



## LEVERAGING ARTIFICIAL INTELLIGENCE TO COUNTER THE IMPACTS OF CONTESTED LOGISTICS

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**Lieutenant-Colonel Joel D. Levandier**

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# LEVERAGING ARTIFICIAL INTELLIGENCE TO COUNTER THE IMPACTS OF CONTESTED LOGISTICS

## AIM

1. Canada's defence policy, *Strong, Secure, Engaged* (SSE), highlights the growing importance of "information technologies, data analytics, deep learning, autonomous systems" and a range of anticipated "transformative technologies" that the Canadian Armed Forces (CAF) will need to employ in the future operating environment (FOE).<sup>1</sup> Further to Canada's defence policy, the recently published *Pan-Domain Force Employment Concept* (PFEC) illustrates an ever-changing FOE that necessitates the integration of artificial intelligence (AI) to enhance the CAF's operational outputs.<sup>2</sup> Realities of the contemporary operating environment (COE) and FOE directly impact the ways and means in which logistics and sustainment activities occur in the context of expeditionary operations. The purpose of this service paper is to highlight the challenges raised within the COE and FOE regarding operational logistics – commonly referred to as *contested logistics* in many publications – and to propose recommendations to overcome the challenges of sustaining operations by leveraging emergent technologies (e.g., AI and digitization). This service paper will do so by addressing elements of the following policy research challenges proposed by the CAF's *Mobilizing Insights in Defence and Security (MINDS) Policy Challenges for 2023-2024* advertisement:

- a. "Identifying what new or modernized force structures, capabilities, infrastructure, and technologies are needed to enhance DND/CAF's presence, operational effectiveness, and sustainment in the Arctic;"<sup>3</sup>
- b. "Understanding the strategic, operational and tactical implications of emerging technologies for DND/CAF;"<sup>4</sup> and,
- c. Increasing use of AI-enabled systems for guidance/analysis in military and political decision-making."<sup>5</sup>

## INTRODUCTION

2. The COE and FOE are characterized by a joint multi-domain operating space in which adversaries will use all means available – conventional, irregular, and whole-of-

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<sup>1</sup> Canada. Department of National Defence. *Strong, Secure, Engaged. Canada's Defence Policy* (Ottawa: Department of National Defence, 2017), 55.

<sup>2</sup> Canada. Department of National Defence. *Pan-Domain Force Employment Concept; Prevailing in a Dangerous World* (2023), 25–26.

<sup>3</sup> Canada. Department of National Defence. 'MINDS Policy Challenges 2023-24', 29 September 2023, sec. Continental Defence, <https://www.canada.ca/en/department-national-defence/programs/minds/defence-policy-challenges.html>.

<sup>4</sup> Canada. Department of National Defence. 'MINDS Policy Challenges 2023-24', sec. Domains and Technology.

<sup>5</sup> Canada. Department of National Defence. 'MINDS Policy Challenges 2023-24', sec. Domains and Technology.

state – to target vulnerabilities across individual nation-states and alliance capabilities.<sup>6</sup> The Canadian Army (CA), and to a more concerning extent, the CAF, are not postured and aligned to adapt to the emergent challenges that the COE and FOE pose to the logistics enterprise from the strategic through to tactical levels. Contested logistics significantly threaten the CAF’s ability to contribute meaningfully to any future conflict in the joint coalition multidomain arena.

3. To overcome the challenges associated with contested logistics, the CAF - and the Royal Canadian Logistics Service (RCLS) more specifically - should endeavour to modernize officer training to account for contested logistics and the emergent nature of conflict in the COE and FOE; and embrace the power and utility of digitization and AI. The RCLS should explore existing solutions, including bespoke software solutions and commercial off-the-shelf products currently used by many key partners and within the North Atlantic Treaty Organization (NATO).

