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THE CANADIAN ARMY JOURNAL 20.2

Tactical C4ISR: Lessons from the Front

The 2S35 Koalitsiya-SV, Robotics and the Future of Russian Artillery Modernization

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CANADA'S PROFESSIONAL JOURNAL ON ARMY ISSUES

The *Canadian Army Journal*, a refereed forum of ideas and issues, is the official publication of the Canadian Army. This periodical is dedicated to the expression of mature professional thought on the art and science of land warfare, the dissemination and discussion of doctrinal and training concepts, as well as ideas, concepts, and opinions by all army personnel and those civilians with an interest in such matters. Articles on related subjects such as leadership, ethics, technology, and military history are also invited and presented. The *Canadian Army Journal* is central to the intellectual health of the Canadian Army and the production of valid future concepts, doctrine, and training policies. It serves as a vehicle for the continuing education and professional development of all ranks and personnel in the Canadian Army, as well as members from other environments, government agencies, and academia concerned with the Canadian Army, defence, and security affairs.

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EDITORIAL

Russia's invasion of Ukraine is well into its second year without any signs of a resolution. The war is a reminder that we no longer live in a world where major power competition and conventional war in Europe remain unthinkable. The ongoing developments, which may appear geographically distant, dispel the possibility of living in "splendid isolation" or being immune to the changing world order. Contemporary events are a testimony to the evolving character of war and underscore the need to extract relevant lessons that help shape the Canadian Army of today into a prepared army of tomorrow.

As we seek to understand and adapt to the evolving operating environment, this edition of the Canadian Army Journal (CAJ) directs attention to a range of relevant issues. The first feature article by Major Jan Kool addresses the issue of tactical command, control, communications, computers, intelligence, surveillance and reconnaissance through the lens of command and control (C2). He identifies pertinent lessons from enhanced Forward Presence Battle Group Latvia and 2 Canadian Mechanized Brigade Group's experimentation and argues against adopting "purely technical solutions to modern C2 problems." Adding valuable input to the discussion of C2, LCol Andrew Duncan proposes a simplified method for joint operational practitioners to achieve greater situational awareness in complex military operations across multiple domains.

Drawing attention to Russia's overemphasis on artillery in the ongoing war, Drs. Grau and Bartles delve into a crucial yet underexplored subject of Russian land forces—integrating robotics into artillery platforms. They utilize Russian literature and sources to explain the modernization of Russian artillery, with a particular emphasis on the 2S35 Koalitsiya-SV self-propelled howitzer and its induction.

The volume also covers the subject of military training support to foreign partners. Maj Kyle Vetter examines the cultural aspect of this assistance and how it shapes the effectiveness of training programs for host nations. The subsequent articles contribute to the ongoing and dynamic debate on the Armoured Corps modernization. CAJ has been fortunate to feature periodic articles on this subject and will continue to do so in future editions. Maj Bryce Simpson undertakes a historical survey of the Royal Canadian Armoured Corps (RCAC) reconnaissance structures and brings attention to the limitations of the four-vehicle construct when undertaking reconnaissance and security tasks. Additionally, Capt Miles Smith draws upon the Lord Strathcona's Horse (Royal Canadians) reconnaissance squadron's experience during Exercise MAPLE RESOLVE 21 to emphasize the potential difficulties that may arise with the adoption of RCAC's cavalry concept.

The last two feature articles share a common thread on military education and training in the digital age. Maj (retired) Marshall Gerbrandt explores the prospect of using distance learning to reduce military members' time away from home, examining its advantages and drawbacks in the current landscape. In the final article, LCol Nathan Richards evaluates the impact of artificial intelligence tools, particularly ChatGPT, on professional military education.

We are delighted to present an array of thought-provoking book reviews in this volume. Gerry Madigan offers insights into *Auftragstaktik: The Birth of Enlightened Leadership* through his review and compels us to rethink the foundational understanding of leadership. Next, Charlotte Duval-Lantoine's review of *Deploying Feminism: The Role of Gender in NATO Military Operations* is worth a read, where she also poses pertinent questions about the role of militaries in gender equality. Matt Malone's review of *Taking Nazi Technology* and Robert Addinall's review of *12 Seconds of Silence* shed light on fascinating aspects of history and technological innovation. Murray Robertson takes us on a journey through his review of *Courage, Sacrifice, and Betrayal: The Story of the Victoria Rifles of Canada – 60th Battalion in the First World War*. Finally, Capt Alexander Landry revisits a significant episode in Canada's global engagement through his review of *The Lion, The Fox, and The Eagle: A Tale of Generals and Justice in Rwanda and Yugoslavia*.

In closing, I take this opportunity to bid farewell to Maj John Bosso, who played a very crucial role in CAJ's journey for the last many years. I would also like to thank Samuel Priems, who interned with us and utilized the short stint to contribute meaningfully to the journal's production process. We wish them both all the best in their new endeavours.

I hope you enjoy reading the CAJ 20.2 volume. I sincerely thank the Army Publishing Office, our authors, reviewers, editorial board members, and readers for their unwavering support. We invite you to explore exciting new initiatives on our CAJ website and share your valuable feedback to help us enhance your journal. Your engagement is vital to the journal's continued growth and success, and we look forward to this journey with you.

Aditi Malhotra, Ph.D.
Editor-in-Chief

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TACTICAL C4ISR:
LESSONS FROM THE FRONT

Major Jan Kool, CD

For a term that is used so often, "C4ISR" is remarkably ill defined. It seldom appears in NATO or Canadian doctrine, and most definitions tend to merely list its seven components, from which the abbreviation is formed: command, control, communications, computers, intelligence, surveillance and reconnaissance. Most discussions of C4ISR revolve around technology: the satellites, radios, servers, sensors and software that military forces use or should be using to train and fight battles. This focus on technology naturally prioritizes the "computers and communications" part of the definition over the "command and control" part. This is problematic. Command, specifically command philosophy, is *the* essential component of C4ISR, and should be treated as such. Divorcing command and control (C2) from C4ISR also minimizes the importance of control, which can be thought of as the processes and procedures by which a commander and their staff direct, coordinate and organize military forces to achieve tasks. If the aim is effective C2 of military forces, minimizing command philosophy and control procedures to focus on technology is risky. At least until artificial intelligence matures, technology cannot direct itself. It is also susceptible to damage, running out of batteries, or otherwise being denied or disrupted.

This article aims to provide C2-centric insights into C4ISR applied to the tactical level in a multinational context. It argues that, while C4ISR must enable decision making, it must also be resilient to human or technical faults. Resiliency is best achieved by inverting the traditional way of looking at C4ISR, which tends to focus on physical systems. Instead, one must first set the culture, then establish the procedures, and lastly integrate the technology. John Boyd preached something similar when railing against the over-technicalization of the United States Air Force in the 1980s: "People, ideas, hardware—in that order."[1] In the same vein, there is a famous quote, often attributed to Peter Drucker: "Culture eats strategy for breakfast." One problem, as this article lays out, is that hardware and technology can shape culture just as easily as culture can shape technology. A narrow focus on technology, without retaining Canada's hard-earned but malleable culture of mission command as vital ground, may erode our ability to C2 against a peer or near-peer adversary who is capable of attacking or disrupting our physical systems.

Source: Combat Camera

The Pan-domain Force Employment Concept (PFEC) dictates that the CAF must be ready to operate in a degraded environment, be prepared to operate in conditions of ambiguity, and build our systems to be resilient.

Source: Combat Camera

The lessons in this article are drawn from the experiences and analysis of the enhanced Forward Presence Battle Group Latvia (eFP BG Latvia) headquarters (rotation 20-02, hereinafter referred to as Task Force BEAST), and from experimentation conducted by 2 Canadian Mechanized Brigade Group (2 CMBG) since September 2022, which led 2 CMBG to be named the Canadian Army (CA) champion for dispersed C2. When the first draft of this article was written in early 2021, the world was a much different place. Russian had not yet re-invaded Ukraine, and many in the West still viewed the Russian Federation Armed Forces (RFAF) as twelve feet tall. For instance, some practitioners and western defence analysts believed that Russia had mastered its reconnaissance fires complex and was capable of detecting striking targets in depth—especially C2 nodes—rapidly and often.[2] Russia's record in Ukraine since February 2022 has moderated that view. The RFAF is again life-sized, capable *at times* of detecting and striking targets rapidly, though its dynamic targeting is normally slow and ineffective.[3] Russia's command remains centralized and its plans fragile. If anything, Russia's struggles to achieve tactical excellence only prove the premise of this article: that warfare is as complex and adaptive as it has ever been and that our systems for commanding and managing land forces therefore need to be as resilient as possible.

For practicality, this article follows the familiar format of discussing each component of C4ISR sequentially. To avoid falling into the same trap as some previous writing on the subject, it takes a broad view of C4ISR and places each component in context within a system of systems, influenced by culture, procedures and technology. These components, when aggregated, describe how a military seeks to achieve information superiority over its adversary, make decisions on how to fight its battles, and manage its forces during battle.[4] The article steers clear of purely technical solutions to modern C2 problems. Its argument is premised on the belief that warfare is a time-competitive, violent competition between two or more complex adaptive systems and will therefore remain largely unpredictable.[5] It states that complete clarity of the battlespace is impossible and not worth pursuing, and that current or emerging technology is not capable of completely dissipating the fog of war. Barring an unprecedented technological leap in quantum computing and artificial intelligence, these two statements will be valid for some time. While the pursuit of clarity of the battlespace is seductive, it relies heavily on systems that are fragile and susceptible to exploitation by adversaries. It also erodes a cultural foundation of mission command: being able to operate effectively in conditions of uncertainty and chaos. The consequence of a system's denial in combat is more than the loss of the capability it provides; commanders and staff risk becoming dependent on its use, may be disposed to micromanagement, may be distracted from building resilience in training and will become less comfortable with uncertainty and chaos.

To be clear, this is not an argument against technological improvement or digitization. It does not demand that computer screens be thrown out in favour of acetates and grease pencils, though it does suggest that staff keep their acetates and grease pencils handy just in case. Connectivity and digitization are needed to fight at the tempo required to survive and win a modern conflict.[6] By incorporating new systems and programs (i.e. SITAWARE) as part of its dispersed C2 experimentation, 2 CMBG HQ produced a better plan in half the time, compared to its already quick planning cycle using older digital and analog tools. With more practice and with adoption at different echelons allowing for the recycling of products, 2 CMBG believes that it can double its speed again. In battle, who acts first often wins, so this increase in planning speed represents a significant increase in 2 CMBG's fighting power. This article accepts that the CA must digitize quickly, but warns that it should do so carefully. New technologies and procedures must be adopted, but the focus should remain on a healthy command culture and resiliency.

The CAF also recognizes the vulnerability created by "finely tuned" or exquisite systems. The *Pan-domain Force Employment Concept* (PFEC) states,

> Our adversaries will seek to deny us our advantages, attacking capabilities like the space-based geo-location that enables precision strike and the networks that allow us to effectively C2 our forces. […] While finely tuned and therefore fragile capabilities provide us with a competitive advantage, the adversary will inevitably attempt to deny us that advantage.[7]

The PFEC dictates that the CAF must be ready to operate in a degraded environment, be prepared to operate in conditions of ambiguity, and build our systems to be resilient.

COMMAND

As argued in the introduction, the proper application of mission command should be the foundation of any C4ISR system that seeks to be resilient. Mission command is normally described as the decentralized execution of military operations based on subordinate commanders' initiative and understanding of the higher purpose of the operation.[8] This allows military forces to react to unforeseen setbacks or opportunities without necessarily requiring direction or permission from higher command. Mission command, therefore, can have less detailed plans and requires less coordination during execution. This contrasts with detailed command, which seeks to impose order and certainty on the battlefield by limiting the latitude of subordinate commanders to make decisions. Detailed command normally involves a large amount of coordination around a central plan dictated by a higher headquarters, with decision making

centralized at the top of the structure. Operations executed by militaries who culturally adhere to a detailed command philosophy are generally less flexible and less adaptable, and can be more easily overwhelmed by rapid tempo or a changing situation, as changes to the plan require far more coordination and direction.[9]

When applied correctly, mission command is resilient. It cannot be jammed, run out of batteries, or be dropped and broken. It is also very difficult to apply correctly, which is why many militaries opt to pursue detailed command rather than mission command as a command philosophy. Mission command requires highly skilled leaders who are bound together by trust and mutual understanding. It is fundamentally an expression of culture and personality throughout the operations process and thus varies from country to country and leader to leader. This is very apparent within the Canadian-led eFP BG in Latvia, where, aside from cultural and language frictions, the rank and experience level at which command is exercised changes from company to company depending on the sending nation. For instance, for armies that follow the regimental system, the company command is given to majors (OF-3) with 10 to 14 years of experience. For most NATO countries that adhere to the continental system, company command is given to captains (OF-2) with 4 to 8 years of experience. Achieving a high level of trust and mutual understanding is thus made more difficult. Given this context, the eFP BG acts as a microcosm of larger formations. Its challenges remain the same as a multinational brigade, division or corps on a different scale. Therefore, in some ways, the lessons identified in the article are applicable to higher formations.

Fostering trust is a matter of command culture. Trust is built through leadership, socialization and training. It is essentially team building and is the purview of the commander. On the other hand, mutual understanding is a challenge that extends from culture to procedures to processes. Standing NATO standardization agreements (STANAG) and joint doctrine and publications (Allied Joint Publications and Allied Tactical Publications) provide the foundation for mutual understanding. As with trust, mutual understanding can be built through training and socialization. This is more difficult in a multinational context, where everyday frictions are multiplied and amplified by language and cultural barriers.

Culturally and procedurally, the production of short written orders combined with high-quality graphical overlay orders helps in building flexibility, breaking down language and cultural barriers, and bridging experiential gaps. Importantly, it also significantly increased battle procedure speed, as did throwing PowerPoint-driven staff briefs in the burn bin. As Jim Storr notes in his recent book *Something Rotten: Land Command in the 21st Century*, orders have become too long, too complicated and too slow to be useful. Both TF BEAST and 2 CMBG found that by eliminating briefs, following a staff-supported estimate process and creating short orders, they were able to increase precision, reduce errors and save time for subordinate commanders. In place of formal briefings (i.e. information brief, mission analysis brief, and decision brief), 2 CMBG staff instead provided on-call and as-needed informal planning updates to the Commander, facilitated when emissions control (EMCON) states allowed by videoconferencing to remain dispersed. The creation and mass printing of acetate traces in the field requires additional capability and capacity in the BG or brigade headquarters, though it was found that using SITAWARE simplified and sped up the orders creation process significantly. SITAWARE also has the benefit of being digitally shareable, on top of simplifying printing to-scale traces. Finally, to further speed up battle procedure, both 2 CMBG and TF BEAST had as a goal that all orders and command support products be useful two levels down, with shared digital copies and enough physical copies for subordinate commanders to adapt and push to their subordinates.

CONTROL

Control can be described as the process by which a commander and their staff direct, coordinate and organize military forces to achieve tasks.[10] Control is manifested in how the staff manages the actions of manoeuvre, fires, sensors and sustainment on behalf of the commander. This control is conducted in the command post (CP) and is enabled by analog and digital means. Control nodes are natural high-value targets for the adversary; therefore, to achieve resiliency, the first challenge of control involves staying alive and remaining in the fight. Here, it is helpful to use the analogy of the survivability onion (by layers of protection): first, avoid high-risk areas; if you have to be there, avoid being seen; if you are seen, avoid being targeted; if you are targeted, avoid being penetrated; if you are penetrated, mitigate the damage caused; if you are killed or captured, avoid being a liability to your team. This concept, as applied to CP survivability in a threat environment based on the Russian invasion of Ukraine, is found at Figure 1. The tension with CP survivability measures is that each makes control harder to maintain. Obvious examples are the requirement to move, which often takes time and effort away from managing the battle, or the requirement to mask or limit emissions, which prevents communication between elements.

The second great challenge of control is how to gain and use information properly to assist timely decision making. The goal is to achieve an informational advantage over the adversary, so that our decisions more closely match and influence reality than their decisions do, at a faster rate. This is usually referred to as having "information

THE CP SURVIVABILITY ONION

The Goal – to prevent or reduce the adversary's ability to affect friendly force C2. This is achieved through an overlapping system of protections (the Survivability Onion) that degrade and disrupt the adversary's ability to locate, target and destroy you. This makes the enemy work harder to kill you, which slows them down, exhausts them, degrades their systems, gives us more chances to target them, and makes them ever less effective.

The Threat – The War in Ukraine reveals that the air threat is greater than the ground threat. Aerial threats include armed drones, loitering munitions, artillery, air strikes and aviation strikes. Ground-based threats in the rear area are most likely lightly armed partisan/special-purpose forces.

There are no sanctuaries, no rear areas, no safe areas.
Work to be unseen, but assume that you are being surveilled at all times.

DON'T BE THERE 1

- Don't site yourself in obvious locations (landmarks, crossroads, etc.).
- Stay away from other CPs and HVTs.
- Limit human collection by staying away from civilian concentrations and thoroughfares.

DON'T BE SEEN 2

- Reduce Thermal and Optical Signatures – Site in overhead cover, in dead ground, or in/next to buildings. Use multi-spectral cam nets, supplement with natural cam (lots of it!), cover all glass on vehs, minimize foot traffic outside cam net (live under wings). Park vehs in buildings. Maintain light discipline and heat discipline (turn down thermostat!), don't idle vehicles, and shield heat signature of generator. Check your own thermal signature often. Decrease frequency of DPs by carrying double or triple normal DOS.
- Reduce Audible Signature – use shore power, shield noise signature of generator, and use whisper generators.
- Reduce Electromagnetic Signature – Talk on VHF less, schedule less (no hourly radio checks!), use chat systems instead of voice, reduce power of transmitters, shield emitters, use directional antennas, run line, and hide in spectrum. Practise cellular discipline. Turn off and place authorized cellular devices in Faraday bag when not in use. Most importantly, **employ Mission Command**.
- Exploit bad weather. Enemy sensors will be degraded, and air assets may not be able to fly. Plan movement during poor weather.

DON'T BE TARGETED 3

- Don't meet the enemy's engagement criteria. Remain dispersed from other elements. Spread out your vehs. Look like something other than an HVT. Use maquillage to make a Bison CP look like a Bison MRV. No visible antennas, no visible satellites, no visible generators, no obvious CP routine, no large vehicle park, reduce veh and foot traffic in, out, and around CP. Appear fewer than you are. Limit number of people not under cover at one time. Conduct staff feedings, ablution, and rest under cam net.
- Understand the range bands of enemy weapons, and stay out of as many you can. The longer the range, the stricter the targeting criteria, and the more likely you can avoid being targeted. 20 km back puts you outside brigade artillery, mortars, COTS drones, and unguided aviation rockets. 40 km puts you out of range of loitering munitions (Lancet 3 = 40 km). You are always in range of tactical ballistic missiles, air strikes and longer-range rockets.
- Move frequently and maintain an appropriate notice-to-move (NTM). Always BPT crash move CP. Know the criteria to crash move. Know the crash RV location. Find ways to reduce set-up and tear-down time.
- Limit the size of your packet. Four is the maximum. Three is better. Five or more vehicles becomes a target.
- Have a local ground security plan, or contribute to someone else's. Use decoys if possible.

DON'T BE PENETRATED 4

- Harden CP. Use blast blankets on interior walls, and place Kevlar or hard shielding over key equipment (i.e. the PacStar, printers). Place Kevlar on tables so that staff can take cover under them.
- Site under foliage or in building. Russian loitering munitions have detonated prematurely on tree branches in Ukraine.
- An air sentry is now more important than a ground sentry. Employ one. Know how to detect enemy drones and loitering munitions by sound. Have a react to drone attack alarm and drill. Consider turning off generator at times to increase detection time.
- Dig shell scrapes and/or have a plan to get under armour (i.e. Armd MSVS truck cab, Up-armd G-wagon).
- Site fighting positions. Practise react to enemy direct/indirect fire drills. Deploy multi-spectral smoke on contact to disrupt a second attack.
- Wear personal protective equipment, or have it close at hand.

DON'T BE STOPPED 5

- Have a plan to keep working (i.e. battle box and generator in G-Wagon on 5 min NTM)
- Be proficient in casualty care. Have a plan to evacuate casualties. Know the closest ambulance exchange point.
- Cross-train in each others' jobs (ops and technical). Ensure that everyone can emergency drive all vehicles and do basic maintenance.
- Back up work on another server locally and in another location routinely.
- Maintain robust PACE plan. Be able to work with no network. NEVER lose the ability to work analog. BPT send a runner out with the plan, even under contact.
- Be redundant. Make sure someone else, somewhere else, can do your job.
- Think through an internal bump plan. If a vehicle is disabled, who and what gets left behind?
- Think through an external bump plan. If your CP is disabled, where does the team go?
- Be capable of running key electronics off battery power for at least eight hours.

Again…**Employ Mission Command**
It is the only system you have that cannot be hacked, broken, run out of batteries, or denied.

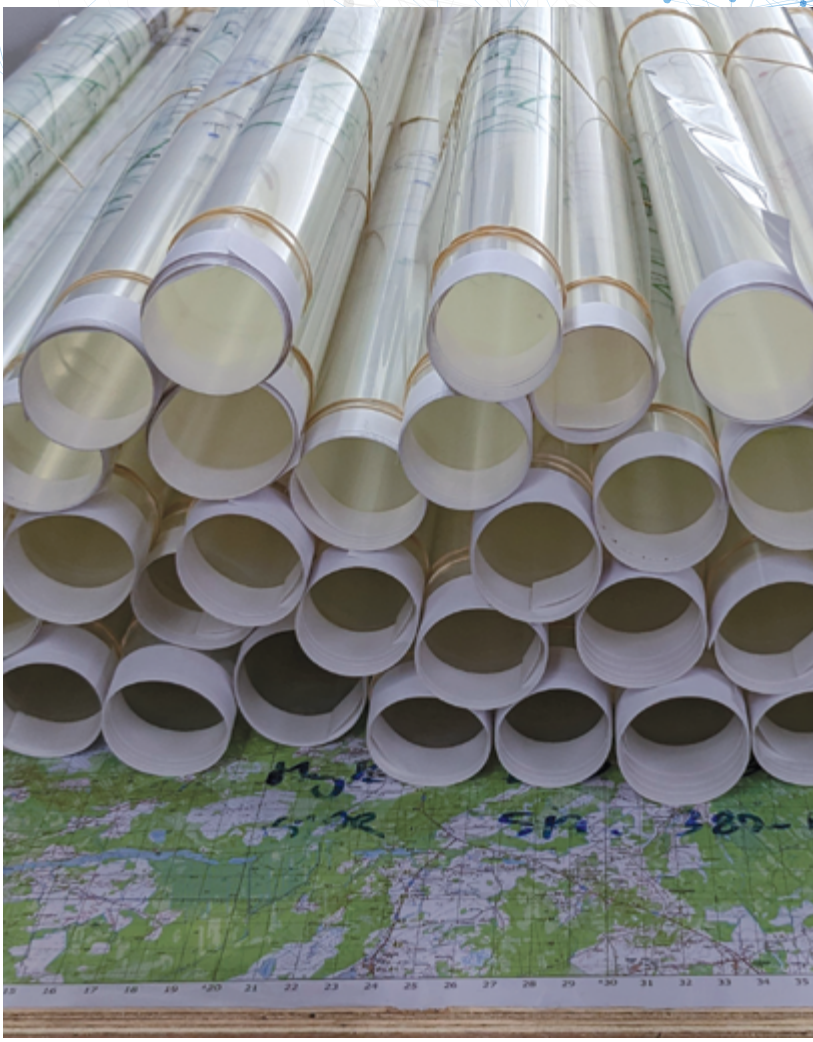
DON'T BE A LIABILITY 6

- BPT execute CP denial. Have a CP Denial SOP. Don't let the plan get into the enemy's hands – at least until it is no longer relevant.

Figure 1: The CP Survivability Onion

Source: Combat Camera

superiority," which includes the sufficiency and quality of information, its relevance to upcoming decisions, and the speed at which it is attained. Too much information, especially unfiltered data, can be counter-productive. Information saturation can lead to decision paralysis, in which commanders and staff are unable to sift through the information they have and identify the relevant pieces in time to act before the enemy does.[11] To gain an information advantage, then, one needs just enough good information to make a rapid decision. How much is "just enough" will vary from commander to commander, will depend on the quality of the battle staff, and is likely correlated with the cultural acceptance of mission command in an organization.



Information in operations is often sorted into two categories. First, there is the common operational picture (COP), which is knowledge of where people and things currently are and what they are doing. The second category is the "running estimate," which is the collective and ongoing assessment of capabilities, strengths, weaknesses, intentions and other important information about the various factors in the operating environment. Together, the COP and the running estimate maintained by the staff provide the information that enables a commander to use both intuitive and rational analysis to make decisions.

John Boyd's Decision–Action Cycle, known to many as the "OODA Loop" for the continuous process in which individuals and systems observe, orient, decide and act on a problem, is illustrative. If an enemy sighting provides part of the "observe" stage of the decision–action cycle, the COP and the running estimate provide the critically important

"orientation" stage. Both the running estimate and the COP are ideally kept in both analog and digital forms, with the most critical aspects of the running estimate posted in the CP for everyone to see and the remainder stowed digitally in an easy-to-use database. TF BEAST identified the problem that years of collected data was inaccessible because it was not stored or organized coherently. To solve the problem, TF BEAST created and populated a wiki database built on the SharePoint site of the Canadian Deployed Mission Network (CDMN), which it called eFPedia. Inspired by the Orion database created within Joint Task Force Afghanistan in the late 2000s, this database contained the bulk of the running estimate, with pages on everything ranging from the local hospital in a key town, to the Russian T-72B3M tank, to engineer bridge assessments. 2 CMBG has since expanded on this concept and, with the help of the General Dynamic Mission Systems analysts with Project X, have created an improved application using Wikimedia, called Battlepedia. This, in addition to the geo-referenced data management capabilities inherent in SITAWARE, represents a significant improvement over current practice.

COP at its root is the knowledge of the enemy's disposition, derived from reports of forces in contact, sensors and educated guesses, and the knowledge of friendly forces' disposition, which is derived from situation reports. The second part of this equation is where digitization and technological advancement promises the most return but is also where the greatest hazard lies. The allure of instantaneous and complete knowledge of one's forces on the battlefield comes with risks. The most obvious is that the so-called blue force trackers continuously emit a signal that may be exploited by the adversary's electronic warfare (EW). It is unlikely that the enemy can locate every emitter in the battlespace, and, if they could, much of the information collected would be misunderstood or misinterpreted and could even lead to information saturation and decision paralysis of the enemy commander. In addition, blue force trackers can be designed to be difficult to detect or to manipulate their signatures to blend in with their surrounding environment. Nevertheless, blue force trackers remain vulnerable to adversary disruption, denial and exploitation. The idea that forces can hide in plain sight—that if everyone on the battlefield is transmitting, the adversary will be overwhelmed with information—is true some but not all the time. While it is true that multiple EW hits may oversaturate the adversary's recce-fires complex, the adversary will still glean valuable information from knowledge of friendly force groupings and movement. Even if the adversary cannot use EW for targeting, they will use it to inform decision making. When Ukraine launched its surprise attack that retook the Kharkiv region in September 2022, they did so by masking the presence of combat-ready brigades that had been trained and held in reserve for the purpose.

If those brigades had been transmitting blue force tracker data, they might have been detected. It may be easy to hide a CP in a brigade's worth of emissions, but it is more difficult to hide a brigade's worth of emissions in nothing.

The second risk blue force tracking poses is to command culture. Seeing icons on a digital map is not the same as understanding their situation. False certainty on friendly force disposition may lead to micromanagement, as senior commanders second-guess their subordinates who are on the ground and likely have a better sense of the problem. Even where the senior commander can make a better decision than the local commander, doing so undermines the distributed nature of mission command decision making, where speed is achieved when multiple decisions are made rapidly by many actors. This potential threat to mission command is highlighted in the NATO doctrine: "[W]ith technological development, equipment that improves the ability to monitor what is happening may also increase the temptation and the means to try to direct action. Equipment that facilitates or encourages detailed command of subordinate units may undermine mission command."[12] Blue force trackers provide more than "just enough" information for decision making, risk enemy detection, and may detract from healthy mission command.

This article's skeptical position on blue force tracking is by now clear. It contrasts with the view of most practitioners: in a 2014 Defence Research and Development Canada (DRDC)-sponsored working group of current, former and future commanding officers, the participants indicated their desire for automated blue force tracking down to platoon level.[13] However, the level of fidelity desired by the DRDC study participants does not actually require continuous ultrahigh frequency (UHF) transmission, with its associated risks. In addition, there was limited understanding of adversary EW capability in 2014 compared to the present day. To clarify, this is not an argument against digitization below the battalion level. On the contrary, there are benefits of an integrated digital system such as Argus or SITAWARE down to platoon, section and even soldier level. The ability to push small data packets to commanders, including text, images and overlays, enables the application of mission command by allowing the clear transmission of intent. Chat functions cut down on lengthy voice transmissions. Graphical orders transmitted via data increase mutual understanding, and as receiving stations are not emitting, security is increased for most users. However, these systems do not need to be transmitting constantly to gain maximum benefits of digitization. Disabling persistent blue force tracking functions—or throttling them to send positional information only on request, for instance—will leave some situational awareness unharvested. Still, the benefit to security and the focus of commanders will more than outweigh this loss.

Source: Combat Camera

2 CMBG HQ's experience with SITAWARE on UNIFIED RESOLVE 2023 clearly demonstrated the advantages of digital COP. The G2 and the G3 each reported that they were able to make faster, better decisions and recommendations than with a pure analog COP system. As this was a computer-assisted exercise blue force tracking was artificial, with sub unit positions entered manually into SITAWARE by exercise control. This simulated throttling blue force data at the sub unit level, supporting the argument that fidelity below sub unit is not always required at the brigade level. Importantly, the G3 maintained a physical map table as a backup to their digital systems, for redundancy in case of system failure.

COMMUNICATIONS

Users often have unrealistic expectations of what military communications should be able to do. This is not helped by familiarity with cellular phones and the popular depiction of military communications in action films, which suggest that an earbud can give secure voice communication around the globe under any conditions. No tool does every job, and all available tools have some drawbacks. Some systems are light and mobile, but easy to detect and limited in range, and they do not carry data well. Others are heavy and static, but have longer or unlimited ranges and are more difficult to detect. Some are easy to use, and some require a significant amount of expertise. Some are compatible with our allies' systems, while others are not, despite numerous STANAGs on the subject. All systems are vulnerable in some way, including satellite communications, which rely on space hardware that may not be available in a major war.[14]

The electromagnetic spectrum is contested, and NATO's adversaries have invested significantly in this field. Rather than more stable communications, Western forces should expect increasing disruptions. The adversary will find emitters with uncrewed aerial systems (UAS) and ground-based EW sensors and strike them with artillery, sometimes without any other sensor in the loop.[15] Alternatively, they may jam friendly C2 nodes at key moments or simply use the information to template our ground manoeuvre and inform the adversary's own decision–action cycle. Very high frequency nets are most vulnerable to this sort of detection, as are commercial means of communication, particularly cellular-based signals. Unfortunately, these two methods—command net radio and cell phones—are those with which NATO forces are most comfortable and which enable C2 the most.

However, the news is not all bad. A basic understanding of how EW works and the range and capabilities of the adversary's EW systems allow planners to prescribe flexible EMCON measures that enable friendly forces to utilize the electromagnetic spectrum (EMS) when it provides a relative advantage over the adversary, and switch to other means when it does not. This understanding also allows a commander to make a clear-eyed decision when and where the relative advantage of openly communicating is with the friendly force, even when the risk of detection and fires is high. Decoys, proper siting of emitters, power setting discipline, using data instead of lengthy voice messages, frequency hopping, and using proper voice culture are measures for mitigating the EW threat. All of them should be reinforced at all levels of communications training. Improvement has already occurred in some areas. For instance, the CA has revitalized its use of signals dispatch riders, field phones and HF radio. On other side of the technological spectrum, CA signallers are increasingly familiar with Tactical Satellite thanks to experience with eFP Latvia. 2 CMBG's CP experimentation with a meshed nodal structure, enabled by MPU-5 mesh radios using short-range UHF signal, allows for dispersal of C2 nodes. This system allows for open communication between mobile nodes with reduced (though not eliminated) threat of detection,

while harvesting the security benefits of dispersion. These networks are self-healing and self-propagating. This increases resiliency within C2, by eliminating large static headquarters that are easily targeted.

As always, the best way to maintain resiliency is to reinforce mission command. Simple, flexible plans executed by commanders and units that are comfortable operating in uncertainty, trust each other, and are enabled to make decisions do not require exquisite communications networks to be successful. Like COP, the movement towards increased data and more communications systems can threaten mission command if the core tenets of mission command are not cautiously safeguarded. Commanders and staff must be comfortable not having persistent, on-the-move communications and large amounts of data. This requires training, education and a healthy culture of trust among commanders and staff.

COMPUTERS

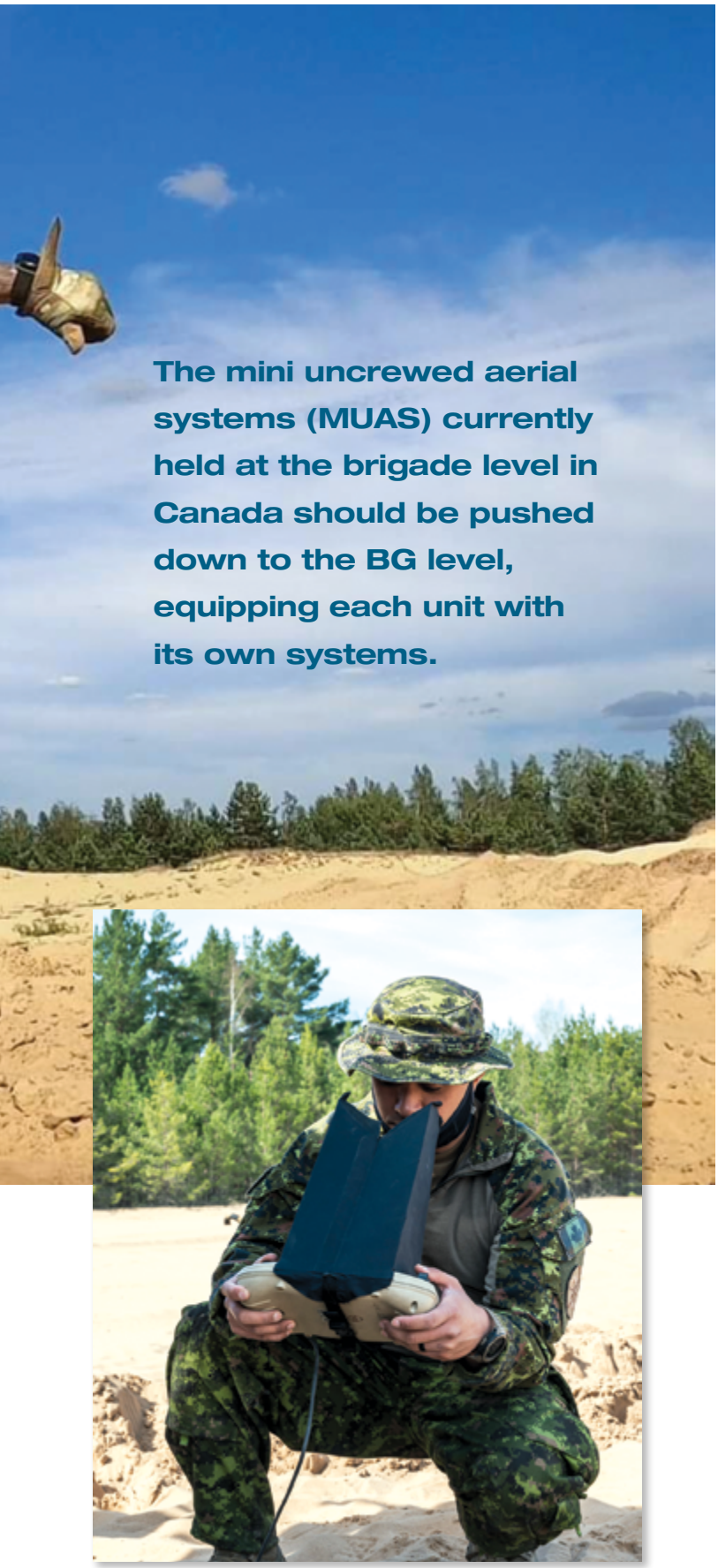
Computers enable commanders and staff to redirect time and energy from lower- to higher-order thinking by performing simple tasks for them. When networked, computers form what NATO refers to as a communication information system (CIS). NATO doctrine identifies two dangers associated with the use of CISs. The first is not taking full advantage of the capabilities provided by CISs. The second is being overtly reliant on those capabilities.[16] These two dangers are in tension with each other. Although this tension can be mitigated by making CISs as simple and resilient as possible, it cannot be fully resolved. As anyone who has attempted to set up their home Wi-Fi or add a printer to DWAN can attest, networks can be fragile even in the best of conditions. In field conditions, the challenges are amplified. In addition to having to deal with extreme environmental conditions, networks require clean power and access to a data bearer (usually a satellite), both of which come with difficulties of their own. Also, the more they are relied upon, the more networks will be targeted by the enemy.[17]

Maintaining a field deployable network (CDMN) in Latvia in 2020 was a challenge. Bandwidth was limited, hardware was bulky and outdated, software was not fit for purpose, data bearers were at times unreliable, clean power was a challenge, and the network did not integrate with the Latvian brigade's systems, despite ostensibly being a federated mission network. Despite these challenges, workarounds were found for most problems, and CDMN provided the BG with a reasonably effective CIS and a secure way of transmitting and storing large amounts of data with a small EMS footprint. It was the venue for all BG planning and was the repository for the data within the running estimate (eFPedia).

2 CMBG's C4ISR experimentation with its own deployed network (dubbed the Experimental network, or X-NET) has dramatically improved on the eFP BG experience. Improved hardware included PacStar servers, improved CF-33 laptops, high-capacity printer/scanner/copiers, and videoconferencing equipment; improved software includes SITAWARE, BattlePedia, Teamspeak teleconferencing, and Jitsi videoconferencing software; improved data bearers included the MPU-5 radio. Taken together, this network provided a virtual environment that effectively replicated in-person collaboration. It allowed, for instance, more frequent command engagement during planning, as the commander was only a button-press away. It was also more resilient. For example, SITAWARE was uploaded onto multiple servers that updated each other. When communications were disrupted between nodes, the local node network still functioned, allowing planners to rapidly produce high-quality physical copies of orders and overlays as a last resort.

Source: Combat Camera

The term "digital divide" is used to describe the level at which the force is enabled with networked data. This is a contentious topic, with traditionalists arguing that networked data is distracting and belongs at and above the battalion level. In contrast, the futurists argue that networked data is enabling and belongs down at the soldier level. The CAF has embraced the futurist approach with the purchase of two systems: Thales's Tactical Battle Management System, which is part of the Capability Pack TOPAZ project and includes vehicle-mounted radios and computers,[18] and Rheinmetall's Argus soldier system, which is part of the Integrated Soldier Systems project and includes soldier-portable radios and computers.[19] These systems are designed to provide dismounted and mounted commanders and soldiers with blue force tracking, and the ability to send and receive images and overlays. Both systems constantly emit on the UHF band, which, while at low risk of EW ground-based detection, is detectable by airborne EW sensors.[20] These programs should be advanced with caution, with the ability to throttle data transmission, and with the aim of integrating them into systems such as SITAWARE at the battalion and brigade headquarters level.



The mini uncrewed aerial systems (MUAS) currently held at the brigade level in Canada should be pushed down to the BG level, equipping each unit with its own systems.

INTELLIGENCE

This section focuses on two pressing issues: ground analysis and intelligence collation. Ground analysis is an area that can be significantly improved with computer assistance. The traditional method of drawing features, lanes, objectives, canalizing ground, approaches, rate, and approaches, and key terrain and vital ground (FLOCARK) on a map is valuable and should not be discarded. That noted, 2 CMBG HQ found the geomatics tools present in SITAWARE, including elevation data, 3D rendering, and satellite imagery, to be very useful. On Ex UNIFIED RESOLVE 23, 2 CMBG HQ was able to create intervisibility traces much more quickly and with far more fidelity than by analyzing topographic maps. This was an extreme improvement from TF BEAST, where ground analysis was done on a map and by leveraging a member's tablet with the United States Marine Corps (USMC) Android Precision Assault Strike Suite application installed.

Information management is an area ripe for improvement. Poor information collation means that information is unavailable when required or takes too long to find. Both scenarios detract from achieving information superiority. As noted previously in this article, TF BEAST determined that three years' worth of accumulated tactical data, information and knowledge in the eFP existed in traditional digital folders across several systems, in printed copies of slides such as the Intelligence Preparation of the Operating Environment slideshow, or within intelligence reports or intelligence summaries. This made recall of information difficult or impossible, especially in the field. Poor collation renders a large portion of the analysis conducted by the S2, the S4, the S5, Engineers and the S9 unusable. The solution to this problem for TF BEAST was eFPedia, which was further improved by its successor TF WOLVERINE (eFP BG R21-01). 2 CMBG HQ and Project X then developed BattlePedia in January 2023, which used improved software and programming. The potential for this program is limited only by imagination. With some investment, at some point in the future, the entirety of the CAF could be contributing to a single level 2 database for a variety of current or potential theatres of operation. This would reduce the time required to achieve information superiority if the CAF is given a new mission.

SURVEILLANCE AND RECONNAISSANCE

The impact of the massive sensor advantage enjoyed by Azeri forces over their Armenian counterparts in the Second Nagorno–Karabakh conflict has driven academics and practitioners to re-evaluate the importance of sensors as a predictor of battlefield success.[21] The ongoing war in Ukraine has shown that it is still possible to hide from sensors, but that it is becoming more difficult. Conversely, improvements in our own sensors give us a relative advantage by improving our COP and information advantage. To frame it using Boyd's decision–action cycle, surveillance and reconnaissance assets are what

"observe" the adversary, allowing the fundamental steps of the cycle (orient, decide and act) to occur first and faster than the adversary's cycle. Those that see first can act first, and acting first usually grants initiative. Holding initiative, the slippery yet intuitively understood concept, is the likeliest path to victory.

The CAF can adapt in order to plug its surveillance and reconnaissance capability gap culturally, procedurally and structurally. The tactics and types of tasks that the BG reconnaissance and sniper platoons use and are assigned to complete should be reviewed to include layback observation posts (OP) in the defence. This tactic of saturating an enemy's avenue of approach with layback sniper and infantry recce OPs was used with great effectiveness by the eFP BG but is not supported by CAF doctrine.[22] Persistent covert human observation on named areas of interest in the adversary's rear allows a unit to confirm adversary intentions and influence their depth with artillery, mortars and, in some cases, direct fires or laying of anti-tank mines. In the case of snipers, the engagement of high-value targets at range in depth is predicted to have an outsized disruptive effect on the adversary's physical capabilities and morale. The risks of leaving forces concealed behind enemy lines are high but can be mitigated with solid evasion and medical plans that may rely on civilian infrastructure. The infantry reconnaissance platoon's organization should be reviewed to better suit it to these activities. For instance, a two-soldier fireteam cannot persistently observe an objective, but a three-soldier fireteam can. The current focus on conducting infantry reconnaissance from armoured vehicles comes with a training bill and a heightened chance of detection. It would be better if at least part of the infantry recce platoon was equipped with light all-terrain vehicles and improved dismounted sensors to allow it to better infiltrate or exfiltrate an objective area. The use of armoured vehicles for reconnaissance should perhaps be left entirely to the armoured corps.

Next, there should be a wider integration of sensors at the unit level. The mini uncrewed aerial systems (MUAS) currently held at the brigade level in Canada should be pushed down to the BG level, equipping each unit with its own systems. This would drastically increase the number of MUASs available in the brigade and close the capability gap with the adversary. The larger RQ-21 Blackjack small UASs currently held at the division level should be reorganized to the brigade level with either the armoured or artillery regiments, further increasing the sense capability closer to the fight.

Electronic sensors can be improved as well. Canadian Light Electronic Warfare Teams have a limited range, making their current employment on an EW baseline less effective. However, when used in layback patrols with infantry recce and snipers, they could look deeper and provide more meaningful information. This would come at a cost of additional fieldcraft training but would likely be worth it. Lastly, the CAF should look to optimize an EW payload for the RQ-21 Blackjack. This would provide a final layer of capability to CAF EW and match adversary capability.

Innovation can help close the sensor advantage with the adversary. One idea comes from Ukraine, where volunteers created and maintained a system of surveillance cameras which monitored most of the line of contact in the Donbas.[23] Networked and closed-circuit television camera systems throughout Latvia, including security and traffic cameras, could be leveraged as ad hoc sensors until they become non-functioning. Aside from existing infrastructure, commercially available portable hunting cameras could be used down to the platoon level to provide local remote surveillance.

