Strategic Influence Reconsidered:
Defence Research and Combat Development in Canada's Early Cold War Army

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Throughout the twentieth century, even when not at war, professionally-minded citizen armies continued to think about future conflicts; in particular what they might be like, where they might take place, against whom, and if possible, why. As well, armies that were smart enough to think ahead did what they could to be ready for the next conflict through engagement in strategic foresight activities, the investigation of new ideas and concepts, the examination and assessment of emerging trends, the creation of new doctrines, and the development of robust physical, intellectual, and social capital within their standing armies. Finally, commanders would often seek to train their soldiers for tasks both probable and possible, knowing all the while that despite the best efforts and preparations it would be impossible to fully anticipate every possibility, and therefore, mitigate all future risk.[1]

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[1] See Andrew B. Godefroy, "Chasing the Silver Bullet: The Evolution of Capability Development in the Canadian Army", *Canadian Military Journal* .8, no.1 (Spring 2007): pp.53-66. More recently the author recycled these words yet again in a draft editorial prepared for the Chief of Army Staff Strategy, see Editorial, *Canadian Army Journal* 15, no.1 (Spring 2013).

From early pre-Confederation militias to modern regular armies, Canada's soldiers have always sought to innovate and adapt to overcome the many threats and challenges they have faced throughout history. These two attributes -- innovation and adaptation -- were in fact often considered the essential hallmarks of success in Western democratic citizen armies, and the Canadian soldier's continued achievement in both war and peace often depended greatly upon his or her ability to consistently embrace these ideals. Institutionally, innovation and adaptation have also always been the essential means by which any modern army has successfully evolved from an idea or a concept on paper to an actual physically equipped force deployed on the battlefield. Driven by the efforts of enterprising individuals, at some point, , the deliberate codification of an institutional approach to conceiving, designing, building, and managing modern land forces -- a tremendously complex process that eventually became known in twentieth-century military circles as "combat development" -- evolved out of these previously less formal and isolated wartime endeavours.

Canada's credibility as a nation that could successfully engage in combat development by conceiving, designing, equipping, mobilizing, deploying and commanding massive citizen armies that could fight and win was solidified by a series of deliberate engagements in defence of the British Empire in the nineteenth century, as well as two incredibly destructive world wars between 1914 and 1945. Yet just as the army had mastered much of what was required to build effective forces for conventional war, the very nature of warfare changed so dramatically that soldiers soon found themselves having to seriously reconsider the very foundations of their long established *modus operandi*. The advent of the American atomic bomb in 1945, and its replication by the Soviet Union shortly thereafter, cast a long shadow over the great conventional military victories of the Second World War. The nuclear weapons[2] that came to define much of the era that followed, commonly referred to as the Cold War era, threatened instant destruction on a magnitude without any precedent in the history of land warfare. The introduction of these technological nightmares onto the battlefield posed new, unique, and very serious problems for all the western allies including the postwar Canadian Army.

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[2] When these weapons were first introduced they were commonly referred to in literature and speeches as Atomic bombs or atomic weapons. The switch to the use of the term 'nuclear' was only officially introduced in the 1950s, and even then the term atomic bomb persisted in popular culture for some time afterwards.

The loss of the American nuclear weapon monopoly in 1949, when the Soviet Union detonated its own first atomic weapon, forced the United States and the recently created North Atlantic Treaty Organization (NATO) allies to not only address the issues surrounding the inevitable future of nuclear weapon parity, but also to rapidly come to grips with the fact that existing NATO conventional armies were completely outmatched on the ground in a newly divided Europe. Towards the end of the 1940s, allied military intelligence assessments estimated that Soviet Union's combat capable conventional ground forces deployed stride of the east-west political divide consisted of approximately 2.5 million men organized into approximately 175 divisions. It was also estimated that this entire force of arms could be mobilized for major combat operations against Western Europe within five to seven days.[3] The imbalance of conventional military power between NATO and the Soviets worsened even further in the early 1950s, when in response to the political and military formation of NATO the USSR brought its own national satellites into a Treaty of Friendship, Cooperation, and Mutual Assistance known as the, *Dogovor o druzhbe, sotrudnichestve i vzaimnoy pomoshchi*, or what the west labeled as the Warsaw Pact.

