# CANADIAN ARMY TODAY

SPRING 2022 | VOLUME 6 | ISSUE 1

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**Photo:** MCpl Genevieve Lapointe

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## EDITOR'S NOTE

One of the intriguing consequences of Russia's unprovoked war in Ukraine has been renewed discussions about Canada's defence capability. The federal government responded to the invasion with both lethal and nonlethal aid such as M72 rocket launchers, Carl Gustav M2 recoilless rifles and 84 mm ammunition, grenades, machine guns, load carriage kit, fragmentation vests, body armour, helmets, night vision gear, surveillance cameras, even meal packs.

As some of that equipment was being shipped via CC-177 Globemaster, both Prime Minister Justin Trudeau and Deputy Prime Minister Chrystia Freeland acknowledged, separately, that the changing geopolitical context could require new investments, though neither committed to specifics. "We need to make sure that the women and men who serve in the Canadian Armed Forces have all the equipment necessary … and we will continue to look at what more we can do," said Trudeau. "Certainly, defence spending is something we have to look at carefully," Freeland told reporters during a stop in Germany.

NORAD modernization and Arctic capabilities, among others, instantly sprang to life in social media threads.

For pundits with more of an Army focus, the fighting in Ukraine has reinforced the importance of projects such as Ground-Based Air Defence and Joint Fires Modernization, both of which have been covered in previous issues, and in more mobile anti-armour systems such as the Anti-Tank Guided Missile Replacement project – you'll find a discussion with the project director on its progression on page 58.

It even prompted a reminder from National Defence of its $44 million investment in the Airspace Coordination Centre Modernization (ASCCM) project, a capability operated by 4th Artillery Regiment (General Support), that in December received its final software component from Elbit Systems.

While these and many more are vital projects for a modern army facing a peer enemy, new equipment in and of itself is not a capability; that requires trained personnel and a plan to sustain the training and equipment. And without an inclusive working environment and a digital culture, retaining and recruiting the personnel to operate that equipment will be a challenge.

In this issue, we explore those two lines of effort. Down one line, the Army is striving to become "digitally armed" at all levels as it develops its future tactical network and eyes the convergence of possibly game-changing technologies. Down the other, it is adopting a new Canadian Armed Forces ethos that places a premium on character in its future leaders.

**Chris Thatcher,** Editor

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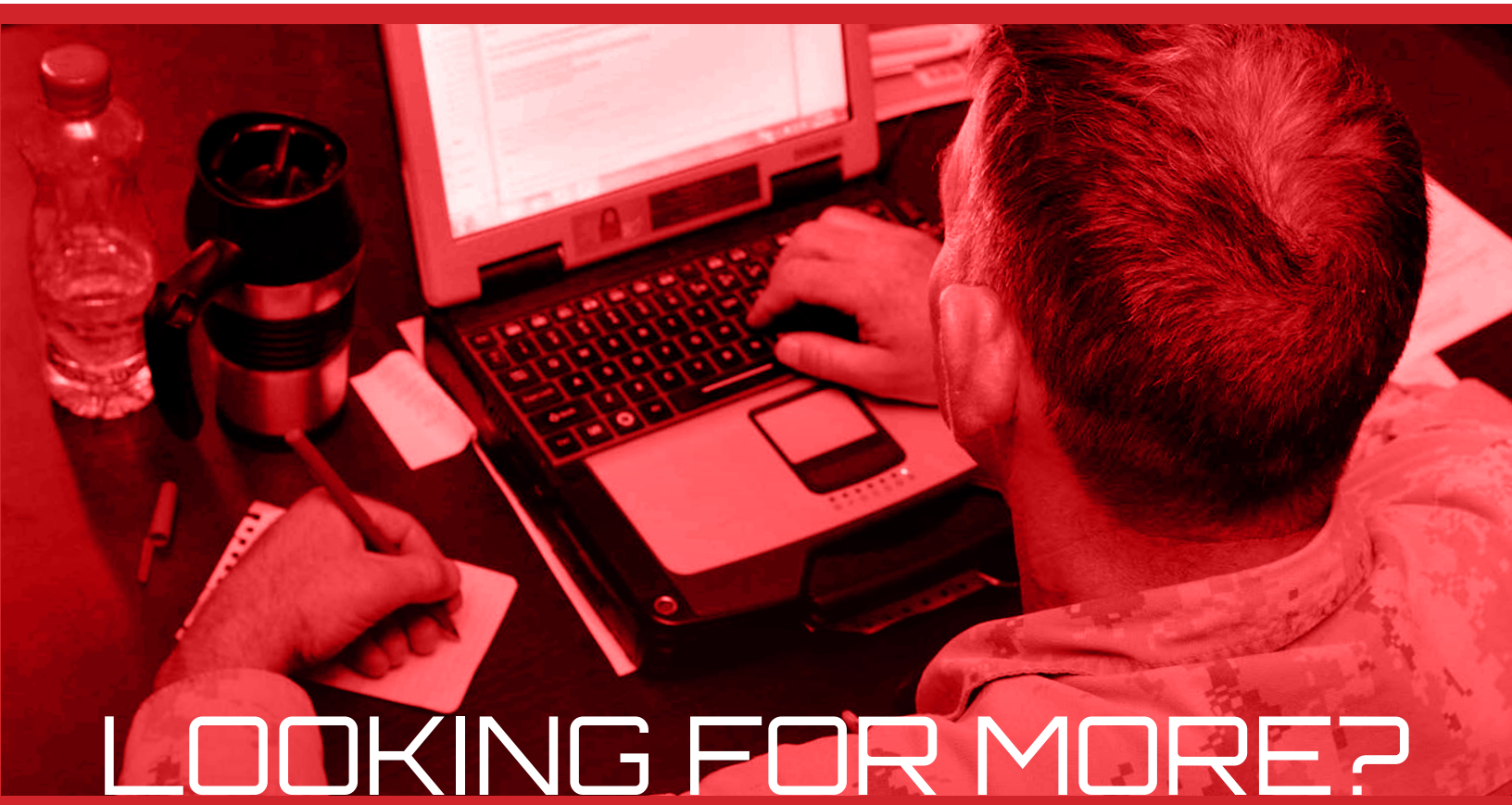

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# ARTILLERY, EW ADDED TO LATVIA BATTLE GROUP

The Canadian-led enhanced Forward Presence Battle Group in Latvia has expanded its capability in response to the Russian invasion of Ukraine in late February.

Since 2017, Canadian Army members have led the multinational force under a Latvian mechanized brigade. The mission is part of Operation Reassurance, Canada's NATO commitment in Central and Eastern Europe since 2014, and is intended to contribute to regional stability by acting as a deterrent against threats, while also participating in multinational training exercises with allies.

The current Canadian rotation of about 540 soldiers, primarily from 5 Canadian Mechanized Brigade Group (5 CMBG), was augmented this spring after the government announced an additional 460 personnel from across the Canadian Armed Forces (CAF) to support land, air and maritime missions in the region.

The additional approximately 145 Army members included a battery of 120 gunners and forward observers from 5e Régiment d'artillerie légère du Canada, equipped with four M-777 artillery guns, and around 25 soldiers from 21 Electronic Warfare (EW) Regiment. The artillery unit deployed in March/April and will remain in theatre for three months. The EW members deployed in early January as part of a biannual technical assistance visit to bolster electronic warfare capabilities during NATO certification exercises and will remain in Latvia.

In Ukraine, the approximately 200 members of Operation Unifier, also primarily from 5 CMBG, were temporarily relocated to Poland until conditions permit a resumption of the training mission. Since 2015, close to 3,000 CAF members have served on Op Unifier, working closely with Ukrainian soldiers now in a fight for the country.

"Your thoughts, like mine, will no doubt be with your friends and comrades as they face the ultimate test," General Wayne Eyre, Chief of the Defence Staff, acknowledged in a statement in late February as the first shelling of the unprovoked Russian invasion began. "Know that we, and our allies, have done everything our governments have asked of us to help prepare Ukraine for these challenging times. No matter the outcome of this invasion, the training you provided, to more than 33,000 members of the Ukrainian Security Forces, will be invaluable in the days to come. You have helped save lives that would otherwise have been lost, and you have helped prepare the Ukrainian Forces to fight tyranny and unbridled aggression."

By mid-March, the Canadian government had announced almost $70 million in military aid to Ukraine, NATO and regional partners, including up to 4,500 M72 rocket launchers and up to 7500 hand grenades; 100 anti-armour weapons systems – Carl Gustav M2 recoilless rifles from Army stocks – and 2,000 rounds of 84 mm ammunition; lethal weapons and support items such as machine guns, pistols, carbines, 1.5 million rounds of ammunition, and sniper rifles; personal protective and load carriage equipment, as well as surveillance and detection equipment, night vision gear, helmets, and body armor; funding for commercial satellite high resolution imagery; and 390,000 Individual Meal Packs. ■

Members from 1st Regiment, Royal Canadian Horse Artillery, fire the M777 Howitzer during a fire mission on Exercise Iron Ram in October 2017. Photo: Cpl Jay Ekin

# ROBOTS AND 3D PRINTERS: THE TOOLS OF FUTURE SUSTAINMENT?

In a future conflict, how can the Army most effectively sustain itself? That's a question the Canadian Army Land Warfare Centre (CALWC) will begin to answer later this spring with the publication of a concept for operational support.

The concept paper stems from CALWC's work on *Close Engagement: Land Power in the Age of Uncertainty*, the Army's capstone operating concept released in 2019. The document suggests a complex and volatile future operating environment characterized by state and non-state actors with "ever-more sophisticated and lethal technologies."

*Close Engagement* envisions the mechanized brigade group headquarters as the central command, control and coordination point, but foresees smaller operational elements with all the requisite enablers as the primary combat elements.

As operations become more dispersed, conducted over greater distances and by smaller combat teams, how should they be supported? "We are saying that as we fight in more austere conditions, with longer lines of communication and with small units that are further down the line, we won't be able to do the same things we do now; we'll have to change the way we are doing business," explained Lieutenant-Colonel Anick Chayer, who along with Major Valérye Hudon and others developed the concept.

Sustainment, in the operational support context, usually includes materiel management and distribution, health services, equipment maintenance and recovery, construction services, and personnel support services. Currently, it is conducted by three lines of support with frontline support elements able to reach back to the second and third. The future operational support concept recognizes that flexibility and effectiveness will be key in the emerging battlespace and may require a more direct approach to support.

General Dynamics Land Systems-Canada Multi-Utility Tactical Transport.

"For example, the first line might [call] directly from the third and not use the second," said Chayer, noting dispersed operations could mean "things happen much faster."

Frontline support will need to become more independent, with the tools and systems to resolve equipment damage and provide power for longer periods than is currently the case.

"[First line] support will need to be light and deploy with less equipment," she suggested, "so we are saying each subunit should have, for example, their own tactical fabrication capability (3D printer) with them to make their own spare parts and tools, rather than carry a lot of cumbersome tools."

Deployed independent elements could also have small, portable water purification systems rather than waiting for it to be "pushed from the third line," as well as lightweight, hybrid energy-efficient power solutions for mobile command, she said.

Health services could employ remotely piloted aerial and ground vehicles to move blood and other supplies forward while also helping to transport casualties and medics to the field hospitals. Material management could involve unmanned systems for distribution and emerging technology such as blockchain and artificial intelligence for logistics management.

The concept was developed in consultation with logisticians, engineers, health services personnel, among others, and will eventually include more detailed approaches for each of those sustainment subsections. "This is the first concept on operational support for the emerging battlespace," Chayer said. ■

# HIGH WINDS, FREEZING TEMPS CAN'T SLOW WATER FLOW

As the Army's high readiness engineer unit, members of 4 Engineer Support Regiment (4 ESR) are often the first team sent down range, to open a mission theatre or respond to a natural disaster. The regiment, based at 5th Canadian Division Support Base Gagetown, maintains the Canadian Armed Force's (CAF) Disaster Assistance Response Team (DART) capability and retains equipment at 8 Wing Trenton, Ont., for rapid deployment anywhere in the world.

In late October, a 4 ESR troop deployed to Iqaluit, Nunavut, with some of that DART kit to provide thousands of residents with potable water after a fuel-like smell was detected at the water treatment plant. Following a request for assistance (RFA) from the territorial government, the troop landed on Baffin Island with two Reverse Osmosis Water Purification Units (ROWPU), a treatment system designed and built by Ottawa-based BluMetric Environmental.

Two days before the formal RFA was issued, a two-person reconnaissance team headed north to scope possible sites for the ROWPU, a 20-foot container portable by truck, air or rail. Three days later a team of about 12 departed Gagetown to meet up with the containers and other DART equipment coming from Trenton on a CC-177 Globemaster.

"From flash to bang, it was very quick," said Lieutenant Robert Chua, the engineer troop commander who oversaw ROWPU operations.

From the outset, weather was a persistent challenge. The ROWPU's membranes and pipes risk freezing when temperatures are below four degrees Celsius, so the troop had to heat the water before it could be processed. "During the initial set up we ran into a couple of problems with the water being so cold it would freeze in our hose as well as in our pumps when we took it out of the river," Chua said. "We came up with multiple solutions to combat this, but it was an ever-evolving problem and solution throughout the operation."

Twice the detachment had to regroup and replace equipment after strong windstorms swept through their site. The first, on Nov. 2, struck while the team was completing set up and had yet to start producing clean water – "we were just starting to bring it up from the river in order to heat it," said Chua. Though the damage was minor, the team had to establish a new site with the existing equipment.

The second storm, on Nov. 23, whipped through with sustained winds of about 80 kilometres per hour and gusts up to 100 kph. The tents were held in place with cargo straps, but the strength of the wind snapped tent frames and forced the team to relocate the ROWPU to a CAF hangar at the Iqaluit airport.

"We had to reconstitute twice and come up with new plans," said Chua, who joined 4 ESR in April 2021 and was on his first operational deployment. "We ended up running operations out of the hangar and transporting the water from the river to the hangar to process where city trucks would take it to distribution centres."

The recce team had looked at several locations that could accommodate two ROWPUs. The troop began at a site adjacent to the Sylvia Grinnell River, which flows into Frobisher Bay, and started providing clean water to Iqaluit water trucks for distribution to residents on Nov. 9. The city's initial request was for around 180,000 litres of water per day, which would have required running both ROWPUs simultaneously. By the time the troop reached full operating capability, the requirement had dropped to about 11,000 litres per day.

"We ended up running one ROWPU at a time," said Chua, noting that many residents were able to get bottled water or draw water directly from the river. "It was so clean they only needed to boil it to drink it."

By the time the city lifted a "Do Not Consume" order on Dec. 10, the 4 ESR team had grown to over 20. Midway into the operation, the Regiment augmented Chua's troop with about 14 more personnel to alleviate some of the workload of a unit that had been "running hard" for several weeks. The additions included several more vehicle technicians. Though the ROWPUs were "quite reliable," auxiliary equipment like generators, space heaters and water heaters "seemed to have trouble when it became really cold," he said, "so the vehicle techs would go out and maintain that equipment."

Once the team was forced to relocate the ROWPUs to the airport hangar, it then required two Heavy Logistics Vehicle Wheeled (HLVW) drivers to transport the water from the river in water tanks strapped to the deck of the trucks.

Though 4 ESR was under the command of Joint Task Force North, leading the operation on behalf of Canadian Joint Operations Command, Chua said the deployment was very much a "joint effort" that involved not only Iqaluit city staff and Nunavut Emergency Management, but also Nunavut Parks for land use near the river and the Nunavut Water Board for water extraction licensing. ■

MCpl Hellen Liu (right) discusses ROWPU operations with Sgt Matt Dimma (left), Lt Rob Chua, and Maj Bernardt Van Zyl. Photo: MCpl Jax Kennedy

MS Matthew Skinner collects ROWPU water samples. Photo: MCpl Jax Kennedy

A 4 ESR team prepares to start a pump to draw water from the Sylvia Grinnell River. Photo: MCpl Jax Kennedy

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# TRIBUNAL RULING CAUSES PISTOL REBOOT

**By Ken Pole**

Army personnel who have been waiting for their vintage nine-millimetre Browning Hi-Power semi-automatic pistols to be replaced will have to wait a while longer. This is even though Hi-Power parts are no longer available – production of the 1930s design ended in 2017. When Colt Canada, the government's Strategic Source and Centre of Excellence for Small Arms, receives a batch for repairs, it generally cannibalizes nearly a third to salvage the rest.

The need for new pistols was identified more than a decade ago. But when the government asked potential suppliers for feedback in 2011, it almost immediately called a timeout to reassess. It would be five more years before the Defence Acquisition Guide defined the General Service Pistol project further. By then, the potential procurement had grown from approximately 10,000 guns to between 15,000 and 25,000 at an estimated cost of $50 million.

Firing the Browning 9mm at CAFSAC 2019. Photo: S2 Camden Scott

A much scaled-down project was re-initiated in 2017 and has slowly made its way through the procurement gates. Deliveries were expected to begin this year.

However, a May 2021 request for proposals (RFP) issued by Public Services and Procurement Canada for a new pistol and holster system elicited a complaint to the Canadian International Trade Tribunal (CITT) by Ottawa-based Rampart International, which represents Glock.

Rampart argued the technical specifications in the RFP breached international trade commitments. "They do not serve any legitimate operational requirement," it claimed in its filing, and "favour a specific pistol design produced by SIG Sauer and Beretta." International trade rules come into play because SIG

# BIDDING OPENS ON LOGISTICS TRUCKS

**By Ian Coutts**

After a timeline beset by fits and starts, the Logistics Vehicle Modernization (LVM) project achieved a key milestone on Dec. 9, with the release of a request for proposals (RFP) to industry.

Originally scheduled for "late summer 2021," the RFP was set back to allow for a series of industry engagements to refine the solicitation documents, said Major Tyrone Duncan, the LVM project director. "Public Services and Procurement Canada received a lot of feedback from our qualified suppliers (companies that successfully passed an earlier invitation to qualify process) … which told us whether [our requirements] were achievable."

The LVM project will acquire up to 542 heavy trucks and as many as 1,113 light trucks to replace the Heavy Engineer Support Vehicle (HESV), Heavy Logistics Vehicle Wheeled (HLVW), and Light Support Vehicle Wheeled (LSVW), all of which entered service in the 1990s.

Photo: Dan Rogall

The light vehicles will serve in a variety of roles, from command post to field workshop and ambulance. The heavy trucks will include up to 22 vehicles capable of hauling 72,000 pounds, the equivalent of a main battle tank on a trailer.

The overall budget ranges from $1 billion to $5 billion, with a fixed budget cost cap applied to the acquisition of trucks as well as trailers, modules and ancillaries. "We have come up with 19 possible bands," said Duncan, each of which represents possible "mixes of vehicles and equipment."

The topmost band would represent the Army's ideal mix of vehicles and capabilities, with each lower band representing a different, but still desirable, mix. The question will be what band a supplier can hit within the fixed amount. Bidders will receive "more points the closer they get to the topmost bands," he said.

The project initially qualified seven suppliers: Daimler/Mercedes-Benz, General Dynamics Land Systems-Canada (GDLS-Canada), Iveco Defence Vehicles, Mack Defense, Navistar Defense, Oshkosh Defense, and Rheinmetall Canada and Rheinmetall MAN Military Vehicles.

Over the past 18 months, however, several have formed new partnerships to pursue the project. Daimler withdrew in September 2020 and announced that it was partnering with GDLS-Canada and Marshall Canada. A year later, on Oct. 6, 2021, Navistar Defense formed a joint endeavour with Rheinmetall they are calling Team 45$^{0}$N.

Now that the RFP has been issued, "there's an expectation that bid evaluation would take place six to nine months after its release," said Duncan. Contract award is expected by the end of 2022 or in 2023 and delivery of the first trucks is anticipated in 2025 or 2026.