CONCLUSION

Without the intention to adopt an anti-technology or anti-futurist posture, this article highlights some hazards and asserts that C4ISR cannot be a series of technological solutions to what is, and will remain, a wicked problem. In a complex adaptive system, exquisite technology will be fragile and vulnerable to exploitation. Modern technology, which may appear as a solution to eliminate uncertainty in the operating environment, can make it harder for the soldiers to cope with an all-but-inevitable loss. For C4ISR systems to be truly resilient, the CA must focus on culture first and reinforce the philosophy of mission command in every aspect of the profession, from field training and garrison activities to administrative authorities. Next, the CA must build resilient procedures that are simple and redundant. This includes how the forces produce and publish orders, store and manage information, and design and use communication and data networks. Lastly, it is valuable to incorporate technologies that give the CA an advantage over the adversary. The technologies should work in a degraded or denied operating environment, their use must not put the CAF at increased risk, and their loss should not lead to paralysis.

To reinforce the central argument, it is pertinent to conclude with an anecdote: A commander finds themselves in a communications-denied, uncertain, and chaotic situation. They ask themselves, "where are my subordinates?" An appropriate response to the questions is this: "If the soldiers have been appropriately trained in mission command and are comfortable operating in ambiguity, they will be precisely where they need to be."

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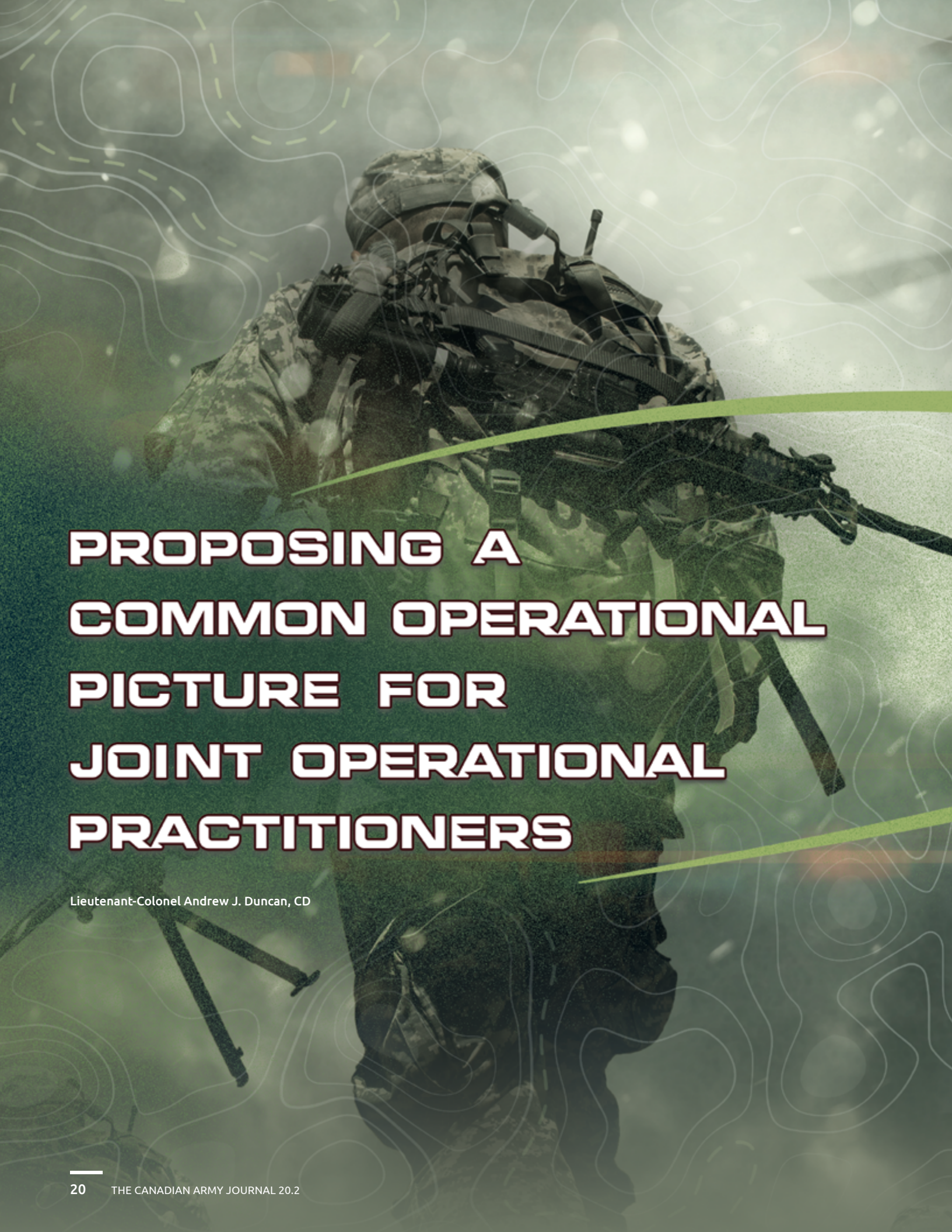

PROPOSING A COMMON OPERATIONAL PICTURE FOR JOINT OPERATIONAL PRACTITIONERS

Lieutenant-Colonel Andrew J. Duncan, CD

INTRODUCTION[1]

The Canadian Armed Forces (CAF) draft *Pan-Domain Force Employment Concept* recognizes that the CAF is primarily configured to counter overt military actions in the traditional domains of land, sea and air by recognizable elements of an adversary's armed forces. However, most of Canada's adversaries are eschewing costly and attributable direct military confrontation in favour of challenging the current rules-based international order within the cyber, space and information domains. These domains provide sufficient opportunities for Canada's adversaries because the generally accepted levels of conduct remain ambiguous and attribution is often difficult. At the same time, democratic states are hesitant to act due to the domestic social contracts within which they operate. Despite these challenges, the *Pan-Domain Force Employment* Concept highlights the requirement to campaign across all the domains, coordinating actions between global, regional and targeted operation areas.[2]

Brigadier-General Jennie Carignan, Commander of 2nd Canadian Division and Joint Task Force (East), receives a briefing on the situation surrounding Operation LENTUS in Gatineau, Quebec, on 24 April 2019.

Commanders and their staffs working within the operational level of war must be able to link developments across many domains and levels of war to exploit fleeting opportunities. Although some of Canada's adversaries have had tangible successes in linking the cyber, information, and land, maritime and air domains together in the past, the clumsiness of their methods has become apparent over time.[3] The future may be much less forgiving as adversaries refine their methods. In short, a country's ability to understand the pan-domain environment, draw out linkages between the domains and levels of war, detect fleeting opportunities, synchronize disparate actions and exploit the combined effects are essential to winning. Despite this, significant doctrinal gaps remain within the CAF which stand in the way of fulfilling this requirement from the draft *Pan-Domain Force Employment Concept*. Specifically, there is still no widely understood and doctrinally accepted method of assembling and depicting an operational-level common operational picture (COP).

This article aims to outline a simplified yet effective method for COP generation from first principles to enable decision making at the operational level of war, both within the traditional (land, air, sea) and non-traditional (cyber, information, space) domains. Staff can take an operational-level commander's operational problem and concept of operations (CONOPS) and use deductive reasoning to break down the commander's operational problem into information requirements and data points. These can then be harnessed to engineer automated and manual reporting systems that, through the use of logical induction, can be visually depicted in such a way as to build a common situational understanding that better enables decision making.

It should be noted that most of the ideas contained in this article are not entirely original. In fact, most of the ideas guiding this work are derived from both superseded and current military doctrine. This is encouraging, as it means that a firm foundation exists for innovation within non-traditional domains. However, the author has observed that, when confronted with an operational problem, staff typically do not methodically use the tools provided in military doctrine. In this case, the Canadian military doctrine regarding intelligence collection planning forms a significant base for the ideas that will be examined below.[4] The article concentrates on information requirements mainly linked to friendly forces, as the intelligence

Brigadier-General S. G. Graham, Commander of 3rd Canadian Division, based in Edmonton, talks with the troops in Drayton Valley, Alberta, on 16 May 2023, in support of Operation LENTUS 23.

Source: Combat Camera

collection planning process has been well covered. Also, the article refrains from recommending visualization options for COPs, but it will provide general suggestions on how to choose one. When developing solutions for commanders, experts in the non-traditional domains of space, cyber and information should reflect on the unique nature of their domains and how they interact with others.

Within Canada's joint doctrine publications, the term "common operational picture" is often used but rarely examined in any detail.[5] A search in *Termium Plus* reveals a recent (2018) definition of the term: "a shared and dynamic representation of information that can be tailored to facilitate situational awareness, collaborative planning, and decision-making."[6] The term "situational awareness" is further defined in *Termium Plus* as "the knowledge of the elements of the operational environment necessary to make well-informed decisions," providing further context.[7] Likewise, the recognized military definition of planning is "the selection of courses of action to attain organization objectives, through a systematic consideration of all alternatives."[8]

It is clear from the definitions that a COP is geared towards two closely related ends. The first is the creation of a "shared" representation of information, which acts as a means to synchronize military actions both vertically and horizontally, resulting in increased internal efficiency and greater external effects. Second, and most important, is enabling decision making, which links back to the stated requirement for a COP to be both dynamic[9] and tailorable.[10] Ideally, a COP should allow commanders to use what Carl von Clausewitz called their *coup d'œil*, that is, to understand and exploit fleeting opportunities in time within and across the domains assigned to them.[11] This includes not only the physical battle spaces but also non-physical opportunities that may be perceptible only through a correlation of elements.

Within the traditional operational-level domains, COPs have evolved based on the cumulative experience of generations of military officers specializing in those domains. The information sought has been learned through reasoning as well as trial and error, while reporting structures, databases, visualization tools and doctrinal standards are typically standardized and well understood. However, as noted in the *Pan-Domain Force Employment Concept*,

Military personnel from multiple nations work in the Combined Joint Operations Center located at the International Security Assistance Force Headquarters in Kabul, Afghanistan, 27 January 2009.

Source: Combat Camera

the CAF will increasingly find itself operating in the non-traditional domains of space, cyber and information. Within these non-traditional domains, the military staff have not yet developed extensive familiarity with the information required to support commanders. Moreover, it is increasingly obvious that joint operational military commanders may be called upon to support non-traditional defence activities across all domains. For example, the operational role of Canadian Joint Operations Command in Op LASER and Op VECTOR (the CAF's response to the COVID-19 pandemic and its support for vaccine distribution, respectively) occurred across all the recognized domains. Those operations incorporated a number of assigned and implied tasks that required the chain of command to follow unique information requirements that are not normally encountered by military forces acting in traditional roles. To maintain information dominance over potential adversaries and rapidly adapt to non-traditional tasks, it is prudent to build a process to design COPs quickly and with a view to leveraging in-place information holdings and reporting structures.

The process of designing a COP can be broken down into three general phases. The first phase, Deducing Requirements, is partially captured in command support and intelligence doctrine within Canadian military doctrine. It involves defining the intelligence and operational problems faced by the commander, dividing them into information requirements and further breaking them down into actionable data points that can be assigned for collection. The second phase, Survey Reporting and Databases, involves employing specialists to capture required data from databases and generalist staff to mandate the required reports and returns to meet the friendly force information requirements (FFIR). The third and final phase, Visualization, involves visualizing information by employing traditional or non-traditional means.

PHASE ONE: DEDUCING REQUIREMENTS

The planning of a COP starts with the identification of the problem facing the operational commander during operational design.[12] Once the overall problem statement is defined, the commander and staff should be able to extract an intelligence problem by looking at factors external to the force and a generalized friendly force operational problem facing the commander. The friendly force operational problem statement should, to the maximum extent possible, capture the following aspects:

a. the internal tensions and dilemmas facing the force the commander intends to use to achieve the mission;

b. the commander's authorities, responsibilities and accountabilities; and

c. the broad sum of the information the commander needs to make decisions within the frame of the friendly force.

The problem statement should generally take the form of a question, but it can be presented in the form of a statement if desired. As the commander's operational design transforms into planning activities that refine courses of action (COA), the staff who are planning the COP should continue to evolve the operational problem until a COA and a finalized CONOPS are selected. At this point, the CONOPS should provide a firm context for the deductive work to come.

Once the friendly force operational problem is confirmed against the CONOPS, it is subdivided into FFIRs. Defined as consisting of "information the commander needs about friendly forces in order to develop plans and make effective decisions," FFIRs form an essential component of the commander's critical information requirements.[13] If complete

CURRENT AS OF: 062000L APR 2020		CANADIAN JOINT OPERATIONS COMMAND COMMANDER'S DATA/INFORMATION COLLECTION PLAN - FRIENDLY FORCE INFORMATION REQUIREMENTS																									
Drafter's Name: LCol AJ Duncan																											
OPERATION NAME: Op VECTOR and LASER																											
Commander's Operational Problem: How are my forces postured to assist our partners in degrading COVID-19, while preserving capacity to respond to other events?																											
#	FFIR	IR#	Data/Information Requirement	IR#	Data/Information	Public Health Agency of Canada (via SJS)	Strategic Joint Staff	Royal Canadian Navy	Canadian Army	Royal Canadian Air Force	Chief of Military Personnel	CFINTCOM	CFJOSG	CMSG	JFACC	HS	JTF(N)	JTF(P)	JTF(W)	JTF(C)	FOI(E)	JTF(A)	Reporting Interval	Reporting Type	Decision Supported
1	What is the health status of forces that are employed or available for Op VECTOR or LASER?	1.1	Health status of forces employed or committed to Op VECTOR	1.1.1	Confirmed COVID infections in Op VECTOR/ LASER-identified projection capabilities (e.g. aircrew).										x								Flash	SITREP	Requirement to retask, manage risk, impose additional FHPM.
				1.1.2	Confirmed COVID infections in Op VECTOR-identified MMATs.						o						x	x	x	x	x	x	Flash	SITREP	Requirement to retask, manage risk, impose additional FHPM.
				1.1.3	Confirmed COVID infections in Op VECTOR-identified GD capabilities.			o	o	o							x	x	x	x	x	x	Flash	SITREP	Requirement to retask, manage risk, impose additional FHPM.
				1.1.4	Confirmed COVID infections in Op VECTOR-identified liaison teams.												x	x	x	x	x	x	Flash	SITREP	Requirement to retask, manage risk, impose additional FHPM.
				1.1.5	Confirmed COVID infections in Op VECTOR-identified warehousing/distr/clinical sites.			o	o	o	o		o	o		o	x	x	x	x	x	x	Flash	SITREP	Requirement to retask, manage risk, impose additional FHPM.
				1.1.6	Confirmed COVID-infections in Op VECTOR-identified vaccine storage facilities.			o	o	o	o		o	o		o	x	x	x	x	x	x	Flash	SITREP	Requirement to retask, manage risk, impose additional FHPM.
		1.2	Health status of forces employed or committed to Op LASER and the SOODOO	1.2.1	Confirmed COVID infections in Op LASER-identified MMATs.						o						x	x	x	x	x	x	Flash	SITREP	Requirement to retask, manage risk, impose additional FHPM.
				1.2.2	Confirmed COVID infections in Op LASER-identified GD capabilities.			o	o	o							x	x	x	x	x	x	Flash	SITREP	Requirement to retask, manage risk, impose additional FHPM.
				1.2.3	Confirmed COVID infections in Op VECTOR/ LASER-identified FN/Remote/Isolated Communities Sp Tps.			o	o	o							x	x	x	x	x	x	Flash	SITREP	Requirement to retask, manage risk, impose additional FHPM.
				1.2.4	Confirmed COVID infections in CRPGs				o								x	x	x	x	x	x	Flash	SITREP	Requirement to retask, manage risk, impose additional FHPM.
				1.2.5	Confirmed COVID infections in IRUs.			o	o	o							x	x	x	x	x	x	Flash	SITREP	Requirement to retask, manage risk, impose additional FHPM.
		1.3	Health status of remaining CAF elements within Canada	1.3.1	Confirmed COVID infections across uncommitted CFHS elements.						o					o							Daily	DSR	Impact analysis for RFFs to L1s.
				1.3.2	Confirmed COVID infections across elements identified for expeditionary operations.			o	o	o						o							Daily	DSR	Impact analysis for RFFs to L1s.
				1.3.3	Confirmed COVID infections across L1s conducting institutional activities.			o	o	o						o							Daily	DSR	Impact analysis for RFFs to L1s.

Source: Lieutenant-Colonel Andrew J. Duncan

Example of a draft Op VECTOR Information Collection Plan.

FFIRs are not available directly from the commander, they can be deduced from the friendly force operational problem. Each FFIR should take the form of a question addressing a subcomponent of the operational problem, using doctrinal terms whenever possible. Although it is theoretically possible to divide an operational problem into an infinite number of FFIRs for the purpose of manageability, the number should be limited to a maximum of ten. To test the validity of each FFIR, staff should make a broad attempt to link each to a commander's decision point, decisive point or related condition. If the staff cannot do so, they should reconsider the requirement.[14] Once the FFIRs are prioritized, staff should consider information requirements (IR) derived from each FFIR. The IRs are statements describing an assessment or known state of an organization or process that, in sum, answer the question posed by an FFIR. There is no limit to the number of IRs within an FFIR, but in order to keep the process manageable, the number of IRs should be kept to a minimum.

Flowing from this, the final level of consideration is a data point or individual assessment. Although the information requested is not normally data, it consists of an individual fact or a simple standardized military qualitative or quantitative assessment that, once considered alongside others, can assist in answering the IR. In the case of standardized assessments, COP planners should consider how the required assessment is created and ensure that they note the methodology. In the case of qualitative assessments, the plan should explain how specific assessments are to be conducted and aggregated from one level of command to another. In the case of quantitative assessments, the mathematical logic should likewise be captured in the plan to establish a baseline understanding across staffs and possible automation.[15]

Once the FFIRs, IRs and data points / assessments have been broken down, they should be plotted against a number of factors. As in the intelligence collection planning process, the factors should include sources and agencies that represent a commander's superior, flanking and subordinate formations. When assessing these sources and agencies, staff should distinguish between an agency, which is typically a flanking, superior or supported formation, and a source such as a subordinate formation or unit. Additional factors that should be included are the expected reporting interval for the data point / assessment requested (including immediate, daily and weekly) and the form of reporting that will contain the data point / assessment in question. It should be noted that the interval and form of reporting may not align with the priorities assigned to the FFIRs and their subordinate information requirements. Rather, the interval of information should reflect the linkage of that data point / assessment to the decision or decisive point it would most likely support. This linkage should be made explicit in another column and indicate whether the data point / assessment is used to support a commander's decision point or the attainment of a decisive point, or is used or can be used as a measure of performance/effectiveness. One last column can expand on the data point / assessment, its form and any additional information that may be relevant to its inclusion and

eventual induction into the COP.[16] At this point, the information collection plan is largely complete. As the operational plan continues to develop, FFIRs should be refined and reprioritized as necessary.

PHASE TWO: SURVEY REPORTING AND DATABASES

The second broad phase facing a planner is to engineer the reports, assessments and data automation that will underpin the COP. The first step within this phase should be to use the COP information collection plan to determine how it will nest within their superior headquarters and/or supported command. It may be the case that the higher formation will mandate the collection of information not relevant to the COP of the subordinate formation. If so, staff may add an FFIR specifically for the collection of that information and assign data points / assessments to subordinate formations for processing. In addition, staff should examine the information "asks" to superior or flanking commands. In some cases, the ask can be fulfilled with a product maintained by those commands, without the requirement for additional processing. At the operational level, these products would not necessarily consist of map overlays but of charts and forms of graphical assessments that could easily be rolled into the formation's COP. To the greatest extent possible, planners should encourage the production of graphical assessments in the form of data objects and other structured formats that can be manipulated to meet information requirements.[17] The end goal of this phase is to achieve a degree of economy of effort in the production of the COP and to draw advantages from the expertise of superior, flanking and supporting commands.

Once the context of the COP is understood from the perspectives of higher and flanking headquarters, planners should move on to the second step. The aim of this step is to understand what information does and does not flow into the headquarters. It also aims to capture the processes behind the subordinate commander's assessments and determine what data/information can be drawn into the COP from shared databases. To this end, COP planners should survey any existing reports and returns systems from subordinate formations to determine what information requirements, data points and assessments are already provided. As the COP planners conduct their work, they should note, in particular, the structure of the available data. In order to fully leverage technology, simplify reporting systems and ease processing, structured data (predefined and formatted to a set structure) should be preferred to unstructured data (i.e. in its native format and not processed).[18] In the case of assessments, staff should confirm the process behind assessments to ensure that there is a shared understanding of their meaning, using the appropriate level of military doctrine (e.g. American, British, Canadian, Australian and New Zealand Standardization Program; NATO; national) as a baseline. It is critical that planners survey the operational databases employed across the force and assess the reliability, integrity and security of the data held within those systems. Further consideration should be given to historical record keeping for accountability purposes, in case a need arises.[19]

If the current reporting system is adequate for the needs of the headquarters, and if the reports and returns are properly aligned with the required reporting intervals, the current system may be adequate and few changes may be required. This is the ideal outcome, as changes to reports and returns systems necessitate considerable staff efforts at all levels. However, most of the time, staff will discover information gaps between lower headquarters and their own. If this is the case, there are two options available to COP planners. The first is to alter current reports and returns to force the inclusion of the required information or assessments and/or alter the timings linked to the reporting cycle to recognize the assessed importance of a data point / assessment. This is usually the preferred option, as it leverages existing systems and habits and minimizes staff efforts. The second option is to completely redesign the reporting system to reflect the requirement of the new COP. Although this option may create some economies of effort in the longer term, it will likely require some shorter-term staff effort on the part of subordinate headquarters. It is, therefore, advisable to promulgate new reporting templates only during lower-tempo periods or when a change of campaign theme (and alteration of the operational problem) requires it.

Closely related to reporting are databases. Once planners have determined what databases are being used and how, they must seek to exploit them by automating their holdings into the COP. This process may be challenging given the rarity of the expertise required and the institutional restraints and constraints surrounding the procurement of services in the required fields, but it is a critical step. The draft *Pan-Domain Force Employment Concept* notes the intellectual challenges facing the military profession, while other documentation indicates that the CAF is grappling with retaining and recruiting qualified personnel. It is, therefore, crucial to maximize the outputs of each member, including trained staff officers. Although the collection, analysis and production of a COP are important to decision making, each portion of the process that can be automated represents freed capacity that can be applied against the extraordinary information that emerges in a dynamic, multi-domain battle space. If the planners determine that a database is secure and that the data in it are fit for purpose, efforts should be made to automate its use within a COP. If a database is determined to be inadequate, the database owner should be informed, and efforts must be made to improve it so as to achieve its full potential.

Lieutenant-General Christian Juneau, Deputy Commander of Allied Joint Force Command Naples, visits Colonel Stéphane Boivin, Commander of 5 Canadian Mechanized Brigade Group, during Exercise TRIDENT JUNCTURE at Camp Fremo, Norway, on 26 October 2018.

Lastly, at this stage, COP planners should bear in mind the classification level of the various data/assessments for the IR. Currently, the construction of COPs is limited to the highest level of classification permitted on the IT system hosting it. However, as multi-caveated IT systems become possible through innovations such as tailorable PKI encryption and data meta-tagging, it may become possible to weave together streams of data/assessments across different levels of classification and tailor the COP to the applicable audience. However, in the shorter term, planners will need to strike a balance between the size of the COP's audience and the requirements of information security.[20]

PHASE THREE: VISUALIZATION

Once reporting, assessments and databases have been aligned with the information collection plan, staff can commence the third phase, visualization. It should be noted that within the context of this article, visualization does not equate to the cognitive state of battlefield visualization most often associated with the tactical level. Instead, this phase involves deciding on the form of the COP. On its own, a COP is merely an artifact, an object created by a human being. Only when this object is combined with the cognitive capacities of its users is its purpose is achieved: namely, a shared level of knowledge and understanding of the military operational situation. This renders the choice of form particularly important, since it will play a powerful role in aligning the understanding of the commander and the staff.[21]

Although many staff officers prefer to start with visualization and then work backwards, there are considerable risks in adopting that approach. One of the primary risks is that the visualization will supplant the operational problem, leading to a COP disconnected from the commander's requirements. There are occasions when a COP can, and in some cases should, begin with the visualization. This is specifically the case in those domains at the tactical level where the adversary, environment, FFIRs and military doctrine are generally well understood. However, when operating within and across unfamiliar domains or when facing a unique operational problem, moving forward from first principles offers the advantage of getting it close to right the first time and creating a stronger degree of understanding of the commander's needs within the headquarters.

Visualization is an incredibly complex issue, touching upon a number of disciplines. It is also a subject of intense debate, and numerous papers and studies have expressed dissatisfaction with many of the forms that COPs have taken over the years.[22] To overcome those issues, it is accepted

within its definition that a COP should be tailorable to the needs of individuals using it.[23] Instead of displaying large amounts of fixed information, an ideal COP should allow commanders and staff to select and correlate information they consider relevant to an aspect of the operational problem and the commander's CONOPS. This includes the ability to drill down where appropriate and to look across the ensemble of information in a headquarters to compare different types of information. Making the COP tailorable is related to an implied requirement of presenting data in a manner that enables the headquarters to synthesize information across the staff branches. Given the diversity of information within a command, this is by no means an easy feat.

Despite the complexity mentioned above, admiring the problem of visualization is not going to resolve it. The first step towards building a COP visualization is closely linked to the first step of the COP-building process and to the FFIRs. The staff officers leading the effort should carefully parse the FFIRs, attempting to identify commonalities between them. Typically, there will be some commonality which links some of them together. In the traditional tactical land, air and maritime domains, the FFIRs are linked by the requirement to understand the location of capabilities within time and space, with each of the traditional domains using a different scale relating to the characteristics of the tactical capabilities being used. Tactical practitioners within the air domain, for example, view time and space in scales very different from those used by land tactical officers. Since time and space are usually a commonality between most tactical-level FFIRs within the traditional domains, geomatics products figure prominently in traditional COP visualizations. When planners encounter exceptions, they usually design bespoke graphs, charts and other artifacts that communicate the information and assessments in question in a simplified way for the decision maker to incorporate into their understanding of the situation at hand.

Within the non-traditional domains of cyber, space and information, and in the face of some operational problems that may emerge across them, a geomatics baseline may not be the logical deduction. Although time and sequencing are often associated with FFIRs in direct or indirect ways, physical space may not be. Two examples of types of diagrams that may be more appropriate for baseline visualizations in some domains are network diagrams, which depict linkages and their relative weight of influence, and stylized diagrams, which show infrastructure and its dependencies. Planners should also note that in some instances, an audience may need to be educated on how to read them. Military officers and non-commissioned officers often forget that learning how to use maps and charts is not an automatic skill but one that needs to be taught, practised, and perfected over time. Military professionals must understand that a similar process within the new domains demands a degree of discipline and willingness to learn, and that unnecessarily switching visualizations may hamper effectiveness.

A second consideration facing COP planners in their choice of visualization is the ease of relating the domains to one another. Appealing to the commander's *coup d'œil* is critical in shortening decision–action cycles. Since identifying opportunities across domains is key to striking the adversary from unanticipated directions, relating the three traditional environments to one another and the non-physical domains is essential to success.[24] Ultimately, fighting (or the threat of fighting) in the traditional domains defines warfare and is the historical constant that will likely persist into the future.[25] Therefore, a key challenge of any COP design will be to bridge the cognitive gap between what is known in the physical world and the less tangible and less certain elements of the non-physical domains. The author fully acknowledges the challenge inherent in this task.

CONCLUSION: THINKING AND PRACTICE MAKE BETTER

The process of creating COPs is often assumed to be simple. This could not be further from the truth. Trial and error have led the Royal Canadian Navy, the Canadian Army and the Royal Canadian Air Force to develop best practices related to COPs that reflect the uniqueness of their domains. That noted, the operational dilemmas and characteristics in the non-traditional domains, and within headquarters where those domains intersect, require a more methodical approach to guide their efforts and, to the extent possible, get them right the first time. By understanding the operational dilemma, using deductive reasoning and rebuilding those deductions back up through automated and manual reporting systems towards a visualization baseline, staff can provide their commander with a powerful artifact enabling the *coup d'œil* required to keep our adversaries off balance.

Although this article attempts to lay out a roadway to an effective COP, military specialists in the new domains of cyber, space and information will likely need to develop military doctrine specific to their domains, and teach it to a whole generation of senior leaders, before they reach the "Eureka!" moment. Approaching the issue of COPs in a methodical and disciplined manner can likely improve performance in the shorter term and allow the CAF to push forward in its desire to achieve greater levels of pan-domain integration.

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DISCLAIMER

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ENDNOTES

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CULTURE MATTERS:

Military Training and Host Nation Culture

Major Kyle Vetter

INTRODUCTION[1]

Canada has a distinguished history of providing military training to a number of foreign partners. In addition to other national elements, the Canadian Armed Forces (CAF) is employed by the Government of Canada to develop new or improved military capabilities to enable partner forces and their development. Whether as part of defence diplomacy (DD) or capacity building (CB), the CAF utilizes subject matter experts (SME) to support the development of specific skills in host nation (HN) personnel.[2] Deployed on training assistance visits or as part of a mobile training team, CAF SMEs utilize the Canadian Forces Individual Training and Education System (CFITES) to support the HN in the development of required skills. Through instructional design, CAF SMEs utilize one, some or all phases of CFITES, which include analysis, design, development, conduct, evaluation, and validation of training programs to support capacity building and capability development in HNs.

The DD and CB activities will continue to remain a strategic geopolitical option for the Government of Canada. As the CAF continues to remain involved in capacity building and the provision of military training assistance, it is imperative to focus on one of the underexplored subjects within the broader context, that is, the influence of culture on training. It is pivotal to consider the impact of the HN's culture[3] on orientation, instructional design and training transfer when working to support the improvement or development of military capabilities of partner forces.[4] This is particularly relevant when cultural norms in the HN differ from the individuals' experience within Canada.

Culture can be examined and explained through many paradigms. However, it is often thought of as a group's patterns of thinking, living, and beliefs, including common behavioural norms and manner of communication.[5] As learning is impacted by culture in various ways, CAF personnel deployed on operations in other areas of the globe require a critical understanding of how the culture of an HN has the potential to impact the training and development of skills within partner forces.[6] The process of designing training programs is strengthened[7] and becomes more effective through an examination of how a culture orients itself toward the future, performance and work. It is equally pertinent to assess and understand the relationship that culture has with training and how that might impact the application of training on the job through training transfer. Failure to understand the critical impact of the HN's culture can result in a negative end state, impacted by misallocation of resources and the ineffective and possibly culturally insensitive design, development and conduct of training programs.

Source: Major Kyle Vetter

As a country that is home to diverse cultural traditions from around the world, the CAF recognizes the importance of adapting the training program to the culture and circumstances of the partner force.

Source: Combat Camera

Culture must be a constant factor of consideration throughout the instructional design process, as it is necessary when designing and developing effective instructional programs that adequately address the needs of the HN and partner force.

Source: Combat Camera

THE IMPACT OF ORIENTATION ON TRAINING

As a country that is home to diverse cultural traditions from around the world, the CAF recognizes the importance of adapting the training program to the culture and circumstances of the partner force.[8] In his research on cross-cultural psychology, Geert Hofstede delves into key links between cultures and highlights a culture's relationship with the dimension of time orientation.[9] Time orientation is organized into two categories: long-term and short-term orientation. These orientations can be viewed as the extent to which a culture focuses on the future, that is to say, whether it indexes on the present and past (short-term) or on the future (long-term). It further evaluates whether there are rewards for behaviours such as planning and investing for the future.[10] Cultures that are oriented toward the long term are typically more collectivist and have the tendency to think in terms of "we" instead of "I."[11]

The cultural dimensions identified by Hofstede were utilized as a foundation and expanded upon to explore the differences between cultures by the Global Leadership and Organizational Behaviour Effectiveness (GLOBE) research project in 1991. The GLOBE project rebranded time orientation as future orientation and also included

Source: Combat Camera

the cultural competency of performance orientation. Performance orientation factors in aspects of whether a culture has rewards and mechanisms in place to promote excellence, innovation, and performance improvement.[12] The human resource management theory expanded further on the cultural competency of orientation and included work orientation. Its inclusion helped understand the importance that an individual places on working and whether it is viewed in terms of being a burden, constraint or responsibility, and the degree to which work is prioritized over other aspects of life.[13]

When supporting the development of partner forces in an HN, it is valuable to examine the future, performance and work orientation. Those are important steps in understanding the cultural associations that people have concerning their role as military members of the HN. In a culture with high future, performance and work orientation, members of the partner forces will be highly motivated to learn and develop the identified skills, as they view themselves as part of a collective striving for excellence. They also find value in the training and tasks they are undertaking. That also applies to the organizations that they work for.

Alternatively, in a culture with lower future, performance and work orientation, issues during training can stem from a lack of motivation, participation or even attendance of partner force members. At the organizational level, there may be a lack of motivation to deliver on commitments or contribute resources that may only be beneficial in the long term. Understanding the culture of partner forces is crucial when working on capacity building and the development of skills with an HN. Overall, it can serve as an indicator of the maintenance of interest, level of commitment and dedication of resources (material, human and financial) needed to achieve the desired results.

CULTURE AND INSTRUCTIONAL DESIGN

Culture must be a constant factor of consideration throughout the instructional design process, as it is necessary when designing and developing effective instructional programs that adequately address the needs of the HN and partner force.[14] It is important to "fully understand" rather than "simply consider" the culture of the HN. More importantly, it is worth examining how one's own culture impacts the way training is designed domestically, especially because

DIMENSIONS	EFFECT ON THE TRAINEE	OTHER RELEVANT FACTORS
High future, performance, and work orientation	• High motivation • Enthusiasm to learn and develop skills • Training is valued	• Individuals consider themselves as part of a collective
Low future, performance, and work orientation	• Lack of motivation • Limited participation • Training may not be valued	• Lack of motivation on the part of the organization

Figure 1: Cultural Determinants and Effect on Training

Source: Major Kyle Vetter

the intent should be to design training programs "with" the partner nations and not "for" them.[15] Cultural aspects should also be considered when a skill or capability deficiency has been noted within the partner force, and the training must be designed, developed and customized to address the identified skill gap.

In each phase of CFITES (analysis, design, development, conduct, evaluation and validation), instructional designers must be aware that culture is integral and, for it to be effective, the training must be culturally sensitive.[16] When working with a partner force, the instructional designer must continuously consider the implications of a culture that differs from theirs in a wide variety of subjects, including time, performance or work orientation. For that reason, instructional designers should be embedded with the partner forces because increased interaction with the culture may offer them a more nuanced understanding of whom they are designing the program with and what the most culturally appropriate aspects that must be incorporated are.[17] By being cognizant of our own beliefs, attitudes, feelings and desires, we are better equipped to understand the overlapping areas and intersections between the culture of the HN and partner forces. That ensures that the skills or the identified capability gaps within the partner force are respectfully addressed in the most effective way possible.

CULTURE AND TRANSFER OF TRAINING

The transfer of training, or training transfer, refers to an individual's ability to apply the skill and knowledge they have learned while in training at the workplace.[18] Similar to civilian corporations, the Government of Canada wishes to ensure that the allocated resources effectively contribute to the desired results. Within the realm of military skill and capability development, this is often assessed through the lens of training transfer. When developing training for a partner force, whether as part of CB or DD, it is invaluable to focus on the perceived relevance of the training for the trainees. If the training is not relevant or not perceived to be relevant—regardless of the trainee or work characteristics that were factored into the training design—the learned skills may not be applied upon returning to work.[19] If members do not or cannot apply the skills gained from training, then the training objectives are not achieved, and the needs of the HN remain unaddressed.

In addition to the perceived relevance of training, characteristics of the trainee and their workplace must also be factored in during the design and development phase. That increases the chances of the members' applying the skills learned in training to their place of work. When examining the characteristics of a trainee, self-efficacy and motivation are important factors of consideration. When members leave the training feeling confident in their ability to perform the tasks that they were trained to do, they are likely to be more resilient in facing and addressing the obstacles associated with the training they've completed.[20]

Self-efficacy is very critical because military employment can be dangerous, and the application of skills learned in training can mean the difference between life and death. As the confidence in their training increases, the members' resilience and motivation plays a crucial role in the application of skills or knowledge. If the member's motivation is low during training, the likelihood of them employing the skills gained is also low.[21] When a member is motivated, they are likely to invest more effort in the initial transfer and maintenance of the trained skill. The transferability of skills and knowledge is central to gauging the success of a training program.[22] A trainee's cultural background and values are important because they greatly aid the design and development process in ensuring that the motivation to learn and the perceived relevance of the training are maintained throughout.[23]

In order to preserve the skills and motivation that a member has acquired during training, a trainee's workplace and the organizational reward structure must support the member to maintain these skills.[24] Without support from the organization—including providing opportunities to apply the skills, having tolerance for mistakes, and fostering a supportive environment that facilitates the transfer of learning—a member's ability to apply the skills may diminish over time.[25] This phenomenon is referred to as skill fade. To understand a partner force's relationship with the training through its perceived relevance, developers of the training must consider the characteristics of the trainees and the characteristics of the work environment and ensure that the trainees gain the skills required.

CONCLUSION

The role and impact of an HN's culture within training, while often underappreciated, is vital to the effective design, development and delivery of military training[26] for partner forces. A failure to incorporate the impact of culture can negatively affect the development of new or existing skills in a partner force. Overall, training can be designed, developed and conducted more effectively to ensure that it is tailored to the needs and realities of the HN. That not only requires a comprehensive understanding of the impact of culture but also demands knowledge of the cultural orientation, of how culture impacts learning, and of the characteristics of the HN environment. Finally, it must be recognized that developing culturally aware training programs requires continuous effort and a willingness to constantly learn and adapt to the varied settings and nuances of an HN's culture.

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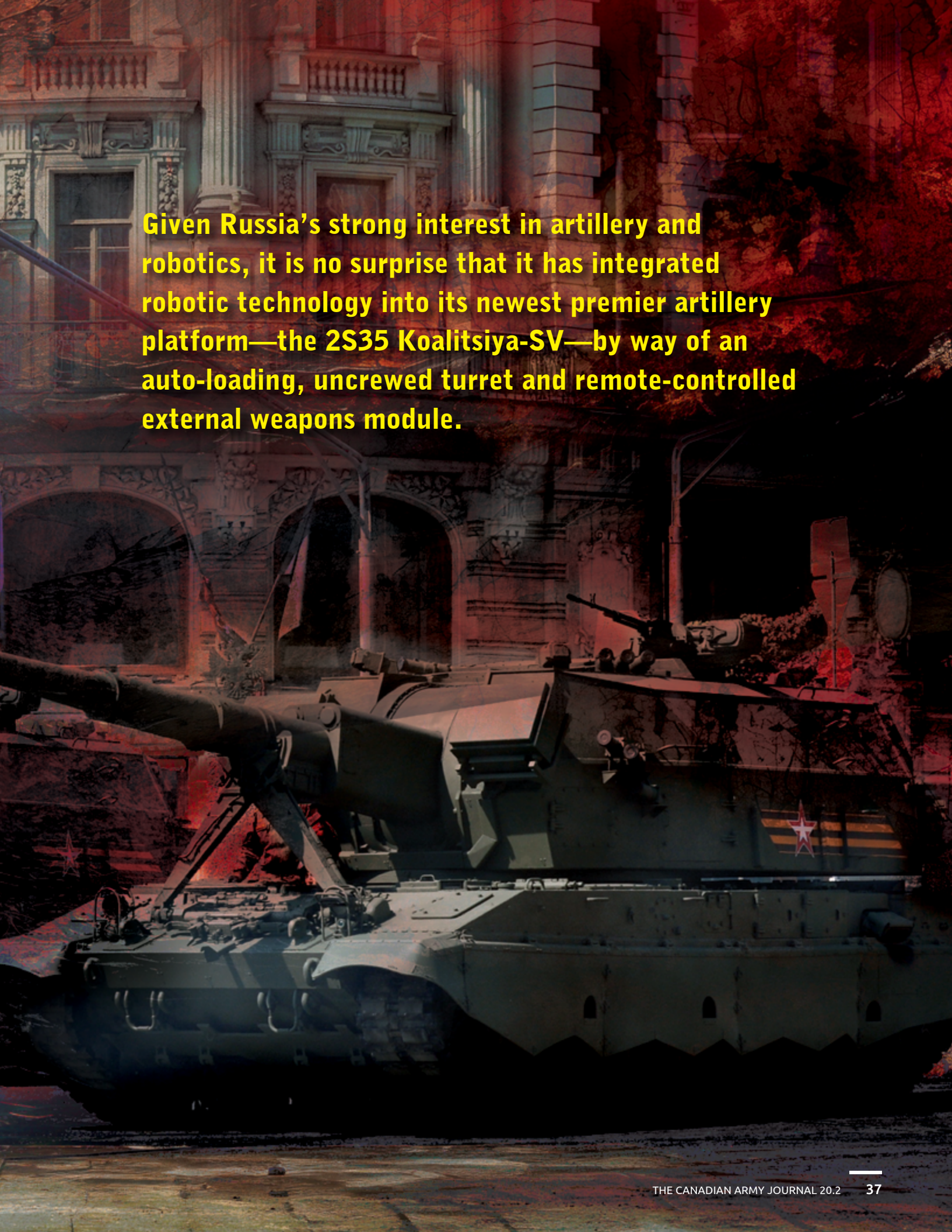
THE 2S35 KOALITSIYA-SV, ROBOTICS AND THE FUTURE OF RUSSIAN ARTILLERY MODERNIZATION

Dr. Lester W. Grau and Dr. Charles K. Bartles

INTRODUCTION

The Russian Armed Forces put a great deal more emphasis on artillery, or the "God of War," than other armies do. While the West has been shifting efforts from artillery and other conventional aspects of war in favour of counterinsurgency, Russia has been consistently pursuing artillery modernization, as its economic resources allow. The war in Ukraine has proved the adage that the Russian Army is an artillery army with tanks: Russia has fought this conflict artillery-heavy and manoeuvre-light. Ukraine, which lost considerable artillery in the first months of the conflict, has been unable to replace it and has had to substitute with large numbers of personnel. In this conflict, artillery reconnaissance has changed from primarily ground reconnaissance to ground, air and space reconnaissance and highly accurate targeting. Artillery must fire and move rapidly to survive. Canada, like other North Atlantic Treaty Organization members, is concerned with European security and how to handle it. Canadian defence planners are dealing with these changing issues and looking to existing and future artillery systems as part of the solution.



Given Russia's strong interest in artillery and robotics, it is no surprise that it has integrated robotic technology into its newest premier artillery platform—the 2S35 Koalitsiya-SV—by way of an auto-loading, uncrewed turret and remote-controlled external weapons module.


T-62


2S3 AKATSIYA


2S5 GIATSINT-S


2S19 MSTA-S

Like many other nations, Russia is now considering the role of robotics in the armed forces. Although Russia was a relative latecomer to the uncrewed air vehicle (UAV) endeavour, it has since made significant advances and was the first to successfully employ UAVs for artillery purposes. Given Russia's strong interest in artillery and robotics, it is no surprise that it has integrated robotic technology into its newest premier artillery platform— the 2S35 Koalitsiya-SV—by way of an auto-loading, uncrewed turret and remote-controlled external weapons module. The Soviet T-62 was the last Russian tank to have a four-person crew. The introduction of a robotic autoloader eliminated the job of the loader, and subsequent tank crews consisted of three people. The robots supporting the 2S35's auto-loading uncrewed turret should allow a reduction in crew size. Russia is also considering effective ways to use robotic technology to support the 2S35 by using UAVs and uncrewed ground vehicles (UGV) to provide reconnaissance and logistically support 2S35 fires. In early July 2022, Russian state-run media reports claimed that Russia has introduced the 2S35 in the war in Ukraine although the development remains unsubstantiated by credible sources at the time of writing.[1]

This article, based primarily on information published in Russian defence journals before the current combat in Ukraine, outlines the purported capabilities of the 2S35, the current structure of Russian artillery units, and how the Russian artillery community envisages future structural changes to these units to best employ the 2S35 and robotics. It is important to note that the 2S35 Koalitsiya has yet to enter combat in Ukraine. This may be because Russia has only a battery of 2S35s that is still undergoing testing to determine the system's capabilities and to work out any remaining bugs and determine how the 2S35 can best be integrated into the force. In addition, Ukraine has reportedly captured many Russian weapon systems fully intact. The capture of an intact 2S35 would be a boon for Western intelligence and a major public embarrassment for Russia.

