32	0.00	0.01	0.34	0.18	0.07	0.17	0.05	0.03	0.01	0.02	0.00	0.03	0.33
Deck Plate	CSA G40.21 50WT/ 350WT- CAT5	0.13	1.05	0.01	0.01	0.23	0.02	0.05	0.01	0.00	0.01	0.01	0.00	0.00	0.05	0.32
Longitudinal Stiffeners	CSA G40.21 M98 Grade 350WT CAT5	0.22	1.00	0.05	0.04	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39

* CE = %C + (%Mn + %Si)/6 + (%Cr + %Mo + %V)/5 + (%Cu + %Ni)/15

additional passes could temper the coarse-grained HAZ and reduce hardness below the 350 HV screening threshold.

Hydrogen modelling was also applied to assess time to peak hydrogen concentration in critical regions of the weld. This modelling is important because final inspection for hydrogen cracking should occur after the period of highest cracking risk has passed. By combining thermal data, weld geometry, material behaviour, and hydrogen diffusion modelling, the program began to establish inspection delay-time recommendations for different weld types and locations.

Preliminary Results

The HSCT for welding below the waterline was derived from industry accepted in-service pipeline welding procedures that heavily rely on the relationship between it and the traditional 800–500°C cooling time ($\Delta t_{8/5}$) to mitigate the risk of hydrogen-induced cold cracking. While $\Delta t_{8/5}$ represents the critical metallurgical window governing the transformation of austenite into hard, brittle microstructures like martensite, directly measuring this high-temperature range in the field poses severe integrity risks to pressurized flowing pipelines. The HSCT resolves this by applying and safely measuring a localized, low-temperature cooling cycle from 250°C to 100°C to empirically quantify the internal fluid's convective cooling severity. This is achieved by heating a 50mm diameter spot on the zone of interest with an oxy-acetylene rose bud torch to 300°C and then measuring the 250–100°C cooling time with a stopwatch. Through analytical heat transfer software, the measured 250–100°C cooling curve serves as a boundary-condition input to calibrate the convective heat transfer coefficient. This allows for the precise numerical extrapolation of the true $\Delta t_{8/5}$ thermal cycle under various welding parameters, establishing a direct mathematical link where a shorter HSC time correlates to an accelerated $\Delta t_{8/5}$ rate, thereby dictating the minimum heat input or preheat requirements necessary to maintain HAZ hardness below the 350Hv critical threshold.

The work completed to-date has produced several important preliminary findings. First, the research confirmed that water backing can significantly influence weld cooling behaviour, particularly on or near the side shell and in locations with direct thermal connection to water-backed plating. The effect is not uniform across all internal structure. Some locations experience a strong heat sink effect, while other components farther from the shell or waterline (even at small distances) are less affected. This finding is important because it supports a location-specific

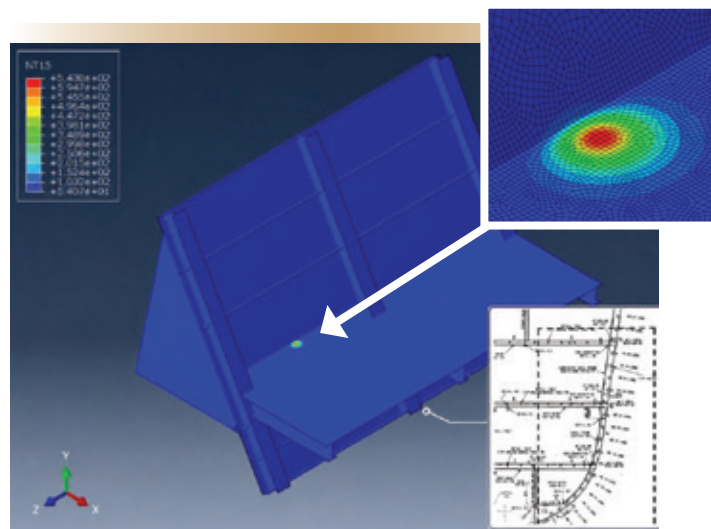


Figure 2. BMT Thermal Prediction Model

assessment approach rather than a blanket assumption that all below-waterline internal welding behaves the same way.

