Reprinted (edited for spelling and grammar) from Dalhousie University Dal Magazine

Dalhousie researchers are advancing technologies that strengthen Canada's sovereignty today while shaping civilian life tomorrow. From cybersecurity to ocean sensing, their work reflects a growing national need for homegrown expertise, and a unique moment where Nova Scotia's defense ecosystem and Dalhousie's strengths converge.

Inside Paul Bishop's (BEng'93, PhD'98) lab on Sexton Campus, just in from the February cold, Rear-Admiral Josée Kurtz looks up. Way up.

She has walked from the street directly into a space that feels disorienting at first to anyone who enters. The footprint is tighter than expected, but the room suddenly opens into a chamber that rises three stories. Dominating space is a towering silver vessel, highly polished and cylindrical, something between a grain silo and a rocket ship.

Admiral Kurtz is contemplating Dalhousie's atomizer, a machine capable of turning naval-grade alloys into powder for high-precision 3D printing. Using this process, Dr. Bishop's research team is developing methods to produce critical components on demand.

Standing before it, Admiral Kurtz is presented with (SIC) a possible future for naval maintenance and repair, a way to restore and sustain equipment that service members rely on, using capabilities developed at home.

Beating a path to Dr. Bishop

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"That's one of the key reasons they've come to us."

The work is not new. Dr. Bishop and his collaborators in DRDC and industry have been developing additive manufacturing techniques for the navy since the lab was set up in 2021. What has changed is the context around it.

As Canada increases its focus on protecting sovereignty and sustaining its fleets and defense infrastructure domestically, research that once sat firmly in the realm of long-term development is now immediately relevant.

Marine Technician, Master Seaman Mathieu Allard-Audet responds to engineering emergency drills on board HMCS HALIFAX. (Corporal Braden Trudeau, Trinity - Formation Imaging Services photo)

Research that's mission-ready

If you're plugged into Canadian politics, you're well aware (SIC) that defense policy is entering a period of renewal. A shifting geopolitical landscape, rapid technological change, and new pressures in the Arctic are prompting the federal government to rethink how the country protects its sovereignty.

That shift is reflected in Canada's new Defense Industrial Strategy, which places emphasis on cultivating capability at home. This focus reaches beyond the acquisition of equipment

and into Canada's research labs, training programs, and innovation networks. Across the country, universities and their researchers are considering how their research can contribute to Canada's ambitions to build, maintain, and protect critical capabilities at home.

In Nova Scotia, this national conversation lands on familiar ground. Halifax is home to the Royal Canadian Navy's (RCN) Atlantic Fleet, the largest Canadian forces base by personnel. The province's defense sector supports tens of thousands of jobs across military, public service, and industry. Dalhousie has grown alongside that community, contributing research expertise, technical knowledge, and graduates.

"This work has been building for years, but the urgency around it has changed," says Dr. Graham Gagnon, Dalhousie's vice-president, research and innovation. "As Canada places greater emphasis on its ability to act independently, the research already underway here and our depth of expertise in areas tied to defense and security take on added significance."

Understanding the human dimension

Cognitive psychology scientist Dr. Heather Neyedli (BScK'07) is leading a research program to prepare Canada's defense community for AI-enabled command and control. With support from an NSERC Alliance grant, she is partnering with colleagues from DRDC, Université Laval, and Thales, a multinational defense, aerospace, and cybersecurity company. Their work examines how Thales's technology could be applied in rapidly

evolving Arctic surveillance scenarios, using simulations to study how humans and intelligent systems make decisions together under pressure.

On a computer screen in Dr. Neyedli's Cognitive and Motor Performance Lab, the Arctic is alive with movement. Colorful symbols representing vessels of all sorts and origins are transiting newly accessible waters. Data streams in from sensors scattered across the northern expanse. It's a massive flow of information that must be integrated, interpreted, and acted on.

The researcher and her team are examining how humans cope with this tidal wave of data using Thales's AI-supported decision-making tools.

Dr. Neyedli fits a participant with an eye-tracking device that reveals how they process on-screen information. (Cody Turner photos)

“What we do is create simulations that replicate the task that the actual experts do,” she explains. “We’re not recreating the classified system. We’re recreating the thinking.”