HISTORY OF THE KOALITSIYA PROGRAM

Although the Soviets produced several 152 mm self-propelled howitzers (including the 2S3 Akatsiya, the 2S5 Giatsint-S and the 2S19 Msta-S), their characteristics were believed to be inferior to those of the self-propelled artillery systems being fielded, or expected to be fielded, by foreign armies, such as the Crusader (the United States), the PzH 2000 (Germany), the AS90 (the United Kingdom), and the K9 (South Korea). To remedy this situation, Russia laid plans in the early 1990s to create a rapid-firing 152 mm self-propelled artillery system for use in division-echelon artillery. The system would specifically be designed to attack personnel and destroy tactical nuclear weapons, artillery and mortar batteries, tanks and other armoured vehicles, anti-tank weapons, air defence and anti-missile defence assets, control points, and field fortifications, and to impede reserves in the enemy's defensive depth.[2]

As the Burevestnik Central Scientific Research Institute (*TsNII Burevestnik*) [Центральный научно-исследовательский институт (Буревестник)], located in Nizhny Novgorod, is the primary designer of tube artillery systems for the Russian Armed Forces, it was assigned responsibility for designing the project. At the same time, the Ural Transport Machinery Factory (*Uraltransmash*) [Уральский завод транспортного машиностроения (Уралтрансмаш)], in Yekaterinburg, was responsible for the manufacturing. Both entities were eventually subordinated to *UralVagonZavod* [УралВагонЗавод] in Nizhny Tagil, the same corporation that produces the limited-production T-14 Armata. In 2016, *UralVagonZavod* was incorporated into the State Corporation for Assistance to Development, Production and Export of Advanced Technology Industrial Product (*Rostec*) [Государственная корпорация по содействию разработке, производству и экспорту высокотехнологичной промышленной продукции (Ростех)].[3]

From the project's inception, the howitzer was envisioned to have an uncrewed turret, as *TsNII Burevestnik* was already conducting research on uncrewed weapon modules. However, due to Russian economic turmoil in the 1990s, the project did not reach full steam until the early 2000s. The project's eventual name, the Koalitsiya or Coalition, can be traced back to *TsNII Burevestnik*. The Main Missile and Artillery Directorate of the Ministry of Defence of the Russian Federation (MMAD MD RF) likely used the name because the system was intended for use by a "coalition" of organizations in the defence ministry, including the ground forces and coastal defence artillery, and is even being considered for use on naval vessels.[4] The prototype developed for the project was a heavily modified Msta-S howitzer with a unique double barrel, over-under design. Apparently, the prototype was deemed unfeasible and was abandoned in favour of a more conventional design in 2010.[5] The MMAD refined its guidance, tasking *TsNII Burevestnik* to develop tracked and wheeled variants of a single-barrelled Koalitsiya howitzer and a wheeled transport-loader vehicle (TZM) to support them. By 9 May 2015, *Uraltransmash* had produced the first batch of what would come to be known as the 2S35 Koalitsiya-SV (2C35 Коалиция-СВ) tracked self-propelled howitzers. Although there have been some significant modifications to the 2S35's internal components, the external appearance has changed little since the initial fielding. By 2020, wheeled and towed variants were in testing.[6] This capability is to be mounted on a variety of tracked and wheeled vehicles, which suggests that the Koalitsiya-SV is following the same design pattern as other Russian military combat vehicles. It is likely an innovation furthered for the benefit of the Russian Defence Ministry but also a selling point on the lucrative international arms export market. In 2016, it was announced that ten 2S35s would be field tested in the Western Military District's 1st Tank Army.[7]

CAPABILITIES OF THE 2S35 KOALITSIYA-SV

Armament

Perhaps the 2S35's most impressive feature is the uncrewed turret. Russia has already had much experience with autoloaders in tanks, starting with the T-64 (also produced by *UralVagonZavod*), but this will be the first Russian artillery system with an autoloader and a completely uncrewed turret. This provides several advantages, namely faster rates of fire, the capability to store more ammunition, and reduced weight. The 2S35 can reportedly fire up to 16 projectiles per minute and store up to 70 projectiles internally. This is a significant capability improvement from the latest modification of the similarly sized 2S19 Msta-S self-propelled howitzer. The 2S19M2 has a maximum rate of fire of 10 projectiles per minute and can store up to 50 projectiles. The Koalitsiya-SV's rate of fire is so rapid that Major General Alexander Dragovalovsky, the Deputy Commander of the Missile and Artillery Troops, stated that "A single Koalitsiya-SV self-propelled gun is worth an entire artillery battery."[8] Although Dragovalovsky's statement is undoubtedly an exaggeration, the improved characteristics are certainly quantitively superior to those of contemporary Russian howitzers. Dmitriy Semizorov, the general director of *Uraltransmash*, offers a more realistic comparison of the 2S35's capabilities with those of foreign analogues: [*translation*] "by the range of fire—1.3 to 1.7 times, the accuracy of fire—1.5 to 3 times, the rate of fire—1.5 times, and the time it takes to accomplish the combat mission—1.5 to 3 times."[9]

The 2S35's loading system handles the charges and projectiles separately, allowing the fire control system to select the best combination of charge(s) and projectiles for the mission, and includes a liquid cooling system for the barrel to facilitate the higher rate of fire.[10] This loading system feeds a 2A88 cannon equipped with a microwave ignition system that ensures a uniform detonation of the propellant charge to increase muzzle velocity and accuracy. This system can employ traditional 152 mm projectiles and a reportedly new family of projectiles designed specifically for the 2S35. In addition to conventional projectiles, the 2S35 also may employ base bleed and rocket-assisted projectiles (RAP) technology. There has been some conflation in reporting the range of the 2S35 regarding the use of these different technologies, but a range of 29 km for traditional 152 mm projectiles, 40 km for base bleed assisted projectiles, and up to 100 km for RAP projectiles appears reasonable.[11] The Koalitsiya-SV can fire several projectiles in rapid succession and, by varying the barrel trajectory, have them arrive simultaneously on target, a capability known as multiple rounds simultaneous impact (MRSI). Based on various Russian mass media reports, *Janes* has assessed that the 2S35 could at least conduct an eight-round MRSI at a range of 30 km.[12] The 2S35 is capable of firing a wide range of munitions, including HE-FRAG projectiles, cluster projectiles with anti-tank submunitions, electronic warfare (EW) jamming, and satellite navigation-guided munitions.[13]

Robotic technology is found not only within the 2S35 but also on it. The 2S35 is equipped with a 6S21 Remote Controlled Turret Module (DUBM) [дистанционно управляемых модулей вооружения (ДУМВ)], also designed by *TsNII Burevestnik*. This roof-mounted, remotely operated turret has a 12.7 mm KORD machine gun with guidance actuators, a laser range finder, closed-circuit television for aiming and situational awareness, and 200 rounds.[14] The equipping of the 2S35 with a DUBM is in keeping with current trends in the Russian Armed Forces to put DUBMs on large weapon systems (such as howitzers and tanks) as secondary weapons and on armoured personnel carriers, armoured cars and support vehicles as a primary weapon system. DUBMs are viewed as beneficial not only for crew protection but also from an intelligence, surveillance and reconnaissance (ISR) perspective, as they are equipped with a variety of sensors which far exceed the capabilities of the human eyes and ears of a crewed turret. Another benefit is that DUBMs such as the 6S21 can reportedly engage low-flying and low-speed aircraft and UAVs. Although the 62S1 has not reportedly been in use during Russia's 2022 invasion of Ukraine, other DUBMs, such as the Arbalet-DM mounted on the Tigr-M, are routinely seen.[15]

Fire Control

There has been little information released about the 2S35's fire control system. Still, it is likely a variant of the automated guidance and fire control system (ASUNO) [автоматизированной системы управления наведением орудия (АСУНО)] or a similar system. The ASUNO is now installed on a new tube, and rocket-launched artillery systems and modernized variants of systems such as the 2S1 Gvozdika, 2S3 Akatsiya, S24 Tyulpan, 2S19 Msta, 2S5 Giatsint-S, 2S7M Malka, Tornado-G and Tornado-S.[16] The ASUNO functions by transmitting data, via wired or wireless means, between battalion and battery command and observation posts, the battalion fire control post, and organic and attached artillery reconnaissance subunits. It collects, processes, stores and outputs data on the position, status, ammunition supply level and meteorological conditions of batteries and individual artillery pieces and uses that information to create firing solutions. The ASUNO includes an onboard computer, a gyroscopic heading and attitude indicator system, gunner's and loader's displays, a gun commander's display, a sight, a digital elevation sensor, and other equipment, ensuring automated gun laying and proper gun orientation.

The ASUNO provides a day/night, all-weather capability to fire in a dispersed combat formation at the firing position. Perhaps the ASUNO's most remarkable improvement over its predecessors is the speed of the system in calculating firing solutions. Not only does this improve support for the combined-arms battle as a whole, but it also increases battlefield survivability for the artillery systems themselves. This is especially important due to modern counterbattery location technology. If the enemy is equipped with this technology, an artillery unit must displace after firing for only 1–2 minutes.

Regarding the organizational aspects of the ASUNO, Russian sources state that it significantly reduces the workload of senior battery officers and gun commanders because the receipt of target data and the creation of firing solutions is done automatically. Senior battery officers and gun commanders can see the firing settings on the display monitor and monitor the accuracy of gun laying. In addition, digital mapping technology has been incorporated into ASUNO to provide better situational awareness.[17]

Mobility and Protection

The Koalitsiya-SV is based on a T-90 tank chassis and therefore shares many of the T-90's mobility and protection characteristics. The 2S35 weighs approximately 48 metric tons and will likely have a maximum speed of 60 km/h, an operational range of around 550 km, and the ability to snorkel across water crossings. The 2S35 can also launch smoke grenades and produce smoke by burning fuel in its exhaust if necessary. Although the 2S35 is currently being built on the T-90 chassis, there are plans for its use on the new Armata chassis.[18]

THE FUTURE OF ARTILLERY AND ROBOTICS IN THE RUSSIAN GROUND FORCES

Expected Roles of Robotics in the Russian Ground Forces

Russian interest in artillery modernization is occurring at a time of rapid technological advances, especially in robotics.[19] The Ground Forces envisage that robotics could support the following activities:

- Conducting a breakthrough of a deliberate enemy defence.
- Supporting defensive operations by using robotics in screening zones.
- Providing covering fire for advancing and suppressing enemy weapon systems.
- Artillery reconnaissance and logistics support.
- Handling dangerous munitions and conducting ordnance disposal in normal and dangerous conditions.
- Casualty and vehicle evacuation.
- Engineer reconnaissance, mine laying, mine clearing and obstacle removal.
- Radiological, chemical and biological reconnaissance.
- Laying of smokescreens in enemy zones of fire.

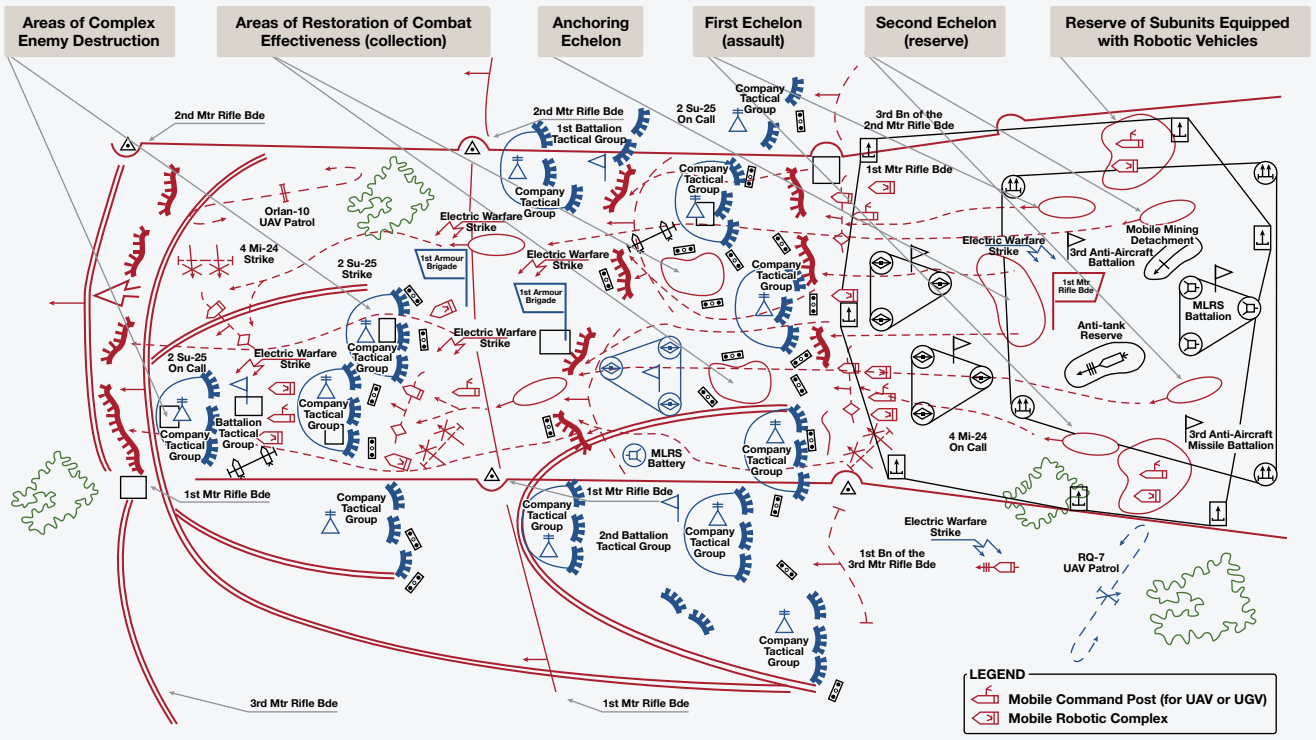


Figure 1: Russian Vision of Robotics in Future Combat[20]

- Delivering munitions and petroleum, oils and lubricants in enemy zones of fire.

- Providing security at borders, unit deployment areas, facilities, mountain passes and road intersections.[21]

It is important to note how Russia classifies different types of robotics. The Russian Armed Forces terminologies vary, but generally the terms "robotic complex" (RTK) and "mobile robotic complex" (MRK) refer to remotely controlled robotic devices (although there may be some limited artificial intelligence [AI] capability), while "robotic systems" (RTS) refers to autonomous or semi-autonomous devices. Command and control (C2) of these devices is usually provided by a mobile command post (MCP).[22] In general, Russia still works primarily with remote controlled–level technology, but advances in AI will permit the eventual fielding of autonomous/semi-autonomous–level systems. Russia is taking a two-pronged approach to creating these types of robotics. The first approach is to modify existing crewed platforms (T-72, Armata) and alter them so that they can be controlled remotely.[23] One reason that the control panel of the new Kurganets-25 infantry fighting vehicle is reportedly based on a computer joystick is to facilitate possible robotization.[24] The second approach is to produce platforms specially designed for autonomous and semi-autonomous operations, such as a military robotic complex (RTK VN).[25] Besides using UAVs (as mentioned above), Russia already had some experience with robotics on the battlefield. In 2018, Russia reportedly field tested an Uran-9 RTK uncrewed combat vehicle in Syria with mixed results, causing some Russian experts to speculate that such technology would need to mature for at least another 10–15 years before being fully ready for the battlefield, despite earlier official announcements that all deficiencies had been corrected.[26]

Figure 1 lays out a future Russian attack by a motorized rifle brigade as the central part of a three-brigade attack on a defending brigade. What is interesting is the new Russian symbology for UGVs and their mobile command posts. On the right side of the layout, there are two reserves of UGVs between the MRLS battalion and the two forward howitzer battalions. Since the howitzer battalions have their own robots for ammunition resupply and howitzer reloading, those reserves are positioned to aid in mine clearing, strong-point reduction, and exploitation. In the middle of the layout, the Russians are attacking using UGVs in defence breakthrough, fire suppression, artillery reconnaissance, mine clearing, and evacuation of wounded personnel and damaged vehicles. On the left of the layout, UGVs are used for fire suppression, artillery reconnaissance and resupply. The layout also shows UAVs, which are controlled by their own mobile command posts.

Robotics and Artillery

The Russian artillery community is particularly interested in how robotics can be integrated into artillery systems.[27] An interview with *TsNII Burevestnik's* General Director, Georgiy Zakamennykh, sheds some light on this thinking:

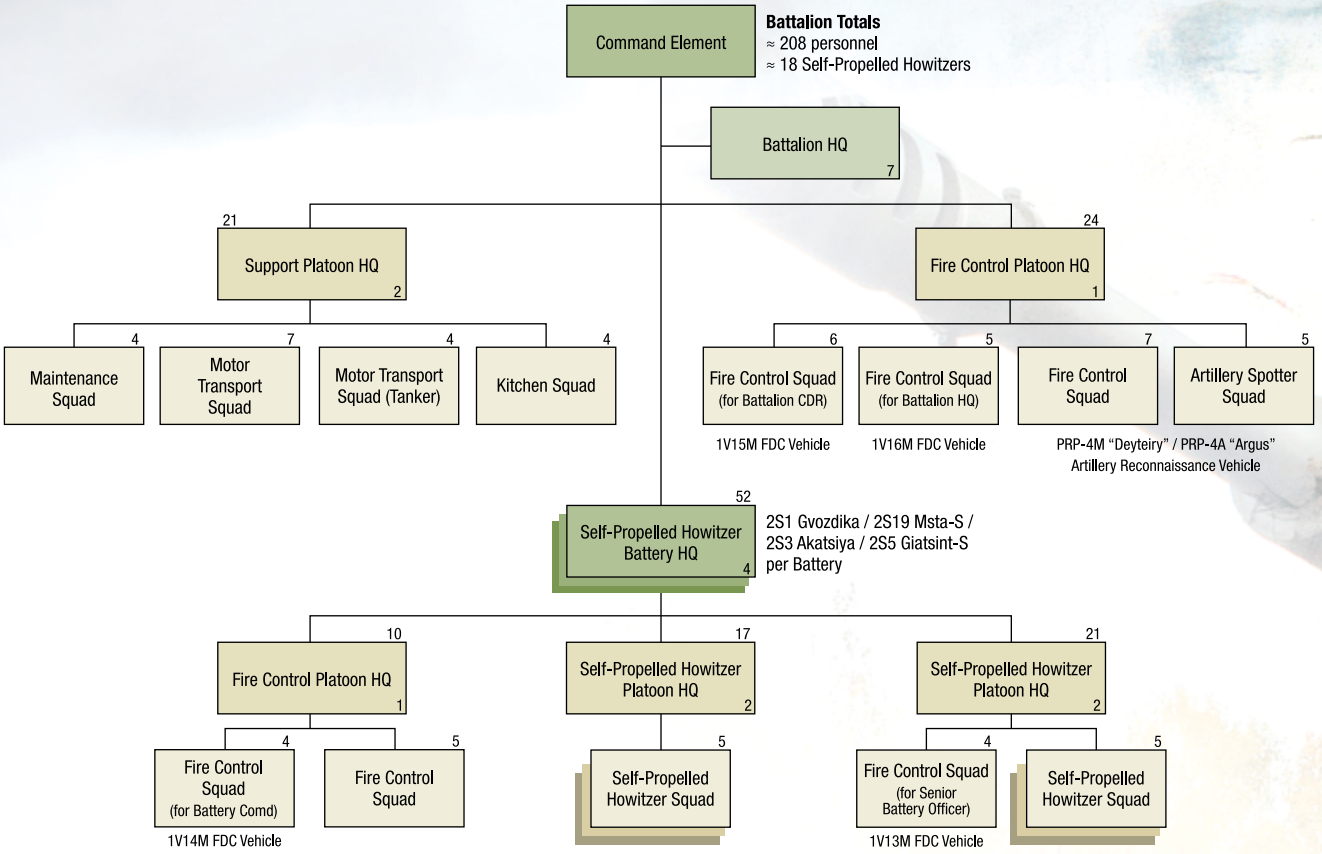


Figure 2: Self-Propelled Howitzer Battalion (Current Structure)[29]

[*Translation*] "An inevitable follow-on from increased specifications and performance is increased complexity of artillery weapons…. There is also a definite trend toward robotics, accompanied by the development and delivery of remote control algorithms…. So an artillery system can be controlled remotely—the operator's location is not of fundamental importance…. We will only be able to talk of a robot having artificial intelligence when it shows it can autonomously form an algorithm for it to proceed correctly in an unfamiliar situation, that is, one not foreseen in its preinstalled scenarios. That is still in prospect—it's attractive but also unsafe."[28]

Zakamennykh's comments are interesting for several reasons. The first is that he evidently considers uncrewed turrets an essential step toward robotization. Given that the first step toward this effort was the autoloader technology developed first for the T-64 tank (although non-digital), it can be argued that Russia has undoubtedly chosen to employ an evolutionary over a revolutionary strategy for this purpose. The second point of interest is his view on the needed level of AI in relation to the current level available. Due to this situation, Zakamennykh does not believe that robotics is capable of autonomous operations yet.

Robots and robotics can reduce force size and save human lives while increasing the intensity and effectiveness of combat, but the force structure, training, logistics and maintenance must be changed to effectively incorporate this developing technology into the force and support it. The Mikhailovskiy Military Artillery Academy is considering how to adjust force structure and the Table of Organization and Effects of current howitzer battalions to incorporate new artillery systems and robotic systems.

CURRENT RUSSIAN ARTILLERY STRUCTURE

Currently, most Russian self-propelled artillery battalions are based on three artillery batteries, with each battery having six artillery pieces (18 artillery pieces per battalion). The self-propelled artillery battalion's capability to lay fires (quantity, distance and targeting) depends significantly on the type of self-propelled artillery piece with which it is equipped, the means of reconnaissance and C2, and the logistics capability, as seen in Figure 2. In terms of the targeting of fires, the Russian self-propelled artillery battalion relies on reconnaissance assets to find targets and a C2 system to relay targets from the reconnaissance assets, conduct mission planning, and create firing data. Although there are several different C2 systems, they all function similarly.

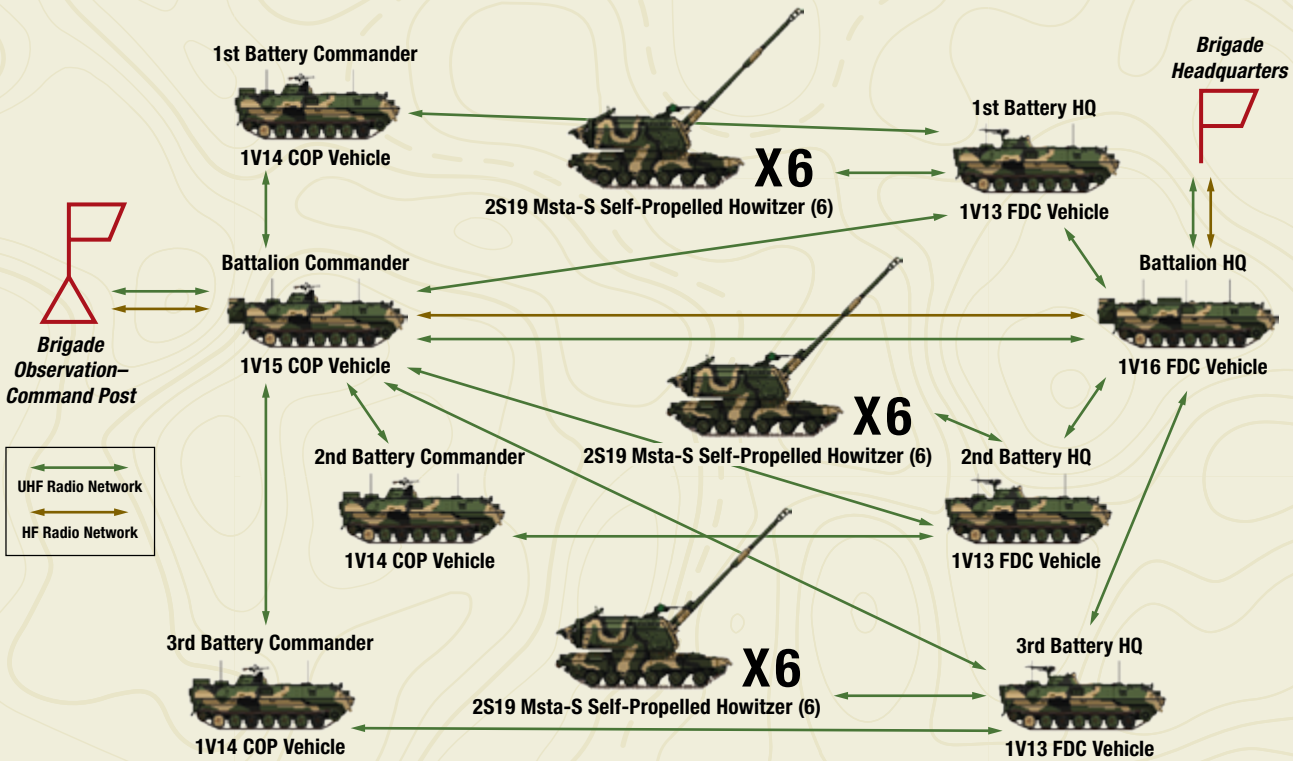


Figure 3: Kharkov Artillery Command and Control System Schematic[30]

The artillery battalion and battery commanders are typically co-located with the supported manoeuvre commander to relay calls for fire to the artillery, or they are on the battlefield, calling for fire on targets of opportunity. Artillery commanders have command observation post (COP) vehicles with appropriate communications, navigation and sighting gear to fulfill this function. The chief of staff provides the fire control for artillery units for battalions, and the senior battery officer (the senior platoon leader) does so for batteries. These officers, not the commanders, are the ones actually co-located with the artillery, providing them with targets and firing data. They staff fire direction centre (FDC) vehicles to fulfill this function. The FDC vehicles are equipped similarly to the COP vehicles but are designed to function as FDCs. That means they usually have less or no sighting equipment and more fire control equipment, and they may be on a chassis more suitable to functioning as an FDC than as a COP conducting artillery reconnaissance on the battlefield.[31]

Aside from the artillery battalion and battery commanders' COP vehicles, the self-propelled artillery battalion has few other organic reconnaissance assets that can provide targeting data, only an artillery reconnaissance vehicle (PRP-4M Deyteriy or PRP-4A Argus) in the fire control platoon. Due to limited organic reconnaissance capabilities, Russian artillery battalions can and often do leverage other reconnaissance assets in the brigade to provide targeting data. Targeting information from signals intelligence (SIGINT) sources can be provided by the SIGINT company in the brigade's reconnaissance battalion or by the brigade's electronic warfare company. Perhaps the most high-profile reconnaissance asset leveraged by Russian artillery battalions is the UAVs in the brigade's UAV company.[32] Although these UAVs are used for target designation, they are multifunctional by design. Their employment for artillery use is weighed against other priorities, as these UAVs also fulfill EW, SIGINT, signal retransmission, and battlefield awareness missions. To alleviate the demand for UAV support in Russian artillery regiments and brigades, there are plans to give these formations dedicated UAV companies.[33]

In terms of quantity of fires, on the lower end of the spectrum, older systems such as the 122 mm 2S1 Gvozdika can fire 4–5 rounds per minute. The higher systems, such as the 2S19, can fire 7–8 rounds per minute, and modifications of the 2S19, such as the 2S19M2, can fire up to 10 rounds per minute. Given these rates of fire, the self-propelled artillery battalion has little in the way of organic logistics support to replenish these systems. The artillery batteries primarily rely on the trucks in the battalion's support platoon to fulfill this task, as well as on the higher headquarters logistics support battalion for external support.

	2S5 "GIATSINT-S"	2S1 "GVOZDIKA"	2S19 "MSTA-S"	2S3 "AKATSIYA"	2S9 "NONA"	2S35* "KOALITSYA-SV"
Calibre (mm)	152.4	122	152.4	152.4	120	152.4
Max Range (km)†	28.4-33	15.2	29	17.3-20	12.8	40
Rate of Fire (min)	5-6	4-5	7-8	3-4	8-10	16
Shell Weight (kg)	46	14.1-21.8	42.9-43.6	43.6	17.3	UNK
System Weight (kg)	28,200	15,700	42,000	27,500	8,000	48,000
Crew	5	4	5	4	4	3
Chassis	Object 123	MT-LB	T-80/T-72	Object 123	BRDM	T-90/Armata
Ammo Load	30	40	50	45	40	70
Set-Up Time (min)	3	0.3	2-2.5	0.5	–	UNK
Unit of Fire	60	80	50	60	80	UNK

* As currently reported in the Russian mass media.
† With standard projectiles, greater ranges are possible if a rocket-assisted projectile (RAP) is used.

Figure 4: Self-Propelled Artillery Characteristics[34]

Proposed Russian Artillery Structure

The Russian Armed Forces' interest in robotics is not limited to the technological aspects but also encompasses the organizational aspects of how robotics can best be integrated into the Russian military units and formations.[35] Given the automated qualities that the 2S35 already possesses and the Russian military's extensive experience using UAVs for targeting, it would be no surprise if the artillery troops became an early adopter and a testbed for robotic vehicle employment and organizational integration. Russian military theorists are already pondering what future structural changes will be needed to fully use the 2S35 Koalitsiya-SV and other robotic technology that is, or soon will be, available. Colonel A. N. Aristarkhov of the Mikhailovskaya Military Artillery Academy has offered one view of how this robotic integration may occur in a 2S35 self-propelled howitzer battalion.[36]

Before expanding on Aristarkhov's proposed artillery battalion organizational structure, it is pertinent to discuss the exact role of that proposed battalion. When initially designed, the 2S35 was intended to serve as division-echelon artillery in the division's artillery regiment. However, around 2009, during the "New Look" reforms, most ground forces divisions were reformed into brigades. This resulted in the new brigades usually having only two self-propelled artillery battalions, one multiple-launch rocket system (MLRS) and one anti-tank battalion. Although the ground forces have reconstituted a few divisions and now have at least twelve of them, recent mentions of the 2S35 state that they are currently not intended to serve in divisional artillery regiments but rather in the artillery brigades assigned to Combined Arms Armies, Army Corps or Russia's one Tank Army.[37]

Although there is no standardized artillery brigade structure in the Russian Armed Forces, these artillery brigades typically consist of a combination of heavy MLRS (220 mm) battalions, heavy tube artillery (S24 Tyulpan, 2S7M Malka) and standard self-propelled and towed howitzer battalions. The self-propelled and towed howitzer battalions are structured identically to the howitzer battalion in the brigades. Although the 2S35 will be a considerably better weapon system than its predecessors, there is no intention that the 2S35 will become the standard artillery piece in the Russian Ground Forces. This is because Russia handles its artillery modernization process as it does other modernization programs: instead of opting to replace or upgrade all of a given weapon system, the Russians generally prefer to incrementally improve a portion of the force.[38] Notably, any changes resulting from the war in Ukraine are unlikely to be implemented in the middle of the conflict.

Colonel A. N. Aristarkhov's vision of a 2S35 Koalitsiya-SV self-propelled artillery battalion differs substantially from the current structure. Most notably, these battalions would be built around three artillery batteries, with each battery

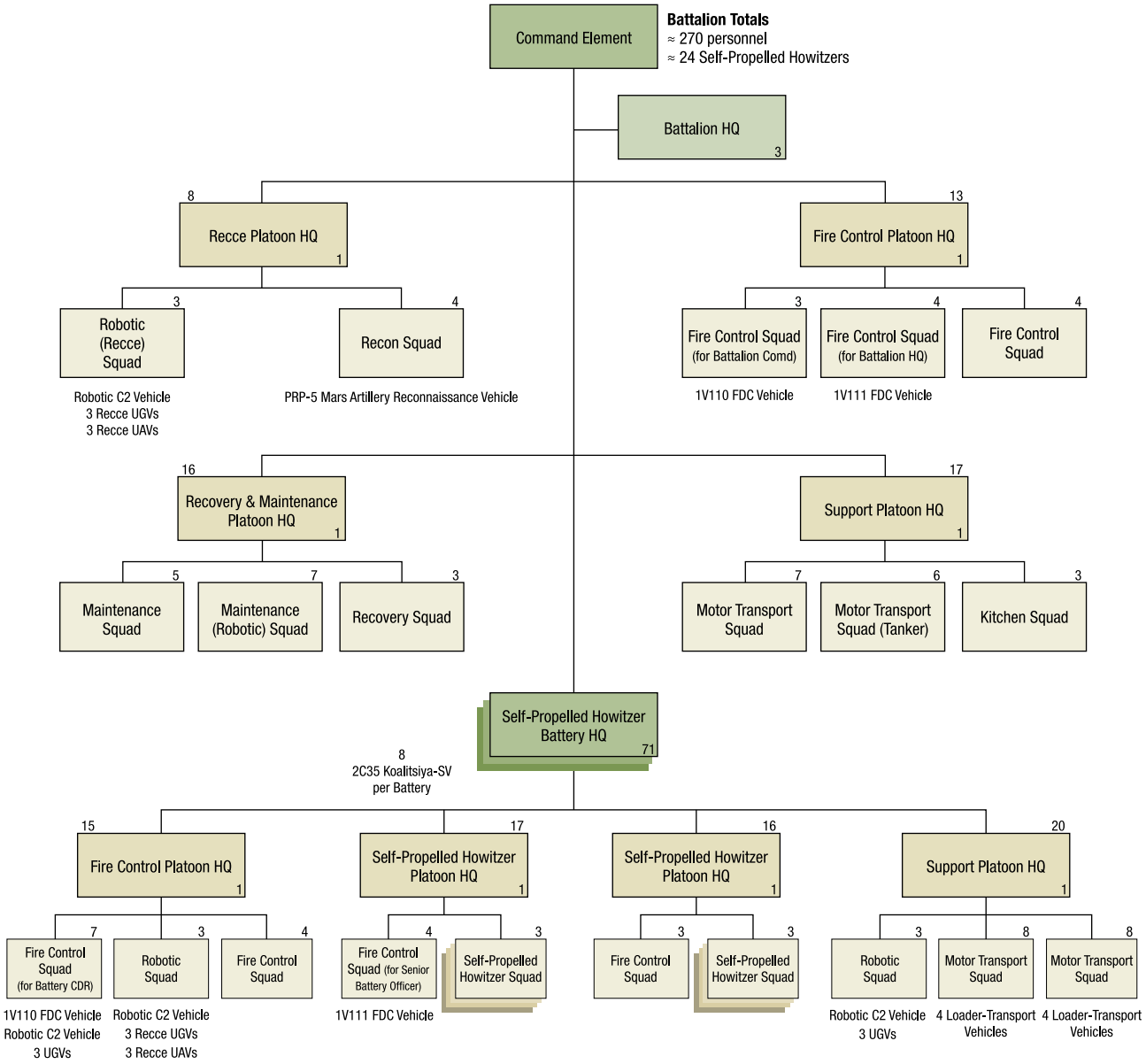


Figure 5: Self-Propelled Howitzer Battalion (Proposed Structure)[39]

having eight, instead of the current standard of six, artillery pieces (24 artillery pieces per battalion). One piece of information lending credence to this belief in an eight-gun artillery battery is a May 2020 Russian media report that the Central Military District had received eight 2S35s, the same number that Aristarkhov proposed.[40]

The combination of the 2S35's higher rate of fire and the increased artillery battery size means that these battalions will have significantly more combat power than a 2S19M2 battalion. As will be seen, the other modifications of this battalion generally concern the reconnaissance aspects of laying fires and the logistical aspects of supporting a rapid-firing 24-artillery-piece battalion.

In terms of reconnaissance, Aristarkhov proposes organic UAV and UGV assets at both the battalion and battery levels. As the battalion-level UAVs and UGVs are specifically designated as "reconnaissance," they may be intended for longer-range reconnaissance and of a different variety than the UAVs and UGVs in the batteries. The provision of organic UAVs is a significant capability improvement, and locating those assets at the COP/FDC level would make sense, as that is currently where attached UAV crews are usually located. One notable aspect is how small the UAV squads are intended to be. Considering that one of the three personnel in the three-person squad is probably just a driver, this leaves only two crew members to staff the UAVs and UGVs. Therefore, it is likely that these systems are intended to be autonomous or at least semi-autonomous.

Source: Vesta48 – stock.adobe.com

In terms of logistics, significant changes have been made to the organizational structure to support the battalion's capability to expend greater amounts of ammunition. A dedicated support platoon has been added that will operate transport-loader vehicles (TZM). The 2S35 will be the first Russian howitzer to have a dedicated TZM. Usually, TZMs are associated only with larger missile systems, but the 2S35's higher rate of fire likely necessitates its use. The platoon also has UGVs that will likely provide some sort of logistical support, as the Russian Armed Forces have been keenly interested in the use of robotics for that purpose.[41]

Aristarkhov's proposed 2S35 Koalitsiya-SV self-propelled artillery battalion is certainly ambitious and has likely incorporated lessons learned from Ukraine and Syria. It raises the question of why the Russians would want more tubes in a battalion when the new system can fire so much faster and so much farther. The Russian army believes that it is better to destroy and disorganize an enemy at a distance rather than have to do so with tanks and infantry in close combat. The Russians have long been an artillery army that prefers to inflict maximum damage prior to close combat. They have developed effective precision fires but still practise mass fires to destroy areas and create psychic terror. Soviet casualties in World War II were staggering, and the Russian Federation preferred to expend projectiles rather than lives and weapon systems, if possible. More tubes that fire more rounds per minute give the manoeuvre commander more options and reduce losses from counterbattery fire. Robotic interface and, eventually, autonomous robots provide even more options.

CONCLUSION

The Russian Federation has taken an evolutionary, as opposed to revolutionary, approach to robotics. The Russians are developing AI technologies to support semi-autonomous UAV and UGV operations, but these developments are also in tandem with their efforts to develop robotic technologies to reduce crew sizes of crewed vehicles. The Russians do not yet envisage a battlefield with autonomous uncrewed systems managed by just a few human controllers. A more likely scenario is Russia's evolutionary approach to robotics that will lead to a gradual increase in the number of robotic systems on the battlefield. The fielding of large uncrewed vehicles, such as howitzers and tanks, is not yet feasible, but if current trends continue, such systems may reach some sort of trial phase in the next 10–15 years.

The Russian Armed Forces perceive robotics to be more than just weapons and reconnaissance platforms and believe that they also have a role in reducing crew sizes, providing logistical support, handling hazardous materials and enhancing manoeuvres. This leads to perhaps the most interesting aspect of Russia's development of robotics and artillery, which is not the technological breakthroughs but the organizational aspects. As previously mentioned, despite being "late" to the UAV game, the Russian artillery community has been the most successful at employing UAV technology, despite having less technically sophisticated systems. Due to Russia's strong theoretical basis for robotic employment, the best lessons likely to be learned from Russian robotics will not stem from the technological innovations of the scientists and engineers in the design bureaus, but from the force design planners in uniform.

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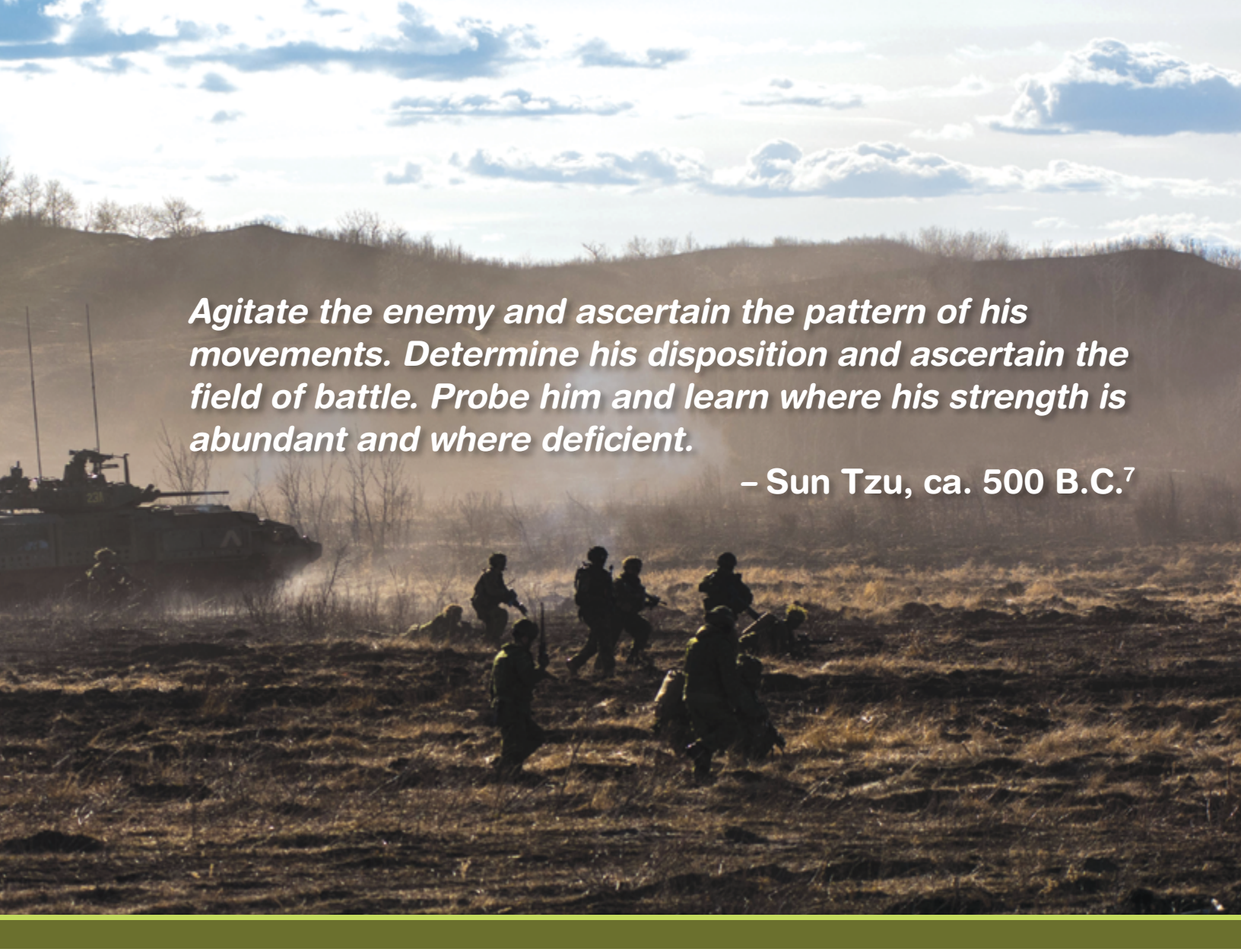
THE RECONNAISSANCE GAP: CANADIAN ARMY RECONNAISSANCE AND SECURITY UNITS IN HISTORY

Major Bryce Simpson, CD

INTRODUCTION[1]

As the practitioner and student of war, Sun Tzu indicates, reconnaissance has always been an essential part of warfare. Few would contest this fact, but it is also clear that there is a decided lack of consensus within the Canadian Army about the conduct of formation reconnaissance. The debate over the Royal Canadian Armoured Corps (RCAC)'s *medium* reconnaissance[2] capability (the capability provided by formation reconnaissance squadrons) is ongoing, and some have argued for a de-emphasizing of this capability in favour of what has come to be termed the "cavalry concept."[3] It is this issue—the place of formation reconnaissance units in the Canadian Army—that will be addressed in this article.

Military doctrine constitutes the "fundamental principles by which military forces guide their actions in support of objectives," and it "represents the distilled insights and wisdom gained from experience."[4] In his seminal treatise *On War*, Carl von Clausewitz argues that the roots of military "theory" (doctrine) in historical experience lead writers aiming to "displace a method in current usage, confirm a dubious, or introduce a new one"[5] towards the exploration of historical examples. However, Clausewitz advises caution in such endeavours, noting that historical examples "may be used to support *the most contradictory views*; and three or four examples from distant times and places dragged in and pulled up from the widest range of circumstances, tend to distract and confuse one's judgement without proving anything."[6] The proponents of the RCAC's recently adopted cavalry concept undertook a historical justification of their theory, and so it is incumbent upon professional soldiers to scrutinize their evidence to determine whether their conclusions are justified. Utilizing a historical survey of RCAC reconnaissance structures, this article will demonstrate that the Canadian Army's pre–cavalry concept reconnaissance doctrine was grounded in a solid foundation of experience and that these reconnaissance units have been identified repeatedly as essential warfighting elements for a modern ground force.



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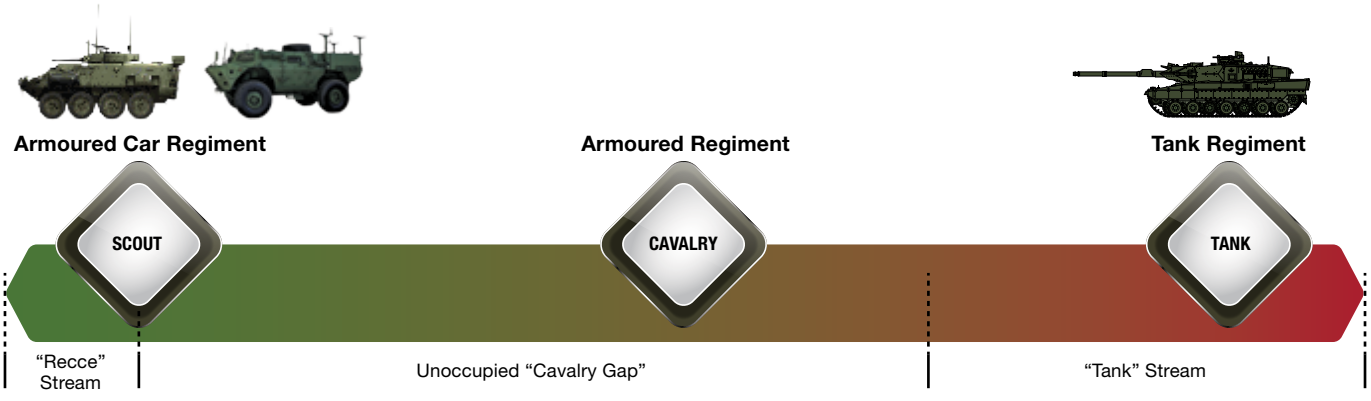


Figure 1: The Cavalry Gap as proposed by Matthew McInnes, "First Principles and the Generation of Armoured Fighting Power," *Canadian Army Journal* 17.3 (2017): 83–113.