Soviet and communist influenced military aggression in Europe and elsewhere after the end of the Second World War encouraged the Canadian government to implement a defence policy designed to protect Canada's sovereignty and national interests, as well as promote bilateral and collective security arrangements that would improve its chances for longer term security and prosperity. At the same time, Canada's defence policy sought to develop a credible and salient military capability that could be deployed alongside the country's primary allies, Great Britain and the United States of America. For Canada's army, specifically, this meant pursuing options that were within its own fiscal and physical means yet still aimed at creating an effective military deterrent to Soviet aggression, while promising mutually assured destruction

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[3] United Kingdom National Archives [UKNA]. Chiefs of Staff [COS] (48) 164th meeting, 17 November 1948 DEFE4/17; and Joint Intelligence Committee [JIC] (48) 100 (Final) agreed Anglo-American intelligence appreciation of Soviet intentions and capabilities for the period 1949 and 1956/57. For a more recent analysis based upon Soviet sources that largely validated this estimate see Dimitri N. Filippovych, "The Logistics System of the Soviet and Warsaw Pact Armed Forces in the 1950s and 1960s", in Jan Hoffenaar and Dieter Krüger (eds.). *Blueprints for Battle: Planning for War in Central Europe, 1948-1968* (Lexington: University Press of Kansas, 2012), pp.109-119.

and massive irreplaceable attrition of Soviet military power using tactical atomic weapons supported by hardened conventional forces.

To counter the Soviet dominated Warsaw Pact, the U.S.-led NATO forces initially opted for an offensively postured forward defence strategy that sought to delay any possible advance of enemy ground forces in wartime with tactical nuclear weapons, thus giving friendly European nations desperately needed time to bolster their own defences, or if necessary, evacuate their own populations towards the Iberian coast.[4] America, Britain, and Canada, (known during this period simply as the ABC Association) also sought whatever wisdom they could gain on fighting the Russian Army through the pursuit of collaborative study, concept development, experimentation, and training.[5] In Canada, these activities began with the detailed academic study of Soviet performance during the Second World War, specifically during their failed military campaign in Finland in 1939-40, for new insight on how one might conduct successful defensive operations against their new main adversary.[6] Additionally, German officers who had fought against and were captured by the allies in wartime now freely shared their experiences and lessons from the war against the Soviets on the Eastern Front. Although it was learned much later during the post-Cold War years that ex-Nazis seeking to ingratiate themselves to their new NATO masters had often been less than truthful in their facts and analyses of Russian performance and outcomes, at the time the Canadian Army and others believed that German operational and tactical solutions inspired by the likes of legendary strategists such as Carl von Clausewitz offered credible solutions to defeating the Soviet adversary on the ground.[7]

[4] UKNA. COS. 55th Meeting, 13 April 1949. DEFE 4/21, JP (49) 3 (Final). Known as plan 'Speedway' – the plan to evacuate Europe in the face of Soviet aggression.

[5] The term Russian or Red Army is applied until at least 1948, after which the USSR adopted the new title Soviet Army. See Leo J. Daugherty III. "Preparing for the Long War: The United States Army and the Early Cold War Period, 1945-1950", *Journal of Slavic Military Studies* 23 (2010): pp.490-516.

[6] DND. Canadian Army Operational Research Establishment [CAORE]. H.A. Bauer and F.G.B. Maskell. *The Battle of Suomussalmi.* Memoranda No.13 dated July 1952; see also R.W. Rae. *Winter Military Operations in Northern Finland, 1941-44.* Memoranda No.16 dated November 1953. These studies also supported the development of experimentation objectives for Canadian Army northern (defence of Canada) exercises that took place between 1948-1953.

[7] This thesis has gained increasing momentum since 2005. For a recent example see Stephen L. Melton's book length study, *The Clausewitzian Delusion: How the American Army Screwed Up the Wars in Iraq and Afghanistan (A Way Forward).* (Minneapolis: Zenith Press, 2009). Professor Joseph Buckley also expressed

Yet even with this knowledge in hand, however, there remained much more work to be done.

A Systemic Approach to Defence Research

In his classic study on the relationship between the soldier and the state published at the height of the Cold War, American political scientist Samuel Huntington argued that in order to assess the efficacy of an army's fighting abilities, it was necessary and essential to study what its captains, majors, and lieutenant colonels were thinking and doing.[8] Similarly, the innovation and adaptation exercised by those military officers and their civilian defence scientists and engineers – essentially the middle men of military change – that shaped nearly every aspect of the Canadian Army's response to the threat of future conflicts between the end of the Second World War in 1945 and the final departmental unification of the three armed services into a single Canadian Forces in 1968, offers historians a valuable framework in which to assess the challenges, opportunities, and limits of the army's influence on strategic change in Canada during the early Cold War era.