## **DISCUSSION**

### **Background**

4. Contested logistics is defined as: “An environment in which the armed forces engage in conflict with an adversary that presents challenges in all domains and directly targets logistics operations, facilities, and activities in Canada, abroad, or in transit from one location to the other.”<sup>7</sup> The post-9/11 warfighting experiences of the CAF – from combat operations in Afghanistan to partner force counter-terrorism operations in Iraq – have occurred in theatres of operation where air superiority was established and remained uncontested; as a result, contested logistics did not threaten operations.<sup>8</sup> However, recent experiences in the Russo-Ukraine war highlight the vulnerability of the logistics enterprise in a near-peer conflict, where the power of standoff munitions, covert deep sabotage raids, and a lack of established and maintained air superiority have resulted in logistics nodes becoming ideal targets that, when hit, significantly stall operational momentum.<sup>9</sup> Additionally, war gaming efforts to understand the FOE through the vignette of a potential conflict with China in the Indo-Pacific theatre of operations highlight the limitations of the contemporary logistics enterprise: in the Indo-Pacific theatre, allied forces would need to operate logistics bases within the range of various Chinese missile capabilities, and therefore need to consider supply chain diversification

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<sup>6</sup> Canada. Department of National Defence. *Strong, Secure, Engaged. Canada’s Defence Policy*, 49–55; Canadian Joint Operations Command, *Pan-Domain Force Employment Concept*, 13–16.

<sup>7</sup> Canada. Department of National Defence. *Operational Sustainment Modernization Strategy* (Ottawa: Department of National Defence, 2023), 18, <https://www.canada.ca/en/department-national-defence/corporate/reports-publications/canadian-armed-forces-operational-sustainment-modernization-strategy.html>.

<sup>8</sup> Goette, Richard. ‘Air Power Principles’ (Lecture, Canadian Forces College, 8 January 2024), 43.

<sup>9</sup> Bradley Martine, D. Sean Barnett, and Devin McCarthy, ‘Russian Logistics and Sustainment Failures in the Ukraine Conflict. Status as of January 1, 2023’, Research Reports (Santa Monica: RAND Corporation, 2023), 16, [https://www.rand.org/pubs/research\\_reports/RRA2033-1.html](https://www.rand.org/pubs/research_reports/RRA2033-1.html).

to achieve resilient logistics.<sup>10</sup> The concept of contested logistics is neither novel nor unique to the COE and FOE; however, given that operational knowledge across the logistics enterprise is accustomed to the post-9/11 conflicts, it necessitates attention, awareness and integration within the force generation of future logisticians.<sup>11</sup>

5. The United States Army (US Army) has diligently increased its awareness of and attention to the problem space of contested logistics, using Exercise TALISMAN SABRE as a venue to test and build capability in austere over-the-shore joint logistics operations and by establishing the Contested Logistics Cross-Functional Team (CFT) under Army Futures Command.<sup>12</sup> The Contested Logistics CFT is exploring all manner of capabilities that could positively impact future sustainment operations: hybrid power, autonomous resupply capabilities and delivery platforms, real-time total asset visibility systems to increase proficiency and understanding of sustainment demands, and additive manufacturing. Additionally, the CFT is looking to AI and machine learning to provide precision sustainment.

6. Although the CAF has recognized the importance of contested logistics as a key variable to the COE and FOE, institutional changes are required to adjust current practices accordingly. The *Operational Sustainment Modernization Strategy* rightly recognizes the requirement to start with education and training of the joint logistics community of practice, noting that “we must be more flexible, agile and contemporary with our approaches to both education and training” and can no longer “enable and prepare our military logistics professionals by doing more of the same.”<sup>13</sup> As an example of this need for modernization, look no further than the Logistics Officer Course – Land (LOCL) offered through the Canadian Forces Logistics Training Centre (CFLTC). As the centre of excellence for logistician force generation, CFLTC is responsible for the education and development of logistics officers and non-commissioned members across all three service branches (Navy, Army, Air Force). Despite the increasingly threatening narrative of the COE and FOE, CFLTC has made no adjustments to LOCL to improve

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<sup>10</sup> Mark F. Cancian, Matthew Cancian, and Eric Heginbotham, *The First Battle of the Next War. Wargaming a Chinese Invasion of Taiwan* (Washington: Center for Strategic & International Studies, 2023), 117–18, 128; Alan Shaffer and Wilson Miles, ‘Enabling the Joint Warfight. Challenges & Opportunities’, *Winning the Joint Warfight Report* (Arlington: Emerging Technologies Institute, November 2023), 14.