The slight delay caused by the additional industry engagement has been worth it, said Duncan, helping to identify any unachievable requirements. "We don't want to find out after the RFP is released." The project is now looking forward to receiving bids, he said, and getting the much-needed trucks into service. ■

Sauer's corporate headquarters are in Switzerland and Fabrica d'Armi Pietro Beretta is privately held in Italy.

The upshot was that CITT told the government in November that it had to issue a new RFP which, if it still referred to a particular design or type of pistol, "shall include words such as 'or equivalent' in the tender documentation."

Rampart complained about a requirement for a removable trigger group (RTG) developed by SIG Sauer to enable the same components to be used in different frames. It also protested requirements for a loaded chamber indicator (LCI), a forward trigger return, a striker deactivation button (STB) or similar mechanism, and a manual safety.

The government countered that the RTG was operationally legitimate and easier to maintain. As for the LCI and STB, those were critical to operational safety. Moreover, Major Carl Gendron, the Department of National Defence's (DND) project director and authority on infantry weapons, filed an affidavit with Keith Grosser, PSPC's contracting authority, in which they told the CITT that DND had conducted extensive testing and market research from 2015 to 2017, including gathering competition-level shooters' opinions of different pistols. DND also purchased various models to strip and assemble and monitored the U.S. Army's acquisition of a new service pistol derived from the SIG Sauer. That led to a draft Statement of Requirements in May 2018 and a draft RFP in February 2021.

As an intervenor in the CITT process, MD Charlton, an Ottawa-area company that includes SIG Sauer in its product line, stated Rampart was "trying to redefine" the project's parameters to accommodate "the limited functionality" of its pistols. MDC also claimed Rampart had known as early as 2016 that the Army wanted modular pistols with a top-mounted LCI – not the smaller side-mounted LCI common on Glocks.

Randy Turner, a retired Canadian Armed Forces (CAF) member with a special forces (SOF) background and owner of Direct Action, an Ottawa firearms training business, was an expert witness for Rampart. He said the LCI should not be a soldier's primary way to determine whether there is a chambered round, and that CAF protocol is a "press check" to confirm visually and manually and that the LCI was not a safety feature as claimed.

A DND weapons technician told the Tribunal that a top-mounted LCI had been specified for training and field considerations and said Turner's evidence was based solely on fieldwork and that SOF experience did not reflect the needs of all CAF personnel. He also stated that the top-mount is more visible and, hence, generally safer in a training environment, a point echoed by Gendron in a subsequent interview with *Canadian Army Today*.

Even so, the CITT's recommendations forced the government to reboot the RFP in late February. The pistol is now defined as "adaptable" rather than "modular." Gendron said "the modern capabilities sought by the Army will remain the same," which suggests the overall timeframe for delivering an effective new handgun should not be seriously impacted. ■

# THE GUNS OF AVALANCHE SEASON

The flooding and mudslides that closed major highways in British Columbia last November were a powerful demonstration of how quickly Mother Nature can sever critical arteries connecting western ports from the rest of Canada. Each year, the Canadian Army plays a small but crucial role ensuring rail lines and a stretch of the Trans-Canada Highway through Rogers Pass remain open to traffic.

At an elevation of 1,330 meters, the Pass through the Selkirk Mountains can see more than 12 metres of snow in a typical year. And around 4,000 vehicles and as many as 40 trains will traverse the mountain in an average winter day.

To prevent avalanches from cascading across those vital routes, members of the Royal Canadian Artillery employ a modified C3 105-mm Howitzer to disrupt snow build-up along the rock slopes above the highway and railway, setting off controlled avalanches before they can occur naturally.

Known as Operation Palaci, the program has been conducted in support of Parks Canada for more than 50 years under an agreement between the federal agency and the Department of National Defence. Rogers Pass cuts across a federal national park. Where most national parks feature signage along trails warning of bears and other wildlife, signs in Glacier National Park warn of artillery.

Shooting at snow might seem a strange expenditure of artillery ordnance, but it makes sense when you see the dangerous conditions gunners are mitigating. "We don't have restrictions on weather like helicopters or the explosive devices [Parks Canada] may use and we are able to reach targets that maybe … they can't reach," explained Master Bombardier Marc Vivier, the second-in-command of a detachment from the 1st Regiment, Royal Canadian Horse Artillery (1RCHA).

The operation is conducted from November to April, with two three-month rotations of up to 20 gunners drawn from 1 RCHA in Shilo, Manitoba, and Reserve members from artillery units in Western Canada.

The "targets" are selected by Parks Canada scientists, who monitor the snow conditions and predict where and when an avalanche might occur. The gunners are co-located with Parks Canada staff in a compound of snowplows and road maintenance equipment about halfway through the 120-kilometre pass. Each morning the detachment command team meets with agency staff to get an assessment of the snowpack and avalanche risks. If the guns are required, Parks Canada provides a target package and timings.

"They control the shoot," said Vivier during a break on his second rotation in the past 12 months.

Gunners from 1 RCHA fire the 105-mm C3 Howitzer during Op Palaci. Photo: SLt M.X. Déry

To minimize traffic delays along the busy route, fire missions are usually conducted overnight, beginning late in the evening and running for six to eight hours until about 5:00 am. (The operation is sometimes "paused to let traffic through" if too many vehicles are delayed, he said.)

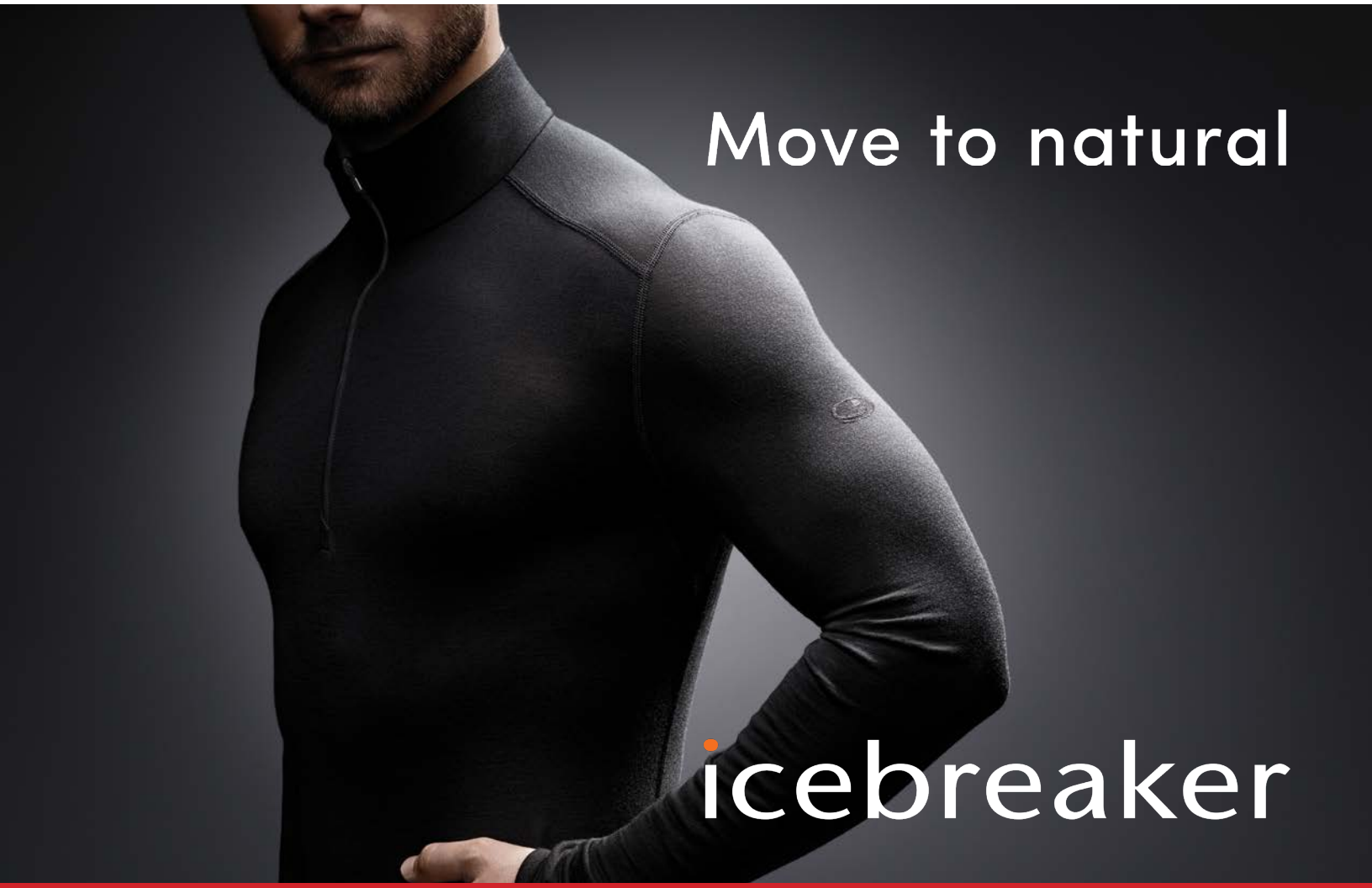
Once the highway is closed, two fire teams, under escort from Parks Canada staff, will leapfrog one another with C3 Howitzers modified to fit 17 concrete platforms along the Trans-Canada. The ammunition, stored separately from the detachment, is brought to the fire team at each position.

The targets can range from three to five kilometres up the mountain slope, and Parks Canada sends a team to recover any unexploded ordnance.

"The fuse we use is more sensitive to the snow," said Vivier. "It will detonate and explode, sending a burst of high energy in all directions to release those weak layers of snow. It looks like a snow blizzard when it hits."

Vivier joined 1RCHA in 2014 and admitted participating in Op Palaci has been on his wish list ever since he arrived in the flatlands of Shilo. "It is beautiful up here. But what we do makes sense when you see how much snow can fall." ■

A night shoot on Op Palaci 2022. Photo: Lt Andrew Casey



# Digitally Armed

**A new digital strategy may provide the roadmap, but unit-level solutions will establish the markers for digital transformation.**

By Chris Thatcher

A Joint Terminal Attack Controller examines targeting data on Ex. Summer Shield XV in Latvia in June 2018. Photo: Cpl Desiree T. Bourdon

In another era, before the smartphone, there were Communications and Information Systems (CIS). That begat C2 IS, recognition that Command and Control were what Information Systems were intended for. Soon, there was C3 – Signallers still wanted Communications in the acronym. Then came C4I, lest the Intelligence community be neglected. No one's too sure why Computers were thrown in. C4ISR followed to include the Surveillance and Reconnaissance functions. But that left out the Target Acquisition folks, so the acronym expanded to C4ISTAR. What of Electronic Warfare? Again, for some it changed to C4ISTAR/EW. More recently, Cyber and Combat Systems have been tossed into the mix, resulting in debates about whether to adopt C5ISR or C6ISR.

The Canadian Army will never do away with acronyms – members can't help it when they see more than two words that can be combined into letters. But when it comes to networked systems, the Army now has a new term that better describes what it is trying to accomplish: Integrated Command and Control System or IC2S.

"The terms we use should describe what the system does, not what it is comprised of," explained Lieutenant-Colonel Dan McKinney, who leads the Army's working group on Digital Transformation. He served for a period as the program manager of ISTAR projects in the Assistant Deputy Minister (Materiel) Branch and knows the acronyms all too well.

"We keep adding new terms and it's never perfect. And nobody likes these terms anyway, especially outside the military community – you need to provide a detailed explanation every time you use one like C4ISR. Really, what we are talking about is the technology that enables and empowers the Command and Sense operational functions, so when we talk about integrated command and control systems, I think most people intuitively get it."

The change is significant. In late 2020 the Army released a modernization strategy that centres on a digital transformation that is itself nested within larger Canadian Armed Forces (CAF) and Department of National Defence (DND) digital change and tied to transformations across the ABCANZ armies (Australia, Canada, New Zealand, the United Kingdom, and the United States). Without a common language and well-defined terms (and acronyms), interoperability and integration across these new digital architectures will become needlessly complicated. The new idiom also brings the Army closer to the emerging U.S. Army term of Integrated Battle Command System.

For the past year, McKinney has led a tiger team constructing the roadmap for the digital strategy. It's a complex process of Army-wide discussions, interaction with cross-functional CAF and DND teams, and experimentation.

Among the "small wins" the tiger team is hoping to capitalize on is an initiative by 2nd Canadian Division to improve the workflow of Reserve members. At present, Reserve leaders and staff spend considerable time on the phone tracking the availability of personnel for courses, exercises and operations. So, the division developed and is trialing an application Reserve soldiers will soon be able to download on their phone to see

Soldiers with 2 Combat Engineer Regiment on Ex. Stalwart Guardian in August 2015. Photo: 32 CBG

A network of computers on Ex. Unified Resolve 2019 in Edmonton. Photo: MCpl Owen W. Budge

training and deployment opportunities. Like crowdsourcing, if the Army needs a team for a particular task, it can post the opportunity and members with the necessary qualifications can raise a virtual hand and volunteer. The chain of command can then see a near-real time digital dashboard rather than a dated spreadsheet to select the best teams. That initiative could save an estimated 55,000 person-hours per year.

Though most successful initiatives require champions at the highest levels, one of the tiger team's aims to encourage units and commanders across the Army to break from a default analog mindset and "see themselves in a digital world and how that can solve some of their problems," explained Lieutenant-Colonel Tom McMullen, a member of the team and one of the project directors for the Army's Land C4ISR program.

"I find we have a cultural challenge within the Army of not demanding more from digital and realizing how it can empower what we do day to day, either in garrison or in the field, at every level. How do we unlock some of our long-established orthodoxies and get away from that? Digital is about empowering our soldiers to solve local problems. People won't buy in unless this is helping to address their actual day-to-day challenges. The idea here is to create a digital ecosystem and then encourage bottom-up solutions from the unit level that will not only create personalized solutions, but will also create that competition arena in which the best solutions rise to the top and can, if needed, be scaled and applied across the Army. The key to success is having our unit-level commanders and below see themselves in this digital transformation challenge and demand more from it."

To help with that, the Army engaged WithYouWithMe to launch a Data Analytics Training portal aimed at teaching interested soldiers basic data analyst skills that can then be applied to unit problems. The initiative has become a forum for both presenting those challenges and generating specialists who can attempt to solve them. It grew out of a six-week digital boot camp hosted by the Canada School of Public Service last summer for members of Army headquarters and the tiger team.

Though there is always a concern that disparate initiatives will head off in their own direction, solving a local problem without connecting to the larger whole, McKinney noted that successful transformations are often characterized by initial silos. "That seems to be a necessary step to get there. You are creating the small wins that gain momentum," he said. "It creates the forcing function to tie it all together after."

The approach may seem counterintuitive for a military culture that thrives on planning and only "crosses a line of departure" once all assets and resources are ready. But digital is "forcing us into a different way of thinking, where it is more bottom-up to start," he acknowledged.

## DIGITAL LITERACY

For a digital transformation to take hold, the Army will need a different relationship with technology, both McKinney and McMullen stressed. Digital transformation is just part of one line of effort within the Army's modernization strategy, yet in many ways it could transform some of the cultural issues and most of the workforce development and business process challenges the Army seeks to overcome.

Digital literacy is now a common refrain as the tiger team strives to help both digital natives and immigrants understand how to view their problems through a digital lens. It means discarding everything that is "currently in place to solve a problem, and then re-engineer a solution with digital capability at the centre of the solution," said McKinney. Think of the difference in how Netflix and Blockbuster approached the problem of enabling people to watch movies in their homes.

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MCpl H. Hashimi, a Communication and Information Systems specialist, sets up a Ground Antenna Transmit and Receiver during Op Nanook-Tatigiit in Whitehorse, Yukon, May 2019. Photo: Cpl Karen Neate

It's not a natural leap for some leaders. "One way to increase digital literacy is through those siloed successes, the small wins that show value," he added. "That 2nd Can Div application could save around 55,000 hours of work per year just within 2 Div. Scaled Army-wide the app will pay for itself many, many times over."

The Army will get the results it rewards, observed McMullen. If it recognizes and rewards digital successes, "that is going to drive everything else," he said. "If we don't demand it and we don't reward it, then it is not going to happen."

Leaders at all levels need to understand that digital transformation is an existential crisis for the Army, he emphasized. "If we are not able to exercise command and control at the scale and pace of our allies, not to mention our adversaries, then we are not effective as a fighting force. Digital is that enabler to exercise C2 at the scale and pace we need. We are not hiding behind C5 and C6 acronyms and jargon that is not helpful – this is an essential combat function that we need to be effective as an operational force."

The Army is testing the phrase, "digitally armed to protect our tomorrow," said McKinney. "Digital is really part of our weapon system. Tomorrow's fight demands it. The battlefield is becoming saturated with more and more sensors, and the relative advantage you gain is how fast you can process all of this information and make a decision with it."

Allies are making similar investments, he added, so if the Canadian Army wants to "preserve our ability to fight alongside our key partners, especially the ABCANZ community, digital will be the gateway to entry. Our future credibility and effectiveness as a force, our ability to partner and be interoperable with allies, will depend on being able to integrate digitally with them."

The tiger team has debated how to determine when the Army has become a truly digitally transformed organization. A more agile approach to procurement that allows for the upgrade of software almost as regularly as a smartphone will be one measure. But the true test will be when "we consider digital solutions at every turn in our normal way of operating, whether in business or on the battlefield," said McKinney. "We will know we have transformed to a digital army when leaders at all levels can manipulate the technology, the data, to solve their problems. We are definitely not there yet."

## HIGHLY ALIGNED, LOOSELY COUPLED

For the past year, McMullen and the Land C4ISR project team have been gathering feedback from industry on six core projects that will provide critical components of the Army's future tactical network architecture. They are progressing even as the digital strategy is being written, but nonetheless remain the main catalysts "to reshape and modernize the underlying tactical digital infrastructure and the ecosystem," he said.

The projects included:

- Joint Deployable Headquarters and Signal Regiment Modernization (JDHQSRM), an upgrade to the communications systems the Joint Signal Regiment employs when setting up a division or joint task force headquarters;
- Tactical Command & Control Information Systems Modernization (TacC2IS Mod), new hardware and software for the systems and networks in brigade and battle group headquarters, as well as in radios and some communications systems in vehicles to create a shared land tactical domain;
- Intelligence, Surveillance and Reconnaissance Modernization (ISR Mod), the acquisition or upgrade of various sensors, many related to the Army's Land Force Intelligence, Surveillance, Target Acquisition, Reconnaissance (ISTAR) project and connected to the current Land Command Support System network;

Bdr Kenneth Salema and Sgt Champagne from 4th Artillery Regiment (GS) participate on Ex. Turbulent Winds in Gagetown in November 2017.
Photo: Cpl Genevieve Lapointe W. Budge

- Tactical Communications Modernization (Tac Comms Mod), an upgrade of radios and satellites and other communications tools to assure operational and tactical bandwidth for headquarters, vehicles and other platforms;
- Combined Joint Intelligence Modernization (CJIM), focused on deployable top-secret intelligence shelters and training; and
- Canadian Forces Land Electronic Warfare Modernization (CFLEWM), a project to address the Army's capability to counter radio controlled improvised explosive devices and modernize its electronic warfare systems.

The six are "highly aligned but loosely coupled" to move on their own track through the project approval process while still accounting for interdependencies. Most have completed or are completing the options analysis phase of procurement and will be seeking strategic approval and funding to move into definition, a step currently obstructed somewhat by a bottleneck of projects all attempting to get through at the same time.

"We understand more and more that it is industry that is going to lead in this space," McMullen said of the feedback the team has heard. The Army's challenge is to figure out how to apply industry "ideas in a tactical environment. There are a bunch of practical challenges and concerns that come up when you try to apply enterprise IT approaches such as a cloud architecture to a tactical setting, and how you reach back and plug that into the CAF joint ISR backbone."