The nature and growing complexity of army projects undertaken in Canada during the Second World War – including everything from the development of individual soldier systems to main battle tanks – demanded greater management and coordination to be both successful and cost effective. During the war years, American management consultant Peter Drucker introduced the idea of management by objective to the field, a new concept in which managers and professionals jointly negotiated the objectives of a project.[9] Around this time, he also coined the phrase "knowledge workers," describing the type of scientists, engineers, military staff, and policy makers that would become the central managers and actors in future organizational problem solving and project development during the Cold War era. Though Drucker made

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similar comments during a presentation to the Changing Character of War Programme at Oxford University on 18 November 2009. His presentation was titled, "The British Army in Normandy 1944: A Job Well Done?" and examined among other topics the turgid nature of postwar German combat analysis.

[8] Samuel Huntington, *The Soldier and the State: The Theory and Politics of Civil-Military Relations* (Cambridge, Mass.: Harvard University Press, 1957), p. 255.

[9] Drucker wrote nearly forty books on management over six decades. Germane to this study is Peter Drucker, *The Future of Industrial Man* (New York: John Day Company, 1942).

incredibly accurate predictions concerning the rise of knowledge industries in the postwar era, his initial concepts of management by objective still reflected too much of the era before the war. Management by objective alone could not and did not work in complicated defence programs such as the Manhattan Project, the name given to the atomic bomb development effort. Instead, the completion of massively complex military projects such as nuclear armaments, radar, jet technology, and chemical and biological warfare demanded clear leadership, though such direction could now come from not just soldiers but also scientifically and technically trained persons dedicatedly solely to the coordination and flow of information between distant defence research laboratories, organizations, and working groups. Whether from military or civilian backgrounds, these individuals later became known as systems engineers and project managers, responsible for creating and maintaining documents that reflected current concepts and designs on a project as well as coordinating any and all design changes with all those involved in the completion of the program.

Yet before a systemic approach to combat development could emerge there were traditional challenges that first needed to be overcome. During the war, general misunderstandings between military and civilian defence scientists persisted regarding what exactly constituted defence research and development. The situation was deemed to be so detrimental that in January 1945, Dr. Donald C. Rose, a National Research Council (NRC) scientist acting as advisor to the Canadian Army's Chief of the General Staff (CGS), Lieutenant-General John Carl Murchie, attempted to directly address the problem by producing a basic unified guide for planning all future land force research and development.[10] The document offered greater definition and clarity of the terms then in use and laid out a more formal approach to their application across all army research and development directorates. Dr. Rose noted in the document, for example, that, "the terms research and development have been loosely used for some time in planning for post war organization [and] it seems advisable to attempt a clearer explanation of the implications involved. The fault is with the scientists themselves as they talk about 'pure research', 'research', 'development', 'design', etc., understanding each other, but often with different meanings at different times."[11]

At the heart of the document was a list identifying an arbitrary ten-phase approach to Canadian research and development, beginning with pure philosophical

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[10] D.C. Rose, "DND Army Scientific Research and Development -- A Basic Guide for Planning Research," 11 January 1945, RCAF Guided Missile Research Committee HQ File C446-23-8, LAC, RG 24, Vol. 5429, HQS 9012-11-11 (Research).

[11] Ibid.

research leading to the discovery of a new scientific principle or invention. The remaining steps were: (2) measurement of the phenomena discovered; (3) basic research to obtain complete knowledge of the phenomena; (4) construction of the first lab equipment to test applicability; (5) development of a prototype; (6) examination of the prototype to assess value for production; (7) engineering of the design for a production model; (8) development of the tooling and manufacture; (9) inspection and testing; and (10) marketing and use of the new development.[12]

In concluding the guide, Dr. Rose further observed, "In Canada at present phases 1 (scientific principle, invention, or discovery) and 2 (Measurement of phenomenon discovered) hardly exist. Practically no pure research has been done in wartime and the NRC labs have never (even in peace time) done any appreciable amount of pure scientific research."[13] Though he conceded that the line between pure research, applied research, and development could not be drawn sharply, Dr. Rose felt that to prosper and evolve further, the taxonomies involved in such activities needed better explanation. To Dr. Rose's credit, Dr. C.J. Mackenzie, the wartime director of the NRC, expressed similar concerns and would use this reasoning to later argue for the NRC's return to purely civilian research after the end of the war.[14]