<sup>11</sup> Fox, LTC Amos C. ‘Contested Logistics: A Primer’, *Association of the United States Army (AUSA)*, Landpower Essay No. 24-1, February 2024, 1–2, <https://www.ausea.org/publications/contested-logistics-primer>.

<sup>12</sup> Ashley Roque, ‘Army to Use Operation Pathways to Test Assumptions about “contested Logistics,” Prepositioned Stocks’, *Breaking Defense*, 31 March 2023, paras 4–5, <https://breakingdefense.sites.breakingmedia.com/2023/03/army-to-use-pacific-pathways-to-test-assumptions-about-contested-logistics-prepositioned-stocks/>; Jen Judson, ‘What Is the US Army’s New Contested Logistics Team Working on?’, *Defense News*, 9 October 2023, para. 4, <https://www.defensenews.com/land/2023/10/09/what-is-the-us-armys-new-contested-logistics-team-working-on/>.

<sup>13</sup> Canadian Armed Forces, *Operational Sustainment Modernization Strategy*, 11.

officer force generation and account for the contemporary character of conflict.<sup>14</sup> The most recent logistics officer Occupational Analysis (OA) was conducted in 2001, and while momentum to correct this deficiency is accelerating, what remains unclear is to what extent future force generation will modernize to both reflect emergent realities of the COE and FOE and embrace technological advancements supportive of more flexible, agile, and contemporary logistics officers.<sup>15</sup>

7. Further exacerbating concerns regarding the CAF's ability to sustain a current or future fight is the developing awareness of operational support limitations within the Canadian Joint Operations Command (CJOC).<sup>16</sup> Within the current defence policy, the CAF has committed to being able to force employ multiple concurrent operations ranging in size while simultaneously upholding domestic response capabilities and key alliance commitments to NATO and the North American Aerospace Defense Command (NORAD).<sup>17</sup> Factoring in the realities of contested logistics and ongoing retention issues with the CAF's previous policy commitments, it becomes clear that there will be a lack of human resources available to the CAF to coordinate and execute sustainment operations in the coming years.<sup>18</sup> In conjunction with the CAF's international military partners, and to counter our adversaries' advancements, the CAF and the RCLS should invest in AI and digitization to help address many of these challenges.<sup>19</sup>

### **Artificial Intelligence and Digitization**

8. AI and generative AI (Gen-AI) represent a broad range of technological capabilities (e.g., machine learning, deep learning, human-machine teaming, analytics, automation, robotics, etc.) that the CAF should “rapidly adopt and widely integrate.”<sup>20</sup> AI and other technological improvements present an immense opportunity space for the RCLS to exploit as a means to improve the logistics enterprise for the COE and FOE. In addition to force generation and operational support, AI “has the potential to bring about a profound transformation in supply chain management, resource allocation optimization, and decision-making enhancement.”<sup>21</sup> It is estimated that AI integration in the defence

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<sup>14</sup> Canada. Department of National Defence. *Strong, Secure, Engaged. Canada's Defence Policy*, 49–57; Minister of Foreign Affairs, *Canada's Indo-Pacific Strategy* (Ottawa: Global Affairs Canada, 2022), 2; Canadian Joint Operations Command, *Pan-Domain Force Employment Concept*, 7–8.

<sup>15</sup> Royal Canadian Logistics Service - Integrator (RCLS-I), ‘Royal Canadian Logistics Service Logistics Officer Occupational Analysis & Implementation Plan’ (Virtual, August 2023), 3, 9.

<sup>16</sup> Col A.D. Haynes, ‘CJOC Concept Paper. Operational Support’ (Ottawa: CJOC Director Joint Capability Development, 2023), 20.

<sup>17</sup> Canada. Department of National Defence. *Strong, Secure, Engaged. Canada's Defence Policy*, 17.