Beyond the technology itself, there are also big questions about how best to train soldiers and sustain rapidly evolving capabilities, he added. "How do we evolve something within the lifecycle of new emerging technologies that is continuously [being upgraded by] industry? This will definitely be a collaboration."

The unified architecture that describes how projects in the Land C4ISR program plug into CAF joint networks is being developed by the Canadian Army Land Warfare Centre. And each may present some integration challenges. But for end users, the issue is one of data compatibility rather than network convergence, McMullen noted. "If I'm a tactical commander in the field, I don't care which network I'm on, I just need the data to make decisions and gain situational awareness."

In addition to his digital strategy role, McKinney is responsible for the current Land Command Support System (LCSS) and the Army Network Operations Centre (ANOC). Rather than wait for a final strategy and network structure, the ANOC is creating the conditions for a different way of operating.

"More and more we are centralizing the services that are being provided to commanders within the ANOC," he said. "That alleviates some of the workload that is in the field. We have a plan that if connectivity is lost, those key services that are absolutely required are still provisioned forward. We are going towards this unified architecture."

Whatever the future LCSS is called, it will likely "be a suite of applications that are specific to land warfare, riding on the same tactical network the CAF uses. So, we are looking at things from a way more integrated perspective," said McKinney, "and we need to make sure those six projects are integrated as part of the broader IC2S modernization. Looking at it from another angle, if they were LEGO bricks, these six projects will provide the majority of bricks from which we can build a modernized IC2S. This is in contrast to the Army's 'jigsaw puzzle' approach in the past, where each piece needed to perfectly fit and integrate with all other pieces, leading to an overly complex system. It is all one really big problem that we need to solve, and more and more we are looking at it that way." ■

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A future network architecture concept would ensure a less ad hoc structure than the tactical solutions employed in Afghanistan. Here, a forward observation officer technician monitors footage transmitted from a UAS over the Panjwa'i District in October 2010. Photo: Shilo Adamson

# FUTURE NETWORK CONCEPT

By Staff

For an organization that normally looks 10 to 15 years into the future, conceptualizing the Army's near-term tactical network architecture is a bit of a departure for the Canadian Army Land Warfare Centre (CALWC).

Digital transformation, however, is at the heart of the Army's modernization efforts. A future tactical network framework could inform not only the digital strategy currently in development, but also the requirements for pending Land C4ISR projects and for how the Army plugs into the digital backbone of future higher level Canadian Armed Forces (CAF) and Department of National Defence (DND) networks and those of coalition partners.

"We are up against the wall," admitted Lieutenant-Colonel Mike Janelle, who leads a section developing the Network Architecture Concept. "We no longer have the luxury of deciding whether we want to transform or modernize. It is a must-do. And there is a chance this concept can influence what [those projects and the digital strategy] are trying to do."

The concept, which is being circulated among a range of stakeholders and will be presented to the Army Capability Development Board in May, describes a network hierarchy that begins with the individual soldier and advances to the platoon, company, battle group, brigade, and division levels and how those "tactical formations will connect with operational and strategic levels of warfare," explained Major Deirdre Nalepa, the designer of the concept.

"It lays out some of the issues around compatibility of disparate systems," she said, in recognition of the often *ad hoc* and piecemeal way in which the current Land Command Support System has been constructed as technology has evolved.

It does not call for specific Army data protocols and network standards – those will be defined by the CAF in collaboration with industry partners – but it does highlight their necessity and describes a framework for interoperability with CAF networks and those of partners such as fellow ABCANZ (America, Britain, Canada, Australia and New Zealand) armies.

That includes Information Technology Infrastructure in Support of Command and Control, a secret Level 2 cloud infrastructure project led by the Assistant Deputy Minister, Information Management branch, which concluded a request for information from industry in March.

"They are responsible for getting cloud infrastructure to a task force headquarters in a deployed theatre of operations and then enabling how the rest of the services connect to that Level 2 infrastructure," explained Janelle, who heads CALWC's concept development of Command, Sense and Act operational functions. "By synchronizing our efforts with theirs, we can leverage the research they are doing, the data they are getting from testing.

"Standardization is not our focus so much as providing a realistic picture: Here is what the network of tomorrow from an Army perspective should look

like so we can do everything we have been asked to do over the next 15 to 20 years," he said.

To fit within a broader multi-security, multi-caveat network system, "you have to figure out your own piece of the puzzle and start aligning your efforts with the other stakeholders across the joint force so we are moving forward together," said Nalepa.

Consequently, the network architecture concept has a lot of interested organizations. The concept was developed in consultation with Chief of Staff, Strategy, which is leading the Army's larger digital strategy, as well as Director Land Requirements, responsible for current Land C4ISR projects, Director Land Command and Information, and Director Land Command Systems Program Management (DLCSPM), which maintains the current LCSS. It was also influenced by Defence Research and Development Canada and others in the science and technology community.

"We are aligning all our efforts across [these organizations] to make sure we are all on the same page and tracking," she said.

A multinational communications integration exercise in Latvia in August 2020. Photo: Sgt Luis Barbero

Part of the challenge is a common language. Whether you call it pan-domain command and control (C2), all domain or joint domain, as the U.S. is currently proposing, the terminology around network architecture can mean different things to different organizations.

"Once we are all talking the same language, it will ease our interconnectivity and interoperability with allies," Nalepa observed. An Army network, connected to a unified CAF digital backbone, should mean minimal configuration for Signals Operators and other specialized technicians to plug into NATO's Federated Mission Network or the U.S.'s mission partner environment.

By promoting common terminology and greater "digital literacy" within the Army, the hope is that leaders at all levels will be able "to have more mature and meaningful discussions about what a C2 network actually is, and how a network architecture concept can enable that," she said.

Past efforts around network concepts have been perceived as very complex to understand. The tendency has been to leave problems in the hands of engineers and Signals Operators to solve, she noted. "It's no longer the case where you can say, 'the Sigs Corps will figure that out.' Technology is so pervasive that it's quite shortsighted to say, somebody else will figure that out, and just continue doing what we have always done. Digital literacy has to be embraced."

A standard baseline understanding of the technology driving C2 networks would go a long way to alleviating that. CALWC is also developing an Army data architecture concept to better understand and explain the data exchange requirements for command and control and between sensors and shooters.

"From a technical aspect, we wanted to look at the network and figure out what piece of that we could reasonably solve," said Janelle. "The network architecture concept will be the backbone on which everything can rest as we start talking digital modernization of the Canadian Army." ■

Canadian soldiers with the eFP Battle Group in Latvia defend a camp during an Integrated Capstone exercise in January 2019. Photo: Cpl Genevieve Beaulieu

# Technology Nexus

## To digitally transform, the Army will need to adapt new commercial capabilities. Many are already converging on the battlespace.

By Chris Thatcher

Remember those PowerPoint slides of 20 years ago with all the lightning bolts connecting troops of soldiers to icons of vehicles and artillery, to various headquarters, and to aircraft and satellites overhead? "It was pure fantasy," Chris Pogue admits. "It was what we wanted it to be, but nobody could make it happen."

Pogue, a former CC-130 Hercules aircrew member with the Royal Canadian Air Force (RCAF), is the chief executive officer of Thales Canada, which has supported the Army's Land Command Support System (LCSS) for years and is currently among the companies delivering the LAV Reconnaissance Surveillance System (LRSS) project that is replacing 141 Coyote surveillance vehicles with 66 fully integrated surveillance platforms.

"Today," he said, "those lightning bolt diagrams are completely realizable. The technology has progressed dramatically towards achieving what we thought we wanted to be able to do 20 years ago. And that gives promise to the Army's plan to digitize."

Since retiring from the RCAF in 2003, Pogue has been immersed in leading-edge technology, from the virtual and augmented reality of simulated training systems with CAE Defence, to advanced system of systems integration with General Dynamics Mission Systems Canada, and most recently, space-based surveillance, robotics and satellite communications with MDA.

Through the late 1990s and early 2000s, militaries and think tanks talked of a revolution in military affairs and net-centric warfare, but the digital backbone necessary to make much of that happen remained elusive. Capabilities from augmented reality to autonomous systems, artificial intelligence, machine learning, and secure, high-speed connectivity evolved along their own paths, underpinned by the progress of digitization.

What was once fiction, however, may now be possible. Pogue believes we are at "a digital nexus of these technologies," one the Army is "well positioned to be advantaged by."

The Army's 2020 modernization strategy sees "digital excellence" as foundational to modernization and calls for future networks that are "designed and implemented to enhance shared understanding, the speed of decision-making, and the effectiveness of command and control," all of which has the "cumulative potential for transformational change … [E]merging advances

The command team of the 3rd Battalion, R22eR, and an officer of the Sûreté du Québec examine the area of responsibility on a map during the G7 Summit in June 2018.
Photo: Sgt Sébastien Fréchette

A command briefing at Camp Ādaži, Latvia in October 2018 on integration within the eFP Battle Group. Photo: eFP BG ROTO 10

in artificial intelligence, such as its use within predictive planning tools, has the potential to greatly shorten the decision-action cycle."

While the LCSS is often described as the Army's digital command and control backbone, it is far from a unified network. There are multiple variants, each purpose-built to support different missions. Pogue suggests the lessons learned from constructing and supporting those variations have been valuable learning experiences and have helped steer a logical evolution of the LCSS. But the Army is now in a position "to leverage what is going on in the commercial sector" as it grapples with the requirements of a future tactical network that must align seamlessly with a joint Canadian Armed Forces network architecture that is interoperable with ABCANZ (America, Britain, Canada, Australia, New Zealand) army and NATO networks.

Investment over the years in the LCSS has reached a point "where you are seeing you can build it with common COTS (commercial-off-the-shelf) tools, keep it open, secure the data, and take it to the tactical edge," he explained.

Thales, for example, was selected in January 2021 to provide NATO with its first theatre-level deployable defence cloud structure, known as Nexium Defence Cloud, a commercial capability modified for the security and interoperability requirements of a multinational army operating at the tactical edge.

Augmented intelligence (AI) – a term Pogue prefers over artificial intelligence – and machine learning are the tools to help the Army organize and understand the massive volume of sensor and other data in the battlespace. But commanders and soldiers in mission critical environments will only trust and accept information over a cloud network, no matter how well secured, if the AI is explainable and the underlying algorithms are understood.

"If I can't trust that information, I can't make a decision," Pogue acknowledged. "The environment is going to be complicated, chaotic, with degrees of ambiguity. How do we address that? This is where I think augmented intelligence serves as a powerful component of that nexus."

Here as well, Thales has invested in commercial applications such as TrustNest and Cognitive Shadow to develop explainable AI and employ it to help guide decision makers by understanding their typical thinking patterns in difficult circumstances.

Ultimately, the convergence of capabilities could give commanders more time to make critical decisions, he said, creating more decision space in U.S. Air Force Colonel John Boyd's OODA Loop cycle of Observe, Orient, Decide and Act. Business leaders live in the same loop, he notes, and are adopting these technologies to stay ahead of competitors. Quantum sensors will radically change Observe; AI, machine learning and big data analytics will transform Orient and guide soldiers to faster decisions; and connectivity, the degree to which systems of systems are connected and trust each other, will alter how soldiers Decide and then Act.

"If we have trust and understand emergent behaviours, understand the second and third order effects that come from system of systems [interaction], then when we decide we are much more rapid to act," he suggested. "The evolution of tools and technologies has allowed us to focus on places that can give us more time than potentially the threat has."

## FROM THE TESTBED TO THE BATTLEFIELD

Pogue believes many of the technological capabilities the Army is seeking can be found in Canadian small and medium companies, entrepreneurs "who have adopted digital transformation in the past decade as part of their fundamental business model." Some had to "adapt or die" in recent years and have undergone digital culture and mindset changes akin to what the Army wants to achieve.

But testing and validating tech for the battlefield is an arduous process that often involves a lengthy acquisition process. Thales is preparing to deploy

WO Tyler Chetwynd, candidate on the Assistant Instructor-in-Gunnery course, in a live fire exercise in Gagetown in October 2019. Photo: Cpl Genevieve Lapointe

MBdr Annick Vallières, student on the Gun Area Technician Supervisor course, practices calibration on a Theodolite T16 in Gagetown in February 2017. Photo: Cpl Geneviève Lapointe

in Canada a concept called the Combat Digital Platform (CDP), a multi-sided platform along the lines of Shopify for companies to connect with one another and Thales and trial their technology. Rather than a stage for commerce, CDP would be a secure space to replicate the complex conditions of an austere and hostile battlefield – "the kind of environments we put decision makers in in mission critical operations" – to test and validate their digital concepts.

"Everything you do there will be applicable to the field," Pogue said. "It will allow you to bring augmented intelligence into that digital frame, move incredibly large datasets together, and orient them in new ways to extract new pieces of information." The tools and means of sharing information, such as analytical architecture like Data Mesh, "will be built into the Combat Digital Platform."

Like a sandbox, it would allow companies to connect to a digital backbone almost identical to the Army's future network and, in a cyber secure environment, have end users evaluate and validate a C4ISR and integrated command and control capability in the same way they would deploy it in the field.

It would also have the potential to reduce acquisition costs and speed up the procurement cycle, he suggested. When soldiers can bring a technology from a testbed to the field with minimal change, "there is a decreased learning curve. It becomes more intuitive. Training costs aren't suddenly exponential. We see CDP as a key environment, not only to engage the innovation culture of small Canadian companies, but allow the Army to engage and test future concepts in real time and potentially deploy much faster."

The Army's modernization strategy places a premium on cyber mission assurance (CMA). "Cyber infrastructure, whether network or vehicle platforms, presents potential single points of failure on operations and in the day-to-day business of the institution," the document states. So, CMA is "a critical operational consideration … to safeguard system availability, integrity, authentication, confidentiality, and mission assurance of networks, systems and platforms unique to the Canadian Army."

Pogue concurs about the disruptive potential of cyber threats. But he suggests some of that concern could be mitigated by employing frugal AI at the tactical edge, a concept Thales is developing at its digital factory in Montreal. Rather than requiring large quantities of data to move back and forth over a network, frugal AI would employ machine learning algorithms that do not need "truck loads of data" to learn. "It comes from that edge deployment of AI, how we support trust and explainable decisions, but with less data," said Pogue. "It is early days there."

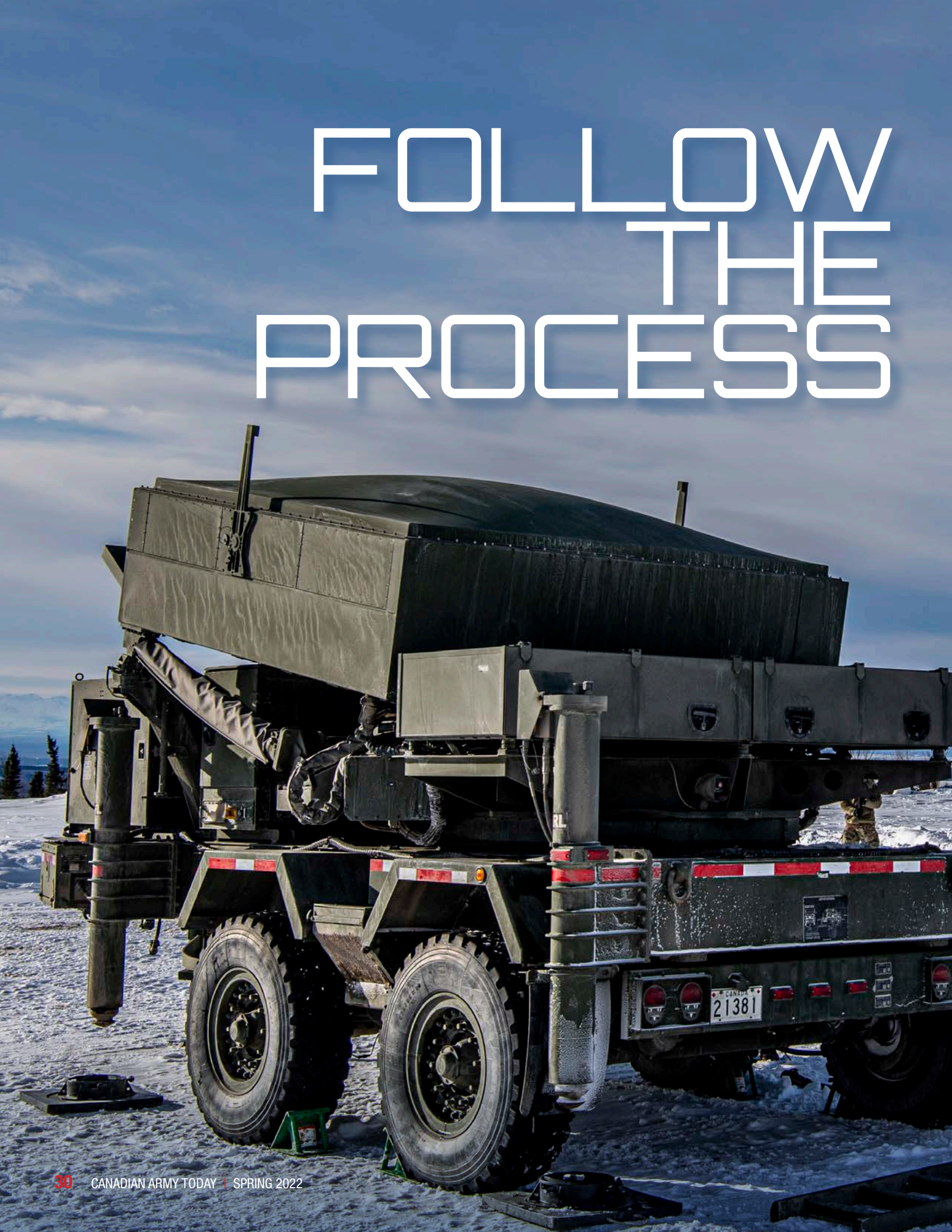
Effective digital transformation will demand a shift in mindset, a way of thinking about problems that is digital in its approach, he noted, but none of the concepts being proposed are new. "We've been talking about them for 20 years; this digital nexus is making them a reality today."

The challenge may be how to import that commercially developed technology into a complex battlespace in a faster and more efficient way than the current procurement system allows. Pogue has seen the potential of relational contracts with Canadarm3 for the lunar gateway while at MDA and now with the in-service support contract for the Royal Canadian Navy's Arctic and Offshore Patrol Ship and Joint Support Ship, known as AJISS. The emphasis on performance – ship availability – instead of meeting specifications rebalances some of the risk that can affect the relationship.

"It is perfect for innovation," he said. "It has incentives for industry and [the military] to innovate. Relational contracting is the most promising procurement evolution I have seen. It has the potential to deliver not only faster procurement, but better procurement, and potentially cheaper because there are incentives to make it cheaper. But we need that shift in mindset to make it work. It is trust-based contracting." ■

Medical personnel in the Unit Medical Station at the International Peacekeeping and Security Centre in Starychi, Ukraine in July 2016. Photo: JTF Ukraine

# FOLLOW THE PROCESS



Sorry, there are no secrets to fast-tracking the process of Canadian Army equipment procurement. After almost four years as Director of Land Requirements (DLR), one of longest serving in recent memory, Colonel Chris Renahan has acquired a sound understanding of how capability is delivered. If there is a secret formula, he hasn't found it.

If you want to move a project forward quickly and efficiently, the fastest way is to follow the process. That's a paraphrased quote from a former DLR coordinator, Greg Burton, that still holds true. "Every time you try to do something different you are rolling the dice," Renahan noted.

He has described the pace of DLR's work as the busiest he has ever seen, and on par with the efforts to support times of high paced operations. Despite two years of pandemic-related disruptions that limited in-person meetings with stakeholders, including industry, the directorate has progressed a sizeable portion of its projects through the identification and options analysis (OA) phases. It delivered the Headquarters Shelter System, started production on the Armoured Combat Support Vehicles, and saw the last of the Medium Support Vehicle System Standard Military Pattern trucks roll into service. While those and other projects have advanced through definition and into implementation, the bulk of the projects that were launched with the release of *Strong, Secure, Engaged* (SSE) – about half of around 40 projects – are working through or at the end of the OA phase.