Subsequently, HSCT testing and its results demonstrated that local cooling severity can be measured and compared with model predictions. The BMT developed thermal model (see Figure 2) was shown to be capable of predicting cooling rates produced by HSCTs with sufficient accuracy to support further assessment of structural configurations. This provides a pathway for using a combination of modelling and targeted testing to quickly evaluate repair scenarios before actual shipboard application.

The thermal modelling and HSCT results indicated that, for the tested structure and variables, side shell and shell frame locations approximately 23 cm above the waterline behaved similarly to baseline “empty-tank” conditions. For deck structure below the waterline, locations approximately 20 cm from the side shell behaved similarly to the baseline case. These distances should be treated as test-program findings for the specific configurations examined, not universal limits for all vessels or repair geometries.

Next, instrumented weld trials (see Figure 3) confirmed the relationship between cooling rate and HAZ hardness. Single-pass bead-on-plate and fillet welds made at or below the waterline can produce HAZ hardness values above the 350 Hv threshold, particularly under high heat sink conditions. These welds would be considered higher risk if tensile stress and diffusible hydrogen are also present.

The results in Table 2 demonstrated that the severity of the welding heat sink is governed primarily by a repair's proximity to the water-backed side shell and the waterline.

Repairs performed directly at or below the waterline consistently produced the highest cooling rates and the greatest HAZ hardness, with side-shell and waterline-connected longitudinal welds regularly exceeding the 350 Hv screening threshold. In contrast, relatively small changes in repair location had a significant effect on weld response. Side-shell welds located only 50mm above the waterline fell below the threshold under comparable welding conditions, while locations farther above the waterline, as well as nearby deck and shell-frame repairs, remained well below critical hardness levels. These findings demonstrate that structural geometry and distance from the water-backed shell are key factors governing weld cooling behaviour and provide a practical basis for identifying locations where enhanced welding procedures or mitigation techniques are most likely to be required.

Temper bead trials were conducted and showed strong potential as a mitigation method for welds that exceeded the 350Hv. Across the trials, strategic tempering passes were effective in reducing CG-HAZ hardness, including in high heat sink locations. The work focused specifically on tempering methods for welds in critical locations such as the side shell at and below the waterline and the deck-to-side-shell region. An example of the tempering influences on reducing hardness are illustrated in Figure 4, showing the hardness profile of an as-deposited bead-on-plate weld on the side shell (300mm



Photo by Darren Beggs

Figure 3. Instrumented Weld Trials on Test Rig

below the waterline), and then subsequently the hardness reduction after three tempering passes are strategically deposited. The results support further development of controlled welding procedures that use temper bead principles to reduce hydrogen cracking susceptibility. Note that a combination of weld temper beads, using subsequent FCAW weld deposits, and Autogenous Gas Tungsten Arc Welding (GTAW) passes, were investigated.

Lastly, the hydrogen diffusion and delay-time predictions using the BMT Hydrogen Model demonstrated that

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Table 2: Summary of Welding and Hardness Test Results vs Location Relative to Waterline