<sup>18</sup> Haynes, ‘CJOC Concept Paper. Operational Support’, 3–4; Department of National Defence, *Canadian Armed Forces Retention Strategy* (Ottawa: Minister of National Defence, 2022), II–V.

<sup>19</sup> R. Alan Blackburn, ‘Summary of the 2018 Department of Defense Artificial Intelligence Strategy’, *Department of Defense, Addressing Key Research Challenges in AI: Defense Advanced Research Projects Agency (DARPA)*, 2018, 5.

<sup>20</sup> Canada. Department of National Defence. *Pan-Domain Force Employment Concept*, 25.

<sup>21</sup> ‘Transforming Army Logistics: The AI Revolution’, *Aerospace and Defence Review*, para. 1, accessed 6 February 2024, <https://www.aerospacedefensereview.com/news/transforming-army-logistics-the-ai-revolution-nwid-1385.html>.

supply chain alone could improve the efficiency of the logistics enterprise by 20% or more; in some private sector industry cases “AI-enabled supply-chain management has enabled adopters to improve logistics costs by 15%, inventory levels by 35%, and service levels by 65%.”<sup>22</sup> This is achieved by leveraging AI to improve process efficiency in routine and repetitive tasks, forecasting and predicting future requirements, analyzing large data sets to support more rapid and accurate decisions, and enhancing employee training.<sup>23</sup> For AI to be transformational across the logistics enterprise, it is also necessary to highlight the tandem importance of digitization and data.

9. Digitization is the technical process by which many analogue-based processes are converted to and replaced by a digital process (e.g., the complete processing of a *Leave Authorization Request Form*, CAF form *CF-100*, through a specific software suite that includes secure e-signature and does not require a hard-copy paper trail). By digitizing forms and processes, there comes an evolutionary processing of mass volumes of available data.<sup>24</sup> Accurate data generated through the digitization of processes and modernization of the logistics enterprise is “the most influential underlying enabler of successful Contested Logistics operations,” as logistics intelligence, operations, and capabilities are data-driven.<sup>25</sup> Many of the CAF’s logistics enterprise functions are currently analogue-based; by digitizing and modernizing the enterprise, the CAF will leverage the automation power of AI and Gen-AI, improve data accuracy, and have immediate positive impacts on the sustainment framework.<sup>26</sup> For AI to work, digitization must come first; this will lead to the data sets needed to be of value to future applications, including but not limited to predictive maintenance, wargames, and mission planning.<sup>27</sup>

10. The following sub-sections highlight applications in which key partners have developed and integrated AI-empowered software programs to help contend with many of the same problems facing the CAF’s logistics enterprise. This is done by looking exclusively at components of the logistics enterprise's force generation and sustainment activities. It would be equally valuable and pertinent to consider the force employment,

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<sup>22</sup> Everett Bud Lacroix, ‘Future of Army Logistics. Exploiting AI, Overcoming Challenges, and Charting the Course Ahead’, *Federal Information & News Dispatch, LLC*, 1 August 2023, Digital edition, 1; Joe McKendrick, ‘Artificial Intelligence: Not A Panacea For Supply Chain Issues, But Extremely Helpful’, *Forbes*, para. 4, accessed 6 February 2024, <https://www.forbes.com/sites/joemckendrick/2022/07/14/artificial-intelligence-not-a-panacea-for-supply-chain-issues-but-extremely-helpful/>.

<sup>23</sup> Samuel Fosso Wamba et al., ‘Are Both Generative AI and ChatGPT Game Changers for 21st-Century Operations and Supply Chain Excellence?’, *International Journal of Production Economics* 265 (November 2023): para. 6, <https://doi.org/10.1016/j.ijpe.2023.109015>.

<sup>24</sup> Adeline Frenzel et al., ‘Digitization or Digitalization? – Toward an Understanding of Definitions, Use and Application in IS Research’, *AMCIS 2021 Proceedings*, 2021, 8.

<sup>25</sup> Shaffer and Miles, ‘Enabling the Joint Warfight. Challenges & Opportunities’, 16.

<sup>26</sup> Canadian Armed Forces, *Operational Sustainment Modernization Strategy*, 12.