So, finding success among projects that can take more than a decade to reach fruition requires a long view. "I need to find the job satisfaction in the little victories, like reaching key milestones that are invisible to most and don't make headlines because they are almost 100 percent procedural," Renahan admitted as he settled into a five-month course at the NATO Defense College in Rome, Italy that, with a few courses from the Canadian Forces College, will grant him the equivalency of the Canadian National Security Programme.

Between some grocery shopping in Rome and an evening of schoolwork, he reflected on the procurement process and the challenges posed by rapidly evolving technology.

Soldiers with 4th Artillery Regiment (GS) stage a Medium Range Radar during Ex. Arctic Edge in Alaska in March 2022. Photo: Senior Airman Joseph P. LeVeille, U.S. Air Force

New Armoured Combat Support Vehicle (ACSV) variants of the Lav 6.0 are rolling off the production line in London, Ont., and a new modular assault rife for soldiers is in testing. Pictured, action during the Combat Team Commander Course in October 2021.Photo: Cpl Djalma Vuong-De Ramos

**I'm not sure if it is refreshing or disappointing to hear there are no shortcuts or novel methods for moving projects through the various gateways more quickly. What works and why?**

I think we often hope for ways to fast track a given project, but oftentimes those solutions generate even more work when not everyone involved understands the intent or reasoning for deviating from the normal path.

A key element is early, frequent, and close collaboration with the many stakeholders involved. This starts with Army project directors building a close relationship with their Materiel Group Project Management team, but also includes all the internal to National Defence (DND) contributors and overseers of the project, along with the other government departments that are needed to enable a project's success. Involving this broad team of stakeholders early helps them to understand what it is we are trying to do and to have their input before critical decision points are reached.

I think the DND Project Approval Directive, our primary reference, does that well enough. I don't think there are any secrets that I have found that would allow us to do things better or more quickly, while still addressing all the elements that are asked of us. The successful project will be one that follows the process, is well-prepared for each upcoming gateway or decision point, and has a cohesive and well-synchronized project team and stakeholders.

**Have you learned a 'best approach' for developing requirements? Are there steps you take to ensure they are sound from the outset?**

I think that the Army's project directors do a good job of building a project based on sound and justifiable requirements. We start with critical, high-level requirements, which are refined and developed in more detail as a project progresses. At various stages we are required to explain and defend our choices, to a number of Canadian Armed Forces (CAF) as well as external oversight bodies. That helps us stay on track and resist the urge to reverse engineer a desired solution, or to 'situate the estimate,' as we like to say.

One of the key steps is to make sure that we are trying to solve the right problem. Some capabilities or objectives could be met many ways, or could encompass wide ranging capabilities or suites of equipment. So, when starting out, it is critical to ensure we have a good understanding of what it is we are trying to achieve, what is in the scope of a project and what is not. We can't expect unlimited funding or significant changes to force structures or staffing unless the larger organization is aligned to do so.

All our projects need to find linkage to policy documents like SSE, as well as future force development requirements defined by the CAF and the Army. We rely heavily on this wider force development community to help us figure out what gap or deficiency we are trying to address with an equipment project.

The Ground Based Air Defence project is a good example. With the release of SSE, the project received the policy coverage required for us to start work in earnest. But our experience with air defence was based on our previous systems that were oriented towards the defence of airfields in Europe during the Cold War. So, before we decided what the project would focus on, we worked closely with the force development teams in the CAF, and in particular, the Canadian Army Land Warfare Centre, to help us narrow our focus. This ensured that we were pursuing the right capability to fit in the envisioned Army of the future. Based on the high-profile nature of this project, we ensured that our planning assumptions were in alignment with the expectations of the leadership of the Army and the CAF, ahead of more formal project approval gateways. Once we had this endorsement and a conceptual idea of what kind of capability we were after, we could then go about the work of developing detailed technical requirements that are needed.

Cargo variants of the Medium Support Vehicle System lined up on Ex. Maple Resolve in April 2021. Photo: S1 Camden Scott

**Solving the right problem is no small task when you are acquiring technology that can change dramatically well before you have delivered the final solution.**

Ideally, because we take those high-level mandatory requirements (HLMR) and refine them out in further detail, we still should be limiting ourselves to what it is we want the solution to be able to do. We tend to keep it requirements-based as opposed to solutions-based. Theoretically, if we were to replace the tank, the default would be another tank. We might be tempted to write a requirement to fit a tank when we should be talking about wanting something to project fire, defeat certain types of targets and cross certain types of terrain. And if industry comes to us with a solution that does everything we need it to do, but isn't a tank, that should meet the requirement.

I think we try to define our requirements to describe what it is we need to do, and then leave it up to industry as to how to do it. But that is still us going down a specific path where we are setting these requirements down on paper. We are trying to find ways to be more iterative in our development and avoid writing requirements that only capture what is available today. But it's a challenge because our process is driven by us nailing everything down to the nth detail. Our ability to go to a cloud network company and say, 'provide us a service that lets us talk and have situational awareness, you tell us how to do it' – we are probably not quite there yet.

**Are you better able to challenge some of the assumptions about how technology will ultimately affect a future capability as a project is being analyzed and defined?**

I think that's where HLMRs and organizations like the Independent Review Panel for Defence Acquisition will help us. The HLMRs set out the capabilities we are trying to achieve: Our command and control (C2) system will have to be interoperable, provide awareness across the battlefield, allow us to communicate, and do all this while allowing us to be efficient with power. We shouldn't be saying, it has to be done with lithium batteries or solar power. The problem is that at some point those HLMRs are refined into detailed requirements and if we don't tell industry what we want, we might not get what we are looking for. It is a balancing act.

Maybe our next C2 system doesn't need a bunch of radio towers and servers and Signals Operators plugging in wires every time we go somewhere. Maybe it can all be done through direct links with satellites and our phones. But some of that is going to be a service, and a different type of procurement strategy from a different implementer. I wonder if some of our projects need to move from a capital equipment focus to a different procurement strategy approach.

**Is that even more problematic when you must factor in systems integration and interoperability very early in a project?**

Interoperability and integration are key elements, and if there was an easy solution, I think we would have found it by now. In the past, we left it up to the individual project to make decisions about what level of interoperability would be acceptable, and where it might not be achievable, and what trade-offs would be in order. The approach today is that we are asking projects to ensure these considerations are included much earlier in the process. Interoperability is now oftentimes a high-level requirement, and not something to be done at a later stage.

It is a really challenging problem space. We have to decide what level of interoperability we are seeking. Is it within the larger CAF joint force? With some key allies or all potential future partners? There is such a large number of references and standards that can be used to help align efforts, but not everyone adheres to the same ones. Which ones do we choose to focus on? So, we are working to prioritize interoperability, but similar to our requirements development, we need

Night vision systems, small arms and clothing projects are progressing. Here, a candidate on the Patrol Pathfinder course waiting for a helicopter insertion in September 2021. Photo: MCpl Genevieve Lapointe

to clearly define our interoperability objectives and partners, and then work to build a system that works with them.

**Do software-defined solutions make that easier or is there still a challenge in first understanding who you need to be interoperable with?**

It is a challenge. In the past we defined a radio and then tried to talk to somebody, and you could do that because the frequency was the frequency. You now have to have the right crypto. Before we went to a software-defined radio, the waveform that provided the security was on a circuit card you couldn't change. Now it is less of a hardware challenge and more a software challenge. But you still have to define who it is you want to talk to. The Army, Navy and Air Force have their own C2 systems. Even the American Army, I don't think, is interoperable 100 percent as different regional commands prioritize interoperability with their different regional partners. So which part of the U.S. Army do you need to be interoperable with?

And that is only one ally. You can draw the circle larger with ABCANZ (America, Britain, Canada, Australia and New Zealand) armies or even bigger with NATO, which is 30 nations plus the partners. NATO is the gold standard, it has a comprehensive and broad standardization agreement (STANAGS) program, but not every nation follows those STANAGS. So, we have to figure out who it is we are trying to be interoperable with and that is not easy.

The fact that we will have a software-defined system should allow us to plug different systems together even if we need an adapter or a black box to do the translation between them, as opposed to a man in the loop who has to look at one screen and type stuff onto another because there is an air gap.

**Are more projects moving toward cycles or spirals to introduce and upgrade technology over time?**

This is definitely something we have been working towards, and the project approval process does have a cyclical model that allows us to take a more iterative approach in some cases. But it is still a model that is defined by a limited timeframe, and formal approval gateways, so it is not necessarily a completely agile or open-ended system of continuous upgrades.

In general, I think our process was developed for an industrial age, where we can spend a lot of time and effort to develop a well-justified and researched solution, and then field a reliable piece of machinery or equipment that can be used for 20 plus years. We obviously can't do that with our C2 systems, and in many cases, even more traditional capabilities like vehicles that are dependent on that highly perishable high technology.

So, yes, we are looking at ways to provide a more agile or iterative process to capability development, and then capability lifecycle management, to ensure we aren't investing time, effort, and funds into a capability that will be obsolete before it delivers. It is something we talk about often, and I think all involved understand the challenge, and are working on finding solutions.

**Are you seeing value with early experimentation and buy-and-try with troops to develop requirements?**

We will take any input, experience, and opportunity we can get to help us improve our final product. Trials or buy and try give us the chance to get a close look at what kind of solutions are available now, get feedback from operators or experts, and then use the results to inform our requirements development. Army project directors don't write a statement of operational requirements in isolation, and there is a significant amount of consultation, research, and analysis that goes into the process. Being able to add a more hands-on or substantive perspective of what works and what doesn't, can only help. When we can do this with more developmental or pre-production equipment, that helps us ensure we have a good understanding of what the state of technology might be by the time it comes to develop or deliver a new capability, and then we can use that insight to better develop our requirements. ■

# TAILORED TO THE MILITARY

Each individual is different, each mission has its set of challenges, and all uniform components must adapt to this unique reality. Especially in the military, uniforms serve more than a functional role, and represent more than rank; they must meet critical needs in action.

To deliver state-of-the-art garments to its valued clients, Logistik consolidates widespread expertise within its networks of subsidiaries and partners, including Australian Defense Apparel (ADA), Mawashi and Wintex. To accomplish this task, the group is banking on the synergies brought about by the cooperation of numerous experts in R&D and human-centric design.

For over 25 years, the company has been supplying the Canadian Armed Forces and now provides operational items to the New Zealand, French, German, and Australian Defence Forces through its international network of subsidiaries. The group has established a substantial global expertise in the development and design of weather-specific operational clothing and equipment. From Australia's desert and tropical climates, to Europe where Wintex is renowned for its wet weather gear, to Logistik and its Canadian partner Mawashi's extensive experience in extreme cold weather uniforms, the group is delivering solutions for all conditions.

The new agreement between ADA and the New Zealand Defense Force, which includes the management of both operational and non-operational items for up to 16 years, will be sustained by the opening of new facilities in New Zealand. In addition to promoting domestic expertise, setting up locally will create jobs and business opportunities for the partners, reflecting the organization's approach of creating local economic benefits.

"As a supplier to the defence forces of three of the Five Eyes countries – Canada, Australia and New Zealand – our group's proven skill set and credibility in combat clothing and equipment reaches far and wide," declares Louis Bibeau, the group's President and CEO.

## GLOBAL EXPERTISE, LOCAL APPROACH

A critical focus for any military organization is to ensure that combat equipment fulfills the comfort and functionality needs of a variety of soldier populations in the field.

Accordingly, the company fosters relentless initiatives to continually improve and adapt military uniform components. In collaboration with the Department of National Defence – Directorate of Land Requirements, Logistik Unicorp design experts conceived and developed integrated uniform systems including the Multilayer System (MLS). The interchangeable MLS components are configured to seamlessly work together for optimal performance regardless of weather conditions, user preferences, or the type of duties performed.

The use of anthropometric data-driven design for combat uniforms has proven its value, particularly in optimizing service attire for women soldiers. ADA notably employed a 3D scanning technology encompassing 200,000 measurements on the body, along with extensive female demographics via a survey to develop an innovative collection tailored to their physiognomy.

Mawashi – Multilayering System for extreme cold weather

ADA – Combat Uniforms tailored for woman physiognomy

## OFF THE BEATEN PATH

To remain at the forefront, the Logistik Group benefits from a broad range of in-house competencies, including several information technology and data protection resources, an on-site laboratory supporting R&D initiatives, and military uniform design specialists. This allows the group to maximize an in-depth knowledge of client specific needs, as well as being proactive in the optimization of services and products.

As a company that believes in science-driven solutions, Logistik is involved in a number of initiatives with partners in the textile industry and higher education institutions. One partnership currently underway is a DND-initiated scientific research project with the University of Alberta. "The project focuses on the development of self-decontaminating textile in the form of fabric treated with a non-hazardous germicide, which is reactivated when the garment is washed," explains Mehdi Ben Salah, PhD, Director of R&D at Logistik Unicorp. Another project in collaboration with two Montreal universities aims to better understand thermal insulation mechanisms and harness their capabilities for advanced applications for the military.

With an international expertise and agile production network, Logistik is keen to extend the reach of its leading-edge service to armed forces across the globe.

LGen Jennie Carignan, Chief, Professional Conduct and Culture, held a series of town hall general meetings this past fall/winter. Photo: MCpl Darryl Hepner

# A QUESTION OF CULTURE

**The Canadian Armed Forces will release an updated ethos that ranks character as high as competency for current and future military leaders.**

By Lisa Gordon

In the wake of a turbulent year characterized by multiple sexual misconduct allegations, the Canadian Armed Forces (CAF) is responding by implementing key changes to its core ethos — the values, beliefs and expectations that form the bedrock of this country's military.

The revised blueprint, *CAF Ethos: Trusted to Serve*, has been in development since October 2020. At that time, the CAF's *Duty with Honour* textbook was slated for updates and the Canadian Defence Academy commenced work on *Trusted to Serve*, its companion user manual. The new manual is scheduled to be digitally released to all CAF members this spring. According to Lieutenant-General Jennie Carignan, Chief, Professional Conduct and Culture, this approach will do more than just treat the symptoms of professional misconduct.

"It's going to be a deliberate and holistic approach to the various systems that create a culture," said Carignan, a senior Army engineer who commanded the NATO Mission in Iraq between 2019 and 2020. "There needs to be an outside/in as well as an inside/out approach to change culture."

The outside/in perspective, she told *Canadian Army Today*, includes all military systems that create culture — how members are trained, retained,

A panel discussion at the Senior Army Leadership Symposium in September 2021. Photo: S1 Camden Scott

promoted and nominated to positions of command.

"The second piece is inside/out, and that pertains to each individual," she continued. "We will work on this at the same time."

Carignan said the plain-speak *Trusted to Serve* sums up "who we are and what we are about, both individually and as an organization."

The new document will be a comprehensive guide for all CAF members, helping them reconnect regularly with inherent values, principles and professional expectations.

As soldiers move through their military careers, the document will provide examples of expected behaviours, Carignan explained. The document will explore the concept of character and the important role it plays alongside competence in a leadership context.

"These are professional expectations that we have refreshed and reframed as part of this work," she said. "Duty, accepting unlimited liability, fighting spirit, leadership, discipline, inclusion, teamwork. These are all professional expectations and values that are being redefined."

Carignan explored the concept of character even further: "Character is a key piece. It's a change that we have included as part of our ethos, and it is as important as being competent. Character is what enables decision making. It's how you exercise judgment on a daily basis on sometimes very tough decisions."

Specifically, desired leadership attributes will include the ability to foster an inclusive and psychologically safe work environment. Carignan said inclusivity and the ability to lead different people with diverse backgrounds and experiences will be "key to our future, because building a strong cohesive team is at the heart of an effective military."

## TRACKING PROGRESS, MEASURING SUCCESS

The CAF has adjusted its performance review system to include criteria for fostering inclusive behaviour. All leaders within the CAF and the public service will be evaluated in this area, said Carignan.

"As soon as you start assessing people in that space, you immediately develop inclusive behaviours. All leaders at all levels across Defence — all supervisors — need to evaluate their subordinates and vice versa. This will be done at all levels: Army, Navy, Air Force and Special Forces."

When asked how success will be measured, Carignan said a framework is being developed that incorporates best practices and a mix of quantitative and qualitative data. "We are already doing that, for public accountability, in terms of annual reports on sexual misconduct. My intent would be to do that on an annual basis, [to see] where we are in terms of culture."

She said the CAF is consulting with other allied military forces around the world to identify the best path forward, particularly when it comes to

## SOFT-SKILLS INSTRUCTION

The Combat Training Centre (CTC) in Gagetown, N.B., is in the midst of building a comprehensive Instructor Development Program (IDP) with the aim of enhancing the interpersonal skills of instructors. Instructors are a conduit for the socialization of soldiers and must model the behaviours and values the CAF upholds as an institution.

The current Instructor Standardization Training informs 'how' and 'what' technical skills are taught, but does not focus on the overall environment where the training will be delivered. CTC is now requiring that instructors also create and shape a safe and inclusive, yet demanding training environment to enable student learning and growth.

The new IDP permits instructors to obtain a greater understanding of themselves, focusing on five key attributes:

**Power Dynamics:** How power affects a relationship between two or more people;

**Empathy:** The ability to understand and share the feelings of another;

**Emotional Quotient Inventory (EQi):** Self-rating assessment for emotional intelligence;

**Biases:** Feeling or displaying prejudice; and

**Behavior Modeling:** Portraying the example the Army wants members to emulate.

The IDP represents an investment in instructors, the training system, and the overall production of world class soldiers.

Cpl Garcia of the Loyal Edmonton Regiment, during Ex. Western Sabre in August 2021. Photo: Pte Daniel Pereira

handling sexual misconduct allegations.

"We are going to the heart of what allows misconduct to happen . . . looking at the various processes but also doing the work with individual behaviour, to understand what allows people to misbehave. What creates an environment where people can get away with misbehaviours?"

As an example, the CAF is currently working on an exemption for its so-called "duty to report" for cases of sexual misconduct.

"Members of the military are currently obligated to report any type of misconduct or infractions," explained Carignan. "This duty includes all forms of misconduct and infractions to make sure we address wrongdoings, or do not walk past unacceptable behaviours that may be harmful to the team, individuals or the mission. However, when dealing with sexual misconduct, this has impacted the way victims feel about coming forward and reporting. In other words, it has been identified as a barrier to reporting.

"We are developing a policy exemption but understand that we need to first modify the regulations. This can be a long process, as we first build the policy and then run it through the regulatory change process. But we are moving full speed ahead to make that exemption a reality."

Carignan said the CAF's revised ethos and the changes it will bring are different from past efforts to reform the military. It will involve consultations with various experts, both internal and external. Five advisory groups within the Department of National Defence will inform future policymaking.

"We want to understand our member experiences and this is what will be fundamentally different."

A five-year horizon is being planned for sustained change. Carignan said culture is a continuous and deliberate effort and "it's not something we will fix and then move on to something else." Instead, she explained, the CAF is working to build the capacity and processes for "constant and continuous" culture monitoring.

Some pilot projects are already underway, at CFB Gagetown, for example, where a review is evaluating how instructors deliver training.

"Instructors have a lot of influence on culture, so how we conduct training has a lot of influence on the culture of new recruits and future instructors," said Carignan. "So, it's key to review how we conduct this training.

"We must match grassroots initiatives as well as top-down guidance," she continued. "Culture belongs to all of us, so it's important to do work across all services because they have ownership of culture change initiatives. At the strategic level here, we will look at the systemic processes that influence culture, such as how we recruit, retain and conduct succession planning. There is also an internal portion to people which is how they embody or live values on a daily basis. *Trusted to Serve* aims to clarify those concepts."

