





Developing Engineering Capabilities Through the Canadian Army Capability Development Continuum

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DEVELOPING ENGINEERING CAPABILTIES THROUGH THE CANADIAN ARMY CAPABILITY DEVELOPMENT CONTINUUM

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DEVELOPING ENGINEERING CAPABILTIES THROUGH THE CANADIAN ARMY CAPABILITY DEVELOPMENT CONTINUUM

AIM

1. This paper contends that the Canadian Army (CA) will continue to face gaps in terms of its engineer capabilities based on a narrow approach to engineering input in the Army Capability Development Continuum (ACDC). An examination of the ACDC process and existing organizational structures offers insight into the extent engineer capability development is reflective of future threat designs. Recommendations are then provided for strengthening the integration of engineer capabilities across the CA. Where this paper provides an engineering perspective on the CA capability development process, amendments to current engineer capabilities and equipment fall outside the scope of the research and would require further examination.

INTRODUCTION

2. The Canadian Armed Forces (CAF) capstone document titled *Close Engagement – Land Power in an Age of Uncertainty* defines a capability as "the ability to carry out a military operation to create an effect."¹ To meet mission requirements in the evolving global environment, the CAF must constantly evaluate its structure and capabilities. Where *Strong, Secure, Engaged* (SSE) provides the long-term vision that guides defence capability investment, a Capability Based Planning (CBP) approach helps the CAF make strategic decisions related to capability development.² However, the CAF has also identified the need to adjust its enterprise to meet requirements. ³ As a result, future success requires a broader set of military capabilities integrated across domains and levels, and coordinated with other government partners.

3. Falling under the direction of the CA, the Corp of Royal Canadian Engineers' (RCE) primary role is to "assist friendly troops to live, move and fight, and to deny the same capability

¹ Department of National Defence, *Close Engagement - Land Power in an Age of Uncertainty* (Kingston, ON: Canadian Army Land Warfare Centre, 2019), 42.

² DND/CAF utilizes the Defence Capability Development the Program (DCDP) to govern CAF capability development. In addition to outlining departmental roles and responsibilities with regards to capability development and procurement, the DCDP describes how a Capability Based Planning (CBP) approach enables DND/CAF to meet governmental defence objectives. CBP delivers an overview of the strategic CAF capability portfolio, defines future requirements based on modern threats and trends, assesses risks, and identifies which capability areas require Investment, Divestment and Sustainment (IDS) decisions. The CBP is therefore a key institutional process that governs capability development in the CAF, albeit the

identified need for renewed military conceptual thinking. See Canada, *Strong, Secure, Engaged: Canada's Defence Policy* (Ottawa, ON: Department of National Defence, 2017), 8; Department of National Defence, Capability Based Planning Handbook (Gatineau, QC: National Printing Bureau, 2019), 2-5; Paul K. Davis, *Analytic Architecture for Capabilities-Based Planning, Mission-System Analysis, and Transformation* (Santa Monica, CA: RAND Corporation, 2002), xi.

³ Department of National Defence, *Close Engagement - Land Power in an Age of Uncertainty,* 9; Department of National Defence, "Evaluation of the Defence Capability Development Program," Assistant Deputy Minister (Review and Services), November 2017, https://www.canada.ca/content/dam/dnd-

mdn/migration/assets/FORCES_Internet/docs/en/about-reports-pubs-audit-eval/294p1258-3-003.p.df

to the enemy."⁴ Across the full spectrum of operations, the RCE ensures that mobility, counter mobility, survivability of CAF manoeuvre forces are met, and must therefore ensure that capabilities are conceptualized and developed in a way that reflects these mandates.⁵ However, and despite the RCE's significant contributions to past operations, RCE Corp staff have identified a gap in the ability to ensure the development of engineer capabilities reflect future capability requirements. Current development initiatives tend to prioritize updating old equipment, filling immediate gaps through Urgent Operational Requirements (UORs), or are based off RCE traditional practices. This contrasts with the CA's desired approach of a systematic development of pan-CA operational imperatives and requirements.