Heat-Sink Severity	Location ID	Location on Structure	Location Relative to Waterline	Weld Type	Heat Input (kJ/mm)	Peak – As Deposited HAZ Hardness (Hv5)
High	SS-WL	Side Shell	0 mm from WL	Bead-on-plate / surfacing	0.67	448 Hv
High	SS-BWL (-50mm)	Side Shell	50mm Below WL	Bead-on-plate / surfacing	0.67	433 Hv
High	SS-BWL	Side Shell	≥300mm Below WL	Bead-on-plate / surfacing	0.67	442 Hv
High	LONG-BWL	Longitudinal	≥300mm Below WL	Fillet weld	0.76 – 0.98	440 Hv
High	LONG-WL	Longitudinal	0 mm from WL	Fillet weld	0.98	438 Hv
Marginal	DSS-BWL	Deck to Side Shell	≥300mm Below WL	Local repair weld	1.36	357 Hv
Low	SS +50mm AWL	Side Shell	50mm Above WL	Bead-on-plate / surfacing	0.67	334 Hv
Low	SS +150mm AWL	Side Shell	150mm Above WL	Bead-on-plate / surfacing	0.67	329 Hv
Low	Deck 25mm	Deck	≥300mm Below WL (25mm from side shell)	Bead-on-plate on deck	0.67	232 Hv
Low	Deck 100mm	Deck	≥300mm Below WL (100mm from side shell)	Bead-on-plate on deck	0.67	242 Hv
Low	Deck 200mm	Deck	≥300mm Below WL (200mm from side shell)	Bead-on-plate on deck	0.67	235 Hv
Low	SF-WL 1 in	Shell Frame	0 mm from WL (25mm from side shell)	Frame weld / bead-on-plate basis	0.79	237 Hv
Low	SF-BWL 1 in	Shell Frame	≥300mm Below WL (25mm from side shell)	Frame weld / bead-on-plate basis	0.79	247 Hv

inspection timing is a key part of below-waterline welding control. Welds at or below the waterline can require longer times for hydrogen to reach peak concentration in critical regions compared with welds above the waterline. This means that final inspection delay times should be selected using evidence-based modelling and should account for weld type, location, cooling behaviour, and mitigation strategy. The results of the BMT Hydrogen Model can be used on a case-by-case basis for specific repair scenarios and configurations, allowing inspection delay times to be calculated based on when hydrogen concentration has reached its peak and when the risk for cracking has passed.

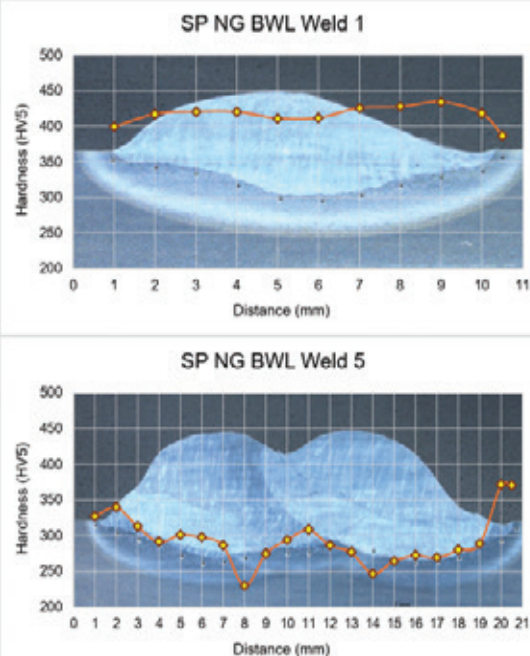


Figure 4. Influences on Hardness Using Tempering Weld Beads
a) As-Deposited Weld Pass and Hardness
b) Hardness Reduction with Tempering Weld Pass

Path Forward

Collectively, the results to-date suggest that weld repairs on water-backed structure should not be approached as routine welding operations. However, they also indicate that such repairs may be feasible, without drydocking, for selected RCN ship structures when supported by local heat sink assessment, validated thermal modelling, suitable weld procedures, hardness control, and appropriate inspection delay times.

The next phase of the work will further validate and refine the modelling and assessment methods developed to date. A key focus will be understanding environmental influences that were not fully bounded in earlier work,

including ambient air temperature, water temperature, convective cooling, wind, and cold air movement in the air gap above the waterline. These factors may influence HSCT cooling times, weld cooling rates, predicted HAZ hardness, and hydrogen diffusion behaviour.

BMT is also extending the thermal and hydrogen modelling to consider these environmental boundary conditions. The intent is to determine whether existing heat sink capacity guidance and inspection delay recommendations remain conservative under colder or more severe environmental conditions, or whether environmental correction factors are required.