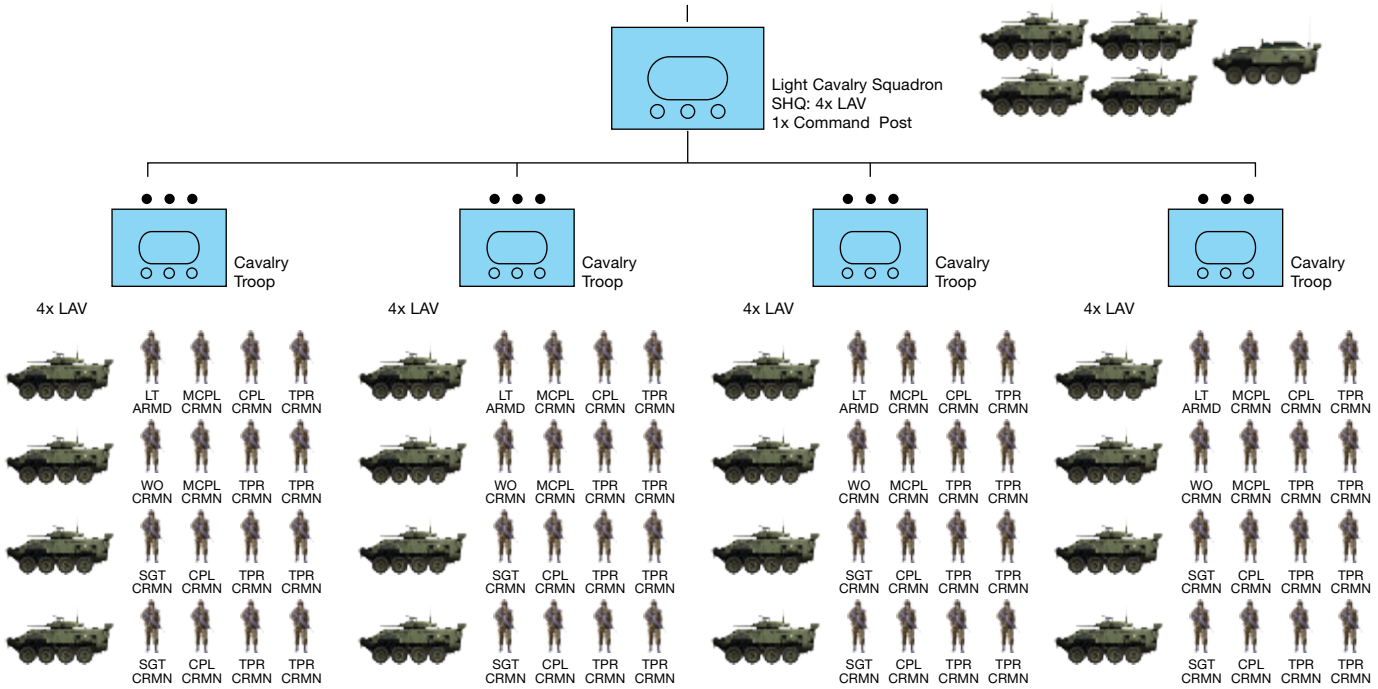


Figure 2: Cavalry Concept "Light Armoured Squadron" (2021)

The cavalry concept owes much to the publication of an article by then-Captain Matthew McInnes in 2017.[8] Though the cavalry concept has been much discussed in the RCAC throughout the last several years, and rapidly shifting arguments in its favour have regularly appeared in innumerable Army briefings, McInnes's 2017 article in the pages of this journal remains the solitary published articulation of the concept's "first principles." McInnes attempts a historically grounded argument for what he terms "the cavalry gap," a conceptual space between the RCAC's reconnaissance and tank subunits whose doctrinal separation results in undesirable "streams" within the Corps.[9] Further, McInnes critiques the maintenance of formation reconnaissance elements within an army, arguing that "there is no greater need for a reconnaissance-specific manoeuvre organization than there is for an attack-specific manoeuvre organization, as multipurpose combat forces are by their very nature equipped and trained for the full range of tactical activities."[10]

The RCAC officially accepted the historical assertions and associated recommendations made in McInnes's article, promulgating the cavalry concept in an August 2021 letter to all RCAC commanding officers.[11] The precepts of the concept include "the rescinding of all extant armoured, 'tank,' and 'recce' doctrine" and the assertion that "there is only one type of combat squadron within the RCAC, the armoured cavalry squadron," which calls for the reorganizing reconnaissance subunits into "a single organizational structure predicated on the *principle of four* (four Armoured Fighting Vehicles per troop, 20 AFV[s] per squadron divided amongst four troops and squadron headquarters)."[12] The former reconnaissance squadrons (now "Light Armoured Squadrons") were assigned the same spectrum of tactical tasks as tank subunits, with a significant focus on offensive and defensive tasks for both squadrons.[13] This order effectively deleted specialized reconnaissance squadrons from the Army's doctrine for the first time since they had been initially formed in 1940.[14] If, as Clausewitz suggests, war's "very nature is usually revealed to us only by experience," the historical analysis of our past reconnaissance structures and doctrine to which we will now turn will demonstrate that in attempting to close a *conceptual* "cavalry gap" between light and heavy elements, the RCAC may have opened a genuine *physical* cavity in the Army's battlefield framework: the reconnaissance gap.[15]

RECONNAISSANCE IN THE SECOND WORLD WAR

The RCAC experience with formation reconnaissance had its genesis in the 1920s–1930s doctrinal debates within the British Army.[16] Ironically, given the recent use of the term in the RCAC, a theory known as the "cavalry concept" emerged, which promoted the notion of AFVs "merely replacing horsemen in their traditional mobile role" separate from other arms, as opposed to more radical reformers who promoted something recognizable as modern combined arms tactics.[17] As one decorated veteran officer bitterly recalled, "very unfortunately for the Royal Armoured Corps, the cavalry influence predominated" before the war and contributed to what he characterized as the generalized slaughter of light-AFV units thrown without integral combined arms support into offensive tasks for which they were almost as unsuited as their equine

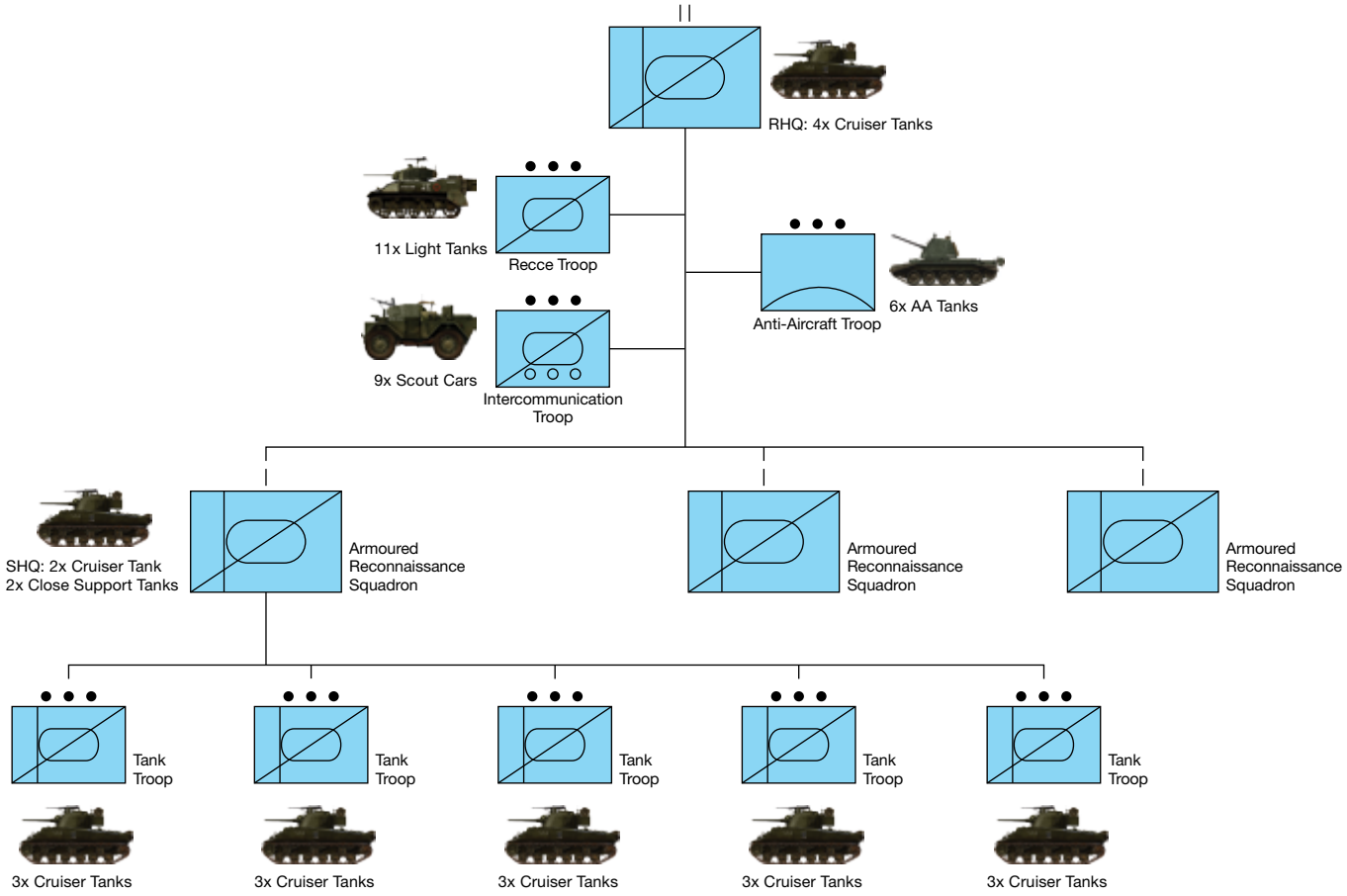


Figure 3: Royal Canadian Armoured Corps Armoured Reconnaissance Regiment (1944)

predecessors.[18] These issues remained unresolved during the conflict, contributing to what historian John English calls "tactical schizophrenia" in doctrine, and led to the formation of three distinct Commonwealth reconnaissance unit establishments with different equipment and doctrinal underpinnings.[19] These were the armoured reconnaissance regiments, armoured car regiments, and infantry division reconnaissance regiments. Recent RCAC commentators tend to highlight only the armoured reconnaissance regiments in their analyses, citing them as a positive example; McInnes uses them to promote his contention that armoured tactics, even in reconnaissance roles, are universal and that armour and reconnaissance simply exist on a spectrum of tasks.[20]

The emphasis placed on only this single unit type has led to the propagation of a myth that tank-equipped units conducted *all* formation reconnaissance functions. For instance, Captain Vladimir Kessia, recently commenting on Canadian reconnaissance, was able to hastily generalize that "during the war, "reconnaissance within the RCAC was conducted by four vehicle troops in tanks."[21] Despite the confidence of this declaration, neither he nor other recent commentators have provided an analysis of the effectiveness of armoured reconnaissance regiments, nor has the structure, role and performance of the armoured car regiments or the infantry division reconnaissance regiments been examined.

By 1944, armoured reconnaissance regiments were structured and equipped as normal armoured regiments of the RCAC. Regiments comprised three squadrons of tanks and were integral to armoured divisions.[22] They were not designed to provide the medium reconnaissance role fulfilled by other units and were, according to doctrinal publications, "equipped to carry out the role of close reconnaissance on the armoured divisional front, and of detailed reconnaissance after contact has been gained."[23] In simpler terms, armoured reconnaissance units were optimized to fight for information as the spearhead of an armoured thrust, while the division's medium reconnaissance functions were expected to be provided by infantry divisions already in contact or by higher headquarters.

In practice, armoured reconnaissance regiments rarely performed their doctrinal function and were instead used as a fourth armoured regiment within armoured divisions.[24]

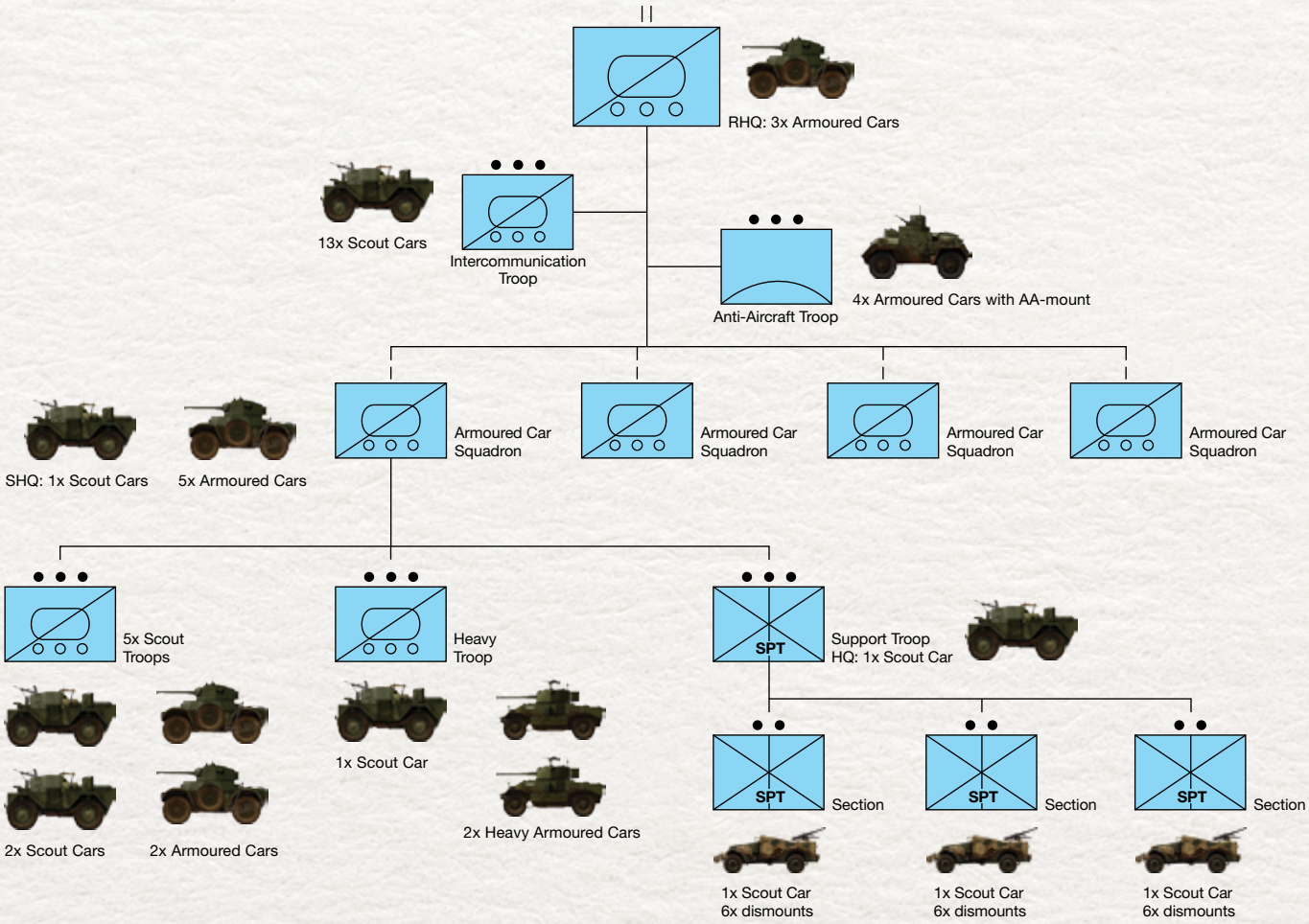


Figure 4: Royal Canadian Armoured Corps Armoured Car Regiment (1944)

The Canadian *Official History* seemingly notes only one occasion when armoured reconnaissance regiments performed their assigned role: the pursuit following the Battle of Falaise.[25] The non-employment of these units in their intended roles stemmed in part from the unsuitability of their equipment and the lack of dismounted capability. British experience highlighted this fact: their units suffered heavy losses while attempting to perform reconnaissance in the absence of infantry or light vehicles.[26] Major-General Bert Hoffmeister's staff in the 5th Canadian Armoured Division concluded that the armoured reconnaissance regiment required "lighter and more manoeuvrable [vehicles]" in order to be effective in its designated role.[27] The armoured reconnaissance regiments cannot be deemed a success in their *intended* tasks, though they performed admirably as standard armoured regiments. Indeed, by increasing the combat "weight" of a reconnaissance element through the predominance of tanks in the structure, the unit's designers were all but guaranteeing that commanders would employ them as regular manoeuvre units, leaving armoured divisions with a reconnaissance gap.[28]

Corps-level armoured car regiments were designed to perform "medium reconnaissance up to a distance of 50 miles ahead of the main columns" of their supported formation.[29] The regiments reflected the interwar cavalry concept's emphasis on the mounted performance of tasks, with few attached combat support enablers and only a small "support troop" in each of the four squadrons to provide some dismounted scouts.[30] The mainstay of the squadrons consisted of five scout troops, each operating as an "officer's patrol" with four light-wheeled vehicles.[31] As they were not designed to fight for information, doctrine dictated that "if enemy opposition is met on one road, the patrol concerned will use its weapons to make a successful getaway, report contact, and seek an alternative route" and advised that armoured car regiments were not to be employed in delaying or offensive actions.[32] This separation of reconnaissance and security functions is important to note: armoured car regiments were structured and doctrinally capable of accomplishing only the former.

Source: Combat Camera

Armoured car regiments in Canadian service delivered a chequered performance in operations. They were originally formed on the scale of one armoured car regiment per armoured division but, following the campaign in North Africa, that was reduced to one per corps.[33] The poor mobility of wheeled AFVs often left them road-bound, and their lack of dismounted strength left them unable to effectively screen their supported formations or perform more aggressive reconnaissance.[34] Commanders often employed them in what one official report called "strange roles" that doctrine had not anticipated.[35] During one of Canada's most significant engagements (Operation TOTALIZE), the 12th Manitoba Dragoons found themselves controlling traffic and escorting trucks, a typical utilization of those units.[36] Indeed, an official historical report noted that the Royal Canadian Dragoons had a "bitter experience" in such roles during their service in Italy. They had to wait until April 1945 (with the war nearly at an end) before weakened enemy resistance allowed for their employment in a "classic cavalry task" for which they believed themselves best suited.[37]

The limited capacity of armoured car regiments to conduct kinetic security tasks became apparent in the multinational context of the war: when it came time to establish a screen at the seams of the British 21st Army Group and the American 12th Army Group, the task fell to an American cavalry organization, as Commonwealth forces lacked a formation-level unit capable of such a vital operation.[38] Post-war writings reflected the somewhat disappointing performance of armoured car regiments, commenting on the relegation of those regiments to rear area security and their placement in the rear of the order of march during offensive operations.[39] In a belated recognition of their limited combat utility, the post-war doctrinal publication *The Armoured Car Regiment* added more "strange roles" to the list of official tasks, including the "dull but very essential" management of traffic control and the protection of headquarters and supply columns.[40]

Military doctrine constitutes the "fundamental principles by which military forces guide their actions in support of objectives," and it "represents the distilled insights and wisdom gained from experience."

Source: Combat Camera

The final wartime reconnaissance unit was paradoxically the most versatile and historically overlooked unit type of the three: infantry division reconnaissance regiments. As with many military innovations, reconnaissance regiments were born out of wartime necessity. In that modernization, Canada actually preceded the British by acting on a post-Dunkirk analysis of the British Army's poor performance against the Wehrmacht in the French campaign. The findings of that report highlighted a gap in divisions' reconnaissance capabilities, and, in response, the Canadian Army established the first brigade reconnaissance squadrons during the summer of 1940.[41] Later, those squadrons were amalgamated into divisional reconnaissance regiments under the RCAC.[42]

Reconnaissance regiments each contained three reconnaissance squadrons, a mortar troop and an anti-tank battery.[43] The reconnaissance squadrons included three "Scout Troops," which consisted of a reconnaissance section of two patrols (each containing a pair of light AFVs), two carrier sections (equipped with Universal Carriers which could generate formed dismounted elements) and a headquarters. A substantial assault troop of forty mounted, infantry-trained troopers rounded out the squadron.[44] Unlike armoured car regiments, the doctrine did not limit these units to stealthy reconnaissance and non-combat roles, and training pamphlets warned that reconnaissance regiments "will seldom gain good information without having to fight."[45] Regiments could also be assigned "protection" tasks, including acting as an advance guard, covering a withdrawal, establishing screens, and performing economy-of-force

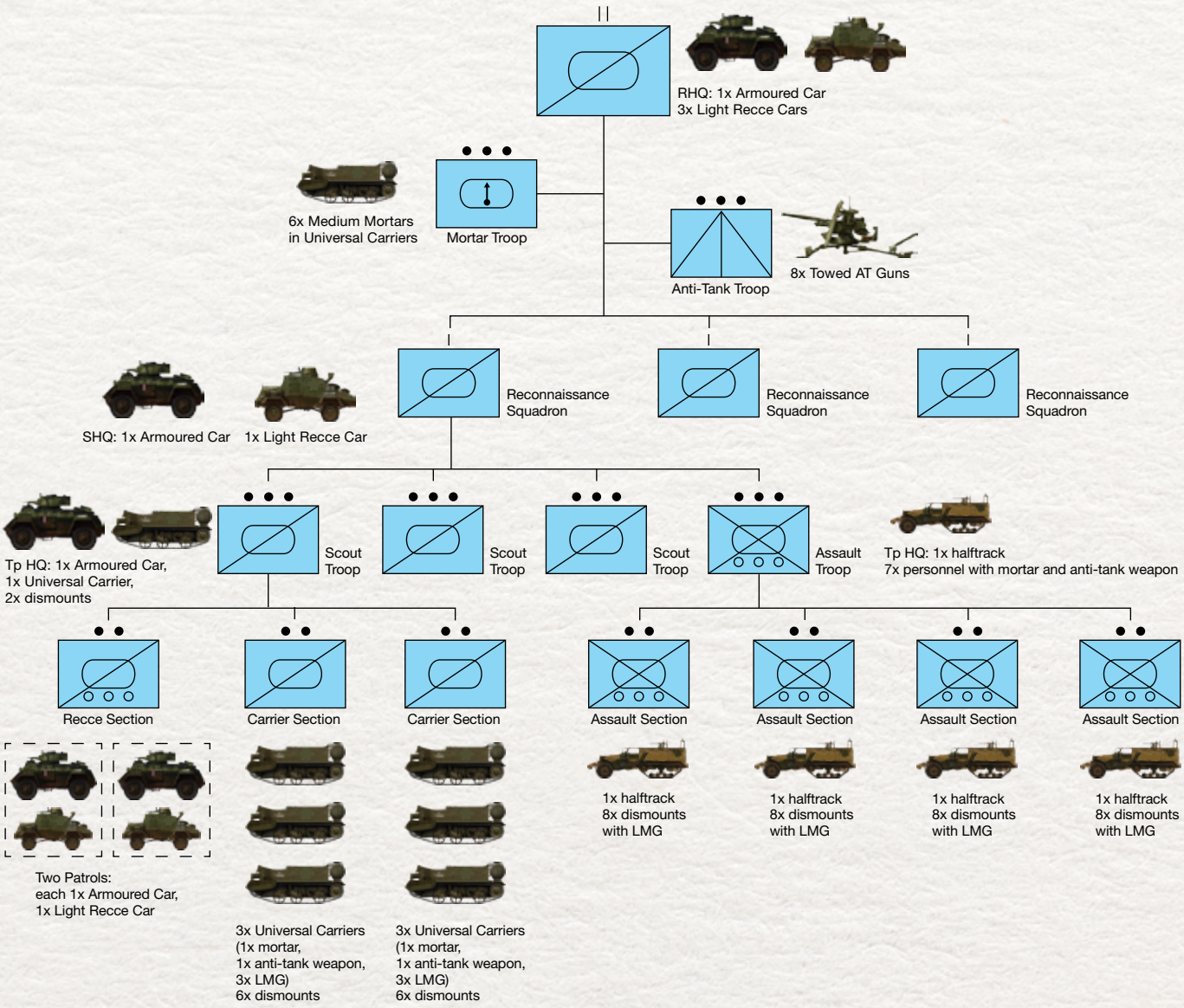


Figure 5: Royal Canadian Armoured Corps Infantry Division Reconnaissance Regiment (1944)

tasks such as "seizing and holding a vital piece of ground," "pursuing a beaten and disorganized enemy" or acting "as a mobile reserve of firepower."[46] As units with a high degree of mobility and a disproportionate amount of firepower for their size, the RCAC's reconnaissance regiments filled vital reconnaissance and security gaps for the Canadian Army as it learned to fight a modern war.[47]

The wartime experience of Canada's reconnaissance regiments was as varied as their equipment. In the reconnaissance role, these units proved capable of the sweeping "cavalry-esque" movement required during a pursuit, such as following the breakout in Normandy where II Canadian Corps' two reconnaissance regiments led the advance, dealing with all minor resistance in the path of the advancing divisions.[48] They were also exceptional in conducting reconnaissance-in-force tasks, such as the remarkable performance of the 17th Duke of York's Royal Canadian Hussars in the assault across the Laison River during Operation TRACTABLE. There, two squadrons bypassed German defenders to seize an intact bridge and fording site and then held the bridgehead against counterattacks until the supported infantry and armour could accomplish their crossing.[49] Though the unusually restricted and densely defended Norman and Italian theatres occasionally limited the full-time requirement for medium reconnaissance, reconnaissance regiments proved they could still complete those tasks when required.[50]

Reconnaissance regiments were arguably the best-performing RCAC unit type in the completion of reconnaissance tasks, but they were also extremely successful in their equally

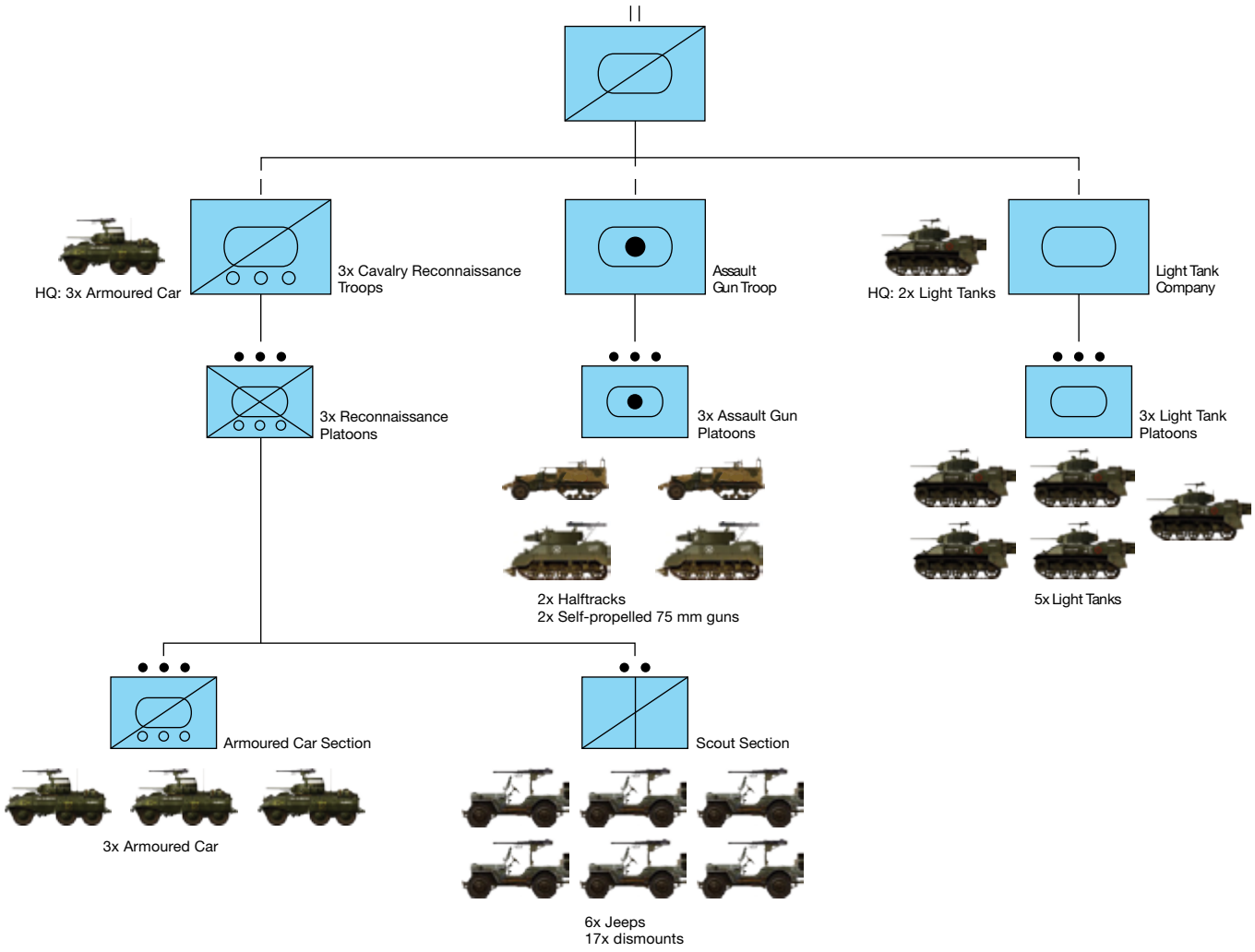


Figure 6: Structural Reconnaissance Parallels in U.S. Cavalry Reconnaissance Squadron (Mechanized) [1944].

important security role. Though unglamorous, the essential task of dominating the ground between and on the flanks of advancing divisions, corps and armies was one at which reconnaissance regiments excelled. Their mobility, large self-contained subunits and dismounted firepower allowed them to screen significant frontages or concentrate on establishing a more robust guard force. The official history of the Italian campaign outlines how the 4th Princess Louise Dragoon Guards managed the "formidable task" of establishing and maintaining for weeks a nearly 50-kilometre screen between the Corps along the Eighth Army's two axes of advance.[51] Reconnaissance regiments continued to demonstrate their versatility when conditions in Italy degenerated into a congested stalemate, and the need for more infantry became desperate: the 4th Princess Louise Dragoon Guards found themselves operating as a rifle battalion in the summer of 1944.[52] The corps commander considered The Royal Canadian Dragoons for the task but, as an Armoured Car unit, they lacked the dismounted experience of the Dragoon Guards. The latter performed admirably as infantry for months before returning to the reconnaissance role.[53]

Canada's three wartime reconnaissance units had considerably different structures and varied performances, which inadvertently created something of a practical experiment in ground reconnaissance theory. The "heavy" reconnaissance provided by armoured reconnaissance regiments proved unsuitable in the reconnaissance role due to their oversized vehicles and lack of dismountable personnel, while the armoured car regiments' small, four-light-vehicle troops were, by design, non-combat elements for stealthy reconnaissance-only operations against minor or non-existent opposition. Conversely, reconnaissance regiments performed well as both reconnaissance and security units and had the versatility to transition to other roles. Clausewitz posits that "if, in warfare, a certain means turns out to be highly effective, it will be used again … and so, backed by experience, it passes into general use," and reconnaissance regiments reflected the wartime trend towards common doctrinal solutions to the new problems of mechanized warfare.[54] That trend manifests in the broad similarity between those units and their foreign counterparts: American and German reconnaissance units

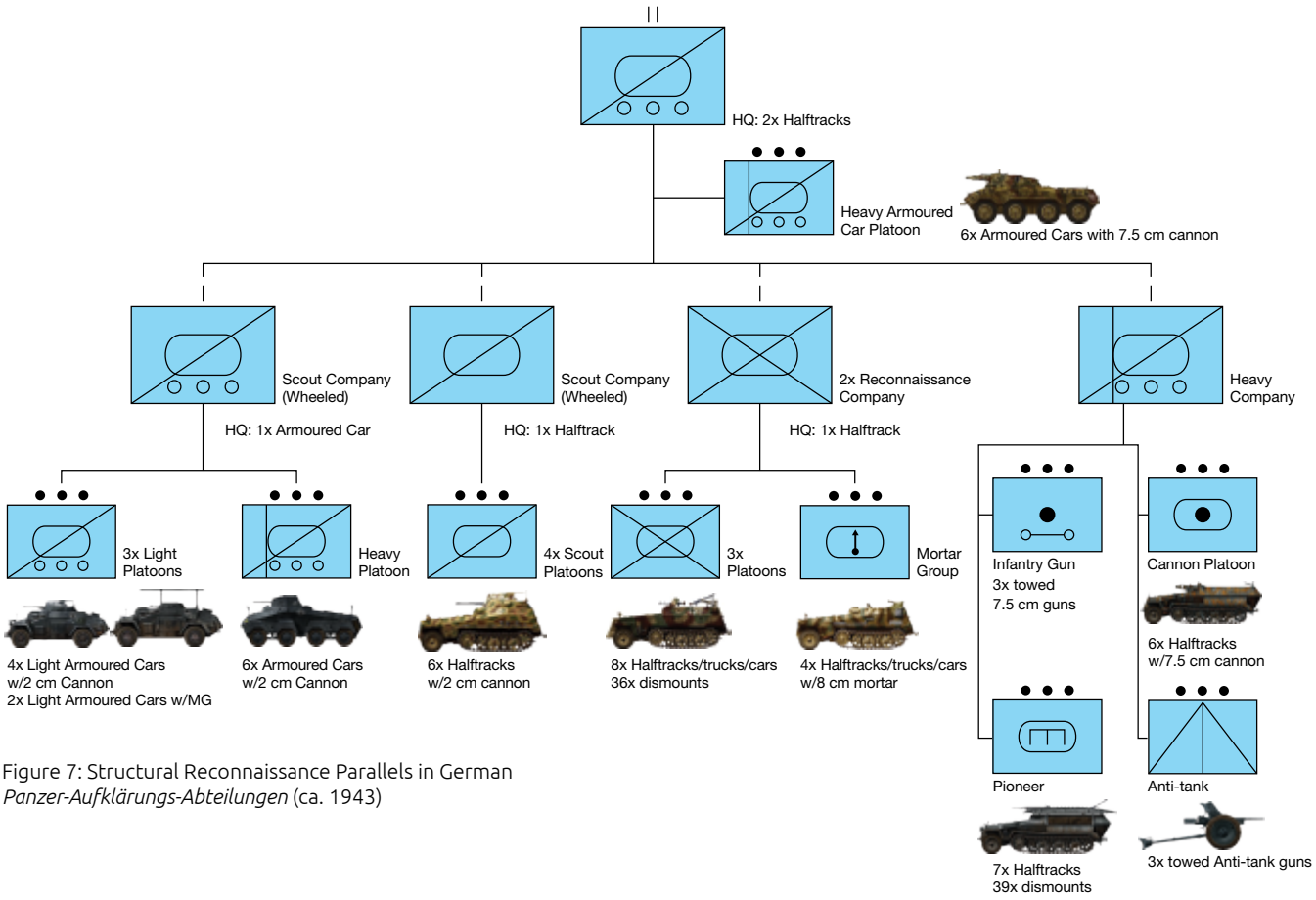


Figure 7: Structural Reconnaissance Parallels in German *Panzer-Aufklärungs-Abteilungen* (ca. 1943)

operated comparable mixes of light vehicles, combat support elements and plentiful dismounts organized into large, multi-platform platoons, which allowed them to perform a similar range of reconnaissance, security and economy-of-force tasks for their supported formations.[55]

The ignoring of reconnaissance regiments by cavalry concept proponents is difficult to comprehend, given that those multipurpose, combat-capable units arguably spanned the "cavalry gap," the alleged existence of which was the primary justification for the reforms of the cavalry concept. By omitting them from his analysis, McInnes creates a false dilemma wherein his artificial gap between armoured car "scout" structures and tanks can be closed only by imposing his proposed reforms, while simultaneously ignoring the proven wartime solution: reconnaissance regiments.

COLD WAR DEVELOPMENTS AND THE "TYPE 56" MYTH

A further historical myth has influenced doctrinal discussions of the present-day cavalry concept: it concerns the origins of what until recently was called the Army's brigade reconnaissance squadrons. McInnes contends that the "first use" of two-car patrols in troops of eight or more vehicles occurred during the peacekeeping deployment of the 56th Reconnaissance Squadron to the Sinai.[56] In light of the examination of the reconnaissance regiments above, it is clear that his contention is inaccurate. McInnes goes on to assert that the "56-Recce Type" squadron only came to be as a combination of three regimental reconnaissance troops created on an ad hoc basis for pragmatic reasons related to the low-spectrum nature of the operation rather than combat effectiveness, as part of his thesis that reconnaissance squadrons have "no place in Canada's warfighting doctrine."[57]

McInnes seemingly bases his assertion on a misreading of a commemorative history of the RCAC. In *The RCAC: An Illustrated History*, historians John Marteinson and Michael R. McNorgan note the fact that only regimental reconnaissance troops existed on the regular order of battle in 1956, from which McInnes mistakenly infers that these elements became the basis of the deploying squadron structure.[58] In reality, the 56th Reconnaissance Squadron deployed its scout cars not in three eight-vehicle troops but in four troops based on the self-contained tank troop standard, with no evidence that they were intended to operate as two-vehicle patrols.[59] The Strathcona officers selected to command two of the four troops were referred to as "patrol officers" in the regimental newsletter, indicating that the Sinai squadron's designers intended it to operate along the lines of the wartime armoured car regiments' four-car "officer patrols."[60] If the squadron did

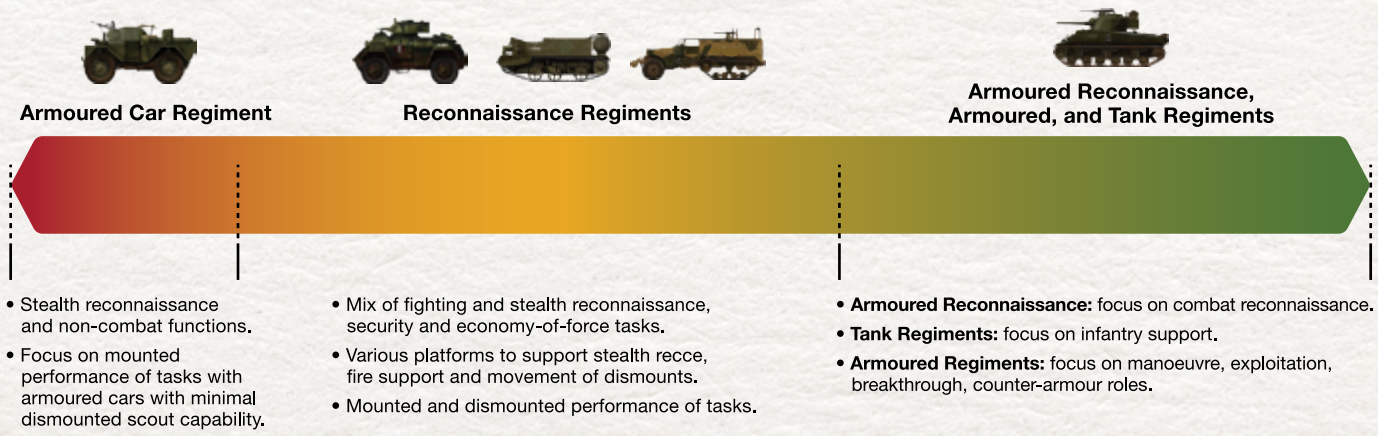


Figure 8: The Historical Resolution to the "Cavalry Gap": Reconnaissance Regiments

split its troops into two-car patrols, that would have been supported by post-war armoured doctrine, which noted that "a pair of mutually supporting tanks or scout cars is the smallest patrol."[61] Still, the 56th Reconnaissance Squadron structure arguably had far more in common with a wartime armoured car squadron than with the now-defunct reconnaissance squadrons.

Rather than being born as an ad hoc compromise for peace support operations, our recently deceased brigade reconnaissance squadrons originated as a response to the undeclared conflict known as the Cold War. Only one regular brigade remained in the Army in the immediate post-war period. Post-war planners designed the Army to require mobilization before a future war, and there were no reconnaissance units in the regular force.[62] However, with the 1951 positioning of a brigade group to Europe as part of North Atlantic Treaty Organization (NATO) commitments, the Army quickly found itself with a large formation overseas, operating as part of a multinational army group.[63] The Army quickly recognized problems with that force structure, including identifying a reconnaissance gap. The 1956 Exercise GOLD RUSH, designed to support the development process for the Army's future structure, concluded that the lack of a reconnaissance element in Canadian formations "poses a very serious weakness in preparing our forces for war. We are not only depriving ourselves of the necessary reconnaissance training but, in addition, failing to provide a balanced force for the training of all arms."[64] Consequently, when the Army expanded 4 Canadian Infantry Brigade Group (4 CIBG) in Europe in 1957, it included, for the first time, a brigade reconnaissance squadron.[65] Though it was deployed almost simultaneously with the 56th Reconnaissance Squadron sent to the Sinai, this squadron would have a very different structure, with its lineage hailing from the wartime reconnaissance regiments rather than the armoured car units. The squadron seems to have had its Ferret scout cars (later Lynxes) organized into large troops of seven vehicles, restructured by 1960 to include a revived assault troop.[66] Deployed on the anticipated front line of an anticipated conventional war, this squadron was self-evidently not intended for peace support operations. The NATO squadron would form the basis of brigade reconnaissance squadrons across the Army and through minor evolutions over the next 53 years before their abrupt dissolution as part of the cavalry concept reforms.[67]

The 1957 formation of both the 56th Reconnaissance Squadron in the Sinai and the brigade reconnaissance squadron in Europe reflects remarkable continuity between wartime armoured car and reconnaissance regiments, respectively. The Army occasionally employed the former throughout the Cold War on peace support operations (e.g. Cyprus in 1964).[68] The latter carried on providing the formation reconnaissance function of the Army until being transformed under the cavalry concept into what appears to be 21st-century armoured car squadrons. The adherents of the cavalry concept would have us believe that the combat-experienced Canadian Army of 1957 knowingly allowed its warfighting reconnaissance function to be filled by a doctrinal construct it knew to be "non-combat-capable," but that stretches credulity, though anecdotally within the RCAC and in print the myth is casually accepted as fact.[69] One wonders whether Major I. MacD. Grant, DSO, a decorated professional and combat veteran of the Second World War who commanded the first 4 CIBG Reconnaissance Squadron, would be amused by such a claim.[70] In actuality, it was his brigade reconnaissance squadrons which were born from the experience of wartime reconnaissance regiments to fill the acknowledged reconnaissance gap in a future conflict.