<sup>27</sup> Lance Menthe et al., ‘Understanding the Limits of Artificial Intelligence for Warfighters: Volume 1, Summary’, *Research Reports* (Santa Monica: RAND Corporation, 2024), vi, [https://www.rand.org/pubs/research\\_reports/RRA1722-1.html](https://www.rand.org/pubs/research_reports/RRA1722-1.html).

force management, and force development aspects; however, they remain beyond the scope of this service paper.

11. Force Generation. Until recently, the Australian Army School of Logistics Operations (ASLO) primarily used training exercises without troops (TEWT) as the mechanism for most of their training delivery. TEWT-based planning iterations embraced the traditional, analogue approach to logistics operations reminiscent of pre-9/11 warfighting: linear, non-contiguous battlespaces that allowed for the tactical conduct of sustainment operations across the system of echelons. Since 2020, ASLO has integrated AI training software into their courseware.<sup>28</sup> Logisticians are trained on the same software interfaces used by operational line units across the Australian Defence Force (ADF), including the decision support and analysis tool – the Battle Management System (BMS) – and the logistics-specific Vital Planning and Analysis (ViPA) tool. In a digital training environment, AI aids in developing future sustainers as they work through a series of planning and staff activities expected of logisticians operating within tactical command posts (e.g., developing and maintaining a common operating picture (COP) and a logistics common operating picture (LCOP), planning sustainment convoys, various delivery operations, and resource distribution calculations). The ADF’s *Defence Science and Technology Group* (DST Group) initially led the development of ViPA in 2006 for their own purposes; recent developments from industry offer a more accessible option for wider audiences.<sup>29</sup>

12. *SitaWare Aspire* is a commercial off-the-shelf AI training interface that matches many of the capabilities that the ASLO program offers: a “‘train as you fight’ approach provides users with experiences that reflect real-life scenarios” that could be encountered on deployment while navigating and operating the actual interface.<sup>30</sup> Training products like *SitaWare Aspire* benefit a fighting force by maximizing training and accelerating integration and interoperability amongst partners. Leveraging the total utility of the *SitaWare* suite of software products can link force generation efforts directly to force employment. NATO and other users have integrated the *SitaWare Headquarters* system into their operations to enhance real-time situational awareness, simplify critical decision-making, and increase operational efficiency; troop-contributing nations can procure stand-alone licences, train on *Aspire* prior to deployment, and seamlessly integrate into their battlegroups upon deployment.<sup>31</sup>

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<sup>28</sup> ‘Army School of Logistics Operations Modernisation’, The Cove, accessed 29 January 2024, <https://cove.army.gov.au/article/army-school-logistics-operations-modernisation>.

<sup>29</sup> Lange, ‘The Vital Planning and Analysis (ViPA) ORBAT Data Service Architecture and Design Overview’ (Edinburgh: Joint and Operations Analysis Division, Defence Science and Technology Group, 2016), 6.

<sup>30</sup> Systematic, ‘SitaWare Aspire’, accessed 29 January 2024, <https://systematic.com/en-gb/industries/defence/products/sitaware-suite/sitaware-aspire/>.

<sup>31</sup> ‘C4I System | Command and Control | Shared Situational Awareness’, accessed 29 January 2024, <https://systematic.com/defence/products/a/command-and-control-information-systems/command-control-information-system/>; Hemanth, ‘Systematic to Provide SitaWare Headquarters System to German Army’,



13. Force Sustainment. The logistics enterprise will be challenged within the FOE due to the increased threats posed to supply chains, reduced freedom of movement and mobility, and resource constraints from personnel to materials. Connecting data sets and using AI to interpret the volume of available data increases asset visibility to ensure operations are sustained.<sup>32</sup> Like most militaries, the CAF uses a wide variety of custom and commercial off-the-shelf software suites to perform functions from personnel to supply-chain management. Unfortunately, most of the software suites are limited in their ability to communicate data across platforms. Bespoke AI software programs - like those offered by Palantir - have the “capacity to gather and analyze extensive data from various sources” and sensors, including military systems of records and non-military systems, to enable “more informed decision-making and efficient logistics operations.”<sup>33</sup>