Additional validation trials are also planned. These will include targeted HSCT and representative weld trials on the BMT scaled ship structure and, ultimately, validation trials on a decommissioned RCN vessel. The decommissioned-vessel trials will be an important step in demonstrating that the methods developed under controlled laboratory and scaled-structure conditions can be applied to real ship structures, geometries, access constraints, and thermal boundary conditions. BMT will also further investigate the use of an induction heating coil for safe application of the HSCT, as opposed to using an open flame on an RCN vessel.

The final objective is to consolidate the developed knowledge into a CFTO, that will provide structured instructions for assessing and conducting weld repairs on internal ship structure located below the waterline or under high heat sink conditions. It is expected to include guidance on HSCT application, weld procedure selection, temper bead strategies, acceptance criteria, inspection delay times, environmental considerations, and decision-making frameworks for determining when a repair can proceed without drydocking.

This phased research program is building the technical foundation for a more flexible, evidence-based approach to RCN ship repair. By combining modelling, heat sink capacity testing, controlled weld trials, hydrogen delay-time assessment, and future shipboard validation, the work aims to reduce unnecessary drydocking while maintaining the safety and integrity of welded repairs on Canadian naval vessels.



*Darren Begg, Capability Manager, Welding Technology
BMT. Contributors: Z. Slumkoski, M. Laronde, A. Roostaei,
S. Guest & C. Mihailescu.*

*Program Sponsor Dominique Isabelle, DNPS 2-4 Naval
Materials, DGMEPM.*

What's on Your Radar?

Featuring: Sailor 1st Class Brian Bruyere

Podcasts or Channels



Kings and Generals: www.youtube.com/c/kingsandgenerals

A channel for massive history buffs like me. This channel goes in-depth into military campaigns, battles, and personalities with extensive analysis using maps and animation. The scope of this channel covers conflicts throughout recorded history, including a month-by-month examination and analysis of the current Russo-Ukrainian War.



Invicta: www.youtube.com/@InvictaHistory

Another channel dedicated to military history, including both fiction and science fiction. Using animated maps and in-depth analysis across a vast array of subjects. One could find a video focusing on the development of modern war-gaming in a military context, to the physical footprint of a standard Roman legion on the march, to an in-depth analysis of regiments of the Imperial Guard from *Warhammer 40,000* (a British miniature wargame produced by Games Workshop).



The Great War: www.youtube.com/user/TheGreatWar

For all the First World War buffs out there, this channel is an excellent pick. The minds behind this channel follow the developments of the entire First World War week by week from the assassination of Franz Ferdinand to the Armistice when all the guns fell silent. They include additional episodes on uniforms, tactical and strategic developments by the combatants, biographies of key players, and even videos on location on many First World War battlefields.



Warfronts: www.youtube.com/@warographics643

For a more contemporary analysis of developing strategic situations across the globe, there is this channel from prolific Youtuber Simon Whistler. *Warfronts* go in-depth with current conflicts of every size, including ones that tend not to make the news. In addition, there are videos on the elements of modern military strategy such as strategic bombing and armoured warfare.

Books



Dune

By Frank Herbert

Published (1965) by Chilton Books

It is a rare thing for an author's work to be described as one of the Greatest of All Time, but the seminal science fiction work

Dune by Frank Herbert shows that sometimes those statements are not hyperbole. An epic tale of a young man being thrust into a vast universe of war, religion, politics, economics, ecology, and the perils of having a charismatic leader with no controls. On my last deployment, I read the entire *Dune* series, all twenty-three books, in chronological order, from *Dune: The Butlerian Jihad* (prequel) to *Sandworms of Dune*.



The Parasol Protectorate Series

(*Soulless*, *Changeless*, *Blameless*, *Heartless*, *Timeless*) By Gail Carriger

Published (2009) by Orbit Books, division of Hachette Book Groups

On the *New York Times* best seller's list, this five-novel series is a guilty pleasure. Put the snooty world of high society such as *Downton Abbey* or *Bridgerton*, a generous helping of steampunk, a pinch of political machinations in Victorian Era Great Britain, add werewolves and vampires, and top it off with a plucky heroine with a penchant for solving interpersonal disputes with the judicious use of a weighted parasol, and you have yourself the *Parasol Protectorate* series.