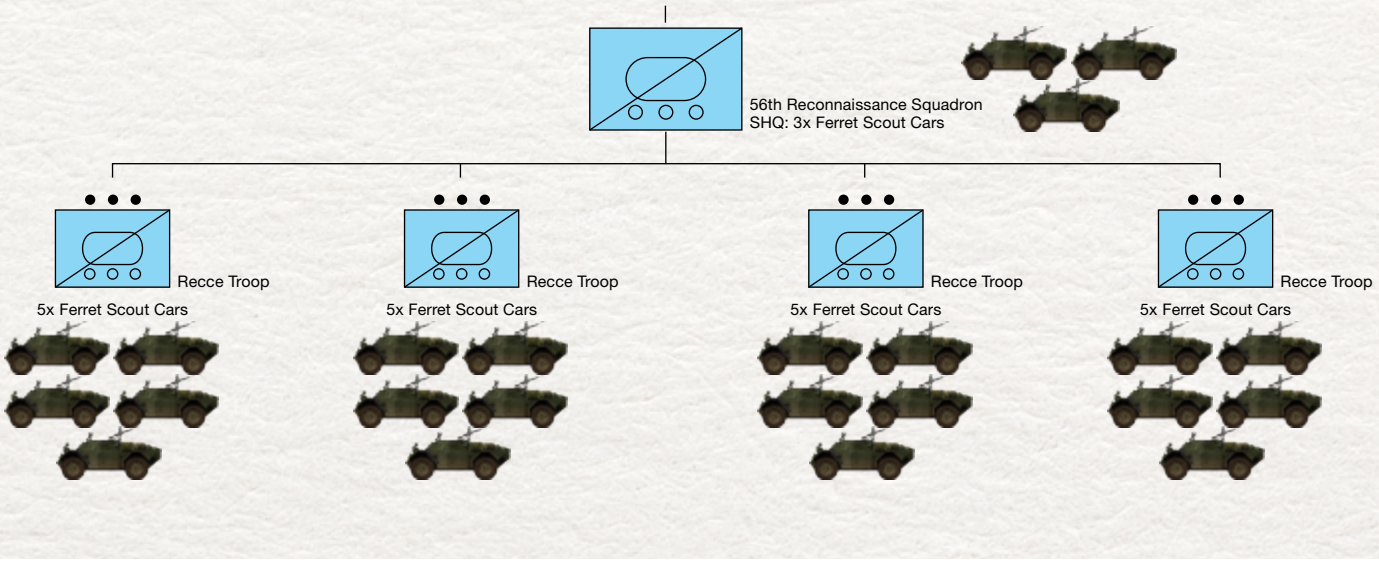
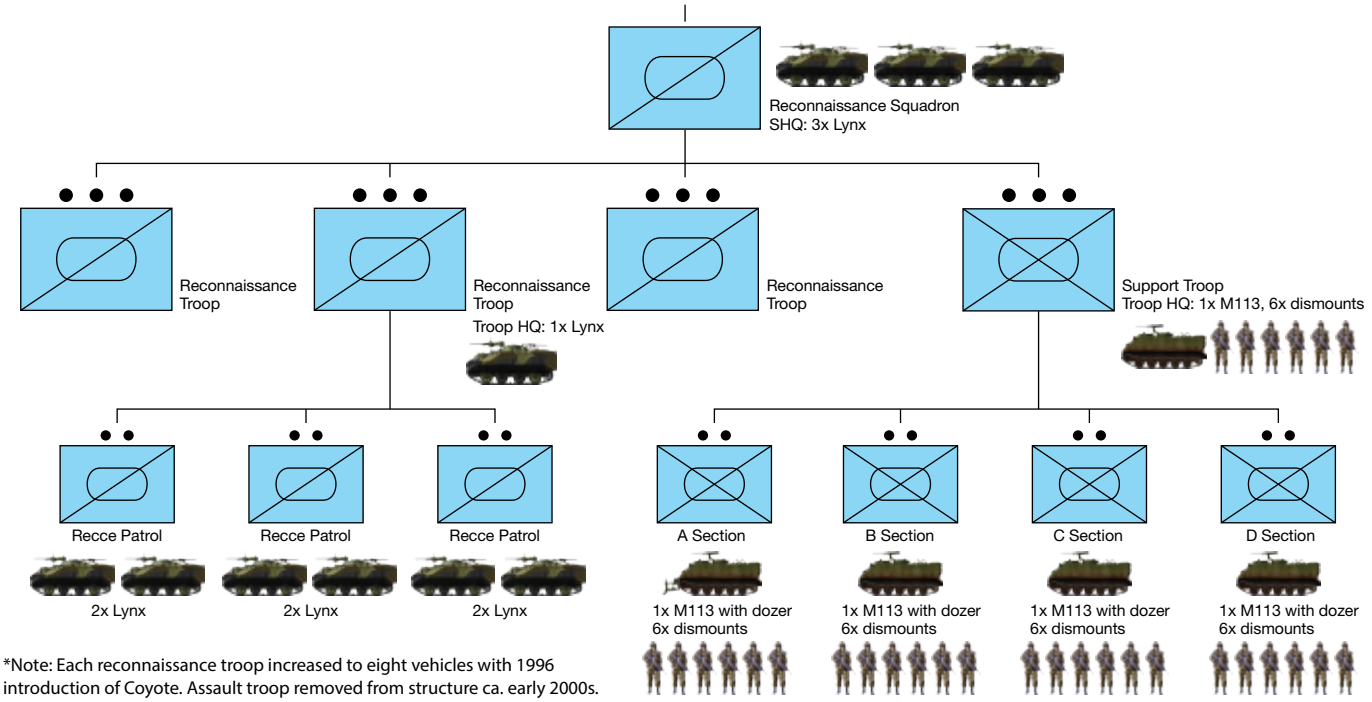


Figure 9: 56th Reconnaissance Squadron (1957)



*Note: Each reconnaissance troop increased to eight vehicles with 1996 introduction of Coyote. Assault troop removed from structure ca. early 2000s.

Figure 10: Brigade Reconnaissance Squadron (1979)

RECONNAISSANCE IN AFGHANISTAN

Proponents of the cavalry concept have also critiqued the performance of reconnaissance squadrons in Afghanistan. McInnes argues that those deployed squadrons were "immediately found to be ineffective due to the innate lack of mutual support, resources and depth inherent in the two-vehicle patrol construct," due to the inability of a two-vehicle patrol to conduct safe tactical movement, maintain observation posts indefinitely, or produce sufficient dismounts to secure patrol bases or conduct dismounted drills.[71] McInnes gleans many of those critiques from the Army Lessons Learned Centre (ALLC)'s *Dispatches: The RCAC in Afghanistan* but fails to cite the ALLC's proposed solutions to the identified issues. The ALLC did find that the two-vehicle patrol had deficiencies in the context of Afghanistan. However, the dispatch authors did not recommend the permanent restructuring of reconnaissance squadrons into four-vehicle troops to compensate for those issues. Instead, they suggested that the three-vehicle patrol model remain a "mission specific employment option" for commanders.[72] In fact, the option to "on occasion" increase patrol size to *three* vehicles

based on task has existed since at least the publication of 1977's *Reconnaissance Troop Leader's Manual*.[73] The flexibility to do so is simply one of the things that made reconnaissance squadrons such versatile assets in operations. It is perhaps unfair to condemn Afghanistan-era reconnaissance commanders for employing their assets in the way they were explicitly designed to be used.

Part of the noted deficiency of the two-vehicle patrol lay with their employment on independent tasks out of mutual support from the rest of their troop. McInnes appears to believe that this utilization was the doctrinal norm for reconnaissance squadrons, referring to the "corrosive effects" of having 16 "fire-units" (patrols) rather than the more manageable four (troops).[74] Contrary to this assertion, most reconnaissance and security tasks were designed to be conducted at the troop level. This can be illustrated through an examination of one of the most common reconnaissance tasks: route reconnaissance. Doctrine from 1944 directed "as a rule" that "a single road" was all a troop could cover, and that a squadron could cover no more than two.[75] Multiple Cold War doctrinal statements were slightly less restrictive, establishing that a squadron could manage only a single route if it was expected to face opposition and three if it was not.[76] The continuity in limiting the scope of the squadron's tasks seems to have been further softened by the publication of 2008's *Ground Manoeuvre Reconnaissance*, which only cautioned against "assigning more than one route" to a squadron, then incongruously provided an example of a squadron tasked with no less than two major and multiple minor routes requiring significant dispersion of the squadron assets.[77] Similar over-dispersion of squadrons in Afghanistan across expansive areas of responsibility may have necessitated the tasking of individual patrols to tasks. Such operational necessities overriding doctrinal prescriptions are indicative of an overtasked asset in an unusually large task force area of operations and do not constitute a repudiation of the reconnaissance squadron structure itself.

Given McInnes's assertion that, when mixing mounted and dismounted forces in squadrons, "one would naturally detract from the other," and his consequent focus on the mounted performance of tasks, he unsurprisingly does not discuss ALLC's identification of deficiencies in the RCAC's dismounted competencies.[78] ALLC identified the "crucial importance" of those skill sets and concluded that the absence of assault troops (with their specialized dismounted capabilities) from Afghanistan-era squadrons was a weakness.[79] ALLC concludes that the requirement for "an Assault Troop capability is valid" despite their current absence from the squadron order of battle.[80] The early-2000s loss of assault troops was a damaging doctrinal blow to reconnaissance squadrons. Their absence, unremarked upon by McInnes in his critique of Afghanistan-era squadrons, may have mitigated many of the problems he cited. Arguably, it was the presence of this and other combat support enablers which had made the RCAC's reconnaissance units so successful in the past.[81] While McInnes's quoting of the ALLC's list of squadron shortcomings is appropriate, failing to include one of its chief remedies for those shortcomings appears somewhat one-sided.

Overall, the performance of reconnaissance squadrons in Afghanistan cannot be said to have been "ineffective," as alleged in the cavalry concept. The ALLC disputes that condemnation, determining that "the utility of the recce subunits across a spectrum of missions further validated the fundamental recce characteristic of flexibility… This capability was an ideal economy of force asset and provided commanders with a vital capability that could rapidly react to a myriad of tactical tasks."[82] Further, rather than implementing a revolutionary removal of formation reconnaissance from the Army, the ALLC proposed evolutionary change, concluding that it was imperative for the RCAC to "reconstitute our core competencies in *both* recce and tank."[83]

HISTORY AND FUTURE TRENDS

The above historical survey of Canadian reconnaissance structures shows quite clearly that the characterization of reconnaissance squadrons as exclusively "peace support" structures is not supported by the historical record. Indeed, the precise opposite of that claim is true: the uniquely structured reconnaissance squadrons were formed to meet the modern Army's requirement to fill a reconnaissance and security gap. At the same time, the non-combat "armoured car" model survived in the post-war Army only as a peacekeeping construct. Revealingly, the 1943 Armoured Car Squadron (Figure 4), the 56th Reconnaissance Squadron (Figure 9) and the cavalry concept's recent "light armoured squadron" (Figure 2) share conspicuous structural parallels. It is also apparent that, until very recently, the Canadian Army's accepted doctrine was to maintain a structural differentiation between armour and formation reconnaissance rather than the conglomerated "platform-neutral" model of the cavalry concept.[84] Therefore the profligate abandonment of reconnaissance doctrine and structures constitutes an unjustified revolution, and ultimately the cavalry concept amounts to a break with experiential precedents.
If there is no compelling *historical* basis for this recent revolution in the Army's structure and doctrine, we must consider the possibility that the cavalry concept hit upon a *future* trend brought about by a change in the character of ground combat. Any one of innumerable military developments (such as uncrewed aircraft systems) may potentially justify the deletion of formation reconnaissance elements from the Canadian order of battle, just as machine guns and the tank heralded the doom of traditional horse cavalry.[85] It is equally possible, though, that potential future conditions will militate for the amplified relevance

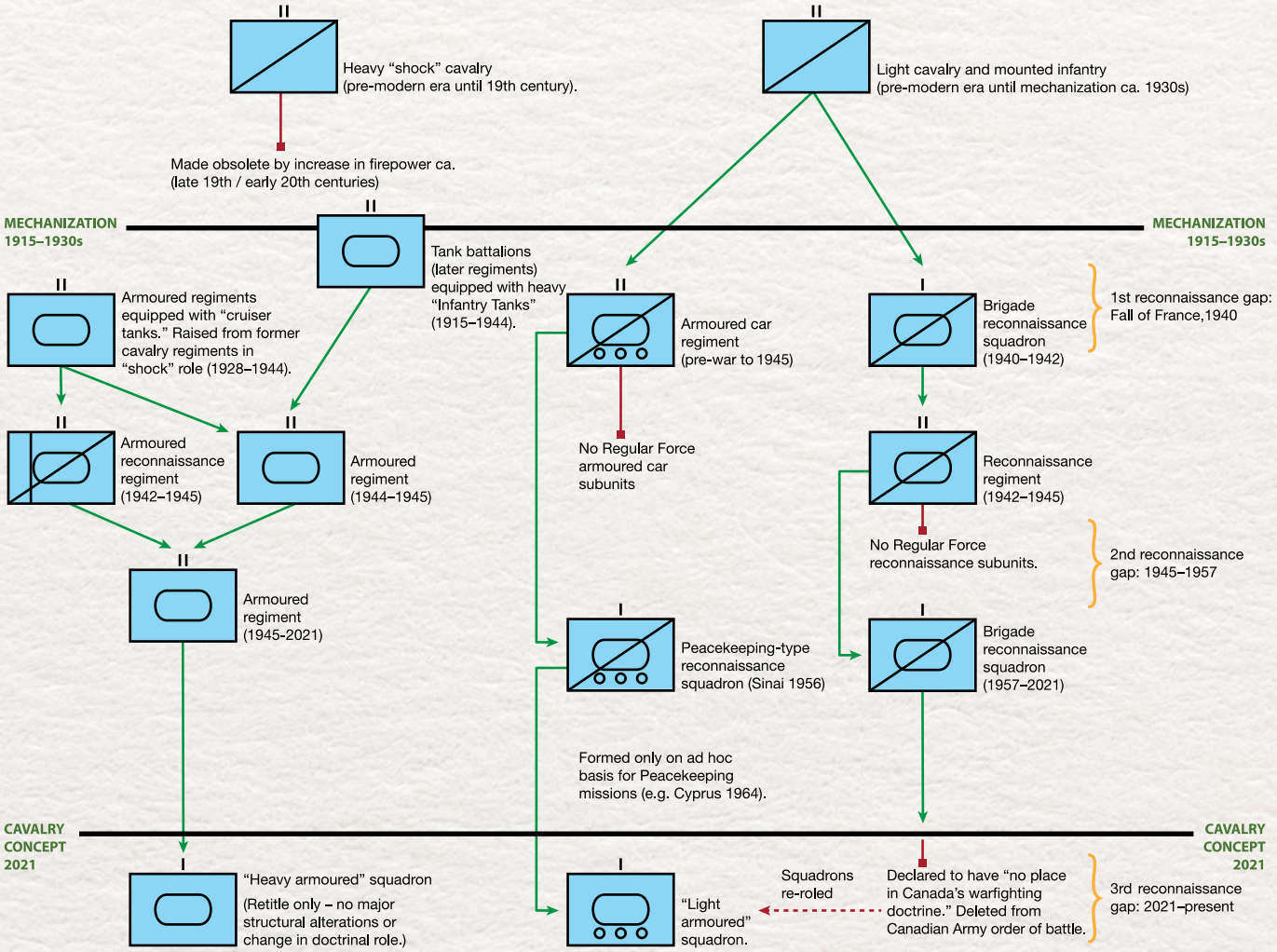


Figure 11: Doctrinal Lineages of Regular Royal Canadian Armoured Corps Subunits and the Reconnaissance Gaps

of formation reconnaissance units. Indeed, it seems that for most of the world's armies, the latter case for increased reconnaissance relevance is the overwhelming consensus.

It is worth noting that no major country's military has removed formation reconnaissance capabilities, and 25 out of 30 NATO countries maintain dedicated formation reconnaissance elements.[86] Major nations have initiated an evolution of their reconnaissance forces to match future realities, just as ALLC recommended that the RCAC do post-Afghanistan. The United States is currently revitalizing its cavalry units given responsibility for reconnaissance and security tasks and is experimenting with the re-formation of divisional- and corps-level cavalry elements.[87] The British Army is ambitiously attempting to shorten the "sensor–shooter" link by grouping much of its mechanized division's reconnaissance and fires units into a "reconnaissance-strike brigade" concept: with five cavalry regiments in the reconnaissance role, this division is slated to have an unprecedented 1:1 ratio of reconnaissance regiments to mechanized infantry battalions.[88] One of our most likely potential adversaries, the Russian Army, enlarged its brigade reconnaissance element to battalion size in 2013 following complaints that its "New Look" reforms left commanders only an inadequate company for reconnaissance.[89] This international "reconnaissance renaissance" indicates a future increased relevance for reconnaissance and security elements that may even exceed their historical importance.

CONCLUSION

It is charming that the German word for Enlightenment, Aufklärung, is the same term used for cavalry reconnaissance.
– Lieutenant-Colonel (ret'd) Roman Jarymowycz.[90]

Just as reconnaissance forces allowed manoeuvre commanders to peer into the still omnipresent fog of war to understand the battlefield and the enemy, there is comparable enlightenment for military professionals in the study of history. Proponents of the cavalry concept

Source: Combat Camera

were quick to cite history to assert the validity of their structural changes to the Canadian Army's "eyes and ears." However, as a comprehensive analysis of these claims has demonstrated, we should heed Clausewitz's admonition against the "superficial, irresponsible handling of history," which "leads to hundreds of wrong ideas and bogus theorizing."[91] The purpose of this article was to revisit some of the cavalry concept's "wrong ideas" and to highlight the Army's historically robust reconnaissance structures and doctrine. Given that our pre-2021 doctrine demonstrably "represents the distilled insights and wisdom gained from experience," combined with the current international trends in formation reconnaissance, there seems to be enough evidence to suggest that the cavalry concept's sudden denigration of reconnaissance elements was hasty, and ultimately misguided.

The Army must seriously re-examine the place of formation reconnaissance elements in doctrine. Discussions within the Army seem to be trending in this direction, and the term "cavalry" itself seems to be falling into disuse within RCAC transformation efforts. A recent RCAC working group agreed that a doctrinal difference should remain between heavy (tank), medium and light armour, with the first focused on close combat and the latter two emphasizing the finding and shaping of the enemy in the covering force area. This is a tentative first step towards a re-recognition of the classic division between armoured and reconnaissance/security elements.[92] However, even with these tepid movements towards a doctrinal revival of reconnaissance, the cavalry concept's transformation had two years to germinate within the Corps. Several light-vehicle squadrons were forced to utilize the revived armoured car–style structures and found—unsurprisingly, given the above historical analysis—that "when conducting traditional reconnaissance and tactical security tasks, the four-vehicle construct was extremely limited."[93] As the officer commanding a "light armoured" squadron, the author discovered that the Royal Canadian Armoured Corps School had rapidly adapted its curriculum to the offence and defence focus of the concept, leading to the arrival of subalterns and non-commissioned officers in the field force who had not been trained to conduct reconnaissance and security tasks and indeed, in some cases, were apparently unaware of their existence. Corps transformation efforts must seek to address these doctrinal, structural and training scars resulting from the cavalry concept. Specifically structured and trained formation reconnaissance elements are a historically established doctrinal requirement. Following an honest reappraisal of its doctrinal past and future, the RCAC will very probably have to acknowledge that the absence of formation reconnaissance elements constitutes an unacceptable gap in a modern army's force structure.

ABOUT THE AUTHOR

Major Bryce Simpson, CD, is an Armoured Officer serving as the Officer Commanding D Squadron, Lord Strathcona's Horse (Royal Canadians). During his regimental career, he was employed as a troop leader in both reconnaissance and tank squadrons, as a tank squadron Battle Captain, Second-in-Command, and Regimental Operations Officer. He also served as a Joint Terminal Attack Controller with 1st Regiment, Royal Canadian Horse Artillery. During his career, he has deployed on international operations to Sinai, Egypt (Op CALUMET), Latvia (Op REASSURANCE) and Kuwait (Op IMPACT), where this article was drafted. Major Simpson holds a Bachelor of Arts in History from Nipissing University and a Master of Arts in Military History from Norwich University.

ENDNOTES

1. The author would like to thank the following RCAC officers for their comments on early drafts of this article: Majors Michael Selberg, Gord Elliott and Martin de Souza, and Captains Nathan Homerski, Sean Danyi and Miles Smith. AFV illustrations for Second World War and Cold War vehicles were provided with the kind permission of Mr. David Bocquelet of Tanks Encyclopedia (https://tanks-encyclopedia.com/)

2. "Medium recce is mounted recce tasked at the brigade and divisional level in support of operations." Canada, DND, *Ground Manoeuvre Reconnaissance*, 1-3-1.

3. Planning guidance directed Army staff to "explore the RCAC proposal to take upon a Cavalry-type role," without further guidance as to what shape that doctrinal evolution might take, nor did it authorize any immediate structural changes. Commander Canadian Army, 1901-1 (DLFD SI-2), "Force 2025 – Updated Commander's Planning Guidance for Course of Action Development," 6 April 2021.

4. Canada, Department of National Defence, B-GL-005-000/FP-001, CFJP 01 – *Canadian Military Doctrine* (2011), 1-1-1.

5. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 2008; orig. 1976), 171.

6. Ibid., 169.

7. Quoted in Canada, Department of National Defence (DND), B-GL-394-002/FP-001, *Ground Manoeuvre Reconnaissance* (2015), 1-3-1.

8. Matthew McInnes, "First Principles and the Generation of Armoured Fighting Power," *The Canadian Army Journal* 17.3 (2017): 83–113.

9. McInnes, "First Principles," 95.

10. Ibid., 101.

11. Director of Armour, 3185-2 (Corps Major) "The Armoured Cavalry Concept," 13 August 2021.

12. Ibid.

13. Ibid.

14. C. P. Stacey, *Official History of the Canadian Army in the Second World War, Volume I: Six Years of War: The Army in Canada, Britain and the Pacific* (Ottawa: Department of National Defence, Directorate of History and Heritage, 1956), https://publications.gc.ca/site/eng/9.691757/publication.html.

15. Clausewitz, *On War*, 170.

16. For a discussion of the interwoven nature of the Anglo-Canadian armies, see J. L. Granatstein, *The Generals: The Canadian Army's Senior Commanders in the Second World War* (Toronto: Stoddart, 1993), 14–15. For analysis of the debate, see A. J. Duncan, "Technology, Doctrine and Debate: The Evolution of British Army Doctrine Between the World Wars," *Canadian Army Journal* 7.1 (Spring 2004): 23–34.

17. John A. English, *Failure in High Command: The Canadian Army and the Normandy Campaign* (Ottawa: Golden Dog Press, 1995), 27.

18. Robert Crisp, *Brazen Chariots* (New York: Bantam Books, 1984), 6.

19. Ibid., 163.

20. See McInnes, "First Principles," 99; and Phillip J. Halton, "The Re-Transformation of the Armoured Corps," *Canadian Army Journal* 17.3 (2017): 76.

21. Vladimir Kessia, "The Role of Armoured Reconnaissance Within the Canadian Army," *Canadian Military Journal* 22.2 (Spring 2002): 17.

22. United Kingdom (UK), Military Training Pamphlet (MTP) No. 60, Part 1, *The Tactical Employment of Armoured Car and Reconnaissance Regiments: General Principles Regarding the Tactical Employment of Reconnaissance Units* (1943), 9.

23. Ibid., 10.

24. Charles Forrester, *Monty's Functional Doctrine: Combined Arms Doctrine in British 21st Army Group in Northwest Europe, 1944–45* (Warwick, UK: Helion and Company, 2015).

25. C. P. Stacey, *Official History of the Canadian Army in the Second World War, Vol III: The Victory Campaign: Operations in North-West Europe 1944–1945* (Ottawa: Queen's Printer, 1960), 279.

26. See Forrester, *Monty's Functional Doctrine*, 128.

27. Douglas E. Delaney, *The Soldiers' General: Bert Hoffmeister at War* (Vancouver: University of British Columbia Press, 2005), 158.

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44. Ibid., 2.

45. Ibid., 4.

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64. Andrew Godefroy, *In Peace Prepared: Innovation and Adaptation in Canada's Cold War Army* (Vancouver, BC: University of British Columbia Press, 2014), 143.

65. Maloney, *War Without Battles*, 130.

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75. UK, MTP, No. 60, Part 4, 10.

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79. Canada, ALLC, *Dispatches: RCAC in Afghanistan 18.1*, 12.

80. Ibid., 12–13.

81. Assault troop capabilities described in *Reconnaissance Troop Leader's Manual*, Chapter 5.

82. Canada, ALLC, *Dispatches: RCAC in Afghanistan 18.1*, 11.

83. Ibid., 42.

84. Prior doctrine emphasized the distinction between reconnaissance and armour elements. Canadian Army Doctrine Note (CADN) 17-1, for the first time, conflated the institutional "Armour" in "Royal Canadian Armoured Corps" with the tactical "armour" of doctrine by including "armoured reconnaissance" in its definition. Canada, DND, CADN 17-1, *The Armoured Regiment in Battle* (18 July 2017): 1-2.

85. Institutional discussion of these trends can be found in Canada, Department of National Defence, B-GL-310-001/AG-003, *Close Engagement: Land Power in the Age of Uncertainty*, 2019.

86. Analysis based on individual country profiles in Janes Information Service. Janes Information Service Online, Country Profiles, https://www.janes.com/ (accessed 25 May 2022).

87. The U.S. Army currently employs one cavalry squadron (battalion) per brigade combat team (BCT), with varying structures and equipment for Infantry, Stryker and Armoured BCTs.

88. For a discussion of British doctrine, see Bryce Simpson, "A Perspective on Cavalry: Re-examining the Mounted Arm for the Future," *The Canadian Army Journal* 19.3 (2022): 11–20; and United Kingdom, *Future Soldier Guide* (2021), 54–58, https://www.army.mod.uk/media/14919/adr010310-futuresoldierguide_25nov.pdf (accessed 7 Oct 22).

89. Russian manoeuvre battalions lack the reconnaissance platoons common in Western armies, potentially making the problems posed by the paltry pre-2013 brigade reconnaissance elements particularly acute. See Lester W. Grau and Charles K. Bartles, *The Russian Way of War: Force Structure, Tactics, and Modernization of the Russian Ground Forces* (U.S. Department of Defence, Foreign Military Studies Office, 2016), 276.

90. Roman Jarymowycz, *Cavalry from Hoof to Track: The Quest for Mobility* (Westport, CT: Greenwood Publishing Group, 2007), 55.

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LESSONS ON FIGHTING RECONNAISSANCE FROM EXERCISE MAPLE RESOLVE 21

Captain Miles Smith

INTRODUCTION[1]

Upon return from Exercise MAPLE RESOLVE (Ex MR) 21, the members of what is now called "D Squadron" of Lord Strathcona's Horse (Royal Canadians) [LDSH (RC)] hung a memorial group photo beside the entrance to their lines. The photo's caption was "The Last Reconnaissance Squadron," as the Royal Canadian Armoured Corps (RCAC) officially retitled its squadrons as "cavalry" from reconnaissance or tank. The RCAC distributed a letter to all RCAC commanding officers in August 2021 explaining the cavalry concept. The letter stated that the cavalry concept "represents a conceptual pathway from the provision of a limited and narrow dual-stream direct fire and furtive reconnaissance combat support capability to a single, cohesive, mounted, close combat manoeuvre force."[2]

A soldier shoulders the Carl Gustav during Exercise MAPLE RESOLVE 21.

The document underlined that the sole role of cavalry forces is to defeat the enemy in mounted close combat. It emphasized that all squadrons were to have a homogenous structure organized according to the "principle of four" to provide more combat power for this role: four armoured fighting vehicles per troop and four troops per squadron.[3] No enablers are included in this organization. The letter did allow for a naming distinction between light cavalry squadrons equipped with tactical armoured patrol vehicles (TAPV) and light armoured vehicle (LAV) 6.0s and heavy cavalry squadrons equipped with the Leopard 2. However, the letter mandated the rescinding of separate tank and reconnaissance doctrine to be replaced by a common document, making the employment of these squadrons platform agnostic. Further, the RCAC aspires to equip TAPVs and LAV 6.0s with anti-tank guided missiles (ATGM) to enhance their combat power to fill this combat-oriented role.[4]

Source: Combat Camera

Despite this shift, the group of officers and soldiers employed tactics on Ex MR 21 that the RCAC will find valuable to examine. This case study will highlight the experience of the LDSH (RC) reconnaissance squadron during Ex MR 21 to present salient lessons for consideration while the shift to cavalry is being implemented within the RCAC. The scope of this article is limited to the implications of renaming reconnaissance squadrons to cavalry squadrons, emphasizing manoeuvre-focussed offensive and defensive operations over combat support enabling operations.[5] For simplicity, the term cavalry in this article refers to light and medium squadrons equipped with the TAPV and LAV 6.0, and excludes tank squadrons. The arguments contained within are not necessarily extended to tank squadrons, which would require a far broader examination and scope.

This article argues that the RCAC must reconsider the emphasis on homogenous squadrons and the mounted performance of tasks at the expense of dismounted expertise. Doing so will ensure subunits are trained and equipped with the skills and capabilities required to succeed in their new role as cavalry on the battlefield. Underpinning this argument is the experience of a real squadron engaged against a motivated and thinking opposing force (OPFOR) under as realistic conditions as can be provided in a training environment. First, examining the problem facing the squadron on Ex MR 21 will provide the context. Second, dissecting the experience on Ex MR 21 will demonstrate the vital importance of a dismounted capability, lethal anti-armour systems, integral airborne sensors, and dedicated indirect fire support. Third, the discussion will conclude with suggestions for improvement in tactics, organization, and doctrine. This article seeks to support its arguments through primary evidence from weapons effects simulator (WES) GPS map overlays, excerpts from orders, and accounts of experiences from those in the squadron who were present on Ex MR 21.

BACKGROUND – AN APPRECIATION OF THE PROBLEM

It is useful to comprehend three aspects of the problem facing the squadron. First, the context of the exercise and the concept of operations provides an understanding of what the squadron was supposed to accomplish, against what enemy, and with what resources. Second, the concept of battlefield density is crucial to understand how the squadron accomplished its task. Third, the risk to light reconnaissance forces as a function of the tempo of the battle highlights the challenges in assigning a comparatively lightly equipped element a dramatic mission task verb against a heavy mechanized enemy force.

The Situation

Ex MR 21 saw two successive iterations of 1st Battalion, Princess Patricia's Canadian Light Infantry (1 PPCLI) and 2 PPCLI battle groups (BG) facing off against the other in the Wainwright training area. The friendly BG for each iteration was largely defending under the command of 1 Canadian Mechanized Brigade Group (1 CMBG) HQ. The brigade provided higher control and retained full command over the brigade reconnaissance squadron, whose frontage matched that of the BG. The squadron's employment straddled the definition of close and medium reconnaissance, as it was employed by a formation but operated strictly within the area of interest of the BG in front of the integral BG reconnaissance platoon.[6]

The composition of the squadron mirrored that of a "light cavalry squadron," equipped predominantly with TAPVs with some Coyotes and LAV 6.0s. However, the squadron was organized into three six-vehicle troops, each composed of three two-vehicle patrols. This was a variant of the 2008 reconnaissance squadron organization outlined in *Ground Manoeuvre Reconnaissance*. This gave the squadron the ability to disperse smaller patrols across its frontage rather than remain concentrated in troops of four as the cavalry concept prescribes.

Although the OPFOR was not allocated real Leopard 2s, a company of OPFOR LAV 6.0s had their WES systems programmed as T-90s. Perhaps the simplest way to explain the task and the problem the squadron faced during Ex MR 21 is in the officer commanding's (OC) own words. Major Dan Gray explained:

> Our task, which we should expect more of if we are transitioning to cavalry, was to identify and destroy enemy reconnaissance, identify the main body (implying we had to do something with the vanguard and lead element), and destroy the enemy recon-strike complex. This all had to be done while minimizing friendly force casualties because we were a limited resource and expected to be in place for 3+ days. These are not tasks that a TAPV or troop of TAPVs can accomplish, especially in the terrain we were operating in, where the only cover is rolling hills with no trees and limited vegetation (the badlands). Identification of enemy elements was easy to do with the optics of the TAPV along with layered MUAS [miniature uncrewed aerial systems], but you can't simply sit there and allow the enemy to bypass you because they will kill you.[7]

The squadron was ordered to accomplish a task that it was simply not equipped nor augmented for, especially when potentially facing elements of a company of T-90s. The 1 CMBG commander directed the squadron to shield the preparation of the main defensive area and, if required to do so, engage in mounted close combat. The squadron was tasked to take advantage of any opportunity to seize the initiative. A critical consideration of the mission was to avoid decisive engagement and preserve combat power for follow-on tasks.

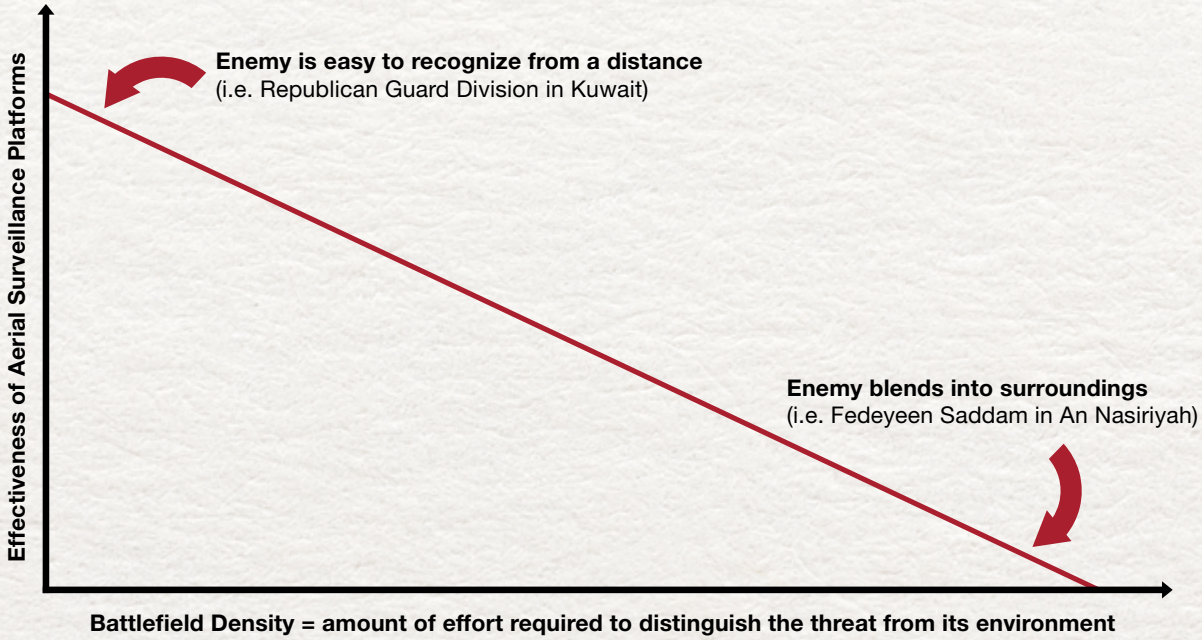


Figure 1: The relationship between battlefield density and detectability. Although the y-axis is titled *aerial* surveillance platforms, the same concept applies to ground observation.

Summarizing the situation, consider the following: first, the brigade commander's concept of employment for the squadron was no different than what is being proposed by the cavalry concept. Ex MR 21, therefore, provides an example of a tactical environment where an armoured reconnaissance squadron was tasked to conduct offensively-oriented tactical security tasks similar to what the cavalry concept envisions for cavalry squadrons. Second, the difference between the force design of a cavalry concept squadron and the squadron employed on Ex MR 21 is that the cavalry concept would organize the squadron in four troops of four vehicles, remove the squadron's option to conduct tasks dismounted, and arm vehicles with a mounted ATGM capability. The experience of Ex MR 21 will provide an opportunity to examine the merits of these proposed changes.

Battlefield Density

U.S. Brigadier General Curtis Taylor, drawing on his own extensive armoured reconnaissance experience, defines battlefield density as "a measure of the amount of energy a reconnaissance force must apply to distinguish a threat from its surrounding environment." This measure is a combination of obscuration from terrain and enemy observation capabilities.[9] During Ex MR 21, squadron operations occurred in an environment where the key limiting factor for mounted forces was low battlefield density. When operating in the sparse Wainwright badlands against an OPFOR equipped with thermal sights, night vision equipment, and uncrewed aerial systems (UAS), a static vehicle-mounted screen would be easily detected and would have stood little chance of meaningfully engaging the enemy to achieve the intent of the 1 CMBG commander. During the counter-reconnaissance and screening tasks assigned to the squadron, staying undetected until within anti-armour range was vital. Figure 1 shows Taylor's linear relationship between the effectiveness of surveillance and battlefield density.

A TAPV or LAV 6.0 is simply too visible in the terrain of the Wainwright badlands to avoid detection. Naturally, dismounted personnel are far more difficult to detect, and the utility of this difference cannot be understated for cavalry forces. Stephen Biddle, a professor at Columbia University who served on strategic assessment teams in both Iraq and Afghanistan, noted the following in his analysis of Operation ANACONDA in Afghanistan:

> […] In March 2002, an intensive pre-battle reconnaissance effort focused every available surveillance and target acquisition system on a tiny, ten-by-ten kilometre battlefield. Yet fewer than 50 percent of all the al Qaeda positions were ultimately identified […] In fact, most fire received by U.S. forces in ANACONDA came from initially unseen, unanticipated al Qaeda fighting positions.[10]

Here, detection was difficult despite the availability of drones, thermal and satellite imaging. Biddle is referring to dismounted enemy fighting positions, not vehicles.

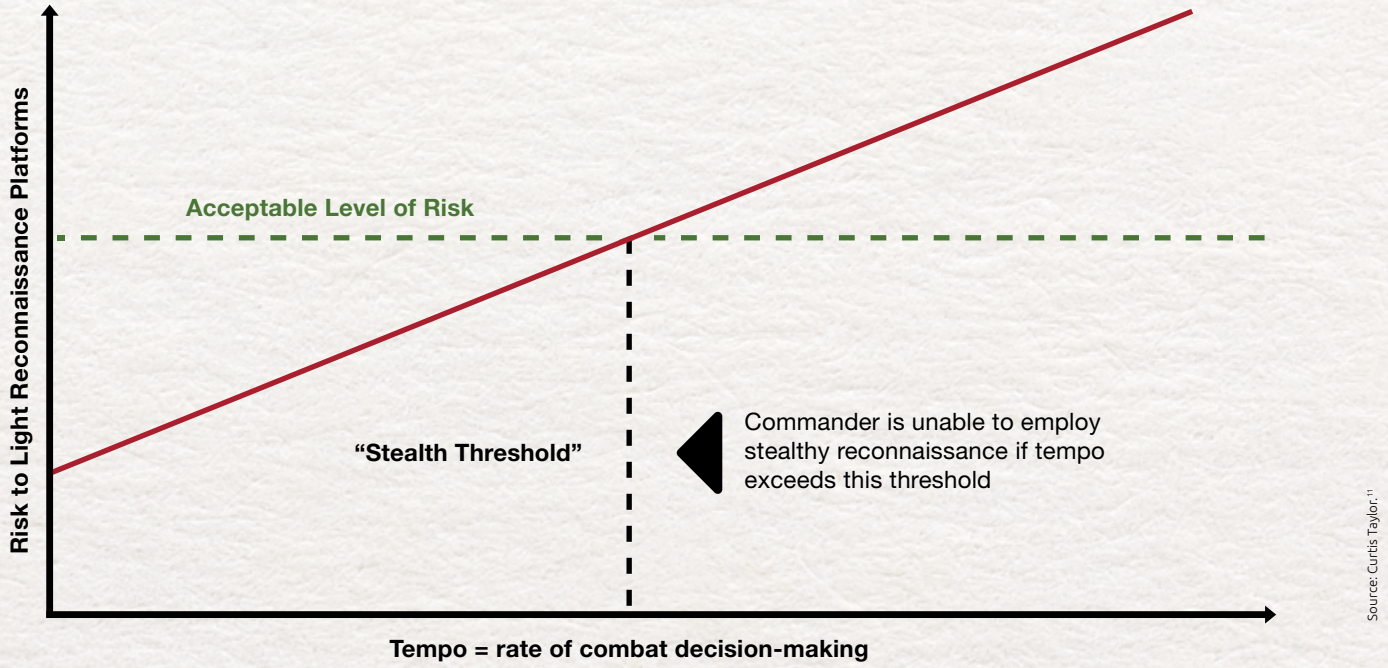


Figure 2: A chart depicting the risk to light reconnaissance as a function of tempo.

Regarding vehicles, Biddle noted that "Taliban combat vehicles and crew-served weapons on hillsides west of the Balkh River could be identified from observation posts (OP) on the Koh-i-Almortak ridge line some 4–5 kilometres distant."[12] That is crucial and shows that advanced surveillance assets could easily detect enemy vehicle positions but not enemy dismounted positions.

Risk to Reconnaissance Forces as a Function of Tempo

Taylor defines another metric, tempo, as the rate of military action or combat decision-making. An increased tempo drives a requirement for faster action from reconnaissance.[13] There is a threshold for both battlefield density and tempo where stealthy, slow reconnaissance is feasible. Reconnaissance forces require time and space to be effective against enemy manoeuvre forces. If stealth is not an option because of the combination of low battlefield density and high tempo removing time and space, respectively, cavalry forces must be prepared to fight to achieve their mission.[14] That poses a risk to lighter reconnaissance forces, shown in Figure 2.

Although Taylor expressed this concept in the context of information-gathering in offensive reconnaissance operations, the same applies defensively. Light forces, especially dismounted, cannot operate without severe risk of being overrun by a heavily armoured enemy pushing at a high tempo. The combat power of the enemy was assessed to be far greater than what the reconnaissance squadron possessed. The TAPV, while possessing excellent optics, simply does not have the armour, firepower, or mobility to engage in a mobile battle against tanks. The 25-mm armament and protection of the LAV 6.0 and Coyote are not significantly better. The squadron was, therefore, certainly a light reconnaissance asset relative to the combat power of the enemy BG.

The squadron second-in-command, Captain Thomas Gray of The Royal Lancers (Queen Elizabeth's Own) [UK], identified the crux of the issue facing the squadron. In his assessment of the situation, neither time nor space was afforded to the squadron on Ex MR 21 because of the tempo of the enemy advance:

> Without two of their key requirements (time and space), how do they (the squadron) fight to provide sight to ground forces? The answer is increased aggression within the cavalry. There is more to the counter-recce battle than just blinding the enemy's eyes. Whilst this is hugely beneficial for friendly forces, counter-recce will also significantly slow down the enemy force. This will allow time for cavalry squadrons to go to work. Secondarily, it will force the enemy force to utilize UAS to screen ahead, giving information on likely enemy routes and direction of travel.[15]

The enemy's awareness that the reconnaissance squadron was lightly equipped was turned against the enemy force. As Captain Gray explains, "Having performed our estimate, we came to the conclusion that their recce (reconnaissance) would be lightly supported, saving a majority of their fighting power for their main force.

Source: Combat Camera

Secondly, we assumed that their recce couldn't perform a detailed search and would instead look for safe routes rapidly, under armour."[16] Thus, although the squadron expected that the tempo of the enemy advance would be high, the initial enemy elements would be only small packets, and the enemy's ability to distinguish a threat from its environment would be degraded.

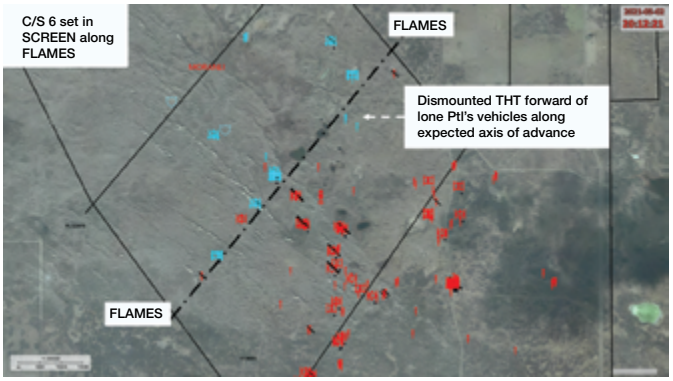
To summarize the appreciation of the problem, the squadron needed to first detect the enemy without being detected, on a low-density battlefield, in the presence of enemy UAS. Once done, the squadron needed to strip enemy lead elements while preserving friendly combat power for subsequent engagements. Finally, the squadron needed to either slow the tempo of the enemy to match their battlefield mobility or employ methods that allowed them to cope with the tempo of the enemy's advance while maintaining contact during the withdrawal. All of that needed to be accomplished with a severe capability deficit as a squadron of mostly TAPVs facing potentially a battalion (-) equipped with main battle tanks. However, the squadron did identify an opportunity to achieve local parity against the enemy reconnaissance elements, and the effectiveness of enemy surveillance for concealed forces would be low.

DISCUSSION – WHAT TO DO? THE EXPERIENCE OF EXERCISE MAPLE RESOLVE 21

Given that appreciation, Major Gray explained the squadron's chosen course of action:

> Our solution was to create dismounted tank hunting teams (THT) based on four pers with Carl Gustavs. We had limited access to ATVs and Tac Hel for movement/infiltration, and they had a fall back plan to the nearest OP. Their task was to destroy recce and vanguard elements as they advanced toward the main screen line. The enemy had done their estimate and were looking for Coyotes and TAPVs (which were easy to find in that terrain) but were not looking for/could not find small, well-placed THTs. These teams were extremely effective in hitting the enemy before they could be seen and caused attrition, chaos and a lack of SA (situational awareness)/recce for the enemy. These teams were extremely effective, destroying 30+ vehicles throughout the exercise. Since we had limited resources and dismounted teams are slow by their nature, it required detailed terrain analysis to identify the two or three likely manoeuvre axes, which is where we would set up the teams.[17]

The innovative employment of combined arms teams between dismounts and vehicles completely changes the estimate. Small, dismounted THTs capitalized on their low signature to ambush the enemy and temporarily slow their tempo. As Captain Gray alluded to in his comments, the shock of encountering those teams and their devastating effects achieved enough of a DISRUPT (or, in some cases, a localized FIX) to slow the enemy's advance in a way that the easily observed vehicles of the squadron could not. Aggression and ambush allowed the squadron to temporarily dictate the tempo. That was complemented by their ability to then remount vehicles and keep pace with the overall tempo of the enemy advance. In that way, the THTs achieved a disproportionate effect by combining



Source: Canadian Manoeuvre Training Centre (CMTC), with edits for emphasis by the author.