Having the right culture will allow the CAF to be more effective in addressing complexities in the security environment of the future, she added.

"Just to be clear: Culture is not a 'nice to have.' It is the foundation of military and defence effectiveness. It's about creating strong teams that can tackle very difficult situations, sometimes in a very hostile environment. It is not something that sits on its own, on the side. Culture is at the heart of everything we do." ■

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LGen Carigan during a town hall address in Winnipeg. Photo: MCpl Darryl Hepner

Soldier on patrol during Op Nanook-Nunalivut in February. Photo: Lt Miguel Moldez

Nova Scotia Highlanders member in urban ops training. Photo: MCpl Trevor Matheson

Cpl Joseph Lovell of The Loyal Edmonton Regiment, C-Company, navigates through the snow while conducting winter survival skills training in Yellowknife, NWT, in January 2019.
Photo: S3 Alexandra Proulx

Members of the Loyal Edmonton Regiment conduct a live-fire mortar fire mission during Exercise Western Sabre in Wainwright in August 2021. Photo: Pte Daniel Pereira

Members of the North Shore (New Brunswick) Regiment in Ex. Rapid Response 22. Photo: Cpl Brad Upshall

# Reserve Readiness

## A new standard for minimum training requirements

By Ken Pole

Military readiness requires the Canadian Armed Forces (CAF) to be mission-ready at all times. That's all well understood by the Regular Force, but what about the thousands of committed Canadians who serve in the Reserve?

The Royal Canadian Air Force and Royal Canadian Navy have 2,000 and 4,000 Reserve members, respectively, to meet their needs. The Canadian Army, however, has a far larger Reserve Force, close to 27,000 mostly part-time members, 22,000 in the Army Reserve and 5,000 Canadian Rangers, who want to serve where and whenever they are needed. Ensuring their skillsets are at a requisite level to meet the demands of domestic and international operations presents a challenge. The Army is currently re-defining what this type of readiness looks like for the Army Reserve.

Addressing that challenge falls to Brigadier-General Nic Stanton, the Director General Army Reserve, whose 34-year career has included deployments to Bosnia-Herzegovina and Iraq. He's overseeing a push to ensure that the "part-time components" of the Army become "an equal contributor" to the One Army Team overall.

The CAF has a Regular Force of 68,000 personnel and a Reserve Force of approximately 30,000 personnel. While the Reserve is considered an integral component of the machinery, policies have not kept pace with their readiness and integration. "Most of our policies for how we manage our people are very much the middle of the last century," Stanton told *Canadian Army Today*. "We have not addressed most of the compensation, benefits and terms of service – key enablers to Reserve service."

In *Strong, Secure, Engaged*, its 2017 defence policy, the government said its "new vision" for Reserves would enable them to provide "full-time capability through part-time service." Nearly four years later, the new Chief of the Defence Staff, General Wayne Eyre, laid out a daunting assessment of the changing world order and its "far-reaching and cascading implications for Canada" and its military. Among other things, he warned of "the continued rise of extremism in novel and unpredictable ways," coupled with the expansion of cyber and other technologies which themselves present a threat. "In the face of this change and continuity, land power retains its relevance and criticality to achieve decisive outcomes," he said, but "to succeed in this milieu, the Army we have is not the Army we need."

Hence, one of the key elements of *Advancing with Purpose: The Canadian Army Modernization Strategy*, is a One Army approach incorporating Regular and Reserve Force, Canadian Rangers, and civilian resources.

Insofar as the Reserves are concerned, Stanton said one approach would be to say, "okay, part-timers do more, commit more time" in the Army. "Well, no," he said, immediately discounting that idea. "A part-time Reserve force is by definition not the same as the Regular Force, and people need to be able to balance their multiple commitments to work, family, and the Army. Most Reservists are already working a significant number of days annually. What we need are new policies by completing the background staff work, that will enable and allow people the flexibility to serve, and for the Army to understand what those restrictions in their lives are, and also the needs of the Army."

That's where the Soldier Readiness Policy – Reserve (SRP-R) comes in. "SRP-R will establish the minimum annual training requirements that all members of the Army Reserve must achieve, in order to maintain their status as a member of the Canadian Army, achieve readiness for domestic operations, and provide a known state of One Army readiness."

Over the past couple of years, Stanton has had working groups reviewing representations from all Army formations, with an aim to drag the working environment into the 21st century by next September. "We looked at it from the perspectives of the individual, the collective unit, and the hybrid – as we

Capt Darren Turner of 37 CBG examines a scenario map during a domestic operations training validation, Ex. Staged Response, in September 2021.
Photo: MCpl Brian WattersImagery

do with all things. We had to start somewhere, ensuring we are synchronized with the modernization strategy."

The Army is halfway through an unprecedented one-year SRP-R pilot – which Stanton explained is a push to communicate and understand readiness and the new policy – asking, "Are we missing anything? Are there lessons we can learn early?"

Before the SRP-R, there was no performance standard for the Reserve, only attendance requirements. The new SRP-R recognizes the need for Reservists to balance the requirements of both their civilian and military lives. Under the policy, when a member cannot, for valid reasons, attend all scheduled unit training activities (approximately 40 days per year), the minimum standard they must now achieve is to turn out for at least 10 training days each year, attend unit training at least once every 60 days from September to May, and in that time complete a variety of essential readiness activities. This will ensure that Reservists are up to individual combat standards and also CAF mandatory activities, he said.

Under the new policy, readiness for an Army Reservist is considered to be when the member is effective in their attendance, and has completed the required essential activities. Giving a soldier a predictable minimum standard, they now know what they must achieve when they have schedule and commitment conflicts to resolve, Stanton added. This will allow soldiers to plan ahead, be better prepared, and most importantly be "ready."

The policy will make sure that more Reservists are ready for domestic operations. Notable recent deployments include responses to severe flooding in Quebec, wildfires and floods in the West and, nationally, the coronavirus pandemic.

When Covid-19 erupted two years ago, "few people realized the potential for the largest activation of Reservists since World War II," Stanton said. More than 8,000 Reservists and Canadian Rangers volunteered for operations in 2020. "That significant contribution confirms that people are ready to serve."

Reservists are clearly incented to keep their training up to date if they want to be deployed at home or abroad. While personal and professional life outside the military can be challenging to balance with a military career, "what we're asking for is availability and predictability during the year," he said. "If you're a member of a regiment [and you want to deploy on expeditionary operations], you know and can ensure that 18 months out, you've got to have your baseline readiness good to go."

What happens when an employer won't free a Reservist for what could be several months? "It always has been a challenge; it has been for me," Stanton replied.

It's an issue being tackled by the Chief of Reserves and Employer Support, Major-General R.R.E. "Rob Roy" Mackenzie. Mackenzie, who works from National Defence Headquarters in Ottawa, also leads by example; his full-time employment is as a patrol sergeant in the Vancouver Police Department, but he has served on operations in Cyprus, Central America, and Afghanistan.

"We've done a lot of work with employers to have a Reserve policy," said Stanton. "My former employer had a very clear policy that allowed you time off (for a deployment). But we also need time off for training, career courses and the like. That's being worked on for sure."

It's a long-standing challenge as evidenced by the fact that some provinces with large Reserve populations – British Columbia, Ontario, and New Brunswick – still do not have government policies supporting time off

Members of the Nova Scotia Highlanders during urban operations training in February 2022. Photo: MCpl Trevor Matheson

Cpl Jarrett Butler explains the functionality of the Ground-Air-Transmitter-Receiver for remote satellite connection. Photo: MCpl Brian WattersImagery

for Reservists to conduct necessary training. Of note, Ontario just recently announced proposed legislation to address this.

Predictability enhances readiness. "If a trooper tells the boss they need to take six months off 18 months down the road, that's something the [employer] can work around," Stanton noted. Though the business culture in the United States is more attuned to supporting deployed employees, the CAF can "send someone who can talk to your employer, realizing the value of the training the employee receives in the Reserves, the leadership skills, and so forth, that is completely applicable to supporting their business. We can help to build a positive employer-employee relationship."

Canada is not alone in striving to improve Reserve readiness. Stanton belongs to several forums, one of which is an ABCANZ (American, British, Canadian, Australian, New Zealand) Army Reserve platform. "Some of the influences on our policy came out of the U.K., Australia and the U.S," he said. "Now they're interested in how Canada is implementing its policy changes."

So, too, are members of the Army Reserve and their families – as well as their employers. ■

Reservists from 38, 39, and 41 CBGs, part of a Domestic Response Company, suppress hotspots while fighting wildfires near 100 Mile House, B.C. in August 2021. Photo: S1 Victoria Ioganov

Ex. Maroon Sojourn 22 included instruction from 37 Combat Engineer Regiment and 1st Battalion The Royal Newfoundland Regiment on building improvised shelters, fire making and smoke signal generation. Photo: WO James Roberge

# Finding opportunity in an Arctic pivot

## DESPITE THE RISE OF OMICRON AND, IN SOME CASES, A LACK OF SNOW, 37 CANADIAN BRIGADE GROUP VALIDATED MANY OF ITS ARCTIC RESPONSE COMPANY GROUP BATTLE TASK STANDARDS.

By Chris Thatcher

Each year several hundred Reserve members from across 37 Canadian Brigade Group (37 CBG) arrive in Happy Valley-Goose Bay, Labrador, for a collective exercise to validate the capabilities of an Arctic Response Company Group (ARCG). The brigade is one of four in Canada responsible for the critical Reserve mission task and Exercise Maroon Sojourn is a core event for demonstrating its ability to conduct a wide range of operations in Arctic and sub-Arctic conditions.

Like many units of the Army Reserve, the members of 37 CBG have seen their training plans significantly disrupted by the Covid-19 pandemic. Winter warfare exercises have been no exception. Maroon Sojourn was cancelled in 2021 and potentially faced a similar fate in 2022 as cases of the Omicron variant rose in New Brunswick and Newfoundland and Labrador.

"We realized this year would have considerable challenges with the Omicron variant," said Colonel Gregory Kennedy, the commander of 37 CBG. An outbreak among the usual contingent of 300 to 400 soldiers would quickly overwhelm the health services on the base and in the community of Goose Bay. The exercise normally involves visits with First Nations and Inuit leaders and their communities, and "early on they signaled to us that this was a concern."

The result was a decentralized version of Maroon Sojourn, geographically based in three locations to minimize interprovincial travel while simultaneously encouraging the largest number of members possible to engage in winter-focused training.

In the area of Emerald Vale, about 80 kilometres west of St. John's, Newfoundland, the 1st Battalion, Royal Newfoundland Regiment led a weeklong exercise in mid-February to coincide with the Newfoundland winter break.

On the west coast of the island, the 2nd Battalion, Royal Newfoundland Regiment conducted a series of exercises over multiple weekends focused on mobile operations and winter survival training. As much of the current ARCG leadership is from the Regiment, most have completed the Army's Cold Weather Operator Course and are qualified in Light Over Snow Vehicle

A member of 1st Battalion, The Royal Newfoundland Regiment conducting cold water immersion training. Photo: WO James Roberge

Members of the North Shore (New Brunswick) Regiment and the Polish 25 Air Cavalry Brigade during light-over-snow patrolling near Bathurst in March 2022. Photo: Cpl Brad Upshall

(snowmobile) operations, so the training had a more tactical focus.

And in New Brunswick, the North Shore (New Brunswick) Regiment led soldiers through winter skills training and over-snow manoeuvres on the trails and training areas between Campbellton and Miramachi over the week of the March break.

Though weather conditions were not quite the same as the often-frigid temperatures of Goose Bay (for example, the St. John's portion of the exercise occurred with little snow), the brigade was "still able to practice many of the same ARCG core key competencies," said Kennedy.

Training events at all three locations involved winter warfare and survival, including defensive winter warfare tactics, live-fire rifle training, combat casualty care, snowshoe operations, dismounted patrol tactics, and tactical manoeuvres in austere conditions.

"One of the great things that has come out of this is that we have been able to add some skills, things we wouldn't normally be able to do because of the scope and time involved," said Kennedy.

In New Brunswick, ice fishing and trapping expertise was incorporated to help soldiers learn how to live off the land, while in Newfoundland, Reserve members with civilian jobs as paramedics and other health professionals led survival training in through-the-ice incidents. "That's not something we have done in the past," he said.

The ARCG has been a core mission task for the Army Reserve since 2007 (the Strengthening the Army Reserve initiative in 2016 added others such as assault pioneers, cyber protection troop, mortar platoon, and light urban search and rescue). Ex. Maroon Sojourn is structured to validate winter warfighting capability in an Arctic context, but the exercise scenario has shifted in recent years from a focus on domestic operations to one incorporating tactical components based on the Army's Decisive Action Training Environment (DATE).

"This is not the same kind of training you would see in preparation for Op Reassurance in Latvia," said Kennedy. "The enemy we would face in the Arctic is quite different. There is an emphasis on integration across the Army, including with the Canadian Rangers, so we have been selecting exercises where we can do that. This exercise has a DATE piece that includes protecting critical infrastructure, providing reconnaissance and patrolling, information gathering, and providing leader engagement and key support to an isolated community in a humanitarian situation."

## LOCAL INITIATIVE

The modified version of Ex. Maroon Sojourn might not test and validate ARCG battle tasks standards (BTS) in quite the same way as previous exercises, but it will ensure certain BTS such as battle procedure, command post operations, patrolling and local defence are still met. Rather than view the "pivot" to a dispersed exercise as a disappointment, Kennedy saw it as an opportunity for local leadership to demonstrate more initiative, introduce new

Polish infantry were also part of Ex. Northern Sojourn near Goose Bay, Labrador, in March 2020, working with members of 37 Canadian Brigade Group. Photo: DND

skills, and broaden Arctic training to a wider Reserve audience.

"This has been an opportunity for local leadership to step up and not just participate in a division- and brigade-led centralized exercise; they are using their own initiative to propose the activities that make sense and are of particular interest. Local NCOs and officers showcased their talents, both military and from their civilian careers," said Kennedy, a logistics officer by trade and Reservist since 1997 who assumed command of the brigade last June.

"It was still a great opportunity to practice a number of BTS and to expose a greater number of soldiers, particularly junior soldiers who maybe would not have been fully qualified or ready to go to Labrador and into that austere environment. More brigade soldiers were able to complete a Cold Weather Operator Course (CWOC) or practice more advanced survival techniques, and they will have more confidence and perhaps be more motivated to [participate] next year when we go back to Goose Bay. This was really about capacity building for the future."

The exercise also involved specific training for members of 37 Combat Engineer Regiment, 37 Signal Regiment, 37 Service Battalion, and 35 Field Ambulance, including an emphasis on sustainment of the regiments while they were operating in the training areas.

Previous iterations of Maroon Sojourn have involved international participation, including members of the United States National Guard, who have provided logistics convoy support to move supplies and vehicles north to Labrador. That too was scaled back, though a small contingent of 15 Polish infantry from 25 Air Cavalry Brigade returned to join the New Brunswick exercise for the CWOC and mobile operations, and to continue to build on a winter training partnership extending back several years.

"On a larger scale, I see this as part of reconstitution, as part of retention. When soldiers can be trained locally, be led by local NCOs and officers who get the chance to be involved and innovative, that builds cohesion and trust across the force," Kennedy stressed. "I really believe this will help contribute to having a larger pool of people who are qualified and ready to go in future years."

A professor of early Canadian history at the University of Moncton for the past 12 years, he has seen the toll the pandemic has taken on his students and on Reserve members who have had their military careers disrupted by limited training opportunities and less opportunity to socialize and work with their regiments.

"When we can still do a meaningful exercise in this way, I think it sends a clear message to the soldiers and, hopefully, to local communities in Atlantic Canada, that the Army is well prepared and innovative for training, while ensuring safety. This is a way that we can build trust across the organization and with Canadians." ■

# RESERVE FLOOD PREVENTION

By Ian Coutts

Members of Lord Strathcona's Horse and 39 Canadian Brigade Group fill sandbags. Photo: Pte Daniel Pereira

***In November 2021 the government of British Columbia requested assistance from the Canadian Armed Forces (CAF) to deal with flooding caused by severe weather events in the Lower Mainland. The CAF was given the go-ahead on Nov. 17. As part of Operation Lentus, the CAF's ongoing aid to civil authorities, Captain Liam Lees, a member of Vancouver's Seaforth Highlanders of Canada, was among those from 39 Canadian Brigade Group who volunteered for service.***

Once the province identified the need for some extra hands on the ground, the ask went out to the units through the brigade. It was really positive in terms of the response. In three days, we put together a company-sized unit of soldiers who were ready to go out the door. In the Reserve world, sometimes it can be a little bit tricky with regards to managing your civilian job and your Army work. But it was really quite impressive how fast we responded, how fast we were able to generate the soldiers, and then how respectful their employers were of their request as well. From there it was a matter of determining where we would be operating out of.

***Lees was in command of one of three platoons drawn from across the brigade's units. For the duration of the emergency, they were stationed in Chilliwack, using the RCMP facility there, and commuted daily to the affected areas throughout the Fraser Valley. They connected with elements of Lord Strathcona's Horse (Royal Canadians) (LdSH(RC)) who had travelled from Edmonton.***

The main headquarters element was the LdSH(RC). They were delegating tasks based on our area of responsibility. A lot of the tasks came down to filling sandbags and generating a reserve stock the civilian population could use to reinforce their homes or producing those sandbags as water deterrents, building walls, building dikes, that kind of thing.

***Lees and his fellow soldiers were called on to assist in several communities along the Fraser and Sumas Rivers.***

Our tasks stretched over a wide area. We went all the way up to Boston Bar [a small community along the Fraser River] to complete a sandbagging task to protect their local fire hall, and we left a big supply of sandbags behind for the local population to take home and use around their properties.

***Heavy rains washed out roads and railway lines, endangering human life and damaging the British Columbia economy.***

We had a massive stretch of railway, near the Sumas-Huntingdon Border Crossing, that we were sandbagging along. We probably started about 0700. As the day went on the rain just kept getting worse. It was crazy because more and more of the local population kept showing up. Here's a couple of tents to warm up in when you're ready, here's some coffee for you to stay warm. Before we knew it, we had three separate warming sites with homemade meals and carafes of coffee. In the evening, these people start showing up with rain gear and rubber boots, and their shovels and [started] filling sandbags. A mixed population – older folks making sure everyone was warm and getting fed, kids with beach type shovels trying to help out and fill sandbags. It was quite the collective effort to see.

The next day, we blocked off Highway 1 to prevent any further mess. We employed a tiger dam at that site. That's an orange fillable tube. The nice piece there was that, as part of the Reserve force, we hit different training objectives sometimes than our Regular Force counterparts. With the tiger dam, we had a bunch of soldiers already trained in how to deploy it and how to pack it up, so it was really advantageous.

***By early December, the rain was letting up, the floodwaters were beginning to recede and the emergency was ending. The CAF started drawing down its forces on Dec. 6. The operation concluded on Dec. 17.***

By the end, we had quite a few days of working together as a team and we were quite accomplished. As the waters began to recede, things got a little lighter in terms of the tasks. Overall, we were there three weeks. The one big perk was that all our soldiers had friends and families and connections with these local communities. I think that being able to step in and make a big impact on the ground was a really positive experience. The other side of that was the appreciation and the support that we got from the local communities. ■

Caption: Capt Liam Lees of the Seaforth Highlanders of Canada on camera.

Soldiers reinforce a riverbank in Princeton.
Photo: Pte Daniel Pereira

# ON UNIFIED RESOLVE, EXPERIMENTING WITH COMBAT CAPABILITY

By Chris Thatcher / Photos by Cpl Melissa Gloude

When the headquarters staff of 2 Canadian Mechanized Brigade Group (2 CMBG) participated in Exercise Unified Resolve 2021, their first actions as a flanking brigade to 1 CBMG, the primary training audience, were a relief-in-place of local forces followed by a major river crossing in enemy territory.