Their research is helping DRDC and system designers understand what information people need in high-pressure moments, how interfaces can reduce overload, and where human judgment must remain central.

“There are a lot of things we want to understand deeply about how this technology affects human behavior. But we just can’t do that work ourselves at scale,” says Dr. Aren Hunter, head of the Maritime Science Experimentation and Analytics Section at DRDC. “Being able to say to Dr. Neyedli , ‘Heather, can you go investigate this?’ and then take what she finds and validate it with the operational community — that’s incredibly valuable for us.”

Dr. Aren Hunter and LCDR Shawn Stacey discuss a DRDC-developed underwater battlespace awareness tool. Photo provided.

Leading from the lab

For Dr. Gagnon, this research reflects the kind of made-in-Canada expertise that underpins the vision Prime Minister Mark Carney outlined at the World Economic Forum in Davos. It's a vision that depends on the country's capacity to build and maintain essential capabilities domestically.

"This is part of a broader role universities play in moments like this," says Dr. Gagnon. "Our responsibility is to generate knowledge, train highly skilled people, and work with partners to build the capabilities Canada needs over the long term. And at Dalhousie, that contribution is shaped by where we are, in a province where defense is a significant part of the economy and community."

Dr. Gagnon describes an ecosystem anchored by the Royal Canadian Navy as a convening force for partners across government, industry, and academia. He points in particular to (SIC) the River Class Destroyer program being delivered by Irving Shipbuilding in Halifax for the RCN — a once-in-a-generation effort to replace Canada's aging surface fleet that is also helping to shape regional innovation and an industrial base around naval readiness.

Among a growing ecosystem of federal research organizations, funders, industry partners, and innovation centers, he also points to newer initiatives. Chief among them is Canada's first Defense Innovation Secure Hub (DISH). Announced in late 2025 with a federal investment of $29.4 million and to be based at the COVE ocean innovation hub in Dartmouth, the DISH will provide a secure, collaborative environment where Canadian researchers, industry and defense partners can develop, test and transition ocean technologies with defense capabilities into real-world application.

Dr. Gagnon also cites NATO's Defense Innovation Accelerator for the North Atlantic (DIANA) as an important recent development. Launched in 2023 and including Halifax as one of three sites, NATO DIANA's transatlantic network is designed to help translate research into deployable capabilities across the alliance.

HMCS Corner Brook operating in the eastern Canadian Arctic. (Image courtesy Department of National Defense)

Defense in a connected world

Beyond the hardware and the people who operate it, the future of defense is also being shaped by our interconnected digital world, where critical systems can be disrupted and battles won without a single vessel leaving port.

Through a partnership with Calian, a Canadian company that provides mission-critical solutions for defense and other sectors, computer scientist Dr. Nur Zincir-Heywood studies how that massive swirl of data emitted from our technology moves and how it can be exploited.

In a defense context, this ambient digital exhaust exposes routines, relationships, and operational insights. The intelligence value emerges when fragments are aggregated, cross referenced, and analyzed at scale.

Kevin De Snayer, Calian's vice president of IT and cyber solutions for defense and space, says the research is prompting serious conversations with clients. "We are now able to put a report in front of somebody and say, 'By the way, here we are in a meeting, and everybody's got their phones turned on and nobody's got an air gap, and here's the bad part of that.'"

A constant role in a changing world

Dr. Gagnon sees the activity across these diverse research programs as a continuation of how the university has always responded to society's most complex challenges, grounding them in discovery and a commitment to the public good.

“The circumstances may feel urgent,” he says, “but our role is constant. We create the knowledge behind emerging technologies, we help determine how they’re mobilized, and we educate the people who carry the work forward into the world.”

As Dalhousie researchers consider how their work can contribute to Canada’s sovereignty and resilience, Dr. Gagnon is quick to note that the research is likely to extend well beyond that purpose. Many of the defining technologies of modern life, including the Internet, GPS, and jet propulsion, find their origins in defense before transforming the civilian world.

He sees similar dual trajectories today, with innovations in advanced manufacturing, cybersecurity, ocean sensing, energy storage, artificial intelligence, and biotechnology having the potential to strengthen national security, while also advancing industries, infrastructure, and civil society.