4. Although CAF CBP is led by the Chief of Force Development (CFD), critical considerations contributing to this analysis are obtained from the components across the CAF. The CA is specifically mandated to force generate land capabilities to attain Canadian defence objectives across the full spectrum of operations.⁶ CA capability development and force management is governed through the ACDC, which consists of four pillars – Conceive, Design, Build and Manage.⁷ Given that the ACDC enables force design planning and integrates specialized capabilities into force packages, examining the ACDC can identify areas where RCE input can be optimized to ensure capability effectiveness against threats, and facilitate capability integration across the CA.

DISCUSSION

RCE Advisor Input into the ACDC

5. The CA HQ is shaped around a continental staff structure, with future planning and capability development nested under the Chief of Staff Army Strategy (COS A Strat) line of governance.⁸ The ACDC includes governance bodies such as the Army Capability Development Board (ACDB), which integrates CFD's CBP-based practices and methodologies to enable CA capability development. While CA HQ staff and advisors oversee and execute CA capability development and governance, each regiment, corp, and branch within the CA has an equal obligation to contribute to the process.⁹ However, the compartmentalization of capability development and management by regiments or other similar entities poses a challenge to the CA's ability to create and design new military capabilities that address future trends and threats.

⁴ Department of National Defence, B-GL-361-001/FP-001, *Engineers in Operations*, 1st ed. (Kingston, ON: Army Doctrine Centre, 2018), 1-1.

⁵ Examples of military engineer support to operations, which encompasses tasks that span the spectrum of military engineering in the CAF, can be found in the following article: Nicholas Vlachopoulos, Patrick Heffernan and Gordon Wight, *Canadian Forces Military Engineering in a Global Framework* (Kingston, ON: Royal Military College of Canada, 2009).

⁶ Canadian Army Staff, "Canadian Army Placemat," PowerPoint briefing (Ottawa, ON: 2020).

⁷ Canadian Army Staff, "Army Governance," PowerPoint briefing (Ottawa, ON: August 2015), slide 10.

⁸ The continental system uses a letter and number system to delineate staff functions and specialties. See Department of National Defence, B-GL-300-003/FP-000, *Land Force Command* (Ottawa, ON: Directorate of Army Doctrine, 1996), 70.

⁹ Regiments, corps, and branches are generally represented a combat, combat support, or a combat support element. This paper uses the term branch and regiment to capture the concept of land force element structures. See Department of National Defence, B-GL-300-001/FP-001, *Land Operations* (Kingston, ON: Chief of the Land Staff, 2008), 1-4.

6. The Director of the RCE (Dir RCE) is the primary RCE advisor to the Commander of the CA (CCA). The role of Dir RCE is to support and enhance the CCA's decision-making process by providing advice on strategic policy, force development, training, and personnel.¹⁰ Dir RCE also guides engineer capability development as part of the ACDC. Despite the appointment being fulfilled as a secondary duty, Dir RCE exposes critical gaps across the spectrum of regular and reserve force engineering capabilities to Comd CCA.¹¹ This is further demonstrated by incorporating multiple perspectives, such as a lack of interoperability with coalition forces, for consideration in the development of future capabilities.¹² However, given Dir RCE's multiple areas of focus, defining and understanding linkages between threat analyses and as other areas that inform engineer capability development requires supporting efforts.

7. Dir RCE is supported by a virtual staff. Deputy Dir RCE, for example, is Commandant of the Canadian Forces School of Military Engineering (CFSME). CFSME also houses the RCE Center of Excellence (COE), which is responsible for the coordination and maintenance of the intellectual foundation necessary for input to engineer capability development.¹³ Depending on whether others practice the capability, the COE also adopts a "policing" role to ensure policies are up to date and being followed. The use of explosives, for example, spans multiple trades and components. However, as the training authority for military engineering training and development, CFSME's focus is indeed on training. Thus, while CFSME conducts tactical level analyses of specific threats, they are not directly responsible nor staffed to conduct analysis for higher, strategic level concepts.

ACDC Organizational Structure

8. One of the significant factors hindering the RCE's ability to ensure that engineering capabilities are designed to be responsive to future threats, is the structure of personnel and positions directly responsive under the ACDC. The Engineer Support Coordination Center (ESCC) is the only dedicated engineer advisory cell located in the CA HQ. The ESCC focuses on providing support to current operations and supports capability development activities such as UORs. However, while the current CA HQ's structure sustains CA force generation activities, it is arguably a design that places a stronger emphasis on the current state of its capabilities versus focusing on future capability requirements.