"We were right on the offensive," recalled Colonel Eric Landry, commander of 2 CMBG. "This year was very different."

Unified Resolve is the Army's largest computer-assisted training event and often serves as a validation of the brigade headquarters and the command staff of key subunits on the brigade's build year to high readiness for contingency operations.

In previous years, the exercise has played out over a battlefield among fictitious countries set in the Caucasus Region, supporting an ally against a near-peer enemy in a complicated battlespace involving insurgent activity and criminal organizations.

Last year, the Canadian Manoeuvre Training Centre (CMTC), which delivers the Army's core collective exercises, and the Canadian Army Simulation Centre, which designs and develops the scenarios supporting them, adopted a new Eastern European overarching scenario from the Decisive Action Training Environment (DATE), a database for generating exercises.

The shift from the Caucasus to a training scenario set along Europe's eastern borders meant a decidedly more defensive focus, with operations centred on defending a NATO ally from a foreign invader. When Unified Resolve 22 (UR22) began on Jan. 24, rather than advancing an attack as in previous exercises, the brigade was holding ground near the border of a NATO partner, facing an autocratic neighboring state, Donovia, planning an incursion as soon as a 150-day ceasefire ended.

"When that ceasefire ended, they crossed into NATO territory. We did what we call a mobile defence, conceding a little bit of ground to the enemy in order to destroy it and then go back on the offensive to re-establish the international border," Landry explained.

Army members participated from three locations in Ex. Unified Resolve (UR22) this year.

Col Eric Landry, commander of 2 CMBG, meets remotely with Red Cross representatives.

"The tactical plan from the Corps level was to make the enemy believe that we had a hard defensive line right on that ceasefire line," a deception to give the impression of success as Donovian forces penetrated over the border. "What we wanted to do was lure the enemy in to achieve an easier destruction."

The change in the scenario and the initial response reinforced some hard-learned lessons and introduced a few new ones.

For the first time, the brigade was provided a simulated British Army divisional reconnaissance battle group, but when the fighting reignited after the ceasefire, "they did not have enough space between the ceasefire line and our main defence to really identify where the enemy's main push was," Landry said. The result was heavy casualties and an enemy force that very quickly came in close contact with the brigade. "It was a tactical lesson learned: If you are going to use ground reconnaissance troops, they need space to manoeuvre and they didn't have that." By not integrating the division reconnaissance "in an optimal manner … [it] had an impact on the conduct of the operation."

UR22 continued to emphasize the importance of using non-kinetic capabilities in a complex battlespace. Failure to think about and employ civil-military cooperation (CIMIC), psychological operations (PSYOPS), information operations, and public affairs officers quickly had an impact on how local populations, refugees and the Canadian public responded to the brigade's actions.

Landry noted the deliberate working groups and training that goes into generating kinetic effects such as fires and suggested more work remains on how best to use non-kinetic effects. "They shape the battlespace almost as much as artillery," he said.

"We had to use our own assets to move civilians during the exercise," so synchronizing the effects of CIMIC and PSYOPS with combat support, rear area security, and the manoeuvre unit was critical to ensuring "they were all conveying the same message to the civilian population" and coordinating their actions.

Many of the injects thrown at the brigade remained the same, including engaging with non-governmental organizations like the Red Cross and with local religious leaders, as well as responding to a barrage of cyber threats and information operations. But it was the subordinate commanders and staff of 2 Combat Engineer Regiment, 2 Service Battalion and the 2nd Regiment of the Royal Horse Artillery that "were challenged the most during the exercise," he said.

UR22 also saw the ongoing experimentation with a new model for integrating the enablers of the Canadian Combat Support Brigade (CCSB).

Col Landry and Capt Luke Mitchell, the Combat Support Group Chief of Information Operations, discuss intelligence assets and analysis.

Rather than each unit of CCSB arriving with its own command team, CCSB began trialing a concept last year known as the Combat Support Group (CSG) to provide the manoeuvre brigade commander with a single point of contact to plan and generate the effects of sensors such as small remotely piloted aircraft, medium range radars, electronic warfare and, most importantly for Landry, "a lot of intelligence assets."

"Integrating the CSG into the brigade played a big role in me knowing where the enemy was, what it was doing, and what were its intentions," he explained. "It became a big part of the brigade fight and a key enabler to achieving our mission."

The CSG concept is still being refined, so Landry took the opportunity to test an idea by providing the CSG with a light cavalry squadron for part of the operation. "Most of their sensors are not ground based, so for them to have ground sensors helped plug gaps when they were trying to paint the enemy picture as a whole."

Adding to the realism of the exercise, 1st Canadian Division Headquarters played a more direct role as a multinational division command, meaning Landry reported to Major-General Mark Misener, commander of 1st Can Div, rather than a partially simulated command. "When I debriefed my boss, it was a real general who had his own concerns and for whom I was not always the main effort," he said. That forced him to think through how his plans aligned with the other formations in the division. His frequent phone conversations with flanking brigade commanders and the division commander "added a lot to the kind of pressure I would feel for pushing information upwards. I think it was far more realistic."

As part of the NATO context, the exercise included a Latvian mechanized brigade, the U.S. Army 2nd Stryker Brigade Combat Team from the 7th Infantry Division, and reconnaissance forces from the British Household Cavalry, all of which were present in the divisional headquarters. "International collaboration brings its share of friction, so practicing this when no lives are at risk is always a good idea," Landry added.

MGen Michel-Henri St-Louis, Acting Army Commander (centre), during a "theatre" visit.

## TAKING IT TO THE FIELD

Much like in 2021, Unified Resolve was downsized to respect local health authority concerns about a rise in the number of Covid-19 cases caused by the Omicron variant. CMTC originally planned for about 1,500 participants but reduced that to around 900 at three locations in Petawawa and Kingston, Ont., and Edmonton, Alta. Most participants had three vaccine shots and rapid tests were conducted every second day over the eight days of the exercise. Soldiers also wore N95 masks throughout. Just two asymptomatic cases were detected.

Members of 2 CMBG HQ on the first day of the exercise as the brigade conducted defensive operations.

Lt Hamilton prepares a brief of UR22.

Normally a 24/7 training event, UR22 was scaled back to 10 hours per day (in 2021 it was 12) to reduce the number of soldiers and contracted support. "I got what I needed to get out of it," Landry affirmed. "You can double shift, day and night, but the key people are still the key people. And I certainly appreciated not being woken up at 0200 to be told a Chinook [helicopter] had crashed."

The manoeuvre units worked with the equivalent of tactical forward command post staff, but the three subunits being validated had their full headquarters.

With members of the 3rd Battalion, The Royal Canadian Regiment (3 RCR) conducting training at the Joint Readiness Training Center in Fort Polk, Louisiana, Landry integrated Reserve members from across 4th Canadian Division to form an infantry battalion. 4 RCR, as it was called, conducted rear-area security, flank security and other tasks "that I normally could have given to 3 RCR," he explained. "It reinforced the One Army concept, and it gave these Reservists good exposure on what the Regular Force brigade and division have to deal with when they train at Level 7."

As 2 CMBG prepares for exercises Maple Resolve and Intrepid Bear, a combined arms live fire event later this spring, Landry is planning to take ideas that worked well in a simulated environment and trial them in the field. On UR22, he employed the Royal Canadian Dragoons as a cavalry regiment, expanding their normal footprint of two light (wheeled) squadrons and a heavy (tank) squadron to three heavy squadrons and one light squadron.

"They were used in a manner to counterbalance what the rest of the brigade was doing," he said. Major events like the demonstration at the ceasefire line, then a rearward passage of line, followed by a counterattack, consumed "a lot of my fire power and resources," including "most of my planning assets and most of my enablers," all of which needed to be reconsolidated and built back to combat strength.

"During these lows where the enemy can regain the initiative, I used the Dragoons as a counterforce. When most of the brigade was doing a main event, they were in a more defensive posture; when most of the brigade was consolidating, they did something very offensive to keep the enemy thinking and on its toes while we were trying to build back our combat power. That concept worked very well."

During the first defensive manoeuvre following the end of the ceasfire, the Dragoons gave him some flexibility to respond to the initial assault on his division reconnaissance battle group. "It was a different way to fight the brigade, but I'm happy with what was accomplished. It's certainly a concept that I will keep using during Maple Resolve and some of the other follow-on field training exercises. It's good to see icons do it, now I really want to do this with vehicles on the ground. For this exercise, it was a cavalry force, but it could have been 3 RCR used in an air mobile role. The idea is to always have the enemy thinking about something else." ■

A member of 1 RCR during Ex. Royal Rumble in Petawawa, Ontario, in November 2021, prior to undergoing Ex. Unified Resolve. Photo: Dan Rogall

# MALWARE DETECTED

By Ian Coutts

In life, the devil is in the details. In exercises like Unified Resolve, the details are in the injects. For UR22, the exercise controllers (EXCON) delivered a new little twist. As 2 Canadian Mechanized Brigade Group worked with NATO allies to defend an Eastern European border from an invading force, the EXCON inserted a malware attack.

It wasn't intended as part of some fiendish strategy on the part of the enemy. Just one of those glitches that can potentially derail the actions of a modern networked army.

Injects are precisely what the name suggests — something injected into the simulation or live training event, sort of rogue variables that must be dealt with or they can take the exercise in a different direction. Their use predates today's elaborate simulations, but the idea behind them remains the same as in the days when they were written out on a piece of white card — to subtly or not so subtly reinforce certain responses or behaviours and to make sure that training goals not explicitly embedded in the Decisive Action Training Environment (DATE) scenario are achieved.

The malware attack was not drawn from the DATE script. It was developed by the Canadian Army Simulation Centre (CASC) as a way of driving home to participants that kinetic warfare in the 21st century will have a large cyber aspect, and they'll be as vulnerable in that realm as they might be to an artillery bombardment.

Other injects dealt with problems with space-based assets, another area becoming of increasing importance to operational commanders.

Lieutenant-Colonel Lesley Kerckhoff, the exercise director who conducted the multi-location training event from CASC in Kingston, Ont., said UR22 included more than 500 injects. Not all involved coping with technological innovations that are transforming warfare. One that has also complicated matters for the brigade headquarters staff in previous iterations of Unified Resolve was the announcement that child soldiers had been seen on the battlefield.

"It's a great inject to ensure that we're not just thinking kinetically, that we are also thinking ethically, morally, and looking at what's right in the actions of our people," said Kerckhoff.

Not all injects developed for the exercise are used. A lot depends on how the training audience reacts. Injects are written so that they can work in sequence. The initial inject for the malware attack, for example, might be "malware detected on a station," explained Eric Norton of Calian Group, the Ottawa-based contractor that supports CASC. From there, additional injects might be used, "adding more detail and information for the training audience so they start to initiate whatever it is that they need to do."

Each inject or series of injects has a desired result – if the training audience meets that, then subsequent injects can be dropped. On the other hand, said Norton, "if they didn't quite get it," the exercise controllers can create further injects to lead them along. It is a dynamic process.

Creating the injects for an exercise like Unified Resolve is a year-long process that begins not long after the previous year's event has wound up. Calian draws on a range of military and civilian experts to develop them, based on the training principles the Canadian Army wants reinforced. They are presented in a way that will "tickle the training audience" into responding the way the Army wants, said Norton. ■

A member of C company, 1 RCR, on a dismounted section attack in Petawawa, Ont., in May 2021. Photo: Cpl Sarah Morley

# What's replacing the C7 assault rifle?

By Ken Pole

There's no gainsaying the history of the Colt Canada C7 rifle in the hands of Canadian Army operators – essentially an evolution of the venerable U.S. Colt M16 that has been used by many NATO allies. But neither is there any question that it has been overtaken technically after more than three decades.

The government acknowledged that in its 2017 *Strong, Secure and Engaged* (SSE) defence policy, confirming the Army would undergo long-term recapitalization of "much of its land combat capabilities." Among those was a new Canadian Modular Assault Rifle (CMAR) to replace the C7, the Canadian version of the M16A2.

Ensuring the CMAR plan becomes reality is up to a small team coordinated by Major Carl Gendron, program director of Army Small Arms. A member of the storied Royal 22e Regiment, his career has included deployments to the Middle East, Bosnia, Afghanistan, and Africa that honed his awareness of modern combat environments.

The CMAR project is currently in the options analysis phase, and he expects to enter "the definition phase by the end of 2022," he told *Canadian Army Today* in February. "By then, we'll know if we're going to do an upgrade or buy a new design. If it's a major upgrade to the C7 or C8 or if it's an entirely new design, we expect it to be made through Colt Canada."

A division of the historic U.S. firearms company, which is now a brand of the CZ Group, Colt Canada is the government's Small Arms Strategic Source and Centre of Excellence, with a workforce of some 100 at its facilities in Kitchener, Ontario.

Ultimately, Gendron is looking for an initial delivery of CMARs and related gear in 2026-2027, with final deliveries in 2032-2033. But he stressed that "everything would need to go very well. Until I'm ready to submit all the financials and get approvals, I don't know the exact timeline." While the budget is not finalized, it's estimated at around $500 million.

"I wish we could streamline the process," he replied when asked about what seems to be a lengthy timeline. "One of the big issues is the amount of paperwork the staff is required to produce at each step and level of the process." The project office must generate large amounts of data, delve into all the technical minutiae and figure out exactly what it's going to cost. That alone can take three years, by which time "you've proven that your plan is affordable and practicable."

Though still highly capable, the C7/C8 is considered by some to be a less able weapon than, for example, the Russian AK-12 assault rifle, which is said to exceed the Canadian rifle in terms of lethality, modularity, target acquisition,

night fighting capabilities and operator protection. CAF operators need a weapon that would enable them to function effectively across the entire modern combat spectrum, which can range from the Arctic to jungle or desert, and in congested urban theatres.

Gendron said the CMAR project is expected to yield a two-tier fleet: Full Spectrum (CMAR-FS) rifles optimized for high lethality in complex urban and open terrain offensive operations, and General Service (CMAR-GS) rifles for personnel protection. Regular infantry units, which provide the bulk of fighting dismounted troops, would be the main CMAR-FS recipients, while the CMAR-GS would be for more general distribution.

In parallel, the Army is prototyping the C8A4 upgrade to the current C8A3. This is meant as a test bed for many CMAR features as the C8A4 could become the upgrade option leading to the CMAR-GS. "It is based on the Colt MRR and will be no longer than the current C8 (84 centimetres or 33 inches), including a suppressor," said Gendron. "We are considering a new scope, new reticle, maybe a red dot also, a new trigger system, and several other improvements. We are currently working with Colt on testing and integration of all the components."

The CAF C7/C8 inventory currently totals almost 90,000. The CMAR project could reduce the fleet by 10 to 15 percent to better reflect the active employment of the rifles. Despite the fleet reduction, there would still be plenty of CMARs to cover all SSE deployments. Those deployed would be equipped with a mix of CMAR FS and CMAR-GS, which has slightly shorter barrels and range. The additional rifles would be for training and stockpiling to ensure operational readiness.

Other key elements of the CMAR project being considered include improved ergonomics and potentially lighter materials, as well as advanced day/night and close-quarters optics, a suppressor to limit an enemy's ability to locate where fire is coming from, the option of powering add-ons with a live rail, and the ability to integrate with soldier information and sensing devices.

Then there's the ammunition. The current NATO standard is a 5.56x45mm round, but Gendron noted in a previous interview about considerations for a new calibre or maintaining .556. In theory, the accuracy with the current calibre is excellent up to 500 metres and it has a surprising amount of energy left at greater distances. So, the project is looking at a new 5.56 mm bullet for the CMARs.

"Beyond extending the range, we can expect a new toxic-free cartridge as lead is a growing environmental and medical concern," he said. "The aim is to avoid sustained and long-term exposure to lead and related toxic chemicals that can cause medical issues later in life. Low toxicity rounds are becoming the norm as more countries restrict or even ban lead rounds for training."

A member of 1 CMBG on a level 5 range exercise, Agile Ram, in May 2021. Photo: Cpl Djalma Vuong-De Ramos

That improved round – currently called the XC77A2 – is being developed in conjunction with General Dynamics Ordnance and Tactical Systems and has already undergone testing with CMAR FS and GS barrel configurations.

Gendron noted that prototype live-fire tests of both the weapons and ammunition by users late last year were "very successful." He declined to elaborate, but the new round and several hundred rifles are slated for production this year to support larger scale testing and trials. ■

Prototypes of a pre-production C8A4/CMAR-GS weapon and extended-range, toxic-free ammunition. Photos: ADM (Mat) DSSPM 9

UKRAINE'S RESPONSE TO RUSSIAN TANKS IS A REMINDER THAT ANTI-TANK WEAPONS ARE STILL A NECESSITY

# Time for a new tank killer

By Staff

The steady build-up of Russian tanks and armoured vehicles along Ukraine's northern and eastern borders was a stark reminder of the relevance of anti-armour capability. Since the early 2000s, as priorities shifted from the Cold War to combat in Afghanistan, to potential conflict with peer adversaries, the Canadian Army has divested aging mounted and portable anti-tank systems and has yet to replace them with a more modern means of destroying tanks and fortified structures.

"We are overdue for a new anti-tank capability," acknowledged Major Carl Gendron, who leads the Directorate of Land Requirements (DLR 5-1) dealing with small arms acquisition projects. Among a lengthy list that includes everything from pistols to sniper rifles is the Anti-Tank Guided Missile Replacement (ATGMR), a relatively modest project valued under $1 billion for a multi-purpose, anti-armour and anti-structure, portable and mounted weapon.

The Army's sole tank destroying capability at present is the BGM-71 TOW (Tube-launched, Optically-tracked, Wire-guided) heavy anti-tank missile, developed by the Hughes Aircraft Company (since acquired by Raytheon Missiles & Defense in 1997) and first fielded in the 1970s.

Variants of the BGM-71 are still in wide use by almost 50 countries. But the semi-automatic guided TOW is a less than ideal weapon against modern main battle tanks with sensors able to detect optics in the battlefield. The TOW requires a shooter to continuously track a target with its optic sensor until the missile strikes, exposing soldiers for the duration, especially when two rounds might be required to defeat an active defensive system.

"When you are facing modern armor with enhanced detection capabilities and long-range guns in that kind of scenario, it becomes a very dicey proposition to go after a main battle tank in this way," Gendron noted.

So, the Army is pursuing a new generation of missiles that can be employed in various modes like direct fire, fire-and-forget, lock-on-after-launch, and fire-on-grid designated by somebody else. "If you cannot safely observe the target, you want to be able to launch a missile from a safe position and then acquire the target when it comes into view or just input a grid and have the missile bring you over the designated area to acquire and hit the target," he said.

The aim is to keep the human in the decision-making loop, while giving soldiers a non-line-of-sight capability to strike targets from behind the protective cover of buildings or terrain.

"Even if I am totally out of sight of the target, I can fire on a grid area, control the missile and lock on a target once I can see it," Gendron explained. That includes the ability to drop a round directly on top of a vehicle. "When we say we want to put a missile down the hatch, it is not a figure of speech."

Gendron noted that main battle tank defensive systems are "pretty efficient at stopping missiles that are coming head on," so as with the TOW, the next generation system must be able to fire two rounds in rapid succession, one missile to commit the defensive system and the second to breach and destroy the target.

As with the requirements for most new capabilities, the Army wants to shed weight and size while increasing range. Though the anti-tank system will have the option of being mounted on a vehicle, the intent is a solution that offers greater agility for dismounted infantry than the current TOW. Sprinting 100 metres or more to take up a position in a tree line or on an upper floor of a building is no easy feat with the BGM-71. Gendron wants less than 75 kilograms of kit for a three-person team carrying a control launch unit, a tripod and four missiles.

"It's not something they would carry for a long period of time," he said, "but we want to be able to deploy it down to the dismounted section level. If we wanted to stop a big armour push, we could grab two guys from each section to form a super anti-tank defensive position."