The Canadian Army's senior leadership was already well aware that the greater complexities witnessed in its wartime combat development programs were but the first indications of what could be expected in all future projects. The Second World War served as a catalyst for tremendous evolution in Canadian public administration, including national defence. Management principles and practices across all government departments likewise matured to better control budgets, accountability, and deliverables. As the defence planning and management cycle solidified, it became increasingly obvious to military planners that, once the war was over, unforeseen operational requirements and the additional funding needed to deliver them would become increasingly difficult to justify. As Defence Minister Brooke Claxton would continuously remind his senior officers during the early stages of the Cold War, policies and programs had to remain consistent with "the facts of national life" if they were to have any success. Given the tremendously high cost associated with defence science and technology, the only real option was to create a dedicated organization to

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[12] Ibid. There is little question regarding the importance of this methodology, being reproduced in the DRB's official history. See Capt. D.J. Goodspeed, *DRB: A History of the Defence Research Board of Canada* (Ottawa: Queen's Printer, 1958), p. 93.

[13] Rose, "DND Army Scientific Research and Development."

[14] This agenda is discussed in Avery, *The Science of War*, chap. 8-9.

effectively and efficiently oversee and administrate its research and development programs.

The incoming CGS, Lieutenant-General Charles Foulkes, already had strong views regarding the value of science and technology in shaping modern combat and fully appreciated that further steps would have to be taken within Canada to improve the existing defence management system to meet the challenges that lay ahead of the army. He already had some personal ideas regarding how this might be achieved, and his own official agenda was predicated upon the belief that unless war with the Soviet Union broke out immediately, he would likely have roughly ten years to put in place the foundations of a sustainable defence research and development infrastructure for the armed forces.[15] Shortly after taking up his new appointment in August 1945, Foulkes began directing general headquarters staff effort towards the development of options for the creation of a new national defence research organization.

Interestingly, a number of senior army officers in the General Staff Branch, associated with the land force's wartime research and development projects, had already begun an examination of the problem even before Foulkes gave explicit orders to do so. Notable among this group was an army officer named Colonel William Wallace Goforth, who headed the army's Directorate of Staff Duties (Weapons) and acted as the leader and spokesman for this study group. An assistant professor of political economy under Professor Stephen Leacock at McGill University prior to the war, Colonel Goforth had a clear appreciation for the larger military problems that might be solved with better-defined and -organized defence research capabilities.[16]

The influence and subsequent involvement of Foulkes, Goforth, and other army officers in the creation of the Canadian Defence Research Board (DRB) has already been detailed in that organization's official history. Appreciating this, it remains noteworthy that the army's leadership role in, and focus on, creating the DRB after the war subsequently affected the immediate postwar development of its own service-level

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[15] Goodspeed, *DRB*, pp. 17-24.

[16] Ibid., 28-30. Colonel William Wallace Goforth (1899-1956) served as a signalman during the First World War and later graduated from the University of Toronto with degrees in politics and economics. He went on to serve as an officer with the 17th Duke of York's Royal Canadian Hussars in Montreal while also on the faculty of the Economics Department at McGill University. He served in a number of headquarters appointments both in Ottawa and London during the Second World War and was awarded the OBE in 1945 for his contributions to defence research. After retiring from military service, he became a member of the Canadian Institute of International Affairs and the Canadian Political Science Association. Goforth died from a heart attack in his office in Toronto in 1956.

combat development organizations. As well, the army's preference for civilian control of the DRB and a certain reduction in control over defence research by the military caused conflict with its peers in the other two services. They also did not seem to appreciate Colonel Goforth's candid remark that the three services would be unlikely to attract as high a calibre of young scientists in the immediate aftermath of war as could a civilian-led department.[17]

Despite any hurt feelings, it was a simple fact of the time. The war's end brought an exodus of uniformed and civilian scientists from the military as Canadians sought to return to normal life and other pursuits. Additionally, the massive influx of new students to universities across the country created a high demand for skilled professors, and DND's scientific and technological staff was reduced to barely nil by early 1946 as its ranks exited military service to fill many of these new civilian openings. For a population generally weary of war, it was difficult to entice scientists to remain soldiers once the enemy overseas had been defeated. As well, though likely not fully appreciated at the time, the advent of nuclear destruction did not sit well with many scientists whose lives were typically driven by the passion for discovery, not destruction.[18]

After considerable debate and amendment, the Goforth Plan, creating the DRB passed up to the Cabinet level. On 28 December 1945, the Privy Council approved the creation of a new director general of defence research.[19] Despite further dispassion towards the issue from the navy's research community and some outright opposition to the whole idea from senior leaders in the air force, the DRB was legally sanctioned effective 28 March 1947. From then on, the three armed services looked to their own individual development under this new aegis of defence research.[20]

Whatever reservations the three services may have had, the creation of the DRB allowed them to fully exploit a number of emerging tools and applications designed to better organize, manage, and analyze the plentiful data required to solve increasingly complex and complicated military problems. In addition to operational research methods, defence scientists, engineers, and academics working on concepts and designs were investigating other new approaches that could facilitate problem solving. Many ideas and influences originally came from abroad, largely as a result of the Canadian

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[17] Ibid., p. 36.