9. Under COS A Strat, responsibility for capability development is divided among its directorates. Three organizations are of particular interest to understand the gaps in engineering input to the ACDC: Canadian Army Land Warfare Center (CALWC) Director Land Force Development (DLFD), and Director Land Requirements (DLR). First, CALWC champions the

¹⁰ Dir RCE is directly engaged with the career management of RCE members. This focus is imperative in order to sustain the health of the branch, and for personnel retention.

¹¹ Current Dir RCE is a senior staff officer in a CA divisional HQ. See Commander Canadian Army. 5025-2 (CA

Talent Mgt), *Appointment – Director of The Corps of Royal Canadian Engineers* (Ottawa, ON: 25 March 2021), 1. ¹² Input and advice from RCE advisors is collected through working groups such as the Dir RCE Conference, and the Doctrine, Equipment, Infrastructure, Research and development, Training Working Group (DEIRTWG). The former working group is attended by RCE commanders and supporting staff, including those from CFSME. The latter working group is primarily attended by Dir RCE, Army Doctrine Center (ADC) staff, and Director Land Requirements engineer staff (DLR-7).

¹³ This includes joint capabilities, such as countering explosive threats.

Conceive and Design pillars of the ACDC, and develops operating concepts that inform capability requirements across the operational functions – Command, Sense, Act, Shield, and Sustain – for future land operations. Guided by the SSE, Force posture and Readiness (FPR) and Force Mix Structure Design (FMSD) frameworks, CALWC anticipates change, conceives the Army of the Future, designs the Army of Tomorrow, informs capability integration, and conducts interoperability coordination.¹⁴ To create CA concepts, threat profiles and operational contexts are overlaid on current trends and technological availability to identify what capabilities the CAF requires in order to meet emerging threats and capabilities.¹⁵

10. The CA integrates capabilities to achieve the CA's two core competencies – Close Combat (CC) and Close Engagement (CE). In particular, the capstone concept *Close Engagement* (CE) is realized through the development of functional concepts based on the operational functions.¹⁶ These concepts provide essential details for the Build pillar of the ACDC, which involves the integration of capabilities to produce validated designs for force equipment, doctrine, and structures.¹⁷ Additionally, the development of functional concepts necessitates collaboration between CALWC and stakeholders within and outside the CA. To this effect, CALWC incorporates specific capability considerations from different trades and branches within CA, but it does not directly employ personnel to think exclusively from the perspective of these specialized areas of expertise.

11. The third pillar of the ACDC, which is the Build phase, is led by DLFD. DLFD supports the realization of CAF joint capabilities and the Army of Tomorrow by integrating CA capability components.¹⁸ This includes the development of force structures, synchronization of doctrine and equipment procurement, training, and the CA Master Implementation Plan (MIP). One of DLFD's lines of effort, the Joint Counter Explosive Threat Task Force (JCET TF), sees the permanent employment of engineer staff. However, the JCET TF's focus is on countering explosive threats, and thus informs the CCA on one aspect of the overall spectrum of RCE capabilities. Moreover, where DLFD focuses on the integration of capabilities across trades, this is an organization that could benefit from RCE personnel dedicated to providing systematic, coordinated engineer advice to enhance the spectrum of CA capabilities.

12. The Force 2025 initiative illustrates one way that the development of CA concepts has implications for the RCE. As part of the line of effort 4 priority initiatives identified in *Advancing With a Purpose: The Canadian Army Modernization Strategy*, DLFD is responsible for leading the realignment of CA force structure and missions.¹⁹ The primary goal is to determine a structure where CA to generate sustainable Ready Forces that meet the mission

 ¹⁴ Department of National Defence, *Advancing with purpose: The Canadian Army Modernization Strategy*, 60.
¹⁵ Chief of Force Development, Concept Note 22-01: A Primer on Concepts 2022-2023 (Ottawa, ON: 14 November 2022), 3-4.

¹⁶ Department of National Defence, *Close Engagement - Land Power in an Age of Uncertainty*, 9.

¹⁷ Close Engagement - Land Power in an Age of Uncertainty, 42.