14. In partnership with Palantir, the US Army has been developing *Army Vantage* since 2018. *Army Vantage* is a cloud-based next-generation logistics enterprise data analytics platform that connects new and legacy systems to draw relevant data to support decision-making across the force.<sup>34</sup> The US Army touts *Army Vantage* as “enabling Army users at every level and across classifications to view comprehensive Army-wide data, analyze trends and make data-driven decisions.”<sup>35</sup> At the basic level the platform aids in automating ad hoc reporting, routine work, and readiness reporting, while at the advanced level it aids with modelling and predictive analysis.<sup>36</sup> By integrating over 160 source systems and over 30,000 datasets from across the US Army, *Army Vantage* can establish real-time visibility and improve demand forecasts, amongst other things.<sup>37</sup>

## CONCLUSION

15. AI offers a broad range of utilities to the CAF. The specific business use cases offered to the logistics enterprise range from the tactical through strategic levels of the sustainment framework, with the added potential to positively impact the force generation of logisticians and the force sustainment of the logistics enterprise as highlighted in the cases of the ADF and US Army.

16. The CAF is currently experiencing the power of AI thanks to its integration within NATO operations. Most notably, the CAF’s enhanced Forward Presence

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*Army Technology* (blog), 2 July 2019, <https://www.army-technology.com/news/systematic-sitaware-headquarters-germany/>.

<sup>32</sup> ‘Emerging Technology Horizons: Enabling Logistics in Contested Environments’, accessed 29 January 2024, <https://www.nationaldefensemagazine.org/articles/2024/1/5/emerging-technology-horizons-enabling-logistics-in-contested-environments>.

<sup>33</sup> Lacroix, ‘Future of Army Logistics. Exploiting AI, Overcoming Challenges, and Charting the Course Ahead’, 2.

<sup>34</sup> Palantir, ‘Logistics & Supply Chain’ (Palo Alto, 2022), 1–2; ‘The Army’s Vantage Point’, [www.army.mil](https://www.army.mil), accessed 29 January 2024, [https://www.army.mil/article/237749/the\\_armys\\_vantage\\_point](https://www.army.mil/article/237749/the_armys_vantage_point).

<sup>35</sup> US Army PEO EIS, ‘Army Vantage. Unit, Soldier and Equipment Readiness’, 2022, 1.

<sup>36</sup> ‘The Army’s Vantage Point’.

<sup>37</sup> Palantir, ‘Logistics & Supply Chain’, 1–2.

Battlegroup (eFP BG – Latvia) is currently using the *SitaWare Headquarters* suite of software tools provided by Systematic to aid with the command and control of NATO’s most diverse multinational battlegroup on the Eastern Front.<sup>38</sup> The wide range of *SitaWare Headquarters* end-users both within and outside of NATO has proved very successful and it has eased many of the burdens associated with interoperability, likely resulting in the expanded procurement of licences made by key allies.<sup>39</sup>

17. Low-entry commercial off-the-shelf solutions offer accessible avenues into the digitization and AI world. Exploring field-tested solutions used by trusted partners may aid in contextualizing the value proposition of software procurement. Exposure to AI interfaces will better prepare logisticians for the realities of force employment within the COE, and aid in managing the obstacles posed by contested logistics in the FOE. Leveraging the power of digitization and AI will allow the CAF’s logistics enterprise to reduce error rates, increase overall efficiency and effectiveness, and contend with the realities of a diminishing workforce; digitization and AI will have a force-multiplying effect on the CAF if embraced to its full potential.

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<sup>38</sup> ‘Sub-Unit Capability Brief; eFP BG LATVIA 23-02’ (Riga, 16 August 2023), 10.

<sup>39</sup> Systematic, ‘British Army Makes Major Commitment to SitaWare’, accessed 7 February 2024, [https://systematic.com/en-gb/industries/defence/news-knowledge/news/2023\\_british-army-makes-major-commitment-to-sitaware/](https://systematic.com/en-gb/industries/defence/news-knowledge/news/2023_british-army-makes-major-commitment-to-sitaware/).

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