[18] The scientist-security dilemma is explored in detail in Avery, *The Science of War*, pp. 203-55.

[19] Canada, Privy Council Order 1/7503, 28 December 1945. For a short overview of these events, see also A.M. Fordyce, "How It All Started: The Goforth Paper," *Canadian Defence Quarterly* 1, 4 (Spring 1972): pp. 15-16.

[20] Considerable detail of these events is provided in Goodspeed, *DRB*, chap. 1-3.

Army's increased interoperability, liaison, and direct exchange with its main allies during the war. These events subsequently led to the formation of an indigenous cadre of military and civilian officers in Canada who understood how to better organize and coordinate defence research and development. Perceptive senior army officers, like the influential Colonel Goforth, also soon realized that centralized design coordination allowed them to gain and retain much better control of both the creative process and its lively, if at times unruly, knowledge contributors. To this end, modern and increasingly complex army projects could be brought to fruition in a somewhat timely fashion, even given all of the constraints and restraints that accompanied the development of any new idea.

Organizations such as the DRB, and the many service-oriented defence research and development agencies that supported it during the early Cold War era, played critical roles in the development of standardized rules and procedures that would later form the core of modern combat development principles. These organizations also became responsible for the creation of processes that needed to be both flexible and durable so the army could learn, adapt, and sustain those adaptations that advanced its capabilities and combat effectiveness. In many cases, the unique technical problems of both tactical nuclear and conventional warfare posed difficulties requiring institutional solutions both social and procedural, which in turn resulted in changes in how people within conceptual and doctrinal design processes related to one another.

Postwar army project management evolved and spread through four social groups -- army officers, scientists, engineers, and managers. Each of these groups promoted certain aspects congenial to their own administrative objectives and fought those objectives that were not. Some aspects contradicted each other. For example, army officers appreciated concurrent activity, whereas managers preferred phased planning. Systems analysis differed with systems engineering, and academic working groups conflicted with hierarchical military structures. Though the winners of such bureaucratic fights were able to promote their concepts across the organization, they were never completely successful in controlling the whole process.[21]

All of Canada's research and development agencies suffered these growing pains in the immediate postwar era. At the highest level in defence, the DRB soon realized that it would eventually be necessary to separate those charged with the responsibility

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[21] A good example of historical analysis of social groups in systems management is discussed in Stephen B. Johnson, *The Secret of Apollo: Systems Management in American and European Space Programs* (Baltimore: Johns Hopkins University Press, 2002).

for supervising the operation of its many establishments from those who had the responsibility for providing scientific advice and information to the various armed services. Thus, some scientists and engineers would continue pursuing research while others would become primarily managers and administrators.[22] This was necessary not only for the oversight of complex projects and programs, but also for the effective cost control of these programs through their development.

As expected, defence research and development remained an expensive undertaking. Still, during the early stages of the Cold War, Canada's political leaders supported major defence initiatives that either provided a tangible deterrent to Soviet military threats against Canada or contributed to an allied initiative pursuing a likeminded goal. Although costly, these projects were often still less expensive than maintaining a massive standing armed force of a scale Canada witnessed during the Second World War.[23] As well, in postwar Canada, technological solutions to military problems gained both credibility and popularity. The country's involvement in the development of several war-winning technologies -- radar, jet power, atomic energy, etc. -- had exposed Canada's political and defence leadership to the possibilities offered by such technologies. Military officers, especially those in the army and the air force, allied themselves with defence research scientists promoting "big science and technology" and used the Cold War political climate to drive rapid technological development in their respective services.[24]

Canada's Cold War economy, however, could not sustain endless defence investment on a scale similar to its American and British allies. By the 1960s, the government began to seriously question DND's program priorities, methods, and spending and demanded better cost control, technical reliability, and return on investment. Fortunately, though military officers and defence scientists were not traditionally particularly good at this, the engineers and managers within their services were. They heeded government warnings for greater reliability and more predictable costs. As a consequence, managerial and engineering design considerations came to have relatively more weight in land force combat development than purely military and scientific considerations. Managers applied cost accounting practices while engineers performed more rigorous testing and analysis. The end result was not a lower-cost design but a more reliable product whose higher cost was more easily predicted. Engineers gained credibility through successful operations, and managers gained credibility through successful prediction of the cost. The government did not mind high

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[22] Goodspeed, *DRB*, pp. 89-90.