As for range, the Army requires a system able to strike targets from four to five kilometres away and defeat anything on the battlefield. It also wants thermal capability for night and low visibility operations. But above all, the new system must be easy to employ. "This is not a task for specialists," Gendron said. "We want any infantry soldier to be able to take it and use it."

He noted most of the systems he has tested are more intuitive than ever and have controllers like an Xbox. "You just put your hands on it and it feels natural." In one instance during a manufacturer's demonstration in a simulator, he accidentally fired the missile but was able to figure out the controls within the 30 seconds it took to reach the target.

The Army has attempted to replace its anti-tank capability before. Under a project called ALAWS (Advanced Lightweight Anti-Armor Weapon System), DLR sought a short-to medium-range anti-tank guided missile to replace ERYX, an MBDA-produced short-range portable wire-guided anti-tank missile that entered service in 1994. The ALAWS project ran into trouble in 2007 and was ultimately shelved in 2010 due to more urgent priorities. "This is a bit of a reboot of that," Gendron admitted.

At the time, the joint Raytheon and Lockheed Martin developed FGM-148 Javelin and a variant of Rafael's SPIKE were considered the two most likely options. Today, the number of contenders remains small, but keen interest is expected from those such as France's MBDA and Israel's Rafael once formal industry engagement begins.

The ATGMR project is still in the identification phase, but Gendron hopes that with some push a request for proposals could be released around 2025, after more urgent projects such as the Canadian Modular Assault Rifle are near implementation. Until then, the BGM-71 remains serviceable, albeit on its final legs. ■

Soldiers from 2 CMBG conduct TOW launch training in Gagetown, N.B., in 2017.
Photo: Cpl Geneviève Lapointe

# ADAPTIVE EXPERTISE: OP CALUMET

By Tim Dunne

Whether it's combat operations in Afghanistan, training armed forces in Ukraine, providing a deterrence presence in Latvia, peacekeeping in the Middle East, Africa and the Balkans, or domestic operations in support of destructive weather events or a pandemic, Canadians soldiers are adaptive.

"I believe that's one of the competencies that Canadians bring to a multinational force. We are very adaptive, and that comes from our training, our openness, and our diversity," says Colonel Pierre Leroux, an infantry officer with deployments in Bosnia, Congo, Afghanistan, and as the commander of Joint Task Force Ukraine from September 2018 to April 2019.

"If you look at all the missions to which we are called, you can see that they are quite different. We strive to gain an understanding of what it takes for capacity building, what it takes for counterinsurgency, what it takes for peacekeeping, and we can just put on different hats. I really think that's one of the Canadian strengths: to adapt to the circumstances and be effective contributors."

That skillset certainly holds true for Canadian Armed Forces (CAF) operations in the Sinai.

The Canadian military is no stranger to the Middle East. The first Blue Berets entered the region in 1948 with the United Nations Truce Supervisory Operation. The UN Security Council (UNSC) generated mandates to supervise, patrol, observe and report about the various ceasefire agreements between Israel and its neighbours. Thousands of Canadian Armed Forces personnel were awarded the medals and ribbons of the United Nations Emergency Force (UNEF I) (1956 to 1967), UNEF II (1973 to 1979), and the United Nations Disengagement Observer Force (1974 to the present).

The Yom Kippur War of October 1973 motivated Egyptian President Anwar

Members of the Canadian Contingent participate in a counter-IED recognition scenario during the Force Skills Competition in February 2022 at South Camp. The competition is the Multinational Force and Observers' premier military event that tests soldiers' individual and collective skills relevant to their duties in the Sinai. Photo: Force Photographer, Multinational Force and Observers

Photos: Force Photographer, Multinational Force and Observers

Sadat and Israeli Prime Minister Menachem Begin to take their first steps in the historic move to a first Middle East peace treaty. Sadat flew to Israel on Nov. 19, 1977, to meet his Israeli counterpart.

United States President Jimmy Carter then hosted both the Egyptian and Israeli leaders to formal peace talks in September 1978 at Camp David, near Washington, D.C. The result was the *Camp David Accords* and the formal ratification of a Treaty of Peace in March 1979.

The UNSC's abrupt cancellation of the UNEF II mandate in July 1979 left Carter concerned that a conventional UN peacekeeping force to supervise the implementation of the treaty was unlikely. The U.S. then negotiated with the treaty parties to establish an alternative force. The U.S. Sinai Field Mission (SFM), established in 1976, worked with the UN to observe the stipulations of the peace accord and monitor the Israeli withdrawal. The Multinational Force and Observers (MFO) was then established by a protocol to the treaty in August 1981.

As Israel completed its withdrawal from the Sinai, the MFO mission moved in in April 1982 and set up its main camps at El Gorah and Sharm-el-Sheikh to observe, verify and report compliance with and any violations of the peace treaty, and to ensure freedom of navigation through the Strait of Tiran at the southern entrance to the Gulf of Aqaba.

Canada joined the MFO on Jun. 28, 1985, and the Canadian Contingent (CANCON) was first formed in September 1985 under the mission title of Operation Calumet, comprising 408 Tactical Helicopter Squadron (THS) from Canadian Forces Base Edmonton, followed in six-month rotations by 427 THS (Petawawa), 430 THS (Valcartier) and 403 Helicopter Operational Training Squadron (Gagetown).

The calumet is a historic component of the ceremonies of First Nations groups, better known as the venerated "peace pipe."

"It's quite a legacy that we've developed. We've been here almost from the start," Leroux told *Canadian Army Today.* "Since then, there was always a Canadian contribution to the mission. Through the years, our contribution has continuously met evolving requirements, from helicopters in the early years to military police more recently."

The initial Canadian contingent was reduced when the U.S. military took over rotary wing operations in March 1990. Twenty-nine Canadians remained to serve with MFO Headquarters in El Gorah, Egypt. Fourteen serve on one-year tours of duty, the other 14 on six-month tours.

The MFO uses helicopters and small fixed-wing aircraft to travel throughout the mission area. CAF members, part of MFO Air Operations, coordinate air movements with local authorities and keep track of their positions. They also provide them with information on traffic, weather, and flight plans. It provides critical support to the mission.

With the drawdown of the military police contributions, Canada is focusing on delivering key capabilities to support the observation of the Treaty of Peace

and Agreed Activities and facilitate the continuing peace between Israel and Egypt.

"Canada actually provides key members of the MFO headquarters, all of whom are double-hatted with Canadian and MFO duties," Leroux underscored. "The Canadian contingent is led by a colonel or navy captain who also serves as the mission's chief liaison officer. Canada also provides staff officers, senior leaders and experts in logistics, engineering and training.

"Unlike some of the other nations that contribute specific capabilities to the MFO, we're spread out across the force. Most are in the Force headquarters, where we have people in almost all of the branches. For instance, we have eleven people in the J-3 branch, including seven in Air Operations, within the Force Operations Center. Three Canadians are in J-1, three in J-2 and two in J-4."

The contingent includes representation from across the CAF, with Army expertise drawn from the Tactics and Infantry Schools at the Combat Training Centre in Gagetown, to 5e Régiment d'artillerie légère du Canada, and Reservists from units such as 30 Field Regiment in Ottawa.

"While we have most of our folks in the headquarters situated at the southern tip of the Sinai, there are five to 10 of our 55 members working out of North Camp in the northern part of the Sinai, and we also have individuals and pairs at different locations across the Sinai for specific tasks," said Leroux.

"On top of that, we're also leading the J-7 branch, and I am the head of the liaison branch where we have another five Canadians. We also have the Force sergeant major position, currently held by Chief Warrant Officer Dominic LaPointe, a combat engineer senior non-commissioned officer. I am proud to say that a Canadian chief warrant officer has historically been the force sergeant major. That specialized Canadian capacity underscores the high quality of the senior non-commissioned officer corps of the Canadian Armed Forces."

One key to the Canadian contribution is technical competence and expertise, he said. "Each of us is here for our technical competence, to some extent. But it is our professionalism as a whole that brings us together and makes us what we are – a contingent that can be counted on by the MFO.

"In every one of those branches we have go-to people who make it happen every day. And that's truly a nod to our training system, and a nod to the diversity of our operational experiences, and how we prepare so we can be instantly effective when we hit the ground." ■

*Major Tim Dunne, CD, is a retired public affairs officer. His service includes peacekeeping and peace support operations in the Middle East and the Balkans. He is the recipient of numerous awards, including a citation from the Privy Council of Canada.*

**Master Corporal Samuel Martell,** 2IC OR, 84th Independent Field Battery, RCA

# HOW DID YOU GET THAT SHOT?

On Aug. 11, 2020, students on a Basic Military Qualification land course on the Bedford Range near Halifax, Nova Scotia were firing the C9 light machine gun for the first time. It was a foggy morning with sporadic rain showers, ideal light conditions for photography. At the time I was shooting with a Nikon D3200 equipped with a Nikon AF-S DX Nikkor 35MM F1.8G lens, a great starter kit for those looking to get into photography. I knew I wanted to shoot with a very fast shutter speed to get empty casings in the air. After taking a couple photos, I found the perfect spot behind the machine gunner and captured as many bursts as possible. This photo was voted as "Army Photo of the Year" in 2020 on Canadian Army social media, and can be found hanging outside the office of the Commander of the Canadian Army in Ottawa. ■

## CAMERA SETTINGS

| | |
|---|---|
| Camera | Nikon D3200 |
| Lens | 35 mm f/1.8 |
| Exposure | 1/3200 sec |
| Aperture | f/1.8 |
| ISO Speed Rating | ISO 200 |
| Focal Length | 35 mm |
| Flash | Did not fire |

# A GREENER FOOTPRINT

By Ian Coutts

The Army and DRDC are studying the environmental impact of munitions. Photo: Cpl Djalma Vuong-De Ramos

Thanks to the Canadian Army, life should be a little easier for the prairie skink. Although this small, striped lizard is mostly found in the United States, in a band that runs from the Gulf Coast of Texas north to the Dakotas, in Canada it is confined to one fairly small area in southern Manitoba. In what has become an all-too-common story, it has suffered due to widespread habitat loss and is now officially listed as endangered.

Canadian Forces Base (CFB) Shilo falls within the skink's Canadian range. Nothing is set yet, but for the past few years the Department of National Defence (DND) has been working with other branches of government to ensure that the base meets the criteria to be designated an Other Effective Conservation Measure. This is a designation for a natural area found outside of a provincial or national park deemed worthy of preservation and where measures are in place to ensure just that. DND has also worked with the Manitoba government to have the province add Shilo to the Canadian protected and conserved areas database.

The Army may wear it, but green, at least in the environmental sense, is not a colour you might associate with the land force. The very nature of training and missions tend to work against a green footprint. However, the Army has measures underway to mitigate its impact on wildlife at risk, help battle climate change, and minimize environmental degradation and habitat loss. These range from modest efforts to protect groundwater to ambitious plans to protect thousands of square kilometres.

## LESS HARMFUL MUNITIONS?

Can you create a "green" explosive? That's actually something the Army has talked about – a no less lethal but paradoxically somewhat less environmentally harmful version of its venerable C-4 plastic explosive. The idea is currently being examined by DND's Materiel Group.

The Army's munitions can be a source of environmental pollution. While not a primary concern in a genuine battle environment, it is an important consideration when such pollution occurs on firing ranges and in training areas (RTA) in Canada.

Justin Thomas, manager of Range and Training Areas Environmental Sustainability for the Army, says there are three primary concerns: "metals, energetic materials and propellants." The final two are similar, he said, but differ in their chemical composition.

"We have a research program in collaboration with Defence Research and Development Canada to better understand the environmental impact of our munitions," he explained. The research looks at how much pollution will be released by different munitions and how such pollution will move and break down once released into the environment. The Army's primary concern is the protection of water resources, notably those drawn on for potable water, water that flows out of areas controlled by the military and into civilian areas, and water "frequented by fish" as per the federal *Fisheries Act*.

"Canada," says Thomas, "was the first NATO nation to do a deep dive into investigating the impacts of live-fire training on water quality in its land ranges and training areas."

To this end, the Army has issued Order 23-15, which standardizes how and how often Army establishments monitor RTA water quality – generally once, but in some cases, twice a year, depending on the site.

"We've been looking at ways to improve the management of small arms ranges," says Thomas. Ranges are still backed by large dirt berms, where fired rounds bury themselves. These are a potential source of pollution. One of the things they are looking at is "a bullet catcher, a sort of membrane over the berm" that would keep any rainfall away from this possible source of contamination and limit its ability to migrate.

"In the upcoming fiscal year, we're also going to be looking at some modeling," he says, which could determine "when they should be cleaning up the berms before any metals can migrate into the natural environment."

There is more work to do but, so far, they aren't seeing "any major red flags." However, Thomas notes that another big problem, one which they haven't tackled yet, is the ongoing accumulation of unexploded ordnance within training areas that will over time degrade and release high levels of pollution into the environment.

## GREENER MACHINES

Major Nickoloas Kriaris, the program director for the Commercial Recapitalization program at Director Land Requirements (DLR 6-2), is responsible for identifying what might be called the Army's non-military vehicles: the sedans, mini-vans, commercially available pick-ups and so on. "If it's not painted green," he says, "it usually comes through us."

Over the next few years, he plans to make recommendations for 561 of these light duty vehicles. And he'll aim to make sure they are as green as possible. The Army follows DND targets that seek to have commercial light-duty vehicle fleet purchases made up of about 50 percent zero-emission vehicles by 2023. How that is achieved can vary. For each category, "if a hybrid

Less toxic munitions will be used in training areas. Here, soldiers from 1 PPCLI during Ex. Maple Resolve 21 in Wainwright. Photo: Cpl Djalma Vuong-De Ramos

vehicle is available, I select that," he explains. "If a vehicle is a plug-in, then I go with that. If the vehicle is a battery electric vehicle, a Tesla or something in that concept, I'll recommend that. But I make sure that we have the infrastructure to [operate] that."

There are a few caveats. For one, many categories of vehicle – he cites the three-quarter ton truck as an example – have as of yet no green options. "'If available' is a huge asterisk in any of these kinds of conversations," he says. So too is 'when.' Companies limit the times of year when they offer fleet sales and trying to juggle your green priorities with what they are selling can be a challenge.

The next few years will see an increase in the variety of green vehicles, says Kriaris, which will make his job easier. He has been looking at electric snowmobiles, ATVs, and even heavy trucks. "We have not committed to electric anything in the context of heavy equipment. But we are looking at them and trying to understand the impact."

**PRESERVING WILDLIFE**

National Defence is the largest landholder in the federal government – some 2,000,000 hectares – of which the Army's 16 establishments and satellite locations account for the largest share. The biggest of these establishments, CFB Suffield in Alberta, covers 2,700 square kilometres; CFB Gagetown, the second largest, covers 1,100 km$^2$. Shilo, by contrast, is a relatively modest 450 km$^2$. These bases include extensive road networks and numerous buildings, but many also contain large natural areas, including ones that are often home to rare or endangered plants and animals. Shilo, for example, can claim seven endangered species (including the skink), 10 that are threatened and 12 that are of special concern.

Véronic Pichard, an environmental advisor to the Army's Director of Land Environment (DLE), says that each establishment has a "wildlife-at-risk work plan to support compliance with statutory requirements and to ensure due diligence with regards to [the] *Species at Risk Act, Migratory Birds Convention Act*, and other listed species in all Army projects, activities, and operations."

Each plan, she says, "identifies what species are at risk and what kinds on measures they have to apply to protect them." As an example, at Suffield, where several such measures are already in place, vehicles moving through areas that are home to various amphibians and turtles are required to obey lower speed limits to protect them. Different bases, facing different challenges, would have their own solutions.

Pichard emphasizes that training areas like Wainwright can never be untouched, pristine environments like a national or provincial park. Training and other military requirements must come first. But with some care, the Army can make a space where, to mangle the old song, the deer and the antelope – and the skink – can play. ■

Each training area has a wildlife-at-risk plan. Here, members of 1 CMBG on Ex. Agile Ram in May 2021. Photo: Cpl Djalma Vuong-De Ramos

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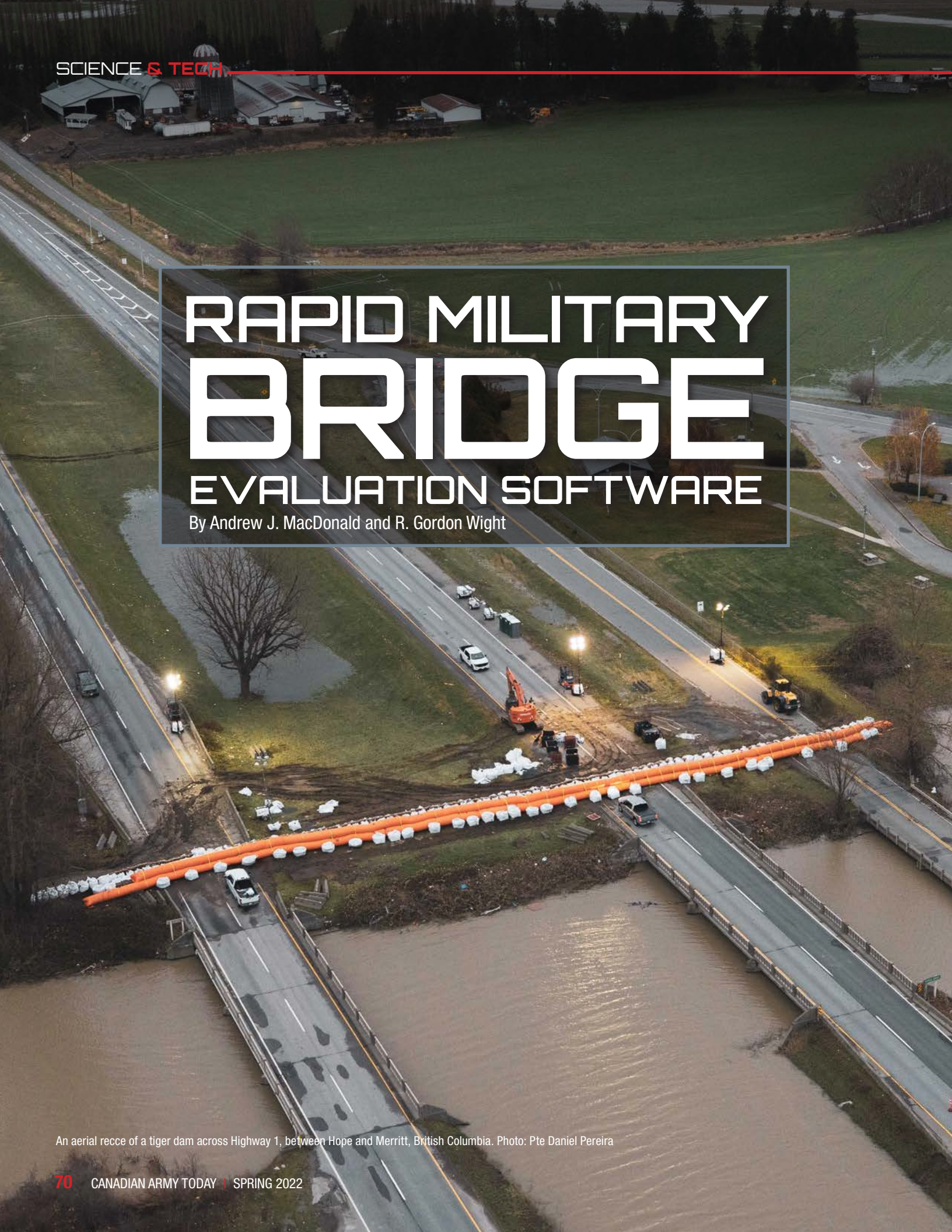
# RAPID MILITARY BRIDGE EVALUATION SOFTWARE

By Andrew J. MacDonald and R. Gordon Wight



An aerial recce of a tiger dam across Highway 1, between Hope and Merritt, British Columbia. Photo: Pte Daniel Pereira

A bridge crossing on the Combat Team Commander Course in the Wainwright training area in October 2021. Photo: Cpl Djalma Vuong-De Ramos

Left: A flooded highway overpass near Abbotsford, B.C. Photo: MCpl Nicolas Alonso

For modern mechanized militaries, mobility is critical. In Field Manual 3-90.2 *The Tank and Mechanized Infantry Battalion Task Force*, nearly a fifth of the pages of the main body of this document mention the word 'mobility'. That is 365 times in a 600-page document! It states that "[a]t the tactical level, superior mobility is critical to the success of the force. Mobility facilitates the momentum and freedom of movement and maneuver of forces by reducing or negating the effects of existing or reinforcing obstacles."