S1 Brian Bruyere is a radar technician currently posted to Fleet Maintenance Facility Cape Scott.



Sailor of the Quarter

(Courtesy RCN LinkedIn)

Master Sailor (MS) Stephen Goulding, a Marine Systems Engineering Technician aboard HMCS *Robert Hampton Gray* (AOPV 435), has been named Canadian Fleet Atlantic Sailor of the 2nd Quarter.

This recognition reflects MS Goulding's strong leadership, professionalism, and dedication. Through mentorship and hands-on training, they've helped develop new engineering watchkeepers, roundspersons, and duty engineers, strengthening team readiness and improving how the unit works together.

The presentation was made by **Commodore Jacob French** and **Chief Petty Officer 1st Class Paul Greene** aboard HMCS *Robert Hampton Gray*.



News Briefs

Launch of Trilateral Cooperation: Germany, Norway, Canada and TKMS Begin Planning Phase for the 212CD Program

(Courtesy of TKMS AG & Co. KGaA) August 2026

Representatives from Germany, Norway, Canada, TKMS, KONGSBERG and Multiconsult met in Kiel at the end of July for the first joint planning event for the 212CD program. The event marks the operational start of multilateral cooperation among the partners, only three weeks after ThyssenKrupp Marine System's (TKMS's) selection as preferred supplier in the Canadian Patrol Submarine Project (CPSP).

The four-day event focused on joint planning of the next program phases, the establishment of multilateral working

structures, and the preparation of upcoming contract negotiations. In addition, the foundations were laid for close cooperation between the navies, procurement organizations and industry. With Canada's participation, the 212CD program will evolve into a unique multinational NATO cooperation. The aim is to further enhance naval interoperability, create synergies across the entire submarine lifecycle, and sustainably strengthen maritime security in the North Atlantic and the Arctic region. The first multilateral planning event in Kiel marks the beginning of an intensive phase of cooperation between Germany, Norway, Canada and TKMS. In the coming weeks negotiations to formalize agreements will be undertaken, as the partners further deepen their joint planning and preparations for the next steps of program implementation.



News Briefs

Foundry Training Helps Keep Rare RCN Machinist Trade Alive

By Nathan Stone, Trident Staff

Inside the historic Lunenburg Foundry, aspiring Royal Canadian Navy (RCN) Machinist Specialists spent two days casting machine parts from molten metal. With its bright flashes of molten metal and tangible results, the trip gave students a hands-on stake in preserving a rare skill that the Navy can't afford to lose. Machinist Specialists maintain, repair and fabricate mechanical parts for RCN ships while at sea.

During their trip to Lunenburg from May 5-6, a dozen students from Naval Fleet School (Atlantic) (NFS(A)) cast five aluminum parts and two red brass components at the foundry, transforming raw metal into the rough beginnings of a new drill press and a gear pump. "This is the highlight of this course for them," says **Petty Officer Second Class (PO2) Desmond Pye**, one of a small number of RCN Machinist Specialist instructors. "They were absolutely blown away by how interesting it was." That interest is something he tries to promote in his students, as the RCN has a shortage of machinists. PO2 Pye counts just 14 Machinist Specialists within Maritime Forces Atlantic. That's the total pool to draw from for instructor positions, deployments, and any task that requires their unique expertise. Machinist Specialists are vital aboard RCN ships.

When a piece of equipment breaks at sea and no replacements are on hand, the fallback is the ship's company and whatever skills they bring. PO2 Pye has experienced this firsthand. In the fall of 2023, aboard His Majesty's Canadian Ship *Montréal* (FFH 336) off the coast of Florida, one of the ship's two desalination plants failed due to a broken rod. Without the ability to make fresh water, the crew would need to postpone the mission and spend a week in port waiting for a replacement part. "The chief engineer at the time knew about my machining ability," PO2 Pye recalls. "He spoke up and said, 'I have a machinist that can make this part.'" Others covered his watch so he could work through the night. By morning, the new rod was made and installed.