[23] Ibid., pp. 17-44.

[24] Ibid.

costs for defence programs but would not tolerate unpredictable costs or spectacular failures.[25]

With military officers demanding rapid progress, scientists desiring novelty, engineers wanting a dependable product, and managers seeking predictable costs, a new approach was needed. What emerged from these conflicting research interests and required bureaucratic outcomes was a new discipline known as systems management. Essentially a mélange of techniques representing the interests of each contributing group, this new type of management was defined as a set of organizational structures and processes to rapidly produce novel but dependable technological artifacts within a predictable budget.[26] The advantages of systems management within the army's force development community were quickly realized, and it soon formed the foundation for other more complex processes that would guide much of the army's institutional evolution throughout the early Cold War era.

The advent of systems management in army development programs also served as the catalyst for the adoption of another emerging discipline known as project management. Project management could trace its foundations to the creative architects and master builders of a previous age, but it was shaped as a more formal activity during the first half of the twentieth century by innovative thinkers such as the American mechanical engineer Henry Gantt and the French mining engineer Henri Fayol.[27] Whereas Frederick Taylor advanced scientific management by focusing on the improvement of industrial efficiency, Gantt is generally credited with the invention of modern planning and control techniques. Fayol, meanwhile, is perhaps best known for his creation of the five management functions that form the foundation of the body of knowledge associated with project and program management today. After the Second World War, the influences and writings of these men, along with the experiences of war itself, served as catalysts for the maturation of project management into a widely recognized and distinct discipline within the field of engineering as it modernized planning, organizing, motivating, and controlling resources to achieve specific goals and bring about beneficial change.[28]

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[25] Johnson, *The Secret of Apollo*, pp. 5-18.

[26] Ibid., pp. 19-46.

[27] Henry Gantt (1861-1919) was made famous by the Gantt Chart, a bar chart employed to illustrate a project schedule. Henri Fayol (1841-1925), meanwhile, developed a general theory of business management to include functions and principles for oversight of complex projects.

[28] Project management history is detailed in several publications. For a concise overview, see http://en.wikipedia.org/wiki/Project_management#History.

Beyond pure project management and budgeting, social and technical concerns often drove the formalization of Cold War combat development. Fears of the quantitative superiority of their Soviet adversaries routinely led Canadian Army officers to seek more qualitative technological solutions as soon as possible. Technical issues, however, just as quickly posed serious challenges or in some cases simply priced certain options beyond the available budgets of the army. To reduce some of the costs of new technology, new methods such as systems integration, testing, change control, quality control, documentation, and configuration management appeared to expedite outputs while reducing waste. Civilian engineers initially led the development of these new technical coordination methods, while technically educated and trained army officers and civilian managers intervened as needed to require cost and schedule information and technical data with each engineering change. As the army progressed through projects, its process matured, and eventually the systems management of all army projects progressed under the aegis of a codified process known collectively as combat development. Thus, combat development became the core process or methodology the Canadian Army employed to generically organize and coordinate the systems management of the land force's intellectual, bureaucratic, administrative, and physical activities. Its taxonomy was first formally articulated in the written proposals of Colonel Goforth and his peers at AHQ and later included rather broadly the conceptual and doctrinal design of land force capabilities as well as their procurement, operationalization, and long-term sustainment and management.[29]

The Combat Development Process

At the outset of the Cold War era, the Canadian Army's combat development process tended to be prescriptive and reactive. Six years of total war in Europe, the Mediterranean, and the Far East followed by the immediate threat posed by the military power of the Soviet Union allowed the army the luxury of knowing who their main adversary in the next conflict was likely to be as well as what military problems might be faced in confronting that enemy on the battlefield. Knowing that the Soviets posed the likeliest threat, the army was better able to focus on preparing for a war against this adversarial military capability than in later years, when it struggled to develop a more generic and general-purpose combat-capable force to fight any and every foe imaginable. Even appreciating that politics, policies, and military limitations might impose further constraints and restraints on the definition of the security environment,

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[29] Goodspeed, *DRB*, pp. 17-44. A contemporary explanation of the process may be found in Maj. D.A. Gronbeck-Jones, "The Army's Combat Development Process," *Canadian Defence Quarterly*, (1983): pp. 25-29.

in the early stages of the atomic era, the army still had a tangible starting point from which to seek its solution to the military problems it faced.