A key component to maintaining mobility in a theatre of operations is viability of the existing road network to facilitate rapid movement of heavier military vehicles. In many cases, bridges will likely be the limiting factor when considering routing options available for these assets.

Now, consider the real possibility of needing to hastily deploy to a new theatre of operations which may contain thousands of bridges. Can these bridges support 60-ton tanks and 120-ton transporters? Perhaps. However, approaching this problem using traditional analytical methods, calculating the capacity of structural components, is a task that requires several hours for each bridge, often requiring as-built drawings or onsite reconnaissance. By any account, this traditional approach can be an overwhelming task in preparation for a hasty deployment. Given that drawings might not be readily available and an initial assessment would need to be done remotely as assets are enroute to the area of operations, there is a risk that the operation will begin before an initial assessment is complete.

However, bypassing this assessment comes with the risk of damaging bridges to the point of no longer being viable for subsequent movement, resulting in unexpected delays, additional engineering tasks which early in a deployment are being triaged, and in the most extreme situations, a potential loss of personnel and equipment.

The spectrum of information available on bridge structures may prompt responses from military engineering planners that vary from, "I have a bridge in a particular country and don't know anything else about it," to, "I have a full set of bridge drawings and have observed a five-axle heavy-lift crane cross it." Unsurprisingly, military doctrine provides various expedient bridge assessment methods which military engineers can utilize to perform rapid assessments with varying quality of data.

To support the tremendous challenge of rapidly assessing many bridges with data of varying quality, the Department of National Defence has been developing rapid bridge evaluation software to bring all these expedient methods together into a single tool, which allows for greater versatility in approach and facilitates a comparison of results from different methods.

The vision for this software is three-fold: (1) to

Example bridge in Kharkiv, Ukraine using CORVMLC to look up design load used at time of construction for bridge. This software has a database of over 900 design loads from over 40 countries that can be used to estimate the MLC of bridges. Image: Google Earth Engine.

provide the best possible bridge capacity estimate based on initially available data; (2) be accessible and useful for military personnel without any specific experience in bridges and to highly experienced bridge engineers; and (3) to facilitate the revision of bridge capacity estimates as new data become available. The software is designed with a "wizard" interface, quickly guiding a user of any level of expertise to enter critical information as it becomes available. The software carries out required calculations, incorporates appropriate assumptions or database information based on user selections and provides relevant solutions and reports.

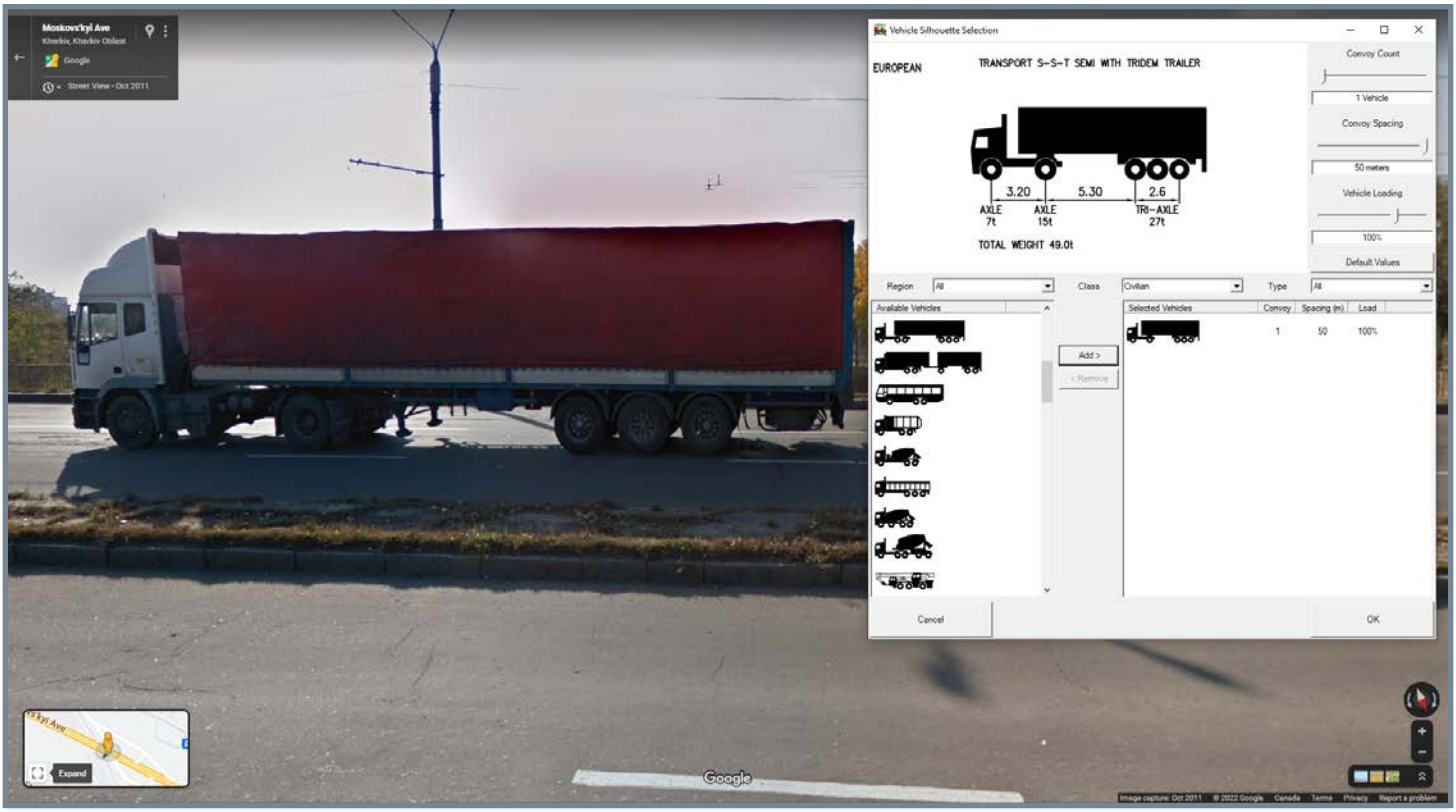
The rapid bridge evaluation software defines bridges and vehicles in terms of a Military Load Classification (MLC) following NATO standards, where if the MLC of a vehicle is less than the MLC rating of a bridge, it can be permitted to cross. The methods used to conduct rapid military bridge evaluation can broadly be delineated into two categories, correlation methods and analytical methods, both which are handled by the software suite.

Supported by the Correlation Vehicle MLC (CORVMLC) module, correlation methods are a proof-of-use approach to determine the capacity of a bridge to carry loads, where if a certain size vehicle can cross a bridge, the user can infer the MLC of the bridge. Because military vehicles generally are heavier than street legal civilian vehicles of the same length, simply comparing the gross vehicle weight will oftentimes overestimate the bridge MLC, so a comparison of the load effects using the software is required even with posted load restrictions. Observed traffic on a bridge, whether with eyes-on-site or imagery from military reconnaissance or publicly available data like Google Street View, can be used to estimate the MLC of a bridge using the software silhouette interface.

If information is known about bridge engineering design standards in the country, the design loads used for the age of bridge and type of highway can also be used to correlate an MLC for a bridge. For the recent floods in British Columbia in November 2021, with the assistance of other tools to automate processing bridge data from the Ministry of Transportation, CORVMLC was used to estimate the MLC of over 3,000 bridges in the province in less than two days for use by the Canadian Armed Forces (CAF) for operational planning. Subsequent checking of the results found that CORVMLC performed very well in providing good estimates for bridge MLC.

A preliminary assessment of bridge capacities using correlation methods provides an approach to prioritize and plan more resource-intensive on-site assessments where analytical methods may be suitable. Analytical methods use a more traditional method of determining the MLC of a bridge by estimating the capacity of key load-carrying components.

The software suite has two modules that utilize analytical methods. The Rapid Field Bridge MLC (RFBMLC) module estimates the MLC of common bridge types based on a limited number of key measurements which can be quickly determined on site without special equipment. The RFBMLC module is especially relevant for a non-expert user, guiding the assessment by identifying relevant data to collect and making reasonable engineering assumptions for the user such as material properties. The second module, Codified Analytical Bridge MLC (CABMLC), facilitates code-prescribed analysis of primary load-carrying elements of the bridge with full knowledge of material properties and component geometry, which is more applicable




Google Street View can be used in CORVMLC software for proof of use to estimate bridge MLC. The software includes many common vehicle configurations from around the world. This information can be used to validate MLC determined from design vehicles and for older structures confirm that there has been no serious deterioration of the structural capacity since construction. Image: Google Earth Engine.

if as-built drawings are available.

The software facilitates a cross comparison of the results of the different methods as a confirmation of the estimated MLC of the bridge. The estimate of bridge MLC can be updated as more information becomes available, such as access to bridge drawings, further observation of traffic, or field measurements taken during on-site assessments.

Furthermore, the software can be used to determine the MLC of vehicles using the NATO Analytical Vehicle MLC (NAVMLC) module. Given the inherent conservatism in the NATO MLC system, the benefit of storing the vehicle MLCs in the software is that a "Go/No-Go" analysis can be conducted for a specific vehicle or grouping of vehicles for several bridges to determine viable routes. If the loading effects of the vehicle are less than the bridge capacity, then a "Go" is designated and the vehicle may traverse the bridge. Otherwise, a "No-Go" situation exists and alternate routes or additional special crossing conditions are applied for the vehicle. Special defined military crossing conditions as defined by NATO include "Caution" crossing where a bridge centreline crossing at reduced speed occurs and a "Risk" crossing where bridge behaviour is closely assessed and monitored during the traverse. These crossings can also be assessed and managed with the software.

The main benefit of consolidating rapid military bridge evaluation techniques into a single software suite is that this becomes an integrated tool to not only provide a repository of up-to-date bridge MLC capacities, but to also plan and prioritize engineer reconnaissance. The software not only provides a preliminary "best guess" estimate for the MLC of a bridge using minimal data; it facilitates more accurate updated capacities as full structural details are known and evaluated.

Early in an operation, this tool can be used in pre-deployment planning using remote data collection, to shape the mobility options available to a task force on the ground and prioritize where detailed assessments may be necessary. Conversely, this tool can be used to determine for an opposition force which route options might be available without the need of major engineering operations if details on their military equipment loads are reasonably well known. Later in the operation, as key bridges are identified, estimates for MLC can be refined through on-site data collection or obtaining access to engineer records for the bridge structure.

Although pioneering work on the software started more than two decades ago, interest in the software's capability has rapidly gained momentum since 2014. At present, this software is used by the CAF, internationally by allies, and is the NATO Military Engineering Centre of Excellence recommended software for rapid military bridge evaluation. Based on recent experiences, including the CAF deployment to British Columbia after the November 2021 flooding, and in consultation with NATO allies, additional features expanding the functionality and usefulness of the MLC suite are currently being integrated into the software. This process includes research and doctrine development to improve the suitability of the MLC system, which is a key component of NATO interoperability. ■

*Andrew MacDonald and Gordon Wight are members of the NATO Team of Experts in Military Bridge Assessment, who have worked closely in the development of the Canadian rapid bridge evaluation software briefly outlined in this article. Both are former military engineers with the Canadian Armed Forces; Mr. MacDonald is currently a defence scientist with the Center for Operational Research and Analysis within Defence Research and Development Canada and Dr. Wight is currently a professor with the Department of Civil Engineering at the Royal Military College of Canada.*

Photo: IDEaS

# COUNTERING THE DRONES

What's the best way to detect and defeat mini and micro drones? In September 2019, the Innovation for Defence Excellence and Security (IDEaS) program hosted a sandbox challenge in Suffield, Alberta, to help answer that. They selected a dozen companies – Canadian and foreign, big and small – to demonstrate how they might identify, track and even destroy individual and swarming unmanned aerial systems (UAS).

The ubiquity of drones is a growing cause for concern. In December 2018, a drone sighting caused the closure of Gatwick Airport for more than two days, affecting 140,000 passengers and 1,000 flights. More recently, during the 2020 Nagorno-Karabakh conflict between Armenia and Azerbaijan, a multitude of UAS and loitering munitions destroyed Armenian armoured vehicles and air defence platforms.

"The range of potential threats is infinite. Counter UAS is not only a defense issue; it's also a security issue," acknowledged Eric Fournier, the director general of Science and Technology Strategic Decision Support for National Defence and the lead for IDEaS.

This October, IDEaS is going back to the sandbox to gauge how counter UAS technology has evolved and evaluate how well it can be integrated with Canadian Armed Forces command and control systems.

The 2019 challenge essentially asked participants two questions: Can you see and identify a small arial threat? And can you remove it or prevent it from doing its intended task? Over 20 companies applied and 12 were selected for a trial of up to five days during which they faced a red team of adversarial drones flown by Qinetiq Target Systems in a range of scenarios. They had immediate access to expert feedback from defence scientists and military partners such as the Army, Special Operations Forces, and other government agencies. Almost 300 test flights of around 3,770 minutes were conducted over 19 days.

There was a deliberate effort to invite companies with different approaches to the CUAS challenge, said Col (Ret'd) Tom Hughes, manager of sandboxes and test drives – another IDEaS tool that allows the program to buy small quantities of a technology on behalf of a service to then test and evaluate.

Although the ideal sandbox technology is at a readiness level (TRL) between six and nine, lower readiness levels were accepted to understand the current state and potential of CUAS. "We recognized that even if it might not be a great performer now, it was worth looking at because it might be a better performer five or 10 years down the road," said Hughes.

In 2019, detect and defeat were two separate tasks, though companies were rewarded for solutions that could do both with integrated sensors and shooters. For 2022, detect and defeat are again the primary tasks, "but now we are asking, 'can you give us a system that will be linked to our systems,'" said Fournier. "We want to be able to integrate it with our networks. It seems to be simple but it's a very complex one.

Combined detect/defeat solutions address part of that problem. "What we have seen from other countries and what we saw there was that the single solution will be hard pressed to deliver. You may have multiple types of detectors, and, at the same time, those detectors could have multiple ways of engaging."

Canadian UAVS was among the participants in the first sandbox with a ground-based radar system called Sparrow Hawk. The company operates UASs for defence and commercial customers and specializes in detecting and avoiding obstacles. The counter UAS problem "is almost the opposite side of the coin," said vice-president John Molberg.

"Our radar is used to track larger objects. The sandbox trial was the first time trying to track drones and our first opportunity to get in front of potential customers just to get some feedback. Defence scientists there gave us a lot of insights on the type of radar we were using and how we might want to use it differently."

At the time, Sparrow Hawk was around TRL 4; it has since evolved to TRL 9. But due to the volume of work with commercial customers, Molberg hasn't decided yet if a return to the sandbox will further the technology's development. He spoke highly of the process and the quality of the feedback during demonstration, but wished for "a little more focus on Canadian innovators." The value for any small company, he noted, is being able to show your technology has been vetted when you apply for any grants.

The CUAS sandbox challenges, the first for IDEaS, are not tied to any specific procurement project, but there is a great deal of Army interest in the results. CUAS could apply to operational scenarios such as defending a forward operating base, a mobile vehicle force element or dismounted soldiers. Of particular interest are capabilities like passive detection, target recognition, locating and defeating ground control stations, defeating UAS swarms, and exploiting data from a target UAS. ■

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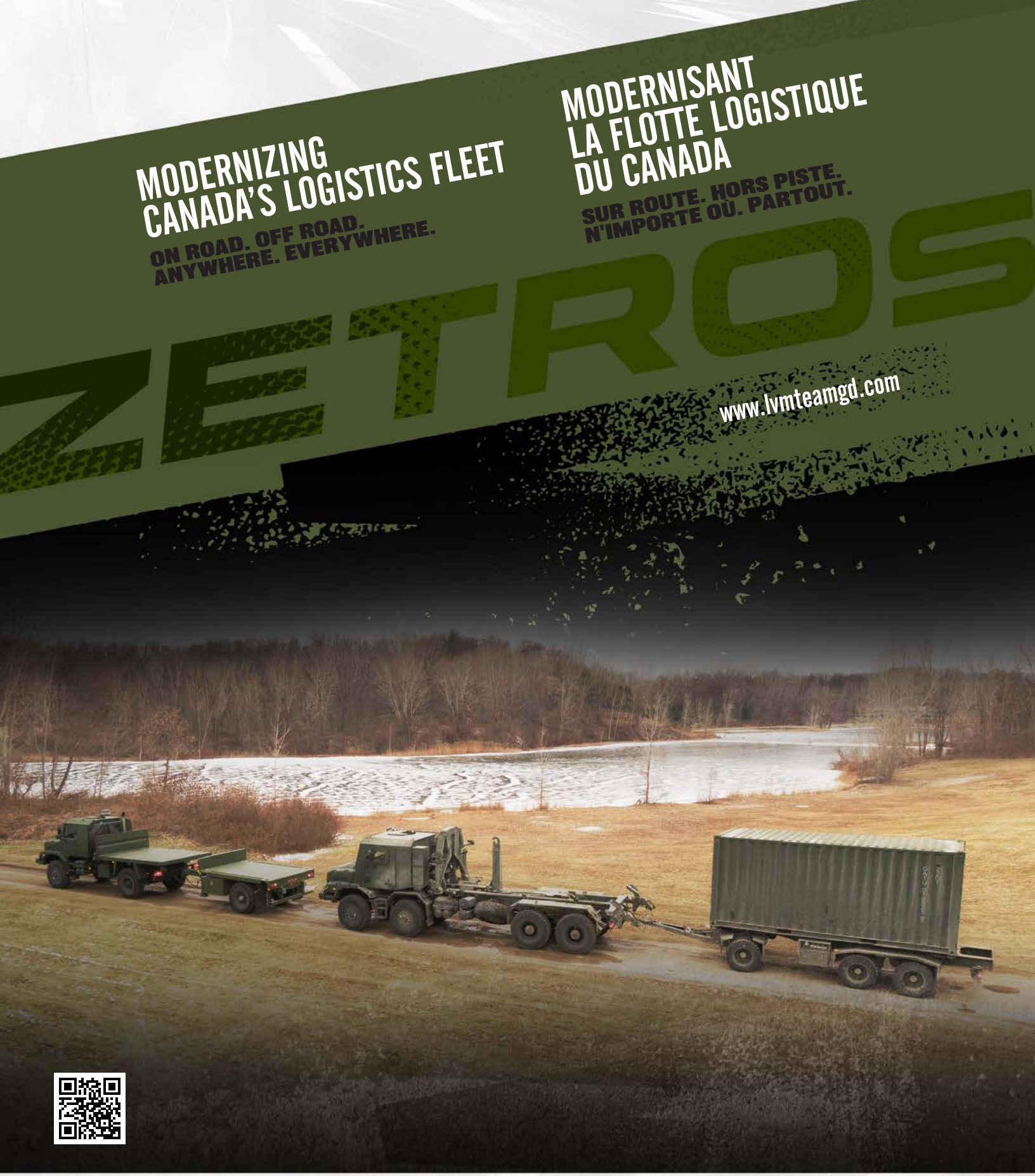

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