It's his hope that students develop that same hands-on confidence early, starting with the training course. The parts students cast in Lunenburg are the foundation of two fully operational machines: a drill press and a gear pump.



Photo by Neil Clarkson, Formation Imaging Services Halifax

RCN members at Seaway Fabrication's Lunenburg Foundry in early May.

Once the rough castings cool, students bring them back to the machine shop at NFS(A) where they'll bore, thread, and mill them into working equipment. "The gear pump that the guys manufacture here is capable of pumping a 45-gallon bucket of water down in about 30 seconds," says PO2 Pye. "They're not just making a stud and a nut. They're making an operational product."

The course typically graduates three to six qualified machinists from a class of twelve. The trade demands patience, precision, and a strong attention to detail, and students must be willing to invest significant time developing those skills. The most successful candidates are often those who discover a genuine interest in machining and embrace the challenge of mastering the craft. PO2 Pye said he'd like to see students get more hands-on time with lathes and mills, similar to the three-and-a-half months he spent training compared to the four weeks students get today. That extra time, he believes, is what helps students develop the skills and passion required for a career unlike any other in the RCN.

As he sees it, a Machinist Specialist can be the ship's last line of defense against operational failure. "I've had captains and everybody down in the machine shop watching me on the machines at different parts of my career," says PO2 Pye. "Warships are meant to move, fight, float. Engineers take care of two or three of those aspects. Having a Machinist Specialist on the ship extends your capabilities of keeping the ship at sea for longer, with the maximum amount of machinery that you need."

Currently, PO2 Pye and his colleagues rotate through instructor positions, teaching courses and hoping to spark interest in one of the RCN's most unique trades.





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HMCS *Labrador* (AW 50) — The RCN's Cold War Icebreaker

By LCdr (Ret'd) Brian McCullough, CD

The Royal Canadian Navy's first Arctic patrol ship may have only served under the White Ensign for a little more than three years, but from 1954 until it was transferred to Transport Canada in November 1957, the Wind-class icebreaker HMCS *Labrador* (AW 50) played an important role in support of sovereignty operations and scientific research in Canada's far north.

Launched on 8 December 1951 at the Marine Industries Ltd. Shipyard at Sorel, Québec, and commissioned into RCN service on 8 July 1954, the ship made history early. On its maiden voyage that began 23 July 1954, HMCS *Labrador* travelled north from Halifax and then westward through Arctic channels to become the first warship to transit the Northwest Passage. By the time the ship returned to home port on 21 November via the Pacific Ocean and Panama Canal, *Labrador* had also taken honours as the first modern deep-hulled vessel and warship to complete a circumnavigation of North America on a single voyage.

In a salute to Canadian naval history, the lead ship of the RCN's current fleet of Arctic and Offshore Patrol Vessels, HMCS *Harry DeWolf* (AOPV 430), would follow *Labrador*'s lead around North America on its own maiden deployment nearly 70 years later in 2021. The two ships may have been decades apart, but they both played important roles in enforcing Canada's territorial sovereignty by establishing a presence and demonstrating the Navy's ability to operate effectively in our northern waters.

Labrador and *Harry DeWolf* shared more than just simple bragging rights for their Arctic exploits. The two vessels were both designed with ice-capable hulls (albeit to different degrees), had similar displacements of around 6,500 tonnes, and were powered by diesel-electric propulsion. Then as now, their northern constabulary roles were enhanced by the addition of rotary wing assets capable of



From the collection of LCdr (Ret'd) Larry Zbitnew, courtesy of For Posterity's Sake.

During HMCS *Labrador*'s short service with the RCN, the ship made history by becoming the first warship to both transit the Northwest Passage and circumnavigate North America in a single voyage.

searching for ice-free leads, ferrying personnel and equipment from ship to shore, conducting coastline surveys and taking on a host of other invaluable tasks in the remote regions of the Arctic.