Once the potential and likely threats were identified, the army's next step was to develop an overall strategy that consisted of two main elements. The philosophical element focused on what academics and scholars have traditionally referred to as the "art of war" or more recently as the "way in warfare."[30] The purpose of this element was to capture the general paradigms or principles that would define why and how the army fought as it did. For example, Canada's wartime army was routinely described as attritionist or manoeuvrist in its approach, which in turn had an influence on the development of its Cold War operational concepts and doctrine.[31] The other element of the army's strategy was institutional and focused on its organizational health, sustainment, succession, and evolution. Though these attributes were not often perceived as strategy in the traditional use of the word, foresight and choice were required as the management and operations of defence institutions became increasingly professionalized and complex during the Cold War era.

Having juxtaposed the security environment threat against the government's policies and the army's institutional strategy, senior leadership could begin developing various operational concepts and approaches to fulfill the mandate, roles, and missions assigned to them within defence policy guidance. Within the army, specialized groups of analysts would analyze identified problems in considerable detail, creating lists of challenges their field forces were likely to face in any given situation. Once the threat was more fully understood, army staff could then begin considering the possible capabilities the army would require to meet the challenges it would likely face. So if the problem, for example, was that the enemy was capable of threatening friendly ground forces with heavy tanks, the army would need to consider the development of some sort of capability to defeat that threat. At this stage, it would not simply decide that it also needed a tank, but instead that it required a line-of-sight, direct fire capability to defeat the enemy threat. That direct fire capability could certainly eventually be delivered by a tank, but it could also be delivered by a ground anti-tank weapon or

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[30] For examples, see Col. Bernd Horn, ed., *The Canadian Way of War: Serving the National Interest* (Toronto: Dundurn Press, 2006). For an opposing view to the concept, see Patrick Porter, *Military Orientalism: Eastern War through Western Eyes* (New York: Columbia University Press, 2009).

[31] For various views of Canadian approaches to war fighting during the Second World War, see Terry Copp, *Fields of Fire: The Canadians in Normandy* (Toronto: University of Toronto Press, 2003), and *Cinderella Army: The Canadians in Northwest Europe, 1944-1945* (Toronto: University of Toronto Press, 2006). For another example, see John Nelson Rickard, *The Politics of Command: Lieutenant-General A.G.L. McNaughton and the Canadian Army, 1939-1943* (Toronto: University of Toronto Press, 2010).

perhaps even by an air platform such as an attack helicopter. At this stage, therefore, the objective was not to decide on a specific piece of equipment but rather the army capabilities needed to defeat the threat. Theoretically, at least, decisions regarding the procurement of specific equipment came much later in the process, but as this study will show, the army could only recommend a specific force structure to the civilian decision makers, not impose its recommendation on the government to actually go out and acquire that specific piece of equipment.

Thus, if one considers that army strategy and policy were framed to explain "why" the army did what it did, and that operational concepts and approaches explained "what" the army did, then the purpose of doctrinal design was to explain "how" the army would do it. Doctrinal design typically began with the construction of a number of different force structure models that encompassed the list of capability requirements proposed by the concept. So, for example, army staff would design a number of different formations containing different mixes of weapon platforms and vehicles, then seek to repeatedly test these various designs, noting deficiencies and gaps in the combat effectiveness of these proposed formations. From 1945 until the mid-1950s, optimal force structures and mixes of battlefield weapon systems and equipment were tested through a wide variety of physical tests and field training exercises. Such methods were effective to a point, but they were also limited in scope and duration, not to mention that they also tended to be both expensive and, at times, physically dangerous. From the mid to late 1950s onwards, these limitations were partially overcome by the introduction of simulated experimentation and war-gaming.

The combat development cycle was neither swift nor sequential in its execution, nor was it always religiously followed by soldiers or politicians in the development of new land force capabilities. The army's combat development communities, in fact, had to constantly adapt to new and significant constraints and restraints that might be imposed upon them at any given moment while they were in the middle of determining how to solve the military problems the army already faced. Regular and significant political and security changes throughout the early Cold War era directly affected not only the government's defence priorities, but also very seriously the Canadian Army's ability to bring its core concepts and doctrines designed to support these priorities to full fruition before things changed and it was forced to change direction or start the cycle over again.

If the army could complete a full combat development cycle uninterrupted by politics, economics, or unexpected operations, it would then seek to initiate a long list of subsequent activities that finally led to the physical creation and deployment of new and assumingly improved land forces. Theoretically, at least, conceptual and doctrinal

design provided direction on the development of force employment models and force structures, which in turn informed the government's defence procurement process. Simultaneously, more consideration could be given to the type of administration, training, and sustainment required to maintain the force over longer periods of time. Finally, experiential learning and the institutionalization of best practices would both inform the existing force and provide judgments and insights that sparked further ideas and debate, leading to even more new concepts.