¹⁸ Six factors are considered to provide the institutional cost to the production of a given capability. The factors include: Personnel and Leadership; Research and Development; Infrastructure; Environment and Organization; Concepts and Doctrine; Information Management and Technology; Equipment and Support; and Generate. This construct is used to break down capabilities into areas of functional responsibility. See Department of National Defence, Capability Based Planning Handbook, 49.

¹⁹ Department of National Defence, Advancing with purpose: The Canadian Army Modernization Strategy, 45.

concurrency requirements based on the SSE, FPR and FMSD frameworks, and operate within a pan-domain environment against peer adversaries.²⁰ Since the brigade group serves as the lowest level of headquarters in the CA that is able to coordinate joint effects and conducts pan domain operations, it is one of the principal structures under review. Moreover, this evaluation includes a preliminary analysis of how engineers are organized to support a brigade operating in a contemporary operating environment.

13. The current CA brigade structure sees Combat Engineer Regiments (CER) attached to the brigades. 1, 2, and 5 CER provide close support, and the 4th Engineer Support Regiment (ESR) provides general support. However, a revisit of this structure could result in alternatives, such as CERs providing either general or direct support, or shifting of the engineer regimental headquarters to another level or command group.²¹ Given this analysis spans several capability components and organizations, such as doctrine, training systems, and the regiments, it is necessary to converge and synchronise the RCE's inputs and advice to best support DLFD's analysis.

Developing Capabilities by Operational Function Versus Trade

14. Although DLFD leads the build phase of the ACDC, other CA stakeholders, such as the Army Doctrine Center (ADC) and the Directorate of Land Requirements (DLR) provide direction and inputs to the process. As the authority for CA doctrine, ADC reviews and produces doctrine manuals, coordinates the production of Tactics, Techniques and Procedures (TTP) manuals, provides CA input to joint doctrine development, and works toward the achievement of Army interoperability.²² On the other hand, DLR provides operational direction and secures department approval for the acquisition and management of select CA equipment, which contributes to the generation and sustainment of combat effective army capabilities. DLR's responsibilities include: identifying operational equipment deficiencies; fulfilling UORs; prioritizing equipment procurement and life cycle management; and maintaining situational awareness of modern technologies.

15. ADC has engineers working on general doctrine advancements and are responsible for the engineering interpretation of higher-level capability development concepts. However, much of the RCE's current and future capability development is driven by DLR projects. Unlike CALWC, which is organized by operational functions, DLR's procurement sections are loosely organized by trade or branch, with organization flexibility to reorganize based on span of control. For example, DLR-7 is identified as Mobility, counter-mobility, and survivability systems. As a

²⁰ Department of National Defence, *Land Operations 2021: The Force Employment Concept for Canada's Army of Tomorrow* (Kingston, ON: Directorate of Land Concepts and Design, 2007), 32.

²¹ Direct support is the support provided by a unit not attached to or under the command of the supported unit or formation but required to give priority to the support required by that force. Close support is the provision of intimate support (mobility, counter-mobility, and survivability) to the commander of a maneuver force to execute tasks of immediate concern to operations. General support is the engineer support provided to a formation or unit as a whole and not dedicated in either direct support or close support to any particular formation or unit. See Department of National Defence, B-GL-361-001/FP-001, *Engineers in Operations*, 1-2 to 1-3.

²² Department of National Defence, "Canadian Army Doctrine and Training Centre (CADTC)," last modified 25 January 2023,

https://www.canada.ca/en/army/corporate/canadian-army-doctrine-and-training-centre.html.

result, significant RCE personnel and efforts are oriented towards the management of equipmentbased capability projects that fall under this section. Notwithstanding these efforts, DLR-7 is not responsible for the conduct of a holistic examination of future engineering capability requirements and gaps, such as a review of search capabilities from a pan-CA lens.