Figure 3: A WES "God Screen" overlay that shows the initial disposition of the squadron in blue against the enemy's initial probing efforts in red.

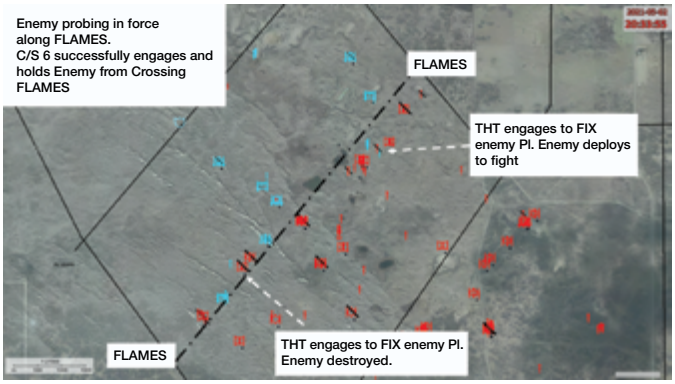


Figure 4: THTs engage enemy forces attempting to penetrate the screen line with devastating effect. Enemy vehicles with black strikes denote their destruction. Note the difference in distances from OPs between the THT in the north and the THT in the south, as well as the low friendly casualties.

a stealthy, slow dismounted capability with a nearby fast yet detectable mounted capability that could not fight effectively on its own. Figures 3–5 show an overview of one example of these THTs in action during Ex MR 21.

The vehicle-mounted ATGM capabilities that the RCAC are pursuing would not do much to help in the fight against tanks here either.[18] Although the terrain was open and enemy vehicles were also relatively easily detected on account of the low battlefield density, they were not easily engaged as the undulating terrain presented fleeting opportunities for destruction. This is emphasized in later pages with Figure 8. It cannot be forgotten that most vehicle-mounted ATGM systems require the firing platform to be static or near-static, demand longer acquisition times than laying a gun, are slow firing, have limited extra ammunition and emit a prominent firing signature. The same is true for ATGMs in the dismounted role. However, at range, dismounted teams are far less visible and more difficult to return effective fire against.

In Figures 3 and 4 that precede, note the engagement ranges shown. Opposing forces are nearly joined before an engagement begins, certainly below 1000 m. A long-range engagement, even with vehicle-mounted ATGMs, would struggle to achieve a DISRUPT, let alone a FIX or DELAY. The shortcomings of the TOW system below 1,000 m are well documented within the Army (see endnote).[19] In these reports from both operations and scientific experiments, the overwhelming conclusion is that the Army does not have an effective capability between 400 m and 1,000 m to reliably destroy enemy armour. Main battle tanks are excluded from this statement, naturally. The capabilities of the 84 mm Carl Gustav recoilless rifle and TOW missile systems both leave much to be desired in terms of lethality, detectability, and overall performance.

Troop leaders were enabled with significant freedom on how to employ their THTs, allowing them to adapt their employment to the circumstances on the ground. In some cases, troop leaders opted to site them near their OPs to provide additional direct fire anti-armour capabilities, while others pushed their THTs further forward as a separate element. For Captain Scott Veale, a troop leader in the squadron, the real value was the additional firepower to augment capability in patrols. The surveillance operators who may otherwise have been idle during the battle were amalgamated from each crew to form a THT.[20] In all cases, THTs themselves were afforded significant freedom to site their positions. Notably, officers in the RCAC are not trained in the employment of dismounted anti-armour weapons. The record of decision for the draft qualification standard of the new troop leader course contains two notable questions: "Are we going to maintain hand-held anti-armour weapons within the Corps?" and "In a reconnaissance context, (dismounted) anti-armour weapons do make sense; for the Corps restructure (to the cavalry concept), does this make sense?"[21] Given the experience on Ex MR 21, the answer to both questions should be a resounding "yes."

A robust dismounted capability equipped with anti-armour weapons is only one part of the larger equation. The use of integral sensors at the troop level, most notably MUASs, was critical to ensure that the teams were placed along the enemy axis of advance. While the appreciation of the ground could coarsely place the THTs, the MUAS ensured that they were finely adjusted. In the words of Captain Alex Schofield, a troop leader in the squadron during Ex MR 21, "We had noticed that the BGs were massing in waiting areas and then pushing forward quickly along easy-to-track routes. We were able to combine MUAS feeds to find the targets and define them—based on this information, the (tank hunting) team would move to a new location if it was close enough/feasible. The MUAS proved

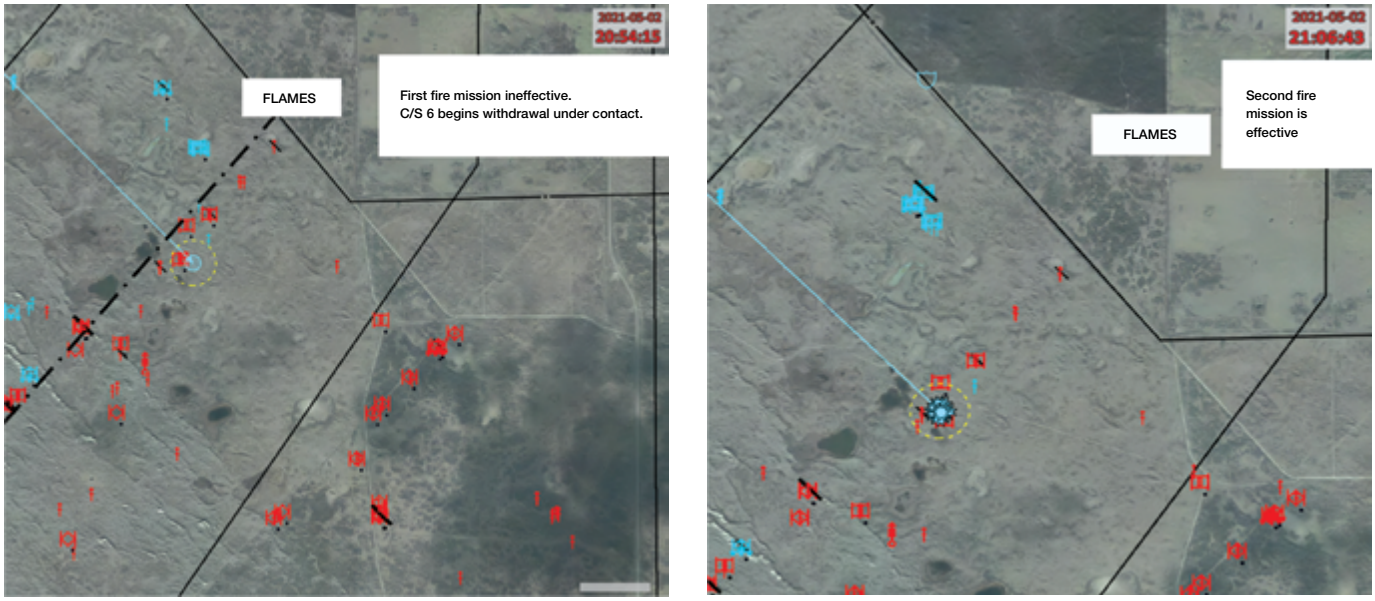


Figure 5A and 5B: The initial fire mission is ineffective because of the movement of enemy vehicles after it was sent to the guns. In the second frame, the fire mission is effective as the enemy vehicles halted to engage the THT and deployed dismounts to clear the THT's position.

to be critical to this execution."[22] She continued to state that the MUAS was so important to the success of this tactic that troops coordinated to ensure near-constant coverage of the line's frontage when others had to land to recharge.[23]

For a cavalry squadron operating independently, indirect fire support, or lack thereof, is another important consideration. Doctrine minces no words in asserting that indirect fire is crucial to successful counter-reconnaissance and, indeed, almost any operation undertaken by reconnaissance forces. That is especially so when the squadron is not augmented with other manoeuvre arms.[24] After-action review (AAR) analysis by Canadian Manoeuvre Training Centre (CMTC) personnel shown in the figures 5A and 5B demonstrates the difficulties that cavalry elements will face without a well-integrated indirect fire capability. Noting the time of first contact in Figure 4, 21 minutes elapse between enemy forces being within 100 m of the THT and the first rounds falling in Figure 5A—not effective, unsurprisingly, as the AAR noted, because of the time required for the guns to receive the information and fire and the rapid tempo of the enemy advance. The second fire mission 10 minutes later, shown in Figure 5B, was successful as, by that point, the enemy elements had been fixed. The current solution for a brigade reconnaissance squadron operating forward is to attach a forward observation officer (FOO) and designate a dedicated brigade source of indirect fires. However, a cavalry squadron employed as a regular manoeuvre element in a brigade group may not be afforded the luxury of dedicated support from limited indirect assets at all times.

Note the integral indirect fire capability, FOO, and even a military intelligence analyst attached within the order of battle (ORBAT) shown in Figure 6. One of the salient observations from the reconnaissance squadron attached to Op ATHENA Roto 1-08 was that a minimum of one trained intelligence analyst should be integrated within the squadron headquarters to provide support.[25] Although this is perhaps not as vital as the addition of organic indirect fires, it is yet another example of the importance of enablers that our preeminent ally believes a cavalry squadron requires for it to successfully perform its role. By extension, these organic enablers could be what truly differentiates an RCAC cavalry squadron from a similarly equipped mechanized infantry company using LAV 6.0s.

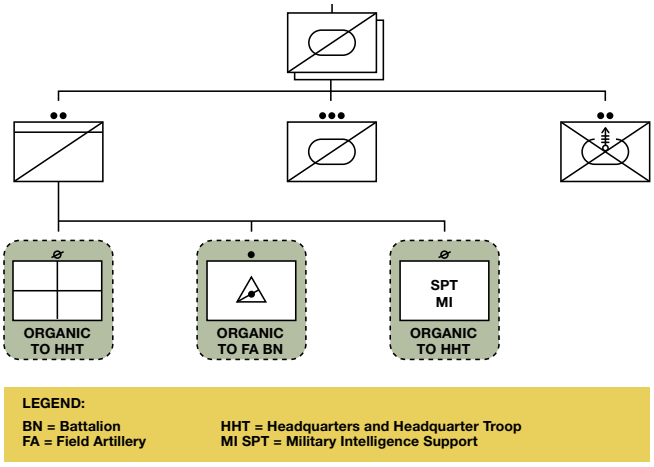


Figure 6: The organization of a US Cavalry Troop (equivalent to a Canadian Squadron).

Source: U.S. Army[26]

Source: Combat Camera

HIGH TEMPO OPERATIONS NECESSITATE THE USE OF VEHICLES; HOWEVER, THEIR VULNERABILITY TO DETECTION IN LOW BATTLEFIELD DENSITY ENVIRONMENTS EXPOSES A NICHE WHERE DISMOUNTED SOLDIERS ARE REQUIRED FOR A SQUADRON TO BE EFFECTIVE.

Snipers are another important enabler that are potentially available to cavalry squadrons. Although friendly snipers detached from the BG were operating along the same screen line, the brigade attached them under tactical control (TACON) to the squadron.[27] This command relationship meant that the squadron could only coordinate their movement and not assign missions or tasks. Despite being assigned nearly identical roles in the brigade intelligence collection plan, the squadron could not control the snipers in any way except for coordination of movement and location to enable them to conduct their tasks.[28] Integrating these organically into the squadron would be similar to the practice of US cavalry within infantry brigade combat teams, where each troop (equivalent to a Canadian squadron) contains a sniper section of three detachments—identical to the snipers attached to the squadron during Ex MR 21.[29] In American cavalry doctrine, the role of the sniper is to provide precision fire and also to "observe, collect, and provide critical, detailed information. Examples include snipers providing overwatch during a dismounted portion of zone reconnaissance or adding depth to a screen in complex terrain."[30] No doubt, the squadron would have made excellent use of the additional capability while arrayed in a screen in the complex terrain of the Wainwright badlands.

Captain Scott Veale noted that the snipers operating in the same area provided utility in their ability to provide a close definition of the enemy and maintain contact through layback patrols, although Captain van Heerden lamented the fact that the snipers were only attached TACON.[31] Although reporting from the snipers contributed to squadron situational awareness, the inability of the squadron to direct how they went about their mission, combined with the requirement to support their insertions, meant that they were a burden more than an asset. If they were attached under operational control (OPCON), meaning the squadron could assign them limited tasks, or were organic to the squadron, their employment could have been better integrated into the squadron scheme of manoeuvre.[32]

Recommendations – Toward the Future

The question now facing the RCAC is whether cavalry squadrons will be sufficiently resourced to fill their new roles or whether they will find themselves in a similar situation to the squadron on Ex MR 21. This subunit was equipped and resourced for screening and surveillance but asked to perform tasks of a combat manoeuvre element. Without changes to the cavalry concept, acknowledging both the need for dismounts and the fact that not all tasks are not platform agnostic, future squadrons will have very similar experiences. As the arguments above illustrate, the number of vehicles in a troop or patrol would have had almost no effect on the outcome of the battle due to the general dearth of capability. The squadron suffered heavy casualties throughout the exercise but, without the creative use of dismounted THTs synergized with MUASs and indirect fire, "it would have been two-to-three times worse, and we'd have done no killing," in the assessment of the OC.[33]

Equipping cavalry squadrons with heavy direct fire weapons in the style of an AMX-10RC or Centauro, as has been proposed within the RCAC, would address the mounted direct fire deficit but not the lack of dismounted capability and the inability to conceal large vehicles on a low-density battlefield. In any environment where vehicles would be easily observed from both ground observation and uncrewed aerial systems, having more heavily armed vehicles is not necessarily the solution nor is it realistic, given that the TAPV and LAV 6.0 were just procured. Although heavier combat-purposed vehicles may cope better with sustained high-tempo operations, their use in a screen line is dubious, given the general lack of heavy forces in the Canadian Army. Resource allocation is zero-sum; a commander would be unwise to commit their decisive forces to what should be an economy-of-effort task, leading to the "reconnaissance paradox" as coined by John J. McGrath in his study "Scouts Out!" and shown in Figure 7.

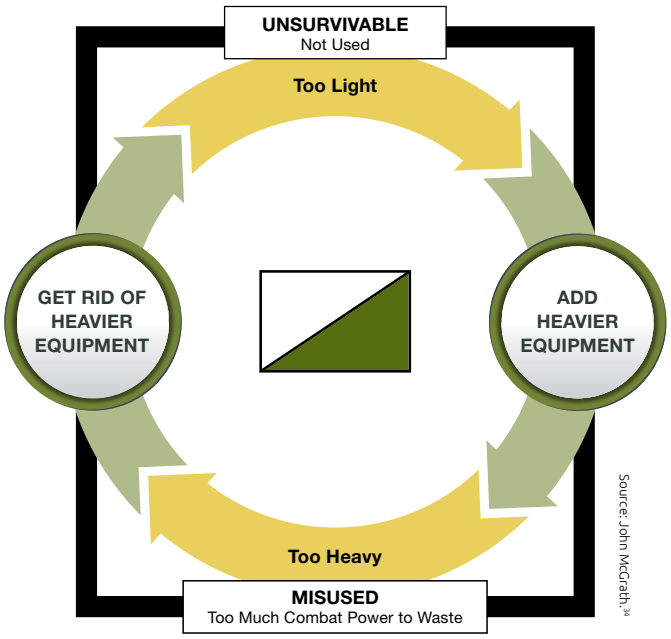


Figure 7: The "Reconnaissance Paradox."

As a Leopard 2 tank troop leader on the same exercise, the author's own experience showed that heavier vehicles alone are not the solution. While attached to a company of Zulu[35] infantry LAV 6.0s, the lack of available dismounts when arrayed in a guard line in the Wainwright badlands was acutely felt. Despite having significant direct firepower available in the form of Leopard 2s and LAV 6.0s, the key challenge was to observe and engage approaching enemy forces without being first detected and engaged oneself.

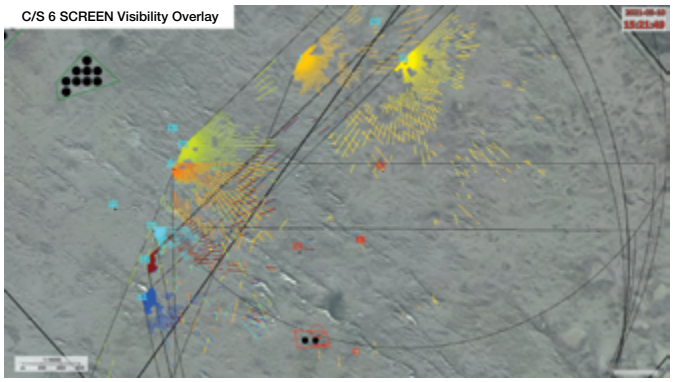
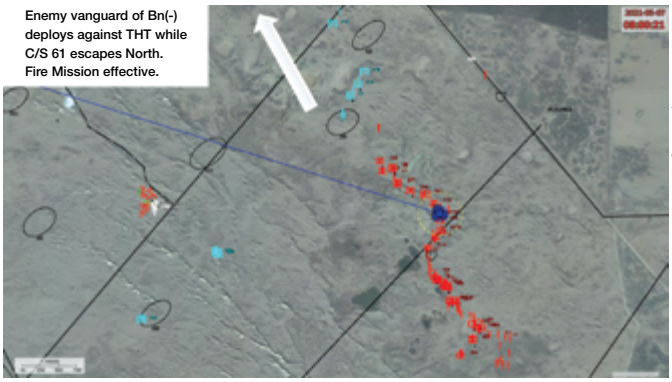


Figure 8: A computer-generated overlay of what a section of the screen line could observe and fire upon.



Source: Canadian Manoeuvre Training Centre (CMTC), with edits for emphasis by the author.

Figure 9: A fire mission called from the troop OP strikes the column in depth.

A single dismounted soldier with binoculars on a crest would have drastically altered the conduct of that mission, let alone incorporating integrated THTs with anti-armour weapons. On several occasions, enemy dismounts were able to infiltrate through the line, and enemy vehicles could not be engaged until the last moment through careful route-finding in defilade. Figure 8 illustrates that in detail from the perspective of the reconnaissance squadron. Note the enemy vehicles in defilade at the centre of the image, no more than 1.2 km from the screen line. Despite the low battlefield density and lack of vegetation, the undulating terrain made engagements very difficult to prosecute. An in-depth examination of the organic integration of infantry within a tank squadron is beyond the scope of this article, but this example shows that heavier vehicles alone cannot compensate for the lack of dismounted capability. The RCAC must reintroduce a dismounted capability for cavalry squadrons.

One way to solve the issue of availability and responsiveness of indirect fires discussed in the previous section is to integrate a source of indirect fires within the cavalry squadron. That exists within American cavalry squadrons with organic 120 mm mortars (see Figure 6). Although there are myriad factors affecting the responsiveness of indirect fire, a dedicated asset would also ensure continuous support on demand for the squadron regardless of where it is employed. Figure 9 shows a dismounted THT forcing the deployment of the enemy vanguard from the line of march, temporarily halting the enemy battalion (-)'s advance.[36] The column is then struck in depth. Providing an organic indirect asset would ensure that this scenario is repeatable, regardless of the distance from conventional batteries behind the main defensive area. Further, the use of assets organic to the squadron would prevent unmasking the brigade's valuable tube artillery assets. The RCAC must investigate the incorporation of organic indirect assets within cavalry squadrons.

If equipped with the right weapons, dismounted THTs also have the potential to be far more potent than their current capabilities suggest. Exercise FUSILIER RECIPROQUE was studied by Defence Research and Development Canada to determine infantry anti-armour capability in the absence of air and main battle tank support. Unsurprisingly, the study noted the same identified shortcomings of the Carl Gustav and TOW missile systems but also tested the allocation of C14 command-detonated "off route" rocket-propelled mines along with traditional magnetic anti-tank mines.[37] As expected, they both significantly augmented the anti-armour capabilities of the dismounted infantry but are currently only available to engineers in the Canadian Army.[38] The RCAC must provide dismounted cavalry soldiers with the option of using both on- and off-route mines to increase squadron effectiveness and tenacity.

The anti-armour weapons available to cavalry squadrons must also be updated. Having deployed with the Carl Gustav to Op IMPACT, the Canadian Special Operations Regiment found the weapon unsuitable in combat beyond 300 m.[39] The subsequent statement of requirements to procure a replacement made it clear that the TOW system was similarly unsuitable because of its immobility when not vehicle-mounted. Instead, the Javelin and Spike systems were suggested for their portability, lethality, and, perhaps most importantly, their fire-and-forget capability.[40] That would allow cavalry soldiers to be exposed for a minimum amount of time before returning to cover and would have doubtlessly changed the calculus of the squadron's experience on Ex MR 21. Although this article has explored some considerations for anti-armour weaponry, the crux of the argument is largely weapon agnostic if the squadron possesses an organic anti-armour capability that can be directed by dismounted soldiers at a minimum and while mounted in vehicles as a nicety. The RCAC must prioritize the acquisition of these weapons for use in dismounted and, if possible, mounted roles.

While direct fire ATGM systems have accompanied cavalry since the inception of the BMP-1 and M2 Bradley, a truly forward-looking solution would explore the addition of non-line of sight (NLOS) missiles and loitering munitions, which would further reduce the signature of forward dismounted elements while maintaining, if not increasing, their lethality. A detailed discussion of these capabilities is certainly beyond the scope of this article.

CONCLUSION

Thomas Friedman once stated that a vision without resources is a hallucination; likewise, a reconnaissance squadron reorganized without robust organic capabilities is not a cavalry squadron in any way but name. Having first examined the problem that the LDSH (RC) reconnaissance squadron faced, how it adapted to perform the task, and finally, how to incorporate and capitalize on the lessons from Ex MR 21, it should be clear that Canadian Army cavalry requires structural changes to its capabilities to function the way the RCAC envisions. The capabilities of tank squadrons and cavalry squadrons are not the same, nor are their optimal roles on the battlefield: cavalry doctrine must not be platform agnostic. While there are certainly tactical tasks that are complementary, attempting to impose a redundant universal structure would leave cavalry unable to provide decisive battlefield effects with the crucial economy of force.

This article largely focused on the LDSH (RC) Reconnaissance Squadron's ad hoc use of dismounted anti-armour teams during Ex MR 21, clearly demonstrating the utility of dismounted forces to a cavalry squadron. Although Ex MR 21 exposed the shortcomings of a platform-neutral doctrine employing the TAPV in a cavalry role, the experience also showed that more capable vehicles alone are not the correct solution. High tempo operations necessitate the use of vehicles; however, their vulnerability to detection in low battlefield density environments exposes a niche where dismounted soldiers are required for a squadron to be effective. Further, the RCAC must avoid the "reconnaissance paradox" by creating only heavily equipped cavalry forces that would be better utilized as standard combat manoeuvre elements. The benefit of organic indirect fires and MUAS integration at the lowest level were also discussed, and the RCAC must push for these capabilities within cavalry squadrons. The RCAC certainly must continue to pursue the acquisition of anti-armour systems, albeit for use in both dismounted and mounted roles. While more advanced direct fire systems would be a boon, the RCAC must not neglect exploring the acquisition of mines, NLOS missiles, and loitering munitions to achieve the same effect.

ABOUT THE AUTHOR

Captain Miles Smith served as a tank troop leader in A Squadron, Lord Strathcona's Horse (Royal Canadians), during Ex MR 21. He is currently posted to the Army Technical Staff Officer Program studying capability development at the Royal Military College of Canada.

ENDNOTES

1. The author would like to extend a special thanks to Lieutenant-Colonel Michael Dunning, Majors Dan Gray and Bryce Simpson, Captains Thomas Gray and Christopher Mack, and the three anonymous reviewers for their assistance and critical thought. Lieutenant-Colonel Michael Mallette provided the initial push to begin writing and offered valuable guidance. Captains Alex Schofield, Scott Veale, Leon van Heerden and Lieutenant Thomas Underwood also contributed crucial assistance and took time to answer questions about an exercise that occurred well over a year ago. Finally, the figures included in this article would not have appeared without help from the staff at the CMTC, most notably Kenneth McMillan, MBE, and Warrant Officer Keary McAtasney. Any errors contained are the author's own.

2. Director of Armour, *3185-2 (Corps Major) The Armoured Cavalry Concept*, 13 August 2021, 1. It should be noted that B-GL-321-005/FP-001, *Battle Group in Operations*, 2012, already classifies armoured reconnaissance as a manoeuvre element.

3. Ibid.

4. This is aspirational—a capability being considered in the medium-to-long term. See 1150-3 (COS A Strat) Record of Decision, Army Capability Development Board 031121, Ottawa, 3 November 2021, 10, and Captain Chris Allen, "RE: Sim Centre Activities," email, dated 28 April 2021 (in author's possession, available upon request). This email details simulated experimentation to substantiate the need for ATGMs in cavalry squadrons but is completely focused on mounted experiments.

5. For a detailed explanation of each category of operation, see B-GL-321-005/FP-001, *Battle Group in Operations*, 2012.

6. B-GL-394-002/FP-001, *Ground Manoeuvre Reconnaissance*, 30 September 2015, 1-3-3.

7. Major Daniel Gray, "RE: Request for AAR from MR 21 – Recce Sqn," email, 23 June 2022. In author's possession, available upon request.

8. Ibid.

9. Curtis Taylor, "Trading the Saber for Stealth: Can Surveillance Technology Replace Traditional Aggressive Reconnaissance?" (Arlington, VA: The Institute of Land Warfare, September 2005), 15.

10. Stephen Biddle, "Afghanistan and the Future of Warfare: Implications for Army and Defence Policy," Strategic Studies Institute, November 2002, 28.

11. Taylor, "Trading the Saber for Stealth," 14.

12. Biddle, "Afghanistan and the Future of Warfare," 26, 33.

13. Taylor, "Trading the Saber for Stealth," 15.

14. Taylor, "Trading the Saber for Stealth," 15.

15. Captain Thomas Gray, "RE: Request for AAR from MR 21 – Recce Sqn," email, 23 June 2022. In author's possession, available upon request.

16. Ibid.

17. Major Daniel Gray, "RE: Request for AAR from MR 21 – Recce Sqn," email, 23 June 2022. In author's possession, available upon request.

18. For an official record of the RCAC request to acquire mounted ATGMs, see Brigadier-General Ayotte, *1150-3 (ACDB 031121) Record of Decision Army Capability Development Board 031121*, Ottawa, 3 November 2021, 10.

19. For further reading on the subject, see the following: Dr. Michel Couillard and Major Julien Chaput-Lemay, "Scientific Letter: On the Canadian Army Infantry Anti-Armour Capability," Defence Research and Development Canada, 27 February 2017. This was a resumé of Exercise FUSILIER RECIPROQUE, designed to test whether a CA infantry company could defeat an enemy force of MBTs during defensive operations without the support of air assets or MBTs; URGENT OPERATIONAL REQUIREMENT ANTI-ARMOUR OP REASSURANCE ROTO 8, signed by then-Colonel W. H. Fletcher, March 2017; Capability Development Experiment 2010, produced by DRDC, May 2012; Major Julien Chaput-Lemay, "Re-Imagining the Close Range Anti-Tank Fight," *Canadian Army Journal*, Volume 17.2; Lieutenant-Colonel Alain Cohen and Major Julien Chaput-Lemay, "Up The Creek Without a Paddle," *Canadian Army Journal*, Volume 17.3, 2017.

20. Captain Scott Veale, "RE: Request for AAR from MR 21 – Recce Sqn," email, 23 June 2022. In author's possession, available upon request.

21. A-P8-002-ACM/PG-B01, "Rank Qualification Armour Officer Qualification Standard and Training Plan," draft, C1-7/21.

22. Captain Alex Schofield, "RE: MR 21 Dismounted Anti-Armour Questions," email, 22 June 2022. In author's possession, available upon request.

23. Ibid.

24. B-GL-394-002/FP-001, *Ground Manoeuvre Reconnaissance*, 30 September 2015, 3-2-5, 3-4-3.

25. 3350-1/BG (UNCLASS) 2 PPCLI BATTLE GROUP POST OPERATIONAL REPORT – OPERATION ATHENA ROTO 5, 14 September 2008, Annex O – page 5/8.

26. ATP 3-20.97, "Cavalry Troop," 1 Sep 2016, 1-4.

27. Colonel Liam Rutland, "1 CMBG FRAGO 001 Op SHIELD RAM," 28 April 2021, A-1/2.

28. Ibid, Annex B, Appendix 2 – Intelligence Collection Plan.

29. ATP 3-20.97, "Cavalry Troop," 1 Sep 2016, 1-6.

30. ATP 3-20.98, "Cavalry Platoon," 4 December 2019, 6-31.

31. Captain Scott Veale, phone interview, 25 June 2022.

32. Captain Leon van Heerden, phone interview, 25 June 2022.

33. Major Daniel Gray, "RE: Request for AAR from MR 21 – Recce Sqn," email, 23 June 2022.

34. John McGrath, *Scouts Out! The Development of Reconnaissance Units in Modern Armies* (Fort Leavenworth, KS: Combat Studies Institute Press US Army Combined Arms Center, 2008), 199.

35. Meaning that the vehicles had dismounted their integral infantry section and were operating empty.

36. For clarification, the (-) modifier denotes an under-strength battalion-sized grouping (with a subunit removed from the battalion, for example).

37. Dr. Michel Couillard and Major Julien Chaput-Lemay, "Scientific Letter: On the Canadian Army Infantry Anti-Armour Capability," Defence Research and Development Canada, 27 February 2017, 4.

38. Ibid, 6.

39. Captain Parnell Pachal, "Canadian Special Operations Regiment Long Range Anti-Armour Missile Statement of Requirements," 5 February 2015, 1.

40. Ibid, 6.

USING DISTANCE LEARNING TO REDUCE ABSENCES FROM HOME:

THE GOOD, THE BAD AND THE UGLY

Major (retired) Marshall Gerbrandt, CD

Source: Combat Camera

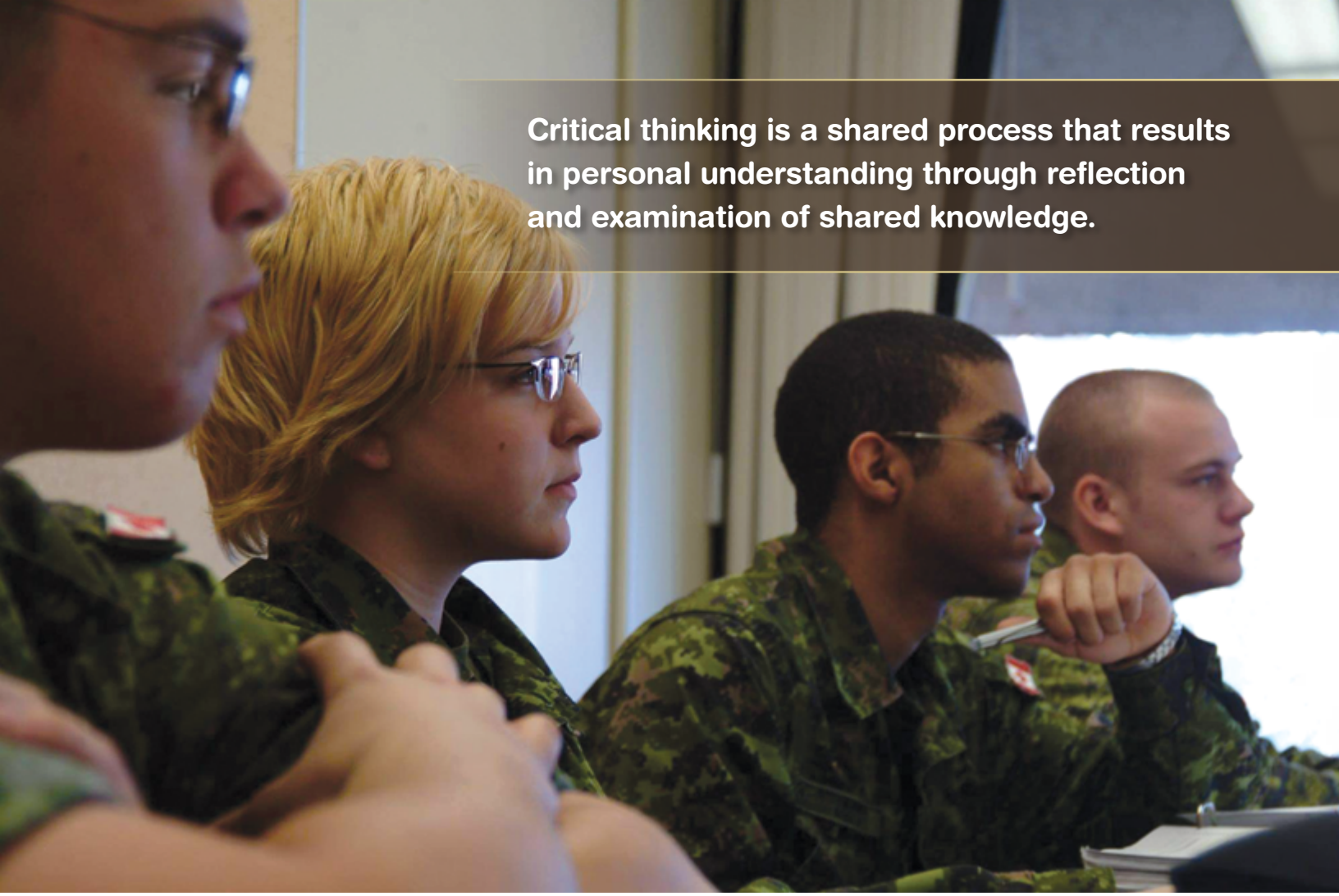
INTRODUCTION

Large-scale exercises and operational deployments represent unavoidable absences from home. In contrast, the predominately face-to-face nature of military training and education signifies an opportunity to reduce time away from home by increasing distance learning (DL). The author believes that the use of DL within the Canadian Army (CA) is presently limited even though the COVID-19 pandemic forced the Canadian Armed Forces (CAF) to re-examine training delivery methods, given the need to train members.

According to the 2016 Minister of National Defence, members of the CAF spend 25 percent of their time away from home.[1] For members of the CA, absences from home are unevenly divided between the individual training (indiv trg) system, collective training (CT), and operational deployments. Studies suggest that time away from home has a negative impact on the quality of life for members and their families.[2] Quality of life is a combination of multiple factors, including well-being, work environment and living conditions.[3] In particular, well-being is influenced by personnel tempo—a term used in the CAF to measure how long and how frequently individuals spend tasked away from home.[4] A high personnel tempo can result from deployments and training and is associated with increased family stress. This increased stress is "disruptive to family life"[5] and negatively associated with CAF retention,[6] whereas additional time home between deployments has a positive effect.[7]

Based upon an empirical investigation exploring how an increase in the use of DL could affect the quality of life of individual members and their families, this article explores elements specific to members' perception of existing and potential DL. While both CT and operational deployments require one's physical presence, it may not always be necessary for indiv trg. Carefully increasing the CA's usage of DL represents an opportunity that can reduce, but not necessarily eliminate, absences from home. Increasing DL within CA indiv trg by adopting a blended approach to instructional delivery offers an opportunity to reduce absences from home without sacrificing quality.[8] This is currently being implemented in the CA's Army Operations Course and the CAF's Joint Command and Staff Program. That noted, simply increasing the number of asynchronous modules—via the Defence Learning Network or delivering generic presentations through video conferencing—fails to replicate the instructor and peer interactions of face-to-face learning.

One way the CA might approach DL is by utilizing the community of inquiry (CoI) model. CoI is a theoretical framework designed to promote higher-level thinking and facilitate beneficial learning experiences within an online environment.[9] This is achieved through three distinct but interdependent presences: cognitive presence, social



Critical thinking is a shared process that results in personal understanding through reflection and examination of shared knowledge.

presence, and teaching presence. Following an examination of relevant literature, this article will describe current CAF DL experiences. At this juncture, it is pertinent to briefly describe the CoI framework. Using CoI as a framework, the findings will be discussed and compared to existing research while simultaneously providing presence-specific recommendations for expanding DL within CA indiv trg.[10]

COMMUNITY OF INQUIRY AND ELEMENTS

In the context of online learning, the term "community" is often described as the "cognitive or emotional connections established between physically separated learners."[11] Existing literature supports the importance of peer interactions within online environments as an indicator of success.[12] According to Garrison, Anderson and Archer, the CoI model aims to create a "meaningful educational experience"[13] through three essential elements: cognitive presence, social presence and teaching presence. These elements are summarized below:

Cognitive Presence – Within the CoI model, Garrison et al. consider cognitive presence to be "the most basic [element] to success in higher education."[14] Cognitive presence describes the extent to which students can construct meaning through communication. This is in part dependent upon how communication is facilitated within a given medium. Case vignettes and problem-based learning are two examples that allow students to apply knowledge to real-world problems and further their cognitive presence. Critical thinking is a shared process that results in personal understanding through reflection and examination of shared knowledge. If critical thinking is the goal, the practical inquiry model, a multi-step shared process, is the answer. The practical inquiry model provides a generic structure to guide analysis from the identification of a problem through to resolution.[15] Upon initiating an inquiry, one progresses through the following steps:

1. identification of the problem, which contributes to cognitive presence;
2. exploration, which orients one to the problem;
3. integration, where similar and competing concepts are formed into a single concept; and
4. resolution, which may see a hypothesis applied successfully or the continuation of inquiry.[16]

Social Presence – Within the CoI framework, social presence enables individual learners to project as well as be perceived by peers as real people within the digital domain.[17] This can be achieved in three ways:

1. emotional expression, which permits the individual learner to share their personal beliefs and values;

2. open communication, represented through mutual understanding and acknowledgement of peers; and

3. group cohesion, seen through the development and sustainment of group commitment.[18]

Creating a virtual space for students to interact informally or through weekly instructor videos are possible means of increasing social presence by decreasing any sense of distance or isolation that may exist. When the CoI was initially theorized, online communication was predominately done through the written word, either through asynchronous forum postings or via synchronous text-based chat. Garrison et al. address this by stating that social presence is not developed by the specific medium being used but instead is the result of discourse being used for participants to develop and share.[19] The validity of social presence was further explored and found to "positively affect student and instructor course satisfaction."[20]

Teaching Presence – Teaching presence consists of course design, facilitation of learning and direct instruction.[21] Considering what constitutes teaching presence, it is difficult to rank the relative importance of each component.[22] The outcome is influenced by student dynamics and educational context, and thus it is not necessarily an instructor-centric endeavour.[23] Its sub-components may include either the student or teacher. However, within the context of the CA, the focus will most likely be solely on the educator. While instructors are primarily responsible for designing and delivering courses, the facilitation of knowledge can be seen as a shared responsibility between instructors and students and amongst students as peers. As one of the three presences within the CoI, teaching presence is best viewed to "support and enhance social and cognitive presence for the purpose of realizing educational outcomes."[24] This can be achieved by designing collaborative online learning environments that promote engagement and allow the instructors to adopt the role of a facilitator.

EXISTING LITERATURE

The well-being of military members and their families remains one of the top priorities for research within the CAF.[25] Despite this, literature discussing CAF training and education is minimal, and focused research on DL is almost non-existent outside of graduate work.[26] Beyond the CAF, the research focused on advanced education aimed at senior leadership (major to lieutenant-colonel) found that DL yielded results comparable to face-to-face delivery.[27] Alleviating this gap in the literature is important to the well-being of military members, given the significant period of time they devote to their professional education and development.

Institutionally, significant resources are invested in training and educating CAF members. However, analysis or scholarly reflection on this large-scale effort is not well represented within the CAF's professional journals. Of published articles, few are research-based and are better categorized as individual opinion pieces,[28] historical accounts,[29] or, most frequently, a medium to promote new endeavours.[30] While this represents continued discussion about education and training within the CAF, it also highlights the lack of discourse directed toward the education and training of CA members.

Scoppio and Tregunna conducted a broad examination of CAF-delivered education and found DL allowed members to "engage in higher level thinking on a frequent basis."[31] DL was seen as a solution that allowed the CAF to respond to quick deployments and support members working in remote locations. While perceptions about DL varied amongst participants, an increased use of blended learning—combining both distance and face-to-face components—was seen as a viable way to implement new technologies while meeting the needs of future students.[32]

Kimberly Jones of Athabasca University (former training development officer in the CAF)[33] expanded on Christine Vaskovics'[34] theoretical examination of asynchronous communication and synchronous conferencing by undertaking research that focused on CAF members' level of satisfaction with DL experiences. Jones' exploration of member satisfaction within the CAF DL (n=368) is particularly important given the range of courses explored (primary leadership qualification to Joint Command Staff Programme) and the lack of existing research on individuals within the CAF training and education system. During qualitative interviews, many participants noted that DL had a positive effect on their quality of life, as they were able to remain home with family, but this was offset by the additional workload resulting from their regular employment.[35]

Bernie Thorne's research found that the impact of part-time DL on individual well-being, when associated with full-time employment and family commitments, negatively affected their quality of life.[36] Thorne examined the individual and organizational costs of distance education and found that part-time students needed institutional support to enable learning and prevent burnout as they sought to balance competing academic, work, and family demands.[37]

The extent to which DL is used across the CAF varies greatly, and there is limited research exploring the development and delivery of these courses or how DL affects individual members. The CA employs both part-time and blended DL as methods of instruction. Asynchronous training most often occurs through the Defence Learning Network and often consists of a variety of professional development courses ranging from the delegation of financial responsibilities to those focused on more mission-specific training. The Canadian Army's Army Operations Course[38] and Army Tactical Operations Course[39] represent examples of blended learning wherein a DL portion (done via synchronous conferencing) precedes the period of residency.

RESEARCH QUESTION

Within the overarching research question, it is crucial to explore how an increase in the use of DL would affect the quality of life of individual members and their families. This article explores elements specific to member perception of existing and potential DL.

RESEARCH METHOD

To best understand participant experiences and beliefs about increasing the use of full-time DL within the CA, a case study method was selected.[40] This method allowed for an in-depth examination within a real-life context and provided an opportunity to identify categories across multiple sources. The present study received approval from the CAF's Social Science Research Review Board and the University of New Brunswick's Research Ethics Board.[41] Given the author's experience as an artillery officer and instructor-in-gunnery, the study focused on the artillery as a case for examination. Eliminating actual or perceived authority over potential participants was achieved through the use of an anonymous questionnaire and by intentionally not selecting their current regiment as a site for exploration. Potential participants were identified through purposeful sampling and needed to meet the following criteria:

1. Participants should have attended a Royal Canadian Artillery School Developmental Period 2 or higher course between January 2018 and August 2020, resulting in 312 unique individuals.

2. Participants should be serving (fall 2020) within the 1st or 2nd Regiment, Royal Canadian Horse Artillery (RCHA), but not be operationally deployed. This yielded 53 potential participants, and a response rate of 32% (n=17) was achieved.

Data collection consisted of an anonymous questionnaire and individual interviews with two participants. The questionnaire consisted of 18 items, including both demographic questions and a series of questions based upon a four-point scale (*no impact to a lot of impact*), with an opportunity to expand for the responders to answer in an open format.[42] The electronic questionnaire and individual interviews focused on exploring four aspects: 1.) Indiv trg experiences, 2.) effects of indiv trg on the member and their family, 3.) the effects of personal tempo (i.e. the sum of demands that military service imposes upon the member), and 4.) individual perceptions on increased use of DL. The individual interviews used the same topics as probes to spark discussion and further one's understanding of the subject.

Coding was an iterative process. First, respondents' own words were used to produce an initial list of codes. The list evolved as codes with similar meanings or redundant terminology were consolidated.[43] During this process, descriptive narratives were created for each code. These narratives ensured a consistent application of codes and increased one's understanding of the data. Additionally, the narratives helped identify and consolidate codes that captured similar sentiments. This process produced a refined list of eight codes divided into three overarching categories. The three categories, including their associated codes, are as follows: 1.) "family and partner relationships," consisting of absence, partner pressure and parental presence, 2.) "distance learning," which is the focus of this article, consisting of instructional design, DL beliefs and networking/socialization, and 3.) "quality of life," which comprises well-being and personal tempo.

RESULTS OF THE STUDY

One might reasonably expect that decreasing the frequency of training-related absences would positively affect the quality of life. However, the responses of the participants offered a nuanced view and identified how full-time DL had the potential to increase tensions at home. Given this background, it is pertinent that unintended consequences are considered prior to implementing DL as a medium for full-time or blended instruction. The DL category captured the experiences of participants and their beliefs on DL as a medium for instruction. The DL consisted of three codes (i.e. *networking/socialization, DL beliefs, and instructional design*). Following a brief description of the 17 participants, this section presents the participant responses by code.

Participants – The diversity of responses provided an overview of the effects of DL across various ranks and family situations. However, it remains narrow in overall demographic scope, as the participants were predominantly male (n=16).[44] The majority were either married or common-law (n=14), with an average of three people living in the household. From the respondents, most were senior non-commissioned officers (n=10) and junior officers (n=6), which aligned with the inclusion criteria.