Although *Labrador* was fitted with a single-barrel 40-mm Bofors anti-aircraft gun on each bridge wing and carried a full suite of air search and navigational radars, the ship was more of a research vessel than a warship. Based on a United States Wind-class design, HMCS *Labrador* was tailored for Canadian operations thanks in part to input from the ship's first Commanding Officer, **Captain Owen Robertson**, who had observed the American vessels in detail. *Labrador* was outfitted with stabilizing fins, sonar to detect hidden ice hazards, state-of-the-art hydrographic and biological labs, a photo lab, mimeograph and printing capabilities, meteorological fax receiver and other scientific equipment. Creature comforts included bunks rather than hammocks, air conditioning and central heating.

With atmospheric conditions always an issue in Arctic waters, the ship's homing beacon was an invaluable aid for its air detachment of Bell HTL-4 single-rotor and Piasecki HUP-3 twin-rotor helicopters that often encountered reduced visibility due to fog, and heat waves rising from the rocky landscape that would disrupt line-of-sight opera-



RCN photo from the collection of Robert Menzer, courtesy of For Posterity's Sake.

HMCS *Labrador*'s angled bow, powerful engines and specialized heeling tanks gave the ship maximum manoeuvrability in heavy ice conditions in the Arctic. The small hydrographic sounding launch *Pogo* is visible stowed abaft the motor workboat.

tions. *Labrador* also carried a number of small auxiliary vessels, including two LCVs (Landing Craft, Vehicles, Personnel) and a small hydrographic survey launch called *Pogo* that could operate independently for up to six weeks at a time. While *Pogo* was equipped with radar, both it and the LCVs carried radar reflectors and VHF radios so that *Labrador* could guide them back to the ship if necessary.

During the long hours of daylight that first summer in the north, *Labrador*'s mixed complement of sailors and scientists maintained a busy schedule conducting hydrographic surveys and oceanographic research, resupplying isolated RCMP posts, carrying out various scientific missions and supporting Indigenous communities along



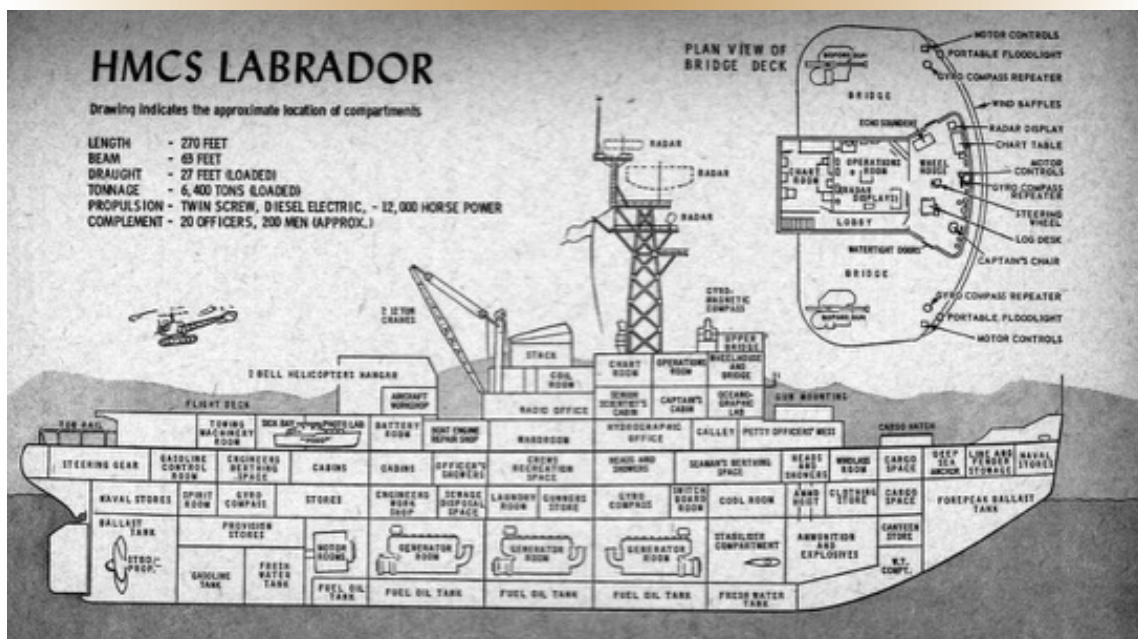
From the collection of Robert V.M. Martin, courtesy of For Posterity's Sake.