16. Across the ACDC, and even within organizations that have been divided up into trade specialties such as DLR, engineering capability development competes with other force elements for funding. The CA has a "wide spectrum of equipment and systems, all of which require recapitalization on a recurring basis if it is to maintain military and technical advantage.²³ Due to limited funding, prioritization is essential. However, and as demonstrated in the Bridge and Gap Crossing Modernization Project (BGCM), prioritization does not mean guaranteed funding, and a lack of funding may reduce the scope of projects.²⁴ Additionally, DLR manages projects over timelines that can span decades, which limits their ability to pivot away from these initiatives. Finally, the current process also forces the development of capabilities that fit into existing support systems, such as infrastructure. As a result, focus and prioritization shifts leads to shelved projects, isolated capabilities, and a reduction of relevant capabilities.

17. A lack of integration across trades and regiments has created a gap that affects the development of RCE capabilities and CA capabilities more broadly. For instance, the CE concept identifies the need for specific force packages, such as the "empowered combined arms team (ECAT)."²⁵ However, *Advancing With a Purpose* provides further guidance on CA force development, and emphasizes the importance of realigning CA force structure and missions to invest in new capabilities while divesting others with "lesser relative benefit." ²⁶ This requires difficult decisions to be made at the CCA level as well as within the CA trades. In contrast, the current organizational structure has led to situations where each regiment identifies trade-based capability requirements based of the broader needs of the CA. This trend is evident in the costbenefit analyses of maintaining a minimum footprint of an acquired capability, instead of treating it as consumables and divesting it.²⁷ Furthermore, sidelined organizations have resisted changes in order to mitigate their ability to gain funds and develop their specific capabilities. Consequently, the regimental system can be considered counter-productive to capability development.

CONCLUSION

18. Future success in the achievement of Canadian defense objectives requires a broader set of military capabilities integrated across domains and levels. To facilitate this integration, and to grow the capacity to provide specialist input into CA concepts, it is necessary to deliberate how the CA HQ is structured. Integration across regiments, corps and branches occurs throughout the

²⁴ Department of National Defence, "Bridge and Gap Crossing Modernization," last modified 9 January 2020, http://dgpaapp.forces.gc.ca/en/defence-capabilities-blueprint/project-details.asp?id=1015.

²³ Department of National Defence, Advancing with purpose: The Canadian Army Modernization Strategy, 28.

²⁵ ECAT is defined as central core of a sub-unit that is organized and re-organized as required by its current set of tasks. See Department of National Defence, *Close Engagement - Land Power in an Age of Uncertainty*, 23.

²⁶ Department of National Defence, *Advancing with purpose: The Canadian Army Modernization Strategy*, 4th ed. (Ottawa, ON: National Printing Bureau, 2020), 45.

²⁷ An example of the sustain versus divest debate would be the Expedient Route Opening Capability (EROC), which was procured based on a UOR from the Canadian mission in Afghanistan.

ACDC. However, the current input structures tend to make Corps/Branch focus on protecting allocated resources and advancing projects that may not fully converge on operational concepts. This creates conflicts between what the CA's needs and those of the regiments.

19. The ACDC also lacks the structures and positions that allow for a focus on the engineering nexus to CA concept development. This observation can be extended to other trades besides the RCE. However, RCE advice must also be based on a systematic and deliberate evaluation of RCE capabilities. Without a more robust and coordinated approach to providing engineer input to CA concept development, RCE capabilities will remain partially blind to future threats.

RECOMMENDATION

20. This paper recommends that the CA HQ and RCE reassess the current input mechanisms of the ACDC to ensure that it is conducive to growing a capacity to think and provide RCE input into CA concepts. This can be accomplished by:

- a. Mandate positions in CALWC and DLFD to specifically consider the engineering nexus to CA concepts and capabilities. These positions must have a direct link into the RCE capability development governing system;
- b. Create, or repurpose an RCE team of personnel to oversee engineering input to CA concepts and capabilities;
- c. Leverage the Dir RCE's role in career management to identify analytical talent within the RCE Corp, which can in turn be reallocated to support RCE capability planning at the CA HQ level; and
- d. Map the connections between the CA concepts, capability components, and the suite of RCE capabilities, and capture this analysis in the RCE capability map. This will ensure that a common operating picture is established within the RCE, RCE capabilities gaps are understood by key stakeholders, and capabilities can be properly linked back to future threat assessments.

21. The scope of this paper was limited to on an examination of national capability development structures. Further investigation into international practices and lessons learned will contribute to the refinement of a more optimized structure and approach to RCE capability development.

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