Source: Combat Camera

Instructional Design – Instructional design defines responses focused on how a course is developed, designed, and delivered. This item was the third most coded item overall but most coded within this category, selected 29 times out of 148 responses. Opinion was evenly split between those who articulated positive views towards the use of DL and those who believed it would reduce learning quality or be detrimental to their family situations. Respondent (R) 5 believed technology and method of instruction can lend itself to "efficiently conduct[ing] DL." R10 thought DL would limit time spent away from home and have a "healthy impact on [their] quality of life." However, they also believed that DL should only be used where suitable, noting the "negative impacts [of non-virtual courses] on [their] quality of life are limited" (R10) and accepted within their household as "face to face instruction is a must" (R10). R13 contrasted the benefits of face-to-face instruction with the "opportunities to stay home," as it reduces their personal tempo but also noted DL's applicability to "specific subjects."

Amongst those who associated DL with positive outcomes, a number were adamant that certain skills are unteachable via DL. Participants felt that practical or hands-on training are not viable for DL. R2 identified "fire planning," which is a team task normally simulated or completed under real-world conditions, as an example of a topic that could not be taught via DL. R11 added that material taught via DL "would not receive the same skill level." R2 noted that, while certain material is not suitable for DL, " [m]ost other lecture[s] can be done [through] DL with [an] instructor available for questions." R16 highlighted how DL could be a "great tool [for] keeping people at home for long courses," especially during theory portions.

R3's experience with DL was "VERY negative." They highlighted a few reasons for it. First, R3 believed that DL is "generally not taken seriously by soldiers due to repetitive" material or a perceived "disconnect between the course and the job," which is due to poor instructional design combined with outdated information. Second, they believe a compromise in quality would occur as "[p]ractical applications are almost always required as a means to ensure members have actually learned what has been taught." Finally, they noted the lack of available technology at home and limited access to computers at work. R1 and R14 expanded upon R3's first point and identified the need to change the culture around DL, with their experience consisting of "click until your [sic] done" (R1). While not citing a specific example, R20 suggested output "would likely be 70% of full potential" and argues that "instructors cannot truly identify where students are struggling."

Networking/Socialization – Networking/socialization describes responses about interactions amongst students and interactions with the instructor and was the least coded item. While some respondents discussed perceived affordances for instruction delivered face-to-face and at a distance, most focused either on the reasons why face-to-face instruction is preferred or how DL is

ineffective. These comments were primarily in response to three questions that addressed their actual experiences with DL or perceptions about how the possible use of DL may have shaped their learning experience. R8 stated DL would "increase the difficulty to plan, coordinate and study with other candidates" while also noting instructor availability may be "significantly reduced." R15 shared similar sentiments and believed that face-to-face instruction "provides a better feedback system due to being involved directly with instructors."

Respondents also noted that face-to-face learning provides an opportunity to establish professional networks. R13 highlighted the importance of meeting members from other organizations because they "bring so much value to the experience," and face-to-face learning allows individuals to see what "other units are doing different… and it widen[s] our knowledge and experience." R11 built upon these connections through their preference for residency, as it permits "[bonding]" with peers.

Distance Learning Beliefs – DL beliefs encompass responses dealing with DL perceptions and values. It coded ten times out of 148. While some respondents identified advantages of DL, most underscored the negative experiences regarding part-time DL. R5 suggested full-time DL would be beneficial if learning was "the only task and responsibility you have for work." However, many were skeptical that full-time DL would be respected by their units based on their experiences. R6 captured this sentiment in a frank manner: "Front line units will never be given the time to work from home. They just have to use their weekends and nights FACT (i.e. *we have to work weekends no matter what people or policy says*)." R18 balanced their optimism about working "9–5 on online lectures," leading to improvements in their home life with the fear (previously highlighted by others) that they "will still get tapped with work/duties from the unit" and ultimately end up with an increased tempo. For some, the geographic separation associated with individual training allows them to "concentrate fully on the course" (R2), "facilitates concentration" (R11) or allows them to "get more out of the course" (R13) while reducing the number of tasks they normally face from their unit (R8).

While considering the possibility of full-time DL, respondents generally provided negative descriptions of their previous experience related to learning online. R1's experience of "click until your [sic] done" was also reinforced by R3: "I'm usually done in 10 minutes depending on how fast I can click through the slides and get to the test at the end." In response to Q15 ("Are there sufficient benefits to DL?"), R3 expressed a similar sentiment to R11 that the "quality of training will always be lessened" (R3), and members experiencing learning through DL would not achieve "the same skill level" (R11).

Using much stronger language, R14 responded to the same question on the benefits of DL: "Absolutely not. [If] anything, we need to refine HOW we conduct our DL… just sending out a [PowerPoint] and moving on is a terrible way of doing business." R14 concluded by saying that the system needs to be "refined," which R15 expanded on in great detail, responding to two issues simultaneously. Specifically, for DL to be viable, R15 remarked: "1. Unit cannot use you for any tasks/duties while taking part in DL," and "2. Training standard [must] be maintained via more effective lectures and readings." R20 spoke to the instructor's perspective and believed an instructor could not "truly identify where students are struggling, nor can they have developmental chats in the sidelines" in the online learning environment.

DISCUSSION

The study sought to discover how increasing DL within the CA indiv trg system could improve the quality of life for individual members and their families. The article focused on data related to one of the three categories identified within the study: distance learning. Compared to the other two categories, DL represented the most polarizing views, with very few respondents opting for the middle ground. Compared to the high levels of satisfaction identified by Jones,[45] most respondents in the study conducted by the author described their DL experiences in negative terms. This difference may be attributed to the smaller sample size (n=17 compared to n=368), types of courses attended (part-time DL vice both and full-time DL), gender, and exploration of a single occupation within the CA.

Maintaining the CoI as a framework for discussion, the following section addresses three areas. First, the trends that surfaced in the research (conducted by the author) mentioned above will be discussed. Second, the findings of that study will be compared with the findings in Jones's work with a view to identify both strengths and weaknesses of current CAF DL. Third, different approaches, grounded in recent research, to delivering effective online instruction will be presented as a means to mitigate perceived issues with the current DL delivery.[46]

Social Presence – Reflecting upon previous DL experiences, respondents highlighted the importance of face-to-face learning as a means of interacting with peers and developing professional networks. DL experiences were often described as isolating and lacking opportunities to learn from peer experience. Respondents noted that the absence of peer interaction negatively affects knowledge acquisition and the overall experience of the course. Consequently, residency-based training is preferred, as it provides direct interaction with peers and instructors. This sentiment aligns with Jones' study, which found that the most cited reason for preferring classroom learning was peer interaction.[47] The lack of meaningful connections during DL was the greatest dissatisfier.[48]

Notwithstanding the limited full-time or synchronous DL experience, the respondents that participated in Jones' research and in the study by the author shared the same sentiment. Considering that this issue has been identified as the single biggest dissatisfier, it is increasingly important to address the gap by incorporating strategies to increase social presence within DL.

Another common finding in the two above-mentioned studies is the lack of connection among peers or a sense of cohesiveness. In a classroom, the lack of peer interaction as part of course design is minimized by proximity and the opportunity to engage during non-instructional moments. Therefore, how can members, disconnected by geography, develop a sense of group cohesion in a virtual classroom? One recommendation is to include activities that are designed to ensure greater student engagement and interaction with one another. This could occur through problem-solving tasks or small group discussions,[49] but simply delivering a lecture and posing questions individually to test for comprehension will not create the desired effect. While positive effects can be achieved through asynchronous communication (forum posts), synchronous video conferencing (even within a larger asynchronous course) is a viable method to reduce the physical distance between students,[50] as is also recommended by Jones in her study.[51]

Teaching Presence – Comments focused on course development, overarching design, and method of delivery speak directly to teaching presence within the CoI framework. When comparing the methods of instructional delivery, respondents expect significantly less interaction with instructors during DL. More concerning is the respondents' belief that useful or meaningful feedback can only occur via face-to-face interactions and, as a result, students that are struggling with the course may not be adequately identified within a DL environment. The lack of interaction with peers or instructors was a common justification for respondents to prefer a classroom over a virtual environment. However, this may be better described as a pedagogical issue as opposed to being specific to DL.

Conversations that focused on the method of delivery elicited strong responses about what should and should not be taught via DL. Many respondents were unwavering in their comments about certain material or tasks that must not be taught via DL. There was a general sense that theory was more suitable for DL when compared to applied or practical material. Given that technological issues were the second greatest dissatisfier in Jones' work, short-term DL within the CA is probably better suited to adapt to the affordances of what is readily available within the CA at this time. In physical classrooms, instructors can expand upon material through personal experiences and can help students that are struggling by giving them additional attention and address their concerns on the sidelines of the course. While similar experiences can be incorporated into an online synchronous environment, asynchronous courses will likely prove more challenging and require instructional material to be developed prior to the start of the course. While synchronous instruction provides a medium to share personal experiences, instructors can leverage short videos to achieve the same effect in an asynchronous environment.[52] Discussion can be encouraged through an active approach that sees the instructor facilitating discourse by summarizing student discussions or posing specific questions to assess comprehension or advance discussion.[53]

Cognitive Presence – While considering what they were learning, many respondents doubted both the quality and the necessity of the material being presented. Bearing in mind the options for delivery, respondents expressed concerns that DL would offer inferior versions of residential programs. Participants in Thorne's research noted their belief that DL programs were perceived as second-tier relative to their full-time equivalents.[54] A lack of engagement, combined with a sense that DL is predominately an exercise in clicking through slides, limits the possibilities of developing critical thinking. The lack of a cognitive presence is perhaps the most challenging of the three presences to change, as it requires individual buy-in. In view of the negative comments about course design (teaching presence) and peer interactions (social presence), it may be more sensible and easier to adapt the current material to address these two presences before trying to improve cognitive presence.

Because of the nature of CA indiv trg, strategies such as allowing students to self-select topics[55] of interest may prove difficult to achieve within the limitations of a specific training plan. However, changes to instructional approach provide opportunities for improvements. Using small groups or role-playing as a means to develop social presence,[56] tactical decision games[57] represent an opportunity to improve cognitive presence by allowing students to move through each stage of the practical inquiry model, from triggering event to resolution.[58]

CONCLUSION

Quality of life is adversely affected by the time military members spend away from their families. This article found that even though increased usage of full-time DL could positively affect the quality of life of individual members and their families, the current experiences related to part-time DL and perceptions of full-time DL are not positive or encouraging. The article sought to highlight current perceptions and offer solutions that could be implemented within the constraints of current training plans. By highlighting a lack of peer interactions,

In physical classrooms, instructors can expand upon material through personal experiences and can help students that are struggling by giving them additional attention and address their concerns on the sidelines of the course.

Source: Combat Camera

networking or learning from shared experiences, it becomes clear that the current DL lacks social presence. Improving social presence represents an opportunity to address issues surrounding a sense of isolation or lack of networking within the digital domain. Increasing access to instructors, either through synchronous discussions (ideal) or asynchronous communication, provides occasions to bring lived experiences into the discussion and help students better understand the applicability of the material being presented.

The proposed solutions are designed to contribute to community building and address the sense of isolation amongst students. The author also acknowledges that this study is not an end in itself but another step toward a better understanding of the challenges and opportunities offered by DL. The author hopes that this article inspires future research endeavours because additional research is necessary to explore effective approaches to DL within the CAF in general and, more specifically, in the CA.

ABOUT THE AUTHOR

Major (retired) Marshall Gerbrandt, CD, is a doctoral student at the University of New Brunswick researching education, culture, and online learning within the military context. Previously, he served as 4th Artillery Regiment's second-in-command, as a battery commander within 2nd Regiment, Royal Canadian Horse Artillery, and as an instructor-in-gunnery within the Royal Regiment of Canadian Artillery School. He deployed on Operations ALTAIR, ATTENTION, and IMPACT.

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A Modern Frankenstein:

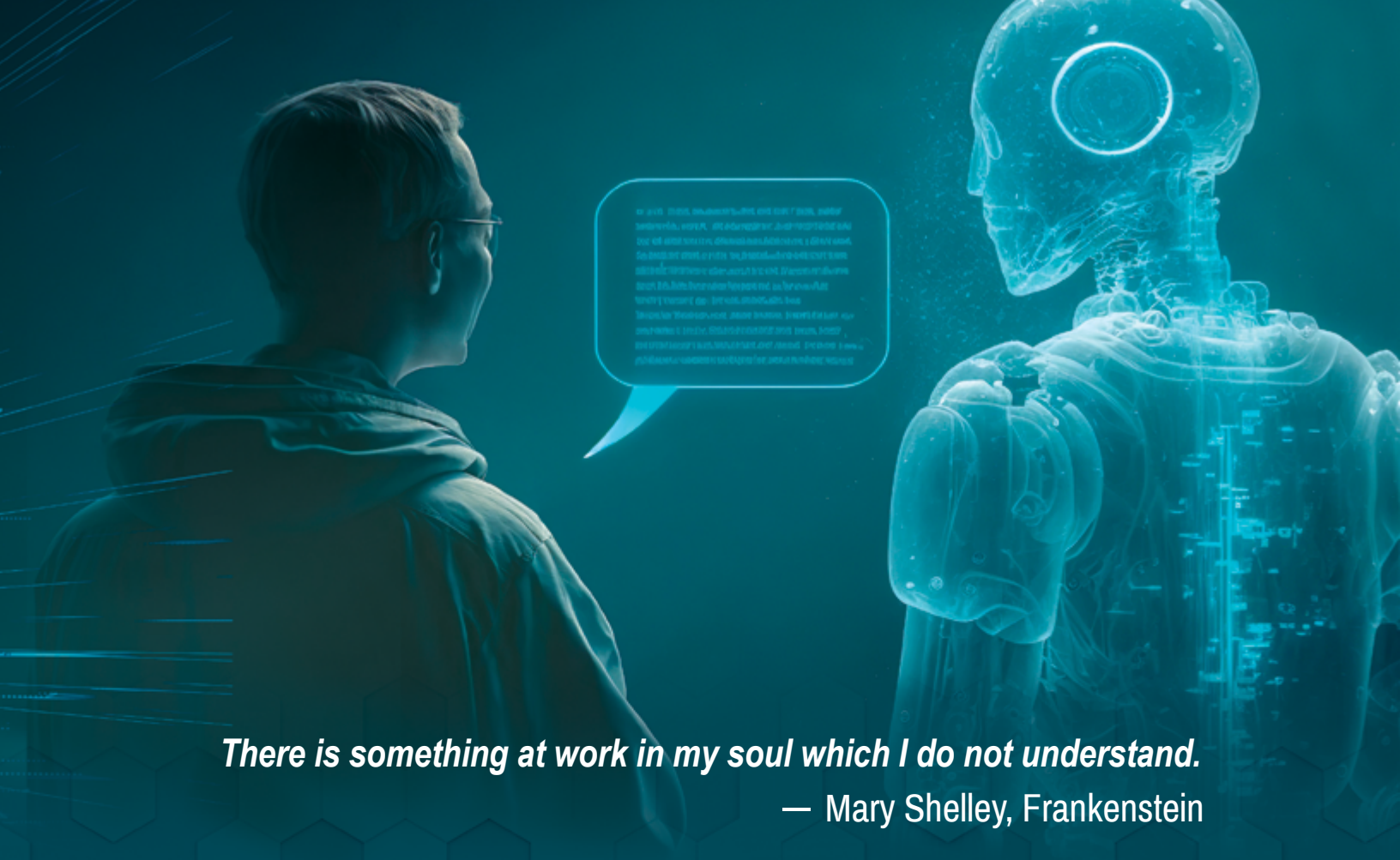
Professional Military Education Reform in the Age of ChatGPT

Lieutenant-Colonel Nathan Richards, CD

INTRODUCTION

The rapid evolution of artificial intelligence (AI) tools such as ChatGPT has ushered in a new era of automated language learning and synthesis and pushes the boundaries of what is possible in terms of knowledge creation and synthesis. ChatGPT has been praised for its impressive abilities and potential applications, but it also raises some serious concerns about its impact on post-secondary education. As this technology develops, it presents several benefits and challenges to the status quo and underlying assumptions of professional military education (PME). In this paper, the author argues that ChatGPT poses a serious challenge to the current model of PME by offering students an effortless way to generate quality academic content without developing critical thinking and communication skills.[1] The article explores how ChatGPT could undermine the quality and integrity of PME by enabling academic dishonesty; how ChatGPT could reduce the value of PME by allowing students to use the technology to produce accurate assignments but avoid developing critical thinking skills; and, ultimately, how PME institutions might reform to incorporate AI tools into the curriculum so the standard of critical thought is preserved for the military leaders of tomorrow.

ChatGPT is designed to remember user input, respond to follow-up corrections and feedback to improve its accuracy and performance, and decline inappropriate requests and sensitive topics.



There is something at work in my soul which I do not understand.
— Mary Shelley, Frankenstein

This article examines the implications of ChatGPT technology on PME, with a focus on the Joint Command and Staff Programme (JCSP) taught at the Canadian Forces College (CFC). While the article focuses on the impacts of AI technology on the JCSP, many lessons can be gleaned from this examination for other PME courses within the CFC and wider audiences in academia.

First, the article begins with an overview of the wider context by looking to other similar historical technology-driven educational crises such as the written word, the printing press, and the calculator and their impacts on the development of intellectual skills. As with many other past disruptive technologies, ChatGPT causes fear and excitement as it challenges the academic status quo. However, over time, it will enable individuals to think more deeply and to explore more complex topics at a much faster rate than what was previously possible. Second, the article offers a brief overview of ChatGPT and highlights its strengths and limitations. Third, the author evaluates the current models of academic assessment and learning objectives for the JCSP at the CFC. Then, the author demonstrates how ChatGPT might be used to circumvent the objectives of PME through creative prompt engineering but without any of the critical thought traditionally required to complete these objectives.

Finally, the author proposes several recommendations for restructuring JCSP to incorporate AI tools for the benefit of both students and instructors. The article argues that, by reforming its approach to JCSP, the CFC might remain relevant in preparing the Canadian Armed Forces (CAF)'s leaders for future challenges.

HISTORICAL DISRUPTIVE TECHNOLOGIES

Technology-driven transformations are nothing new for humanity. There have been several technologies that have demonstrated that, while emergent technology may seem to be a threat to the status quo, humanity ultimately adapts.

Socrates and the Written Word

Perhaps the first crisis of technology was demonstrated by Plato in his work *Phaedrus*, which is written in the form of a dialogue between Socrates, and Attican aristocrat Phaedrus. Plato argued against the invention of writing in favour of the oral tradition.

> [The written word] will atrophy people's memories. Trust in writing will make them remember things by relying on marks made by others, from outside themselves, not on their own inner resources, and so writing will make the things they have learnt disappear from their minds. Your invention is a potion for jogging

> the memory, not for remembering. You provide your students with the appearance of intelligence, not real intelligence.[2]

Socrates believed the written word would lead to widespread forgetfulness and ignorance, as people would depend on written words rather than memorize and learn the information for themselves. He further argued that written words could not engage in debate, clarify, or be corrected.[3] He believed that if one does not engage in memorization, personal study and questioning, then one cannot truly claim to possess any knowledge. Thus, the written word fundamentally challenged the primacy of academic dialogue, which was an immediate threat to the status quo and his way of life. Ironically, the very fact that Socrates' views on writing were recorded and preserved by Plato serves to undermine his own argument.[4]

Despite his warning, clearly, written words can be reworked, challenged, and refuted in both oral and written form. Far from impeding one's ability to create and process knowledge, writing allowed humans to delve more deeply into topics by exposing individual research to a wider selection of sources and perspectives than could ever be experienced from individual face to face contacts. Instead of a hindrance, writing has become an essential tool in the acquisition and synthesis of knowledge. The technology of writing transformed academia and education from one of rote memorization—limited by human faculty—to mass script where knowledge can be stored and shared outside of the human experience. Where at first it was critiqued as the end of critical thought, society embraced this new technology and adapted its structures around it.

The Catholic Church and the Printing Press

The introduction of the printing press in the mid-fifteenth century marked another inflection point in how knowledge was transferred. By enabling the mass production of books, it broadened the access to knowledge to the public, thus allowing for the spread of ideas and challenging entrenched power structures.[5] Moreover, this new technology enabled the dissemination of knowledge from elites to the people, thereby creating a new way to transmit and receive knowledge. As a result, this marked a significant inflection point in the way knowledge was transferred, cultivating a new learning environment, changing the landscape of education and academia as well as theological and political philosophy. The printing press allowed not only the writing of texts but the mass production of books. Where manuscripts were once limited to the efforts of a scribe, machines could now print large books accurately and quickly. This transformation led to the proliferation of ideas and allowed for mass education in an era where only the wealthy were afforded such a luxury. This also had major consequences for the Catholic Church, which used their access to sacred texts to monopolize access to the divine and therefore maintain their knowledge as power. By facilitating the widespread dissemination of sacred texts in common language—instead of Latin—it allowed common people to access divine knowledge independently, thus diminishing the authority of the Catholic Church. This new technology, therefore, was a major contributing factor to the changes in power dynamics that were seen in Europe during the Renaissance. Print technology gave rise to "an explosion of knowledge and a deepening of thought, such as the Renaissance, the industrial revolution, mass literacy, and public education."[6] Where at first this new technology was critiqued as the end of critical thought, society embraced it and adapted its structures around it.

High Schools and the Calculator

Yet another inflection point in emerging technology was the use of electronic calculators, which were widely adopted in the 1970s.[7] The academic community initially reacted with skepticism to the widespread adoption of the calculator. They were concerned that the calculator would be used as a substitute for mathematical skills, making it harder for students to learn and apply them.[8] Some suggested that the use of calculators might lead to students being overdependent on them, thus hindering the development of essential mental math skills.[9] Additionally, it was also argued that the use of calculators would limit student creativity and impede the development of problem-solving abilities.[10]

Over time, though, the academic community embraced the calculator as a tool that could help students learn and practice mathematics more efficiently. The introduction of calculators in math classrooms, first scientific and then graphing, had a profound impact on what was taught and especially on how it was taught. Calculators allowed students to deal with real-world problems; investigate problems of interest to them; and pose and solve problems using mathematical techniques that would have been inaccessible without the technology. They removed the drudgery of long calculations and allowed teachers to focus on important mathematics, rather than on basic calculations.[11] That allowed students to develop a deeper understanding of mathematical concepts and enabled teachers to cover more complex topics in the same amount of time.[12] The widespread adoption of the calculator also made mathematics more accessible to a larger number of students, allowing them to pursue further studies in mathematics or related fields.

Overall, writing, print technology and the calculator have been revolutionary forces in the development of knowledge, challenging accepted modes of knowledge creation and control. Initially, these disruptive technologies caused fear, anxiety, and uncertainty—all human instincts to protect the status quo. These technologies are used for both good and evil depending on the intent of the user. Ultimately, these technological disruptions have led to a transformation of thought and the ways in which individuals interact,

create, and share information. Disruptive technologies have enabled individuals to think more deeply and with greater speed. Prior to these technologies, people were constrained to working on simpler tasks instead of taking the time to dwell on advanced concepts. However, with the introduction of these technologies, individuals have had the opportunity to expand their understanding of more complex topics and to do so with greater speed.

ChatGPT is the next evolution of emergent technology disrupting the status quo. Like other transformative technologies, it is causing waves in education, academia, the economy, and society in general.

WHAT IS CHATGPT?

ChatGPT is a chatbot developed by OpenAI that uses a large language model base to generate human-like responses in conversational dialogue. ChatGPT was released for public use on November 30, 2022, and is designed to assist users with tasks such as answering questions and composing text. ChatGPT's primary sources are based on the "Common Crawl" dataset, which is comprised of 570 gigabytes of publicly available archives of web pages, books, articles, and conversation logs that span from 2016–2019.[13]

ChatGPT can produce and synthesize a large amount of text based on a "prompt." In this context, a prompt is a statement or a question used to start a conversation. ChatGPT is designed to remember user input, respond to follow-up corrections and feedback to improve its accuracy and performance, and decline inappropriate requests and sensitive topics. It can generate data in a table, add indexes, understand code, answer questions, generate text, and translate between most languages, all while using reinforcement learning with human feedback to adapt to different situations.

ChatGPT's pattern-based text generation is fundamentally different than human reasoning. Humans rely on logical reasoning to form conclusions and judgments based on evidence and knowledge. Alternatively, ChatGPT is an AI language model that produces text based on patterns it has learned from large amounts of data. Unlike humans, it does not have the capacity for logical reasoning, instead relying on statistical models to predict likely outcomes.[14] Yet, ChatGPT has evolved to the point where it can provide precision information synthesis, which seems much like human reasoning. As the chatbot learns from users, its ability for information synthesis continues to grow and create higher quality responses.

The Strengths of ChatGPT

One of the most impressive capabilities of ChatGPT is its ability to process and analyze vast amounts of data at a speed and scale that is beyond human capabilities. For example, it can quickly analyze and link data from diverse sources such as academic papers, scientific reports, news articles, and social media posts. By doing so, it can uncover hidden patterns and relationships that would be difficult or impossible for a human researcher to identify. This enables ChatGPT to generate new insights and knowledge that can drive innovation and progress across a wide range of fields. Moreover, ChatGPT's ability to make connections between massive data sets has important implications for decision-making. It can assist humans in making more informed and accurate decisions. This has particular relevance in fields such as healthcare, finance, and business, where the ability to process and analyze large amounts of data can lead to better outcomes and improved efficiency.

However, while ChatGPT's speed and scalability are impressive, it is important to note that AI tools are not infallible. They are only as good as the data they are trained on and the algorithms they use. Therefore, it is crucial to ensure that AI tools are designed and implemented with transparency, accountability, and ethical considerations in mind—OpenAI is still addressing them. By doing so, we can harness the power of AI to make connections between massive data sets and generate new knowledge, while minimizing the risks and challenges associated with this technology. Present-day media is rife with examples of users employing ChatGPT to challenge and ultimately surpass graduate-level-program test and essay requirements.[15]

ChatGPT is a powerful tool that enhances the user's ability to communicate. It can generate high-quality responses to a wide range of prompts, such as crafting essay outlines, arguments, and even entire essays. It can act as a personal assistant that is available 24/7 and is capable of quickly synthesizing and organizing information to help users who struggle with grammar, sentence structure, and spelling. ChatGPT can generate elegant prose from simple bullet points. This feature is particularly useful for those who are not skilled at writing or those who need to communicate complex ideas in a clear and concise manner. In addition, ChatGPT can provide personalized feedback and guidance to meet the user's knowledge level. Whether the user is a child, a layperson, an undergraduate, or a post-graduate student, the AI chatbot can provide feedback that is tailored to their level of learning. Overall, ChatGPT is a powerful tool that can help users save time and effort when it comes to writing, researching, and organizing information.

The Limitations of ChatGPT

There are several limitations to ChatGPT. While it is capable of accurately predicting text, it is not foolproof and is prone to "hallucinations" where it may confidently provide incorrect information.[16] That can happen when the input prompt is ambiguous or incomplete, causing the model to generate responses that may not be entirely accurate or relevant. The frequency of hallucinations requires that the user actually understand the content of what is being asked to properly assess whether the response given

COURSE	GRADED ASSESSMENT METHODS
DS555-49: Leadership	1 x Essay 3 x Reflective Journals 1 x Seminar
DS556-49: Command	1 x Essay 2 x Reflective Journals 1 x Group Research Project (Video) 1 x Seminar
DS569-49: International Security and Canadian Foreign Policy	1 x Essay 1 x Reflective Journal 1 x Seminar
DS521-49: Leading Operational Art and Design (Comp Course)	1 x Essay 1 x Seminar
DS545-49: Component Capabilities	1 x Essay 1 x Seminar
DS520-49: Planning at the Operational Level	1 x Briefing Note 1 x Seminar 2 x Oral Simulations
DS554-49: Advanced Topics in Institutional Policy Development	1 x Seminar
DS557-49: Institutional Policy Analysis	1 x Essay 1 x Seminar

Figure 1: JCSP and MDS Assessment Methods – Table Data

by ChatGPT is correct. Simply relying on what ChatGPT produces without verifying if the response is accurate or not will lead users to fall victim to these hallucinations.

Another limitation of the AI chatbot is its reliance on existing data (the "Common Crawl" data set) to generate text. This means that the quality of the output depends on the quality and diversity of the data it was trained on. If the data is biased or limited in scope, the model may produce biased or limited responses. Importantly, because of its lack of connection to the internet, it is not able to check live facts, which further limits the responses based on information that remains constant within the original data set.[17] In addition, unless sufficiently trained through a detailed prompt, ChatGPT is not focused, as it can pull probabilities from all other sources without limitation, making it a black box with sources that cannot be traced or cited and therefore not verified.[18]

Finally, ChatGPT is not capable of emotional or empathetic responses. It can only generate text based on the patterns it has learned and does not have the ability to truly understand or empathize with the emotions or feelings of the user. Its reliance on large datasets can lead to the perpetuation of preexisting social biases, making it a less-than-ideal tool for engaging in sensitive conversations. That can lead to unfair or inaccurate interpretations of conversations, which can be damaging to individuals or groups who are particularly vulnerable to bias.[19] OpenAI can attempt to mitigate bias by curating datasets to ensure they are diverse and reflective of a wide range of perspectives. However, it can still be difficult to achieve, as bias can be difficult to identify and remove—in humans and AI. Additionally, simply curating a dataset does not guarantee that bias will be eliminated, as unconscious bias can still exist in the data. As such, it is important to be aware of the limitations of ChatGPT and use it with caution.

THE CURRENT JCSP ASSESSMENT MODEL

The JCSP is a military PME program that provides a portion of the developmental period (DP) 3 requirement to selected lieutenant-commanders and majors within the CAF.[20] The CFC also hosts the Master of Defence Studies (MDS) graduate program. The MDS is a professional, terminal master's program offered to qualifying JCSP students that is administered through the Royal Military College of Canada accredited through the Council of Ontario Universities (COU), which sets the standards for the graduate-level learning on MDS courses.[21]

While the JCSP is fully regulated by the military under the Canadian Defence Academy, the MDS is closely monitored by COU on a consistent basis and is subject to their scrutiny and oversight. All courses offered within the MDS are monitored by the CFC academic faculty and regularly confirmed by the RMC Senate and the Dean of Graduate Studies.[22] The entire program needs to meet the standards of the COU on Quality Assurance, Internal Quality Assurance Program, to ensure its consistency with provincial graduate-level standards.

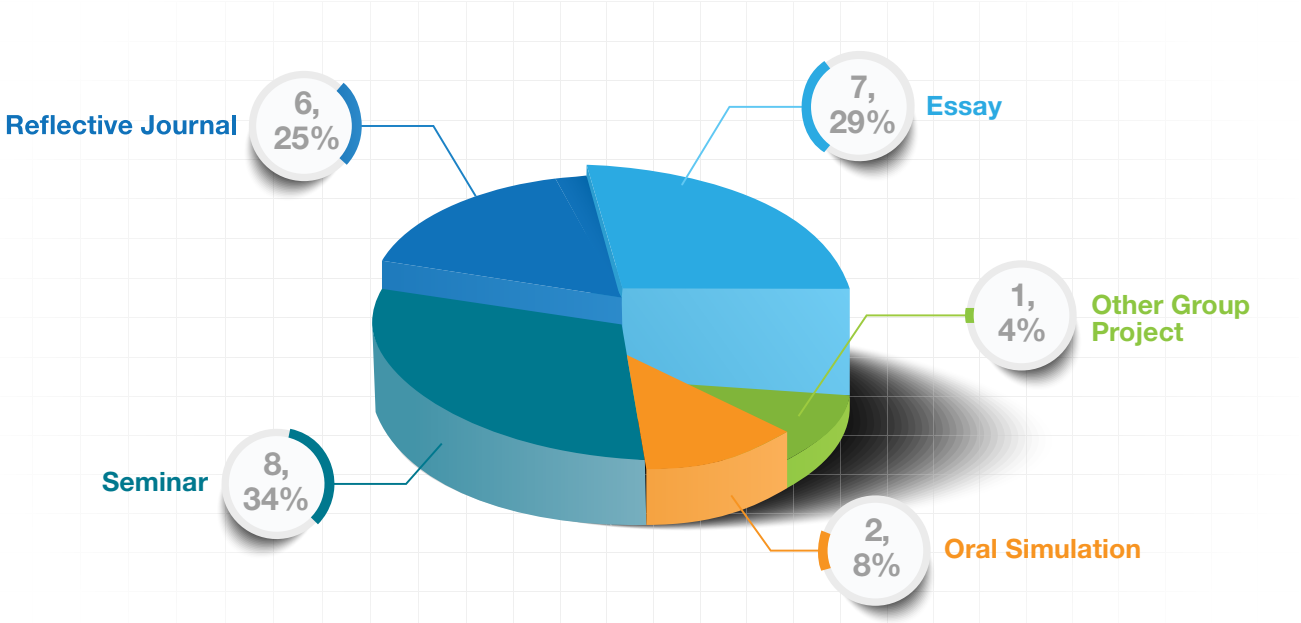


Figure 2: Average JCSP and MDS Assessment Methods – Pie Chart

The JCSP model of pedagogy draws on both military directing staff (DS), military course development officers (CDO) and academic faculty, all of whom provide oversight over the presented content. Each course is led by a DS, or an academic, or occasionally a partnership of both depending on the subject matter. Courses such as DS555-Leadership and DS556-Command are led by military DS, with some minor academic involvement, while courses such as DS569-International Security and Canadian Foreign Policy are led by academics and administered by the DS.[23] In developing courses, the DS, CDOs, and academics can shape the topics and the modules as well as the appropriate methods of assessment.

Figure 1 shows the graded assessment methods of a typical JCSP student for JCSP 49 running in 2022–2023. The courses are listed chronologically.

Figure 2 shows the methods again, but as a percentage of overall methods. Written assessments form most of the formally graded assessments for a total of 54 per cent, followed by seminars at 34 per cent and oral simulations and other group projects at 8 per cent and 4 per cent respectively. The author argues (in subsequent sections) that written assignments and seminars are most vulnerable to allowing ChatGPT to complete assignments, thereby threatening the critical thinking end state of the JCSP.

While the CFC has an overarching philosophy of assessment, when evaluating appropriate assessment method for the JCSP and MDS, the CDOs and academics have a large degree of latitude to change the assessment method to meet the required learning outcomes of each course, provided that they maintain the graduate-level standards.[24] Furthermore, changing the assessment method is a simple change that requires few administrative steps from the faculty. For example, many DS and professors at the CFC have allowed for JCSP students to demonstrate their learning through unconventional assessment methods, such as delivering oral and video presentations or composing podcasts, but as the author noted earlier, these methods account for very few graded assessments (~4 per cent overall). A flexible approach to assessment allows the CFC to remain agile when dealing with disruptive technology such as ChatGPT.

THREATS TO THE CURRENT JCSP ASSESSMENT METHODS

The current PME model is facing a threat in the form of ChatGPT, which has the potential to disrupt conventional education assessment methods of essay writing, seminar preparation and contribution, and operational planning. In particular, ChatGPT's ability to quickly find facts and synthesize thoughts may undermine the hallmark of modern education: critical thinking and communication skills. These vulnerabilities highlight the need for careful consideration of how technology is integrated into education.

Essay Writing: *The End of the Essay?*

Some have speculated that ChatGPT will lead to the end of the essay as a primary assessment tool in education.[25] The purpose of assigning essay writing is not for the value of the final product but for the skills that are developed during the process; these skills include investigating, assessing sources, integrating information, and articulating the found knowledge in a persuasive manner.[26] ChatGPT can make each of these skills easier.

ChatGPT can be a valuable tool to assist JCSP students in operational-level planning.

For example, given an adequate prompt, it can produce an essay outline, thesis statement, abstract, and a variety of paragraphs supporting the argument. It can synthesize and summarize rough information into coherent sentences.

It is important to note that students who are unfamiliar with the basic concepts of their topic may be led astray by hallucinations. In this way, it is critical that ChatGPT users have a cursory knowledge of their topic so that they can differentiate accurate answers from hallucinations. This makes ChatGPT more usable for senior undergrad students (third year and beyond) and graduate students who have a foundational knowledge of most concepts, whereas undergraduate students may be unable to correctly identify hallucinations on account of their limited understanding. A student may combat that liability and improve the quality of their prompts by soliciting feedback from their professors and incorporate that feedback to create superior prompts.

Educators fear that students might use the technology to produce an essay that would meet the objectives of the assignment but that they would not have conducted the required critical thought or synthesis, which is the underlying aim of the assignment. Given the advent of the AI chatbot, several post-secondary professors commented that ChatGPT is better-than-average at writing essays.[27] In a nutshell, it is not so much that the sanctity of the essay be protected but that the skills that are developed through the writing of essays are crucial in developing capable students.

Seminar Preparation and Reading: *No Lead-y – No Read-y*[28]
The JCSP students are required to prepare and lead seminar discussions (as seen in Figure 2) once or twice per course (totaling roughly eight throughout the year). This task involves reading the required and supplementary reading lists to ensure that the students can produce high quality questions that evoke class discussion and meet the requirements of the main teaching points and learning objectives. Students are assessed on their ability to lead these discussions and draw out learning objectives within their syndicate.

Much like the essay, the value of leading a seminar is not in the quality of the seminar, but rather the critical thinking and organizational skills that are required in preparing it. When one leads a seminar, they interact with the material in a way that seminar participants do not; the leader dives deeper into the text and is forced to understand it at a higher level. Defeating the very purpose of the assignment, ChatGPT allows for students to bypass the critical thinking

involved in these steps. It can summarize entire documents, permitting students to gain insights without reading the document. It can provide transcripts of hours of video and synthesize the script into key points. The AI chatbot can quickly organize and synthesize large amounts of data and create an outline to a presentation that has a logical flow with a detailed time appreciation. It can generate relevant questions and produce high quality answers to those questions. It can also provide counterarguments. It can provide high quality pedagogical advice, including suggesting different types of group activities that will allow students to access learning objectives in creative ways.

ChatGPT can also help students with preparing for seminars they do not lead. JCSP students are expected to provide "participatory contribution" in all seminars. Once the seminar leader has provided the discussion questions (sometimes these are provided in the activity description in the course syllabus), a student can simply query ChatGPT with those questions and, after trialing several prompts, receive quality answers with relevant examples for their discussion within the syndicate. ChatGPT can answer all the questions without the student having to read any documents. Needless to state, this threatens the aim of critical thought and interaction with the material, which is the primary aim of the JCSP.

Operational Planning and War Gaming

ChatGPT can be a valuable tool to assist JCSP students in operational-level planning. With its ability to analyze large amounts of data, the chatbot can help students understand the complexities of the operational environment, including factors such as terrain, population demographics, and social dynamics. That is helpful in the operations planning process (OPP) where JCSP students are expected to read through several hundred pages of background documentation to understand a fictional scenario for Exercise (Ex) PHOENIX THUNDER, Ex PHOENIX RISING, Ex BREAKTHROUGH, and Ex ARCTIC FOX. Where students traditionally are expected to laboriously sift through this documentation, ChatGPT is able to find accurate data connections to form quality deductions for further planning.

Through OPP exercises, ChatGPT can provide insights into the potential outcomes of wargames and offer recommendations for mitigating risks or maximizing opportunities. Furthermore, ChatGPT can support decision-making by providing relevant intelligence and data analysis to inform the development of effective tactics and strategies.

RECOMMENDATIONS

At the time of writing, no policy exists to address the use of ChatGPT or AI technologies within the Canadian Defence Academy (CDA), which holds all the CAF's PME organizations: the Royal Military College of Canada (RMC), Royal Military College Saint-Jean (RMC Saint-Jean), and the Chief Warrant Officer Robert Osside Profession of Arms Institute. The CDA has initiated a committee of civilian and military professors, advisors, and students from throughout the above organizations to explore this issue and provide a recommended policy in May 2023 for integration into the 2023–2024 academic year.[29] The author was able to demonstrate some ChatGPT capabilities to the members of the mentioned committee who were at the time beginning to appreciate the potential of the chatbot.

Having demonstrated how ChatGPT might threaten JCSP assessment methods by undermining the goals of the program, the author proposes several recommendations for restructuring the program to incorporate AI tools for the benefit of both students and instructors.

First, the author recommends including an "AI literacy brief" in CF101 for the incoming students, DS, CDOs, and academics that demonstrates the abilities of ChatGPT and AI models, including through a live demonstration. That will expose CFC students and staff to the potential opportunities and threats of ChatGPT. The aim of the brief should be to open up dialogue about the potential of AI chatbots and to inspire trust through transparency. It would allow for the CFC policy to be discussed at length so that the staff and students better understand the technology and the CFC's policy on assignments.

Second, the CFC should safeguard critical thinking as its fundamental aspiration. Critical thinking is a skill that requires creativity, curiosity, and reflection, and AI chatbot services cannot replicate these qualities. Therefore, DS, CDOs, and academics need to safeguard these skills in the era of ChatGPT by designing assignments that challenge students to think critically and creatively about complex issues. These assignments can include tasks such as comparing different sources of information, explaining reasoning and assumptions, providing alternative solutions or perspectives, or applying existing knowledge to new situations. The CFC should re-evaluate the methods of assessment that can easily be undermined by AI chatbots such as ChatGPT. As previously stated, the CFC allows DS, CDOs, and academics the flexibility to change these methods, provided that they still meet acceptable standards. When requiring long essays, the CFC could employ other parallel assignments that evaluate the student's depth of knowledge with the subject through oral presentations, elevator pitches, or three-minute thesis, where instructors and course mates could ask follow-up questions.[30] The gold-standard of this practice is the *viva voce* examination, where students are questioned on their understanding by a panel of academics. By evaluating a student's knowledge away from their computer, you test their ability to engage with a topic that is not easily prepared for, gaining a better understanding of their comprehension.

The author recommends adding an assessed *viva voce* examination to the DS569 Global Vortex activity, where the academic, DS, and peers form a panel to assess the student's grasp of their topic. The author further recommends that an elevator pitch role play assignment be added to the DS555 Leadership Persuasive Paper to convince a student's classmates of a solution to their problem. For seminars, the author recommends encouraging students to teach the material to their classmates, instead of orchestrating wide-ranging, and often shallow, discussions. In the author's experience, DS favour group discussion over deeper engagement with the text from the seminar lead. Teaching requires a deeper level of comprehension that cannot be easily hacked by ChatGPT.

Third, the CFC should embrace ChatGPT and allow students to use the tool, provided that they account for its use. DS and academics can use ChatGPT in the classroom as a tool for sparking discussions and debates among students. Freely using ChatGPT in the classroom will normalize its use, removing the stigma and secrecy surrounding it. DS and academics can use the "flipped classroom method," which is an instructional technique that has students complete research at home and work on live problem-solving during class time. By changing the traditional testing methodology of lectures in class and written homework at home to lectures and research at home and proctored writing in class, students will be able to focus on the application of the critical thinking skills instead of the writing skills themselves.[31] DS could assign a complex topic, allowing students to use ChatGPT to quickly research the topic, and then have students present their findings orally in the form of a discussion where they must present real-world examples of their findings without prepared notes.

CONCLUSION

The potential impact of ChatGPT and other AI tools on education cannot be overstated. ChatGPT promotes excitement and apprehension, but it is our duty to balance this response with further study and regulation until we can realize a full picture of its potential. AI technology is neither inherently good nor evil; rather, it is both good and evil. Humans are prone to fearing new technology that changes the status quo. In time, the current fears will subside, and AI will become woven into the fabric of our daily lives.[32] Until then, it is crucial to remain cautiously optimistic but also adapt to the changes of the technological landscape. While these tools offer unprecedented levels of knowledge-creation and synthesis, there are also significant risks to academic integrity and critical thinking skills, particularly in the context of PME. As such, it is essential to find a balance between technological innovation and academic rigour, through collaborative efforts between students, instructors, and policymakers.

ChatGPT is currently a modern Frankenstein that must be carefully built. Just as Frankenstein's monster was a creation with immense power that was used for both good and evil, ChatGPT and other AI tools have the potential to revolutionize education. However, they must be developed and regulated with care to ensure that their impact is positive, despite the eventual negative impacts that will occur. It is worthwhile to approach this technology with caution and foresight, recognizing its immense power and potential for both benefit and harm. By doing so, educational institutions can harness the potential of AI to transform education and prepare students for the challenges of the future, while ensuring that the value of critical thinking skills, communication skills and academic integrity is not diminished.

ABOUT THE AUTHOR

Lieutenant-Colonel Nathan Richards, CD, is currently on the 3rd Canadian Division Staff in Edmonton. He wrote this article as part of the Residential Joint Command and Staff Programme 49 in the spring of 2023. He spent his junior years in Edmonton as a platoon commander, company second-in-command, and battalion operations officer. As a senior officer, he worked mostly in Ontario on the Canadian Army Staff, as officer commanding the Transportation Company in Petawawa, and as G4 of 2 Canadian Mechanized Brigade Group. He has deployed on expeditionary tours to Afghanistan and Jordan as well as on countless domestic operations.