Labrador's air detachment, which included two Bell HTL-4 helicopters and a twin-rotor Piasecki HUP-3, provided indispensable support for all manner of operations in the Arctic.

the way. As the ship worked its way west, the captain drove the twin-screwed ship's six diesel-electric engines hard through often times difficult conditions. Getting stuck in the ice was anything but a rare occurrence. To rock his ship free, Captain Robertson would call on the combined 10,000 h.p. of his engines, while rapidly transferring ballast water from interconnected port and starboard heeling tanks at an impressive 40,000 gal./min.

Sovereignty in the north was top of mind with government officials in the 1950s. This was the height of the Cold War, and Canada and the United States (U.S.) were working together to establish the Distant Early Warning (DEW) Line of radar listening posts above the Arctic Circle to give North America early notice of any Soviet attack. With fears that two U.S. Wind-class icebreakers—nearly identical in design

(Continues next page...)



Cutaway sketch by D. Baker, from Lt. Thomas Irvine's book, *The Ice Was All Between*.

to *Labrador*—might push their way through the Northwest Passage from the west and upset Canada's territorial claims in the Arctic, HMCS *Labrador* was tasked to show the flag. On 25 August 1954 in the vicinity of Melville Island in the Western Arctic, *Labrador* rendezvoused with the American icebreakers USS *Burton Island* (AGB-1) and United States Coast Guard Cutter (USCGC) *Northwind* (WAG-282). The meeting was all very cordial, and the three icebreakers spent the next few weeks conducting operations in support of the joint Canada-U.S. Beaufort Sea Expedition.

With the Arctic summer drawing to an end, *Labrador* completed its transit of the Northwest Passage and altered course south for the Bering Strait and the Pacific. The days following the ship's arrival in Esquimalt, British Columbia on 27 September 1954 were filled with news conferences and preparations for the next long leg to the Panama Canal, but there was a sad episode as well. Ten days after coming alongside, *Labrador's* chief stoker, 47-year-old Montrealer, **Chief Petty Officer 1st Class Colin MacArthur**, died in the naval hospital at Naden from complications of pneumonia contracted



Photo from the collection of Archie MacArthur, courtesy of For Posterity's Sake.

To assist with hydrographic surveying in the years before GPS, *Labrador* would set up passive shore beacons, some with radar reflectors, along with electronic position indicator (EPI) transmitting stations that allowed the ship to determine its precise position at sea.



DND NDP-1845 via Don MacNeil Collection.

Lt. (P) John A. MacNeil & unidentified crew struggle with a gas-powered drill to set anchor bolts for a shore beacon.

during the Arctic passage. Thanks to the efforts of the crew in jury-rigging an oxygen tent for him on the voyage, he survived long enough for his wife to be at his bedside when he died.

HMCS *Labrador* would make two more northern deployments in 1955 and 1956, carrying out extensive hydrographic surveys, escorting vessels through Arctic ice and supporting the construction of the eastern portion of the DEW Line. Following a transatlantic goodwill deployment to Europe in the fall of 1957, the ship was paid off. On 22 November 1957, *Labrador* was deemed surplus by the Navy and transferred to the Department of Transport where it would end its days as a Canadian Coast Guard vessel breaking ice in the St. Lawrence, conducting hydrographic survey work, and transporting scientists to the Arctic for their summer research projects.

On 28 May 1987, following 33 years of stellar support to the Government of Canada, the RCN's first Arctic patrol ship was retired from service for good. On its final voyage, *Labrador* was towed to a breaker's yard in Taiwan where the mighty ship that once broke ice to keep our northern sea lanes open was itself broken up for scrap.



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The next edition of CNTHA News will feature
HMCS *Labrador's* famous auxiliary vessel *Pogo* (YFL 104)