Despite its apparent sequential determinism, however, any number of complications could significantly slow, alter, or derail the combat development process altogether. First and perhaps most frustratingly foremost was that the process existed only to inform and guide senior civilian policy makers' force development decisions, not absolutely control or direct them. Though professional military advice and decisions may have carried considerable weight during the Second World War, civilian politics came to play a more prominent role in defence management, spending, and procurement as the Cold War progressed. This meant, for example, that even if all army conceptual and doctrinal design pointed towards the acquisition of one type of capability or piece of equipment, there was every possibility that political necessity, or in some cases opportunity, could override that professional advice and result in the acquisition of a completely different capability or item of equipment.[32]

Second, the military personalities themselves also undoubtedly influenced the army's combat development process as it matured. Many of the senior officers involved in the activities examined within this study earned their spurs in Italy and northwest Europe during the Second World War. As such, they brought a tremendous amount of ingenuity and innovation to the process of Cold War military problem solving. Conversely, they also brought their prejudices. These hang-ups became very noticeable beginning in the mid-1950s, when at the highest levels there was visible animosity between the offices of the minister of national defence, the chairman of the Chiefs of Staff Committee, and the army's CGS. Similarly, at the formation level, commanders charged with developing new tactical concepts and doctrine to deal with the problems posed by the conventional--nuclear battlefield often found themselves at first perplexed by them. As a result, they were predisposed to act on older solutions that had worked well enough in purely conventional battle situations during the war but were untested on the atomic battlefield. Only as the full, devastating effect of atomic weapons became

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[32] The primacy of politics over rational decision making in modern Canadian defence procurement is explored in depth in Aaron Plamondon, *The Politics of Procurement: Military Acquisition in Canada and the Sea King Helicopter* (Vancouver, UBC Press, 2010), chap. 1.

better understood did personalities begin to bend in favour of rigorous modern operational research and simulation methods. This is not to suggest that this completely led to solving all the paradoxes of conventional--nuclear war; it did not. But the demands of its characteristics could not be ignored, and this problem increasingly influenced all combat development decision-making as the Cold War dragged on.

Third, both accident and contingency regularly played roles in shaping Canadian Cold War land force development. As will be seen in the following chapters, seldom did the army enjoy periods of stability or singular focus long enough to completely institutionalize a whole new concept or doctrine. Though it was reasonable to accept the argument that, given the lead time required to conceive, design, and build a major land weapon system, any Western professional army required about ten years to complete an entire combat development cycle, neither governments at home nor politics abroad ever remained uneventful for so long. In fact, the only time the army enjoyed anything resembling stability during the period covered in this study was the five years immediately following the end of the Second World War. After this, both standing NATO commitments and an endless series of international confrontations ensured that the army had to diligently divide its time between force development, generation, and employment. Thus, the army always had to readjust, innovate, and adapt its strategy, operational concepts, doctrines, and tactics to reflect emerging trends and developments in the Cold War security environment. And it almost always had to do so at short notice and seldom as a result of its own decisions or designs.

Fourth, the impact of the information age on Canada's Cold War army combat development cannot be understated. The advent of new ideas, theories, concepts such as cybernetics and systems engineering, and new tools such as automated data processing, simulation, and war-gaming were near revolutionary both in their scope and influence over future army force development. For example, cybernetic theory and its manifestation through new automated data processing tools meant that land force developers could now use computers not just for computational functions, but also for information processing and process control. This in turn led to the ability to conceive, design, build, and manage more complex responses to traditional military problems. In some areas, notably new command and control capabilities, the advances in this field were critical. Similarly, war-gaming -- quite literally the activity of simulating a war in the same way one might simulate being a real estate developer in a popular board game -- was not a new device for soldiers. Its progenitors could be traced back to the Roman era and before, yet when combined with modern operational research techniques supported by new automated data processing tools, war-gaming became a powerfully effective and efficient substitute for physical land force operational research and

experimentation. During the Cold War especially, when atomic and nuclear weapons needed to be appreciated on the battlefield, war-gaming not surprisingly provided a much safer and less costly alternative to physical testing and experimentation.

Strategic Influence Reconsidered

Armed with experiences, people, policies, processes, and tools, the Canadian Army in 1945 was more than prepared to tackle problems associated with conventional, and in some instances unconventional, warfare. That it could never have foreseen the advent of atomic warfare and the paradigm shift it would evoke should not be construed