ENDNOTES

1. For this article, critical thinking skills is conceptualized as the ability to objectively analyze and evaluate information, arguments, and evidence to form a reasoned judgment or conclusion. This involves a range of cognitive processes such as identifying assumptions, evaluating evidence, recognizing bias, and considering alternative perspectives. These skills are critical for military officers.

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17. It is important to note that, recently, Microsoft released a new chatbot called "Bing Chat," which is connected to the internet and can check live facts and cite its sources. This paper is limited to ChatGPT 3.5.

18. Jürgen Rudolph, Samson Tan, and Shannon Tan, "ChatGPT: Bullshit spewer or the end of traditional assessments in higher education?" *Journal of Applied Learning and Teaching* 6, No. 1 (2023): 342-263, https://doi.org/10.37074/jalt.2023.6.1.9

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28. This is a common idiom amongst CFC students meaning that, if you are not the leader of the seminar, you will be unlikely to read the required readings given the vast number of readings required in each seminar.

29. Lucie Moussu, "Interview with Nathan Richards," personal interview, MS Teams, Toronto, 27 February 2023.

30. DS569 currently has an assignment that incorporates a three-minute thesis; however, it is not graded, to the detriment of the activity.

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AUFTRAGSTAKTIK: The Birth of Enlightened Leadership

BIBLIOGRAPHICAL INFORMATION:
OLIVIERO, CHARLES S., Toronto, Canada:
Double Dagger Books, 2022, 185 pages.
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Reviewed by Major (Ret'd) Gerry (GD) Madigan, CD, M.Sc., M.A., who is a retired Canadian Armed Forces logistician.

Leadership is often assumed to be an innate gift that comes naturally. More often that not, though, it is found in the continual learning of professional education and career progression. A true leader is one who is open to new experiences, concepts, and ideas, and who sees the value of their application, if not at present, at least for the future.

Auftragstaktik: The Birth of Enlightened Leadership provides such an opportunity. The author, Colonel Charles S. Oliviero, contends that *Auftragstaktik* as a concept remains "poorly understood" despite being embraced as one of the pillars of NATO's Mission Command. He comprehensively explains the concept with the aim of providing a closer understanding of the true intent of *Auftragstaktik*.

Oliviero delves into the historical record, covering the persons, places, events, and evolution of the German General Staff, its rise and fall, and its excellence. It is important to note that the German General Staff led to the evolution and development of this concept through failures and lessons learned, which provide the context to his thesis of the ongoing continuity and relevance of *Auftragstaktik*. Despite its success in some militaries and the desire by other militaries to emulate it, it is not something that can be adopted easily or applied smoothly from one military to another, primarily because of varying military cultures. *Auftragstaktik* is a cultural philosophy, and approaching it as a value system is uneasy.

It is a concept that allows for the possibility of failure and deviation, wherein there is "[…] mutual trust between superiors and subordinates, where superiors set goals, provide resources, and give subordinates free rein to achieve those goals."[1] Oliviero is not alone in the call for leadership change. It is timely that his work comes at a point when our civilian colleagues are looking at the same issue, albeit from differing perspectives. They, too, call for a new concept of leadership, with similar expectations.

The greatest latitude and trust lie in an outcome where a commander's strategic intent is respected. Perhaps that is the issue that is problematic for many, as it also implies shared responsibility and trust amongst leaders and subordinates.[2] In fact, that alone is likely anathema to Canadian strategic thinking, learning, and training. In Oliviero's words, "trust was not only directed upward, but more importantly, it was directed *downward*, from officers to soldiers."[3] Most important is the similarity to our civilian colleague's view—the point of this concept is to make soldiers "shareholders of operations, rather than un-consulted employees."[4] Oliviero's early exposure to *Auftragstaktik* arises from a posting to a German Staff College in Hamburg early in his career. It was in the cauldron of course work, experience, and debate amongst his colleagues and directing staff that he began to explore *Auftragstaktik*'s relevance and application.

The author argues that sometimes the fundamental virtue of concepts is not readily evident. These are often buried deep in the social psyche and language hidden in another culture. Thus, their relevance is neither easily understood, transferable, nor translatable, and that is a difficulty and shortfall of *Auftragstaktik*.

Oliviero's career clearly demonstrates the value of both learning, living the language, and absorbing the culture that makes such an attempt worthwhile, through that cultural exposure. It is where ideas are incubated in the genesis of personal military education and inculcated

through the ideals of history, the cultural values, and the thoughts of a host nation that are openly and honestly explored without pre-condition. Then and only then can one begin to truly understand and attempt to translate these into ones' own maternal language. Few are afforded the privilege of attaining or experiencing such exposure; fewer still are willing to take advantage of it.

Admiral Isoroku Yamamoto is such an example. His career progression, education and personal experience weighed on the evolution of his military leadership style and thinking.[5] Yamamoto, like Oliviero, was exposed to education and postings that led to a lifetime pursuit of professional education and betterment. The takeaway from Yamamoto's life was the crucial role played by his time, experience, and education in the United States and various diplomatic missions overseas. The combination of those factors early in his career shaped his thoughts and concepts that were employed in the Pacific War. Yamamoto considered and embraced new ideas. He steered away from the prevailing doctrine of the great guns of the battleship in favour of the primacy of the aircraft carrier in his planning. His exposure to aircraft greatly influenced the strategic thinking not only of the Japanese naval staff but of all belligerents as well.

Source: Wikipedia

Another takeaway from Oliviero's work is the value of lessons learned, regardless of source, and applying them accordingly. It implies that leadership involves the willingness and openness to learn, concomitant with a will to accept the consequences of an error. In this book, Oliviero admits that the concept of *Auftragstaktik* is not readily transferable and may even shake our Canadian military sensibilities. As a result, some may reject the concept out of hand as doctrinally indefensible. Yet the seed of its implications are important for consideration if strategic concepts and doctrine are to advance.

Auftragstaktik requires faith in one's subordinates. Oliviero was once Chief of Staff to the Canadian Army Command and Staff College. He took the bold step of empowering his civilian and military subordinates for decision making when required, without fear of retribution or censure.

A bold move in the days of "walking the walk and talking the talk" left many with a degree of skepticism. Oliviero gave an example of trust concerning a secretary left alone before a long weekend. The printing office called and required urgent permission to print extra copies for a course's joining instructions. The dilemma was that she could either wait for the manager's return or be proactive and approve the simple request. Oliviero gave the context that, given that the requirement was both legitimate and urgent, she could approve it and advise her supervisor on his return.[6] Such was the level of trust never extended to her before.

Auftragstaktik is a value system that has evolved in Germany from the early 1600s and was sustained and developed through the eventual creation of its General Staff. It may not be a system amenable to many. It is an intellectual challenge that the reader can undertake for themselves. As such, *Auftragstaktik* can be used as an intellectual construct for personal and professional learning.

Regardless of one's opinion and disposition towards the concept and its utility, *Auftragstaktik: The Birth of Enlightened Leadership* is visionary and deserves a greater readership, especially within the Forces.

ENDNOTES

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3. Oliviero, *Auftragstaktik: The Birth of Enlightened Leadership*, 142.

4. Oliviero, *Auftragstaktik: The Birth of Enlightened Leadership*, 186

5. Gerry Madigan, "Admiral Isoroku Yamamoto – A Case for the Value of Professional Reading" *The Canadian Air Force Journal* 1, No. 2 (2008): 6–12. https://publications.gc.ca/collections/collection_2008/forces/D12-13-1-2E.pdf

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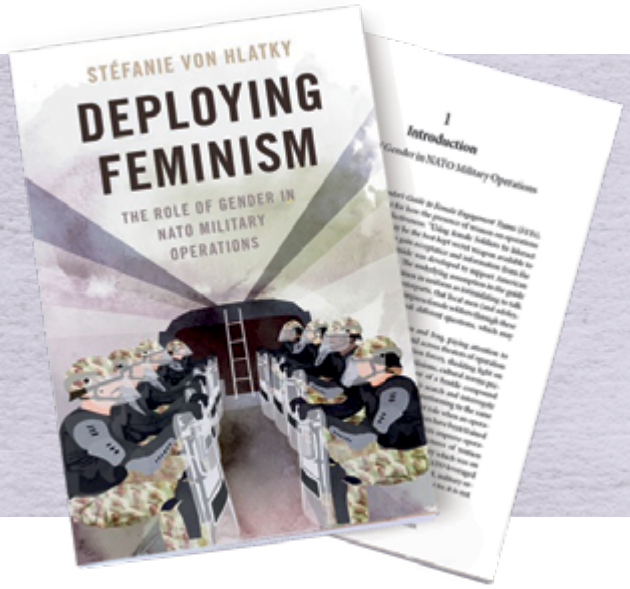

DEPLOYING FEMINISM: The Role of Gender in NATO Military Operations

BIBLIOGRAPHICAL INFORMATION:
VON HLATKY, Stéfanie. New York: Oxford University Press, 2022, 249 pages.
ISBN: 9780197653524

Reviewed by Charlotte Duval-Lantoine, Operations Manager and Fellow at the Canadian Global Affairs Institute.

More than twenty years after United Nations Security Council resolution (UNSCR) 1325 on Women, Peace and Security (WPS) was adopted and international organizations, states and militaries decided to implement its principles, how has that implementation progressed?

Stéfanie von Hlatky's *Deploying Feminism* seeks to answer this central question by examining three North Atlantic Treaty Organization (NATO) missions. Dr. von Hlatky aligns unequivocally with feminist criticism of militaries' co-optation of WPS and looks granularly at how and why those distortions happen.

Deploying Feminism is not only a feminist critical study; it is also a practical work. Through field work at the NATO Headquarters and with missions in Kosovo, with the Canadian-led battle group in Latvia, and in Iraq, von Hlatky looks at how WPS norms are translated at the strategic, operational and tactical levels. There, she finds that the confrontation of those norms with mission objectives and contributing nations' military cultures led to a distortion of the WPS agenda. As she puts it succinctly in her conclusion, "the feminist principles that led to the adoption of the WPS agenda can get lost in translation when these norms are filtered through the prism of military culture which dictates a focus on operational effectiveness" (p. 154). Although this conclusion will not surprise those who have been observing the way states and international institutions are implementing the WPS—a fact von Hlatky is keenly aware of—the novelty of this monograph lies in how thoroughly the author immersed herself in NATO and military culture. Through immersive prose, she enables readers to *see* the realities within NATO and on the ground with the missions and the service they involve; the landscapes surrounding her as she visits the different missions; the way gender advisors and gender focal points negotiate their positions with commanders and fellow service members; and the deployed troops' dynamics with the local populations.

Source: Combat Camera

Deploying Feminism teaches a great deal about the militarization of the WPS agenda and the operationalization of gender perspectives for the sake of mission success. But the book does not focus exclusively on WPS. It also shows how, and sometimes why, strategic intent can change when confronted with the operational picture on the ground, with cultures, and with the personalities of those responsible for carrying out the mission. Stéphanie von Hlatky clearly demonstrates how much insight critical works can offer into the current functioning of institutions. *Deploying Feminism* can serve as a starting point for anyone interested in learning more about how NATO works when preparing for operations and how those operations unfold on the ground. Its immersive and accessible prose makes it a compelling and thought-provoking read.

This is the book's inherent strength: it raises many questions that are both rhetorical and practical. First and foremost, states and international organizations (most of them Western) have put militaries at the centre of WPS implementation, thereby opening the door to the militarization and distortion

of the norms they were trying to pursue. Should NATO, and by proxy the militaries of its member states, be the drivers of gender equality? With the evolution of the nature of the work militaries are asked to do, which has increasingly involved stabilization and capacity building, it is not surprising that we find militaries assigned this task. However, the question of whether they are the most appropriate institutions to do the work is critical. And here, civilian–military relations become more salient. NATO Headquarters exercises rather significant oversight of the application of gender perspectives in missions, but civilian control during missions and at the national level could be improved. Stéphanie von Hlatky, by highlighting the norm distortion that occurs as soon as WPS enters military cultures, effectively underlines this problem. One thing that is not mentioned in the book, but is inherently connected to its thesis, is that militaries have yet to implement the radical culture change necessary for them to pursue WPS the way it was intended. This is essentially a civilian control issue. National Action Plans on WPS have let military cultures absorb WPS and use gender as a means toward achieving mission success, rather than letting the WPS agenda transform militaries. This leads back to the core question: should militaries be the institutions carrying this agenda? Paradoxically enough, as von Hlatky states in her conclusion, this is a point that many feminists and many military traditionalists would agree upon, but one that states have not yet grappled with.

Another challenge associated with militaries' implementation of WPS is those militaries' lack of diversity. Stéphanie von Hlatky repeatedly underlines that the absence of women poses not only the issue of credibility, but also that of real effectiveness in terms of the application of gender perspectives when executing a mission. The associated recommendations of deploying more women and incentivizing countries to do so through mechanisms akin to the United Nations' Elsie Initiative are evident and compelling. However, the feasibility of implementing them remains extremely complex. In 2021, about 16.3 per cent of Canadian Armed Forces members were women, and they were concentrated in the seven following trades: human resource administrator, financial service administrator, material management technician; logistics officer, medical technician, nursing officer and cook. On average, 80 per cent of deployments require troops from the combat arms, of which women constitute about 5 per cent.[1] The Canadian Armed Forces encounter a similar issue with implementing the UN's Elsie Initiative.[2] In 2021, the Canadian military had five missions in which more than 20 per cent of troops were women.[3] Although von Hlatky correctly argues that the selection of missions impacts how many women have the opportunity to deploy, there might also be biases that lead to women being less likely to be selected for more dangerous missions: where women serve in the military strongly restricts the ability to deploy them. To change this situation, societies and militaries will have to do

considerable work to ensure that women can envision themselves pursuing careers in non-traditional roles, and will then have to recruit and retain them. This is a point on which feminists will disagree with one another, and it circles back to the question of whether militaries are the most appropriate institutions to implement the WPS agenda.

In short, Stéfanie von Hlatky's *Deploying Feminism* is a tour de force. It is a powerful book which opens the door to further critical, yet practical, studies of the way militaries approach gender and diversity. Von Hlatky is generous in her writing, offering clear, immersive prose in a book that is suitable for anyone who wants to learn about gender perspectives, gender mainstreaming or the WPS agenda, or who is seeking another view on how NATO operates.

Disclosure: In the summer of 2018 and 2019, the reviewer worked for Dr. von Hlatky as a research assistant on projects that served the writing of this book. However, the reviewer's contribution was at arm's length and consisted primarily of translation and basic data gathering on gender mainstreaming at NATO and attitudes toward women in the countries which are the largest contributors to the International Security Assistance Force.

ENDNOTES

1. Information given to the reviewer by a member of the Canadian Armed Forces via email.

2. Phoenix Strategic Perspectives Inc., "Elsie Initiative Barrier Assessment: Results of the Measuring Opportunities for Women in Peace Operations Assessment for the Canadian Armed Forces," prepared for the Department of National Defence, 31 May 2022, https://publications.gc.ca/collections/collection_2022/mdn-dnd/D2-626-1-2022-eng.pdf.

3. Government of Canada, "2020–2021 Department of National Defence departmental progress report for Canada's Action Plan on Women, Peace and Security, last modified 20 Oct 2022 (accessed 29 April 2023), https://www.international.gc.ca/transparency-transparence/women-peace-security-femmes-paix-securite/2020-2021-progress-reports-rapports-etapes-dnd.aspx?lang=eng. At the time of writing, the 2021–2022 progress report has not been released.

TAKING NAZI TECHNOLOGY: Allied Exploitation of German Science After the Second World War

BIBLIOGRAPHICAL INFORMATION:
O'REAGAN, DOUGLAS M. Baltimore, MD:
Johns Hopkins University Press, 2021, 296 pages.
ISBN: 978-1-42143-984-6

Reviewed by Matt Malone, Assistant Professor (Faculty of Law) at the Thompson Rivers University.

In *Taking Nazi Technology*, Douglas O'Reagan examines the quadripartite occupying powers' efforts at technology transfer from Nazi Germany following the Second World War. His book is replete with lessons for purveyors of today's rhetoric that theft of intellectual property (IP) presents national security concerns. It contributes much-needed nuance to the assertions made in reports like the U.S. Congress Joint Economic Committee's *Impact of Intellectual Property Theft on the Economy*, which highlighted the gravity of IP theft as a national security issue only to note the impossibility of measuring it accurately or creating precise estimates of its magnitude.[1] Such critical lapses are typical of research in the genre.

O'Reagan dispenses altogether with estimating the value of "intellectual reparations,"[2] dismissing attempts to do so as defying easy accounting.[3] However, he accepts that "[a]nyone who wants to argue that the intellectual reparations were an enormous gain for the United States … can find plenty of evidence to support that claim."[4] Indeed, during the war, advanced technology used by the Nazis induced fear and envy among the Allied powers, with developments like the jet engine aircraft and the V-1 and V-2 rockets representing novel breakthroughs. In addition, Germany's research universities (an institution it invented) enjoyed a stellar reputation. From 1901, when the Nobel Prizes were first awarded, through 1956, in every year but one, Germany won more Nobel prizes than any other country.

O'Reagan's principal argument is that an obsessive focus on siphoning off German technology was met by the realization that copying abstract technical documents did not in itself accomplish technology transfer. Instead, it resulted in the occupying powers facing an "information problem,"[5] having to digest a "staggering"[6] quantity of documents. For example, after the Americans occupied the German patent office following the war—microfilming everything they could find and denying access to the French and Soviets (but granting it to the British)—most of the information went unused. This occurred even though the Americans provided weekly bibliographies of technical documents to industry actors. (Executive Orders from President Truman had mandated the release of domestically produced and foreign-acquired wartime intelligence to American industry.)[7] O'Reagan quotes the United States' Technical Industrial Intelligence Committee's observation that by 1947 there were "literally hundreds of tons of undigested data scattered in a number of repositories in Germany, France, England, and Japan."[8]

Technology transfer is not just about "copy[ing] documents."[9] Instead, it requires an acknowledgement that "technology live[s] at least as much in people as in things."[10] O'Reagan points to the most obvious example of this argument: Germany's post–Second World War resumption of productivity during its *Wirtschaftswunder* (economic miracle), showing that, despite being plundered, the country had retained much of its value in postwar international markets.[11] German innovators were also not permitted to file for any registered form of IP protection during the period from 1945 to 1949. Despite all these disruptions, "the economic consequences of technical exploitations were, at absolute worst, insufficiently damaging to prevent the economic miracle."[12]

For readers unfamiliar with the Allied powers' efforts at technology transfer, O'Reagan summarizes each of those efforts in some of the most cogent scholarship available to date. The most eye-catching part of the American effort at technology transfer, Operation PAPERCLIP, had the goal of extracting scientists directly from Nazi Germany. It was as much an effort to bring German science into the American fold as it was to prevent German science from falling into the Soviet fold. Perhaps the most iconic example from Operation PAPERCLIP came in the personage of Wernher von Braun, a member of the V-2 rocket design team at the Nazis' Peenemünde Army Research Center, which the Americans reached before the

Soviets following the war.[13] Von Braun later helped develop the Saturn V rocket, which took astronauts to the moon, and his role in that effort "seems to have been crucial."[14] O'Reagan explains that von Braun was part of a cluster of German rocket scientists who settled in Huntsville, Alabama, following the war. By contrast, the Soviet version of this effort, Operation OSOAVIAKHIM, saw the forcible removal of approximately 3,000 German scientists, engineers and others on the single night of 22 October 1946, and their extraction to Soviet territory.[15] By 1958, most had returned to Germany.[16]

After providing many examples of how extraction of people, not documents, better accomplished technology transfer, O'Reagan posits that this realization shook the foundations of existing legal and national security frameworks. He suggests that the effort pushed Allied powers to move from the fallacy of "thinking of technology as a zero-sum game" towards constructing IP frameworks that recognized and protected "embedded"[17] knowledge. O'Reagan depicts the rise of IP law following Second World War as flowing from this realization and coinciding with a push by the Americans for "other nations to adopt American standards for business law."[18] A recognition of the importance of technical know-how by judges, lawyers and lawmakers in the IP community led to the creation of new forms of law, which "allow[ed] widespread know-how licensing in the 1940s to 1970s."[19] The percentage of law review articles where the term "technical know-how" appeared rose from 0% in 1940 to 0.15% by 1950—and to 0.35% by 1970.[20] Similarly, common usage of the phrase "intellectual property" did not accelerate until the post–Second World War period.[21]

O'Reagan's over-arching argument is that the most important technology transfer comes in the form of people, not things.[22] Digestion of the vast amounts of technical information made available after the war presented a challenge, necessitating "softer"[23] knowledge sets.[24] By wading into arguments around the need to focus on "attracting and retaining foreign scientists and skilled workers … rather than forcing them out once student and temporary visas expire," O'Reagan makes tentative comments on the current state of national security discourse in the United States. He notes that the present-day fear of data breaches is a red herring compared with the "bigger threat"[25] of the movement of people and the loss of talent. One hopes that more scholars will address the issue.

ENDNOTES

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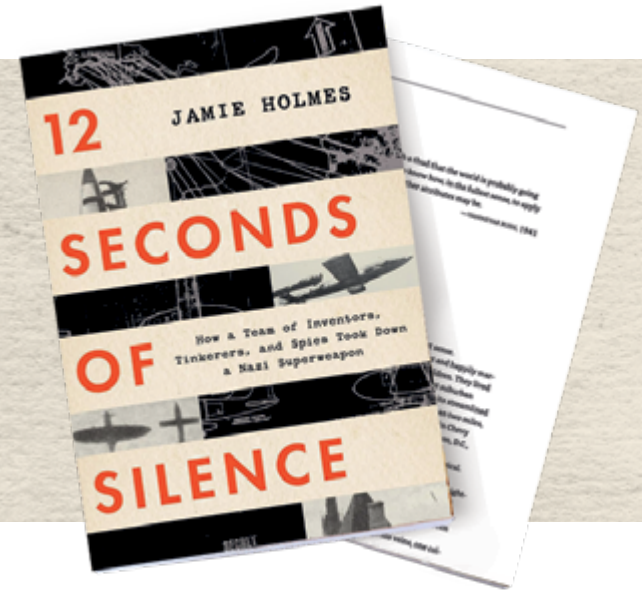
2. Douglas O'Reagan. *Taking Nazi Technology: Allied Exploitation of German Science After the Second World War* Baltimore, MD: Johns Hopkins University Press, 2021, 8–11.
3. Ibid., 50.
4. Ibid., 217.
5. Ibid., 145.
6. Ibid., 163.
7. Ibid., 27.
8. Ibid., 166.
9. Ibid., 3.
10. Ibid.
11. Ibid., 182.
12. Ibid., 215. (Internal citations omitted.)
13. Ibid., 106–7.
14. Ibid., 39.
15. Ibid., 110.
16. Ibid., 114.
17. Ibid., 215.
18. Ibid.
19. Ibid.
20. Ibid., 189–90.
21. Ibid., 190.
22. Ibid.
23. Ibid., 181.
24. Ibid., 181–2.
25. Ibid., 223.



12 SECONDS OF SILENCE: How a Team of Inventors, Tinkerers, and Spies Took Down a Nazi Superweapon

BIBLIOGRAPHICAL INFORMATION:
HOLMES, JAMIE. Boston, USA: Houghton Mifflin Harcourt, 2020, pages 432.
ISBN: 9780358508632

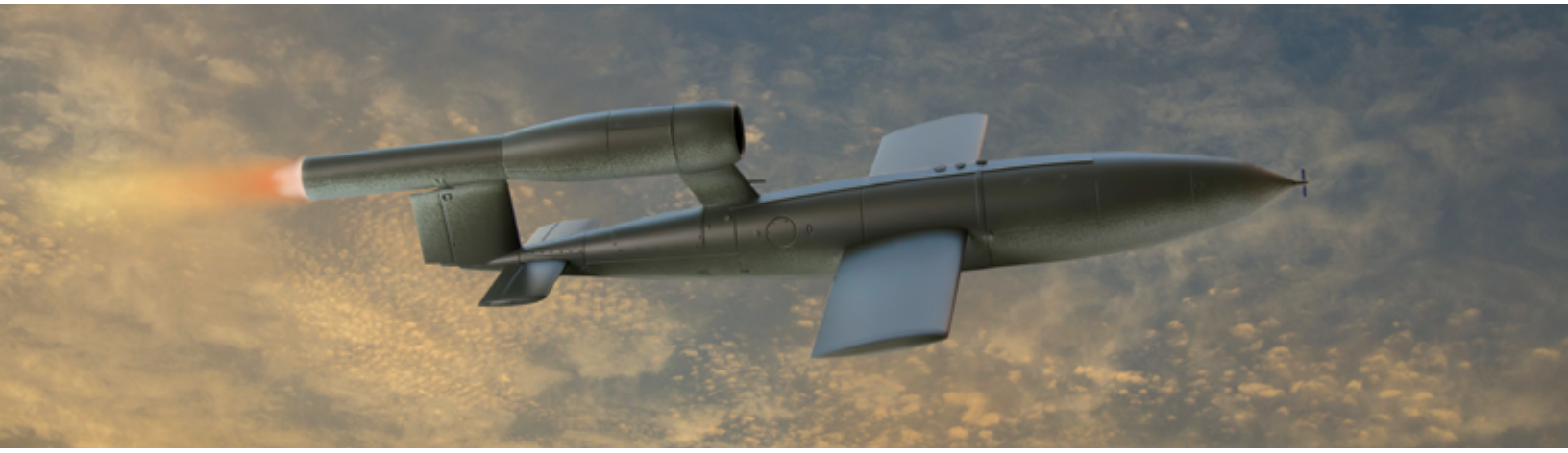
Reviewed by Dr. Robert Addinall, who teaches courses in History and Administration at the Royal Military College of Canada.

12 Seconds of Silence: How a Team of Inventors, Tinkerers, and Spies Took Down a Nazi Superweapon is a book that focuses primarily on two Second World War military technologies: the German development of the V-1 pilotless pulse jet bomb (essentially the forerunner to cruise missiles), and the American development of variants of the proximity fuse for various types of anti-aircraft (AA) and, later in the war, ground bombardment artillery shells. The first part of the title refers to the typical amount of silent glide time that a V-1 rocket took after its engine cut out to impact the ground. The second part primarily refers to the scientists of "Section T," headed by geophysicist Merle Tuve, of the World War II era U.S. Office of Scientific Research and Development (OSRD) overseen by Vannevar Bush.

Despite the title, the story of the smart fuse gives the impression of overshadowing that of the V-1 by the end of the book. In the way that Holmes unfolds his narrative, the V-1 serves as something of a protagonist that ultimately illustrates the importance of proximity-fused weapons in a defensive role. That said, weapons with the proximity fuse went on beyond that role, as seen with the AA fire against Japanese air attacks in the Pacific theatre or against German ground forces during the Ardennes offensive of December 1944 and January 1945. In discussing why he chose to revisit this topic, Holmes notes, "[O]ver the fall of 1945, the smart fuse enjoyed a short time in the national spotlight. Newsreels from Universal, Paramount, and Metro-Goldwyn-Mayer celebrated its feats in theatres. The rush of publicity was newsworthy in itself."[1] He adds, "Silver Spring, Maryland, home of the Applied Physics Laboratory, was suddenly 'on the front pages of newspapers all over the country'"[2] and "Dr. Merle Tuve, 'one of the foremost physicists in the world,' was … 'being billed as one of the nation's No. 1 heroes.'"[3]

However, Holmes finds that general knowledge of the history of the proximity fuse was itself eventually overshadowed by other even more prominent developments of the period and became "a quaint piece of Americana"[4] before being mostly forgotten. He remarks, "[As] the decades passed, Section T's contributions gradually faded from collective memory …. Overshadowed by the atomic bomb and then muddled by a messy patent suit, the story of the fuse receded. Based on the early British work on rocket fuses, which were not effective, a fiction took hold that the British had 'invented' the smart fuse and merely passed it along to Merle Tuve to manufacture."[5]

Holmes indicates that he researched the book based on "a wide variety of archival sources, many of which have never been written of previously," with the assistance of "a great number of archivists and librarians."[6] As such, *12 Seconds of Silence* is well-researched and provides a new perspective on an old and, at times, partially forgotten subject. Regarding military history, Holmes' work contains some subsidiary theses that can provide an interesting basis for discussion. For example, he argues that the proximity fuse was one of the world's first "smart weapons,"[7] although that term only came into wide circulation later in the 20th century. He also argues that ground and ship-based anti-aircraft weapons were largely ineffective before the introduction of the proximity fuse.[8] Overall, though, these aspects of military history are interwoven with other narrative elements of his text. He attempts to—and largely succeeds in—building up what are essentially human-interest stories around various main actors in the history of the American proximity fuse and German V-1 programs. That is a more significant aspect of the first third of the book, entitled "Part 1: Peace," in which he recounts details of the pre-war lives of Merle Tuve and various other members of the OSRD, as well as other research and development



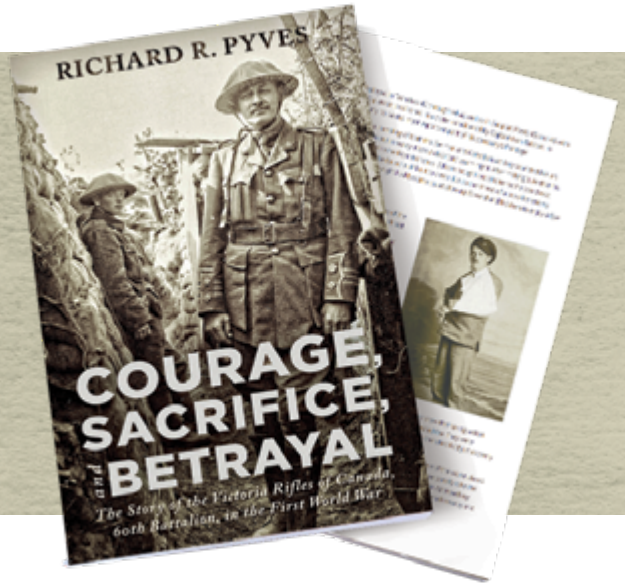
organizations and projects. In the second and third parts of *12 Seconds of Silence*, entitled "Part II: War" and "Part III: Victory," human interest is a less significant aspect. However, Holmes still devotes some attention to fleshing out the personalities and experiences of the individuals who were part of history. In the two later thirds, the human-interest aspect often transitions into occasional sections of organizational history regarding Section T, the OSRD, German V-weapon research at Peenemünde, and so on. Amongst other things, Section T quickly evolved from being "a team of inventors and tinkerers" at the start of the war into a large complex organization with extensive links to the manufacturing industry and with members transferred into military units in active combat zones by the mid-to-late war period.

In addition to the aspects of Holmes' narrative discussed above, there is a less developed parallel narrative focusing on both espionage and information security efforts involving the proximity fuse and German V-weapons research. To this reviewer, the espionage aspect of the book also seems somewhat overshadowed by other aspects of the narrative, similar to how, at least to an extent, the proximity fuse history edges out that of the V-weapons. However, in both cases, this reflects the events of history as much as Holmes' choices in constructing his text. Anglo-American espionage efforts against the Germans in terms of V-weapons were reasonably successful, even if various senior British military personnel were initially skeptical of German efforts in terms of self-guided bombs and rockets. In contrast, German efforts to discover what the Allies were doing regarding proximity fuses failed. By 1944, Anglo-American espionage efforts were also aided by air superiority, which allowed extensive aerial reconnaissance of German V-weapon launch sites. Even though, at times, critical details were missed by Allied analysts, German espionage efforts, as well as efforts at keeping their own projects secret, continued to be ineffective. Similarly, the German V-1 ultimately failed to influence the course of the war significantly, even though it did cause some significant damage and loss of life in the greater London area of the U.K. during parts of the summer of 1944 and required the Allies to commit significant AA assets to defend the port of Antwerp during late 1944 and early 1945, while the proximity fuse became a substantial part of the story of Allied victories of 1943–45 leading to the defeat of the Axis powers. The emphasis of the historical narrative naturally tends to slant towards the victorious side and its weapons and away from efforts that failed.

While the general historical significance of the proximity fuse and the German V-1 were known to this reviewer as a military historian, Holmes' new account of the development of these weapons was quite interesting, and the detailed notes on his archival sources could provide students of history with fresh starting points for additional research. Most military and academic readers are likely to find *12 Seconds of Silence* worthwhile reading, even though it is more popular history than academic study.

ENDNOTES

1. Jamie Holmes, *12 Seconds of Silence: How a Team of Inventors, Tinkerers, and Spies Took Down a Nazi Superweapon* (Boston: Houghton Mifflin Harcourt, 2020), 280.
2. Ibid.
3. Ibid.
4. Ibid., 281.
5. Ibid., 284.
6. Ibid, 286.
7. Such references occur throughout the book, including on the inside of the dust cover.
8. Holmes, *12 Seconds of Silence*, 113–114.



COURAGE, SACRIFICE AND BETRAYAL: The Story of the Victoria Rifles of Canada, 60th Battalion, in the First World War

BIBLIOGRAPHICAL INFORMATION:
PYVES, RICHARD. Toronto, Canada: ECW Press, 2018,
384 pages.
ISBN 978-1-77041-464-8

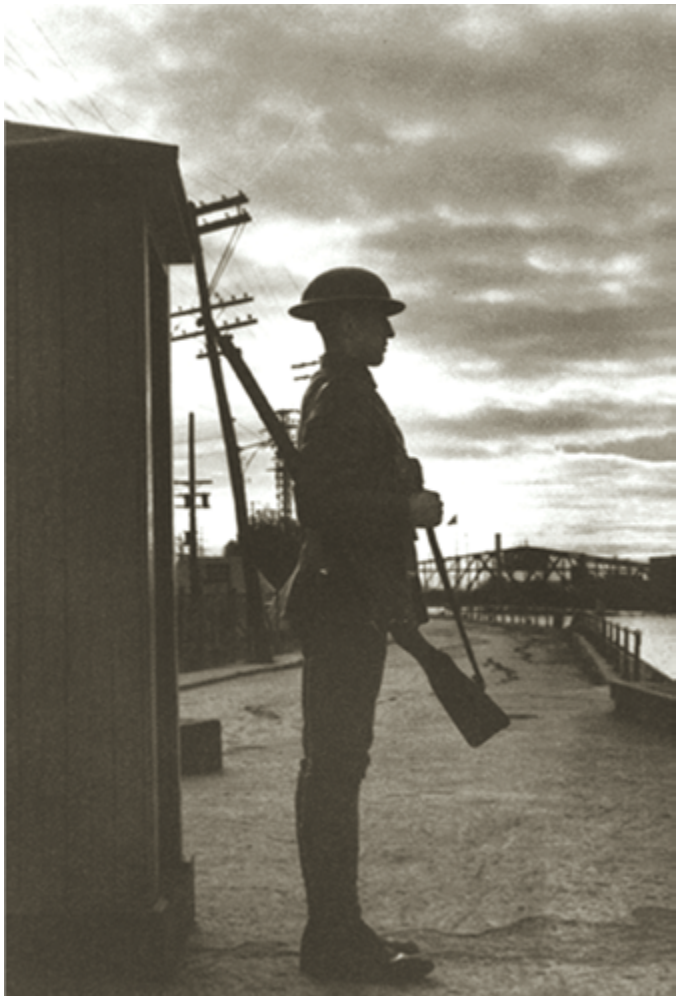
Reviewed by Major (Ret'd) Murray Robertson, retired Reserve Infantry Officer

Courage, Sacrifice and Betrayal offers a personal history of the officers and personnel who made up the 60th Battalion, Victoria Rifles, a Canadian Expeditionary Force (CEF) battalion of the Great War that was originally recruited in Montreal. It tells the story of the formation, training (including initial training in Canada), service and eventual disbandment of the unit.

Readers seeking a detailed description of the major battles that the unit participated in will have to look elsewhere. This study offers excellent descriptions of unit personnel, where they came from, how they joined, and how they were trained and deployed overseas. It details the unit's training in England, its movement to France and Belgium, and its introduction to the trenches. The book also includes sketch maps that are helpful and add to the context.

Throughout the work, the individual experiences of those who belonged to the unit are powerfully conveyed. The author uses letters sent both to and from family members and includes photos of places, equipment and other memorabilia. Of particular interest are letters from Canada. While this reviewer has read many works that include letters from home and from soldiers at the front, opportunities to read those from families and friends are seldom found.

Indeed, *Courage, Sacrifice and Betrayal* is essentially a personal history of the officers and members who made up one of the fighting battalions of the CEF. It contains individual (and some group) pictures of well over 200 unit members, personalizing their experience in a manner that few contemporary works have succeeded in. It also contains short biographies of both notable and ordinary members of the unit, including the Commanding Officer, Lieutenant-Colonel Arthur Gascoigne, Sergeant Edward Pyves (the author's grandfather), and Private A.Y. Jackson—who later became one of the founding artists of the Group of Seven. The accounts of what happened to the unit members after the Great War may well represent the best part of the volume.



Source: Wikipedia

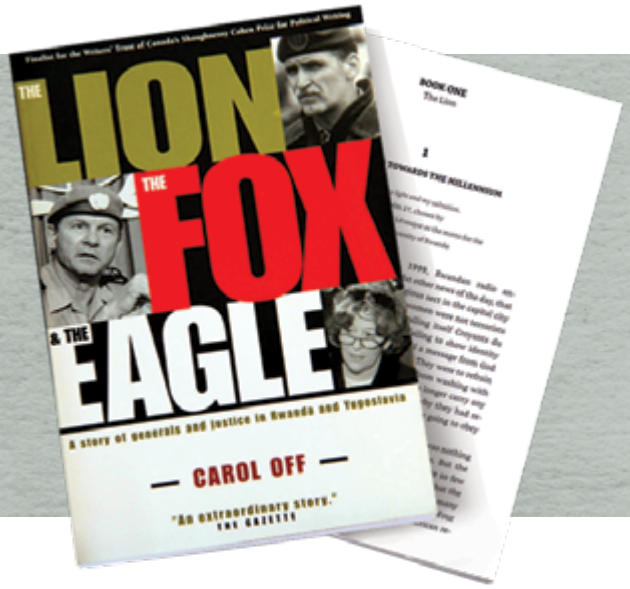
Equally excellent is Pyves' inclusion of data on virtually every officer and soldier who served in the 60th Victoria Rifles. That includes name, rank achieved, date and place of birth, date and place of death, as well as the location of soldier graves (if known). It also includes any honours or awards received, date of wounds, and where battalion members were transferred to. The result is a work that allows readers to identify with the personal stories of the members to a degree that is unique.

Pyves' account of the disbandment of the unit shortly after Vimy Ridge is equally notable. In fact, this event has rarely, if ever, been publicized, much less examined. Here, Pyves notes that it was decided after Vimy that the CEF featured too many units from Quebec and British Columbia and not enough from Ontario and Nova Scotia. That was because the Army made a concerted effort to maintain regional/provincial units with replacements from the same region/province. For various reasons, Quebec and British Columbia were initially overrepresented and, by 1917, their units could only be maintained with replacements from other provinces. This was doubtless a legacy of the somewhat chaotic recruiting process that the Canadian Army went through in 1914 and 1915. At the end of the day, it appears that the remaining provinces were unhappy that their significant roles were not recognized as fully as their sacrifices demanded.

As usual in Canada, politics was pervasive, so a change was made. Notably, the official history mentions this only briefly, and other work such as that of Tim Curry is similarly short on detail. Reasoning aside, the serving soldiers in the disbanded units were transferred to other units at the front, with every effort made to ensure that soldiers went to their regional/provincial units. While the actual disbandments were undoubtedly trying and challenging for the soldiers involved, there were in fact sound political reasons why some units were replaced. That aside, it bears repeating that such decisions are often highly political in the Canadian context.

In all, *Courage, Sacrifice and Betrayal* is an excellent work. It provides a snapshot of a Canada that no longer exists as well as a fresh perspective on Canada and the Great War. Given the enormous impact that the First World War had on developments in Canada and Canadian society—an impact that continues to reverberate today—it is a book that all Canadians must read.

Source: Canadian War Museum



THE LION, THE FOX & THE EAGLE: A Story of Generals and Justice in Yugoslavia and Rwanda

BIBLIOGRAPHICAL INFORMATION:
OFF, Carol. Toronto, Canada: Random House Canada, 2000, 406 pages.
ISBN: 9780679310495

Reviewed by Captain Alexander Landry, MBA, Engineering Staff Officer at NATO Allied Land Command

As the Canadian Armed Forces (CAF) undergoes a period of review and cultural renewal, it is the reviewer's belief that one of the keys to sustainable progress lies in the analysis of a previous tumultuous period for the organization, including the strategies that ultimately led to its exit. Amid the review of CAF missions abroad in the 1990s—perhaps as part of a self-reflection on a time synonymous with what the organization is experiencing today—Carol Off's *The Lion, the Fox & the Eagle* becomes relevant once more, particularly given that one of its principal characters is the former Supreme Court justice currently conducting an independent review of the CAF. Ultimately, it is a self-proclaimed story of generals and justice in Rwanda and Yugoslavia, or perhaps of a lack of justice, depending on how history is interpreted thirty years later.

Carol Off is indisputably a living legend among Canadian journalists; she previously hosted CBC Radio One's *As It Happens* and is one of the leading journalists on CAF involvement in the Balkans during the decline of the former Yugoslavia. Accordingly, *The Lion, the Fox & the Eagle* provides background on the eruption of conflicts in both Bosnia and Rwanda in detail prior to specifically diving into Canadian involvement through two former generals and a judge.

The author first investigates the "lion" of the story, Romeo Dallaire, a self-proclaimed "NATO man" with experience in preparing for what was supposed to be the zenith of confrontation with the Russians. He was arguably unprepared for the powder keg that was Rwanda at the time, leading into one of the worst ethnic cleansing campaigns in recent memory. The author takes great care in outlining the story of a stellar military leader who would unfortunately become embroiled in the politics of the affair. He would realize too late that the cavalry was not coming and that the international community was ready to sit on its hands in anticipation of what was believed at the time to be a conflict between two parties, not an ethnic massacre. Throughout the text, Off provides detail not only on the conflict itself but also on the resulting effects it had on Dallaire in what the reviewer found to be a prelude (as the book was written in 2000) to *Shake Hands with the Devil* and subsequently *Waiting For First Light*. Considering its release date and its inclusion of interviews with the retired general, this alone makes it a must-read for Dallaire fans and United Nations military historians alike.

Changing gears to represent the "fox" of the story, the author brings readers into the setting that saw a city sieged for three years in modern times while a peacekeeping force once again debated moral equivalency between two seemingly armed forces in the area. In this instance, the Canadian at the helm of the task force was Lewis MacKenzie, a general who would become famous (and perhaps later infamous) for his use of the media to bring the eyes of the world onto the conflict between parties. Many things can be said on both sides of the metaphorical token about the former general, and Carol Off emphasizes many of them. In an incredibly fair portrait of someone who could be considered the foil of Dallaire in many respects, the author demonstrates what can happen when the neutral force arguably becomes biased towards one side of the conflict. It also delves into the question of how the bias can consequently compromise the situation through its resulting effects on moral equivalency (if there even was such a thing) or simply the relations between the factions involved.

Source: Wikipedia

Source: The Canadian Encyclopedia

Finally, Off provides an overview of the "eagle" of her narrative, depicting Justice Arbour's appointment to the world stage for both the International Criminal Tribunal for the former Yugoslavia (ICTY) and the International Criminal Tribunal for Rwanda (ICTR). From within this portion of the text, it becomes evident that Justice Arbour was an incredibly fair leader of those two courts, making the best of a difficult situation when the United Nations was looking to lighten the burden of dismay following two arguably failed missions. Although inconsistencies exist within the scope of these tribunals, Arbour moved the yardstick forward concerning international law and successfully underlined the importance of such prosecutions—the first of their kind since Nuremberg. Regardless of the overall storyline, which is detailed in an exciting manner by the author, criminal authorities, including a head of state, were brought to justice for crimes against humanity. That, to an extent, provided some reconciliation for the prior two portions of the book, previously leaving readers distraught with how two situations could have been fumbled in such a manner.

Overall, *The Lion, the Fox & the Eagle* remains a foundational review of CAF and Canadian interest in peacekeeping pre-Afghanistan. The context of the book is becoming increasingly relevant once again, as the world enters a new era of near-peer confrontation and sabre-rattling amidst neighbouring countries in the hot spots of the globe. Two decades onward from its publication, Off's account of two Canadian peacekeeping affairs reminds us of our role in the world and of the times when Canada was at the forefront of foreign affairs in trying to make sense of fairness within declining empires and long-standing ethnic feuds. Although it remains to be seen where the future of the United Nations and its peacekeeping missions lie amid renewed tensions between global powers, *The Lion, the Fox & the Eagle* provides insight into what can happen when these missions go wrong and the situation is not managed in its precursor phases. The book is highly recommended to CAF members as well as to any Canadian looking to get a glimpse of the past when Canada played a pivotal role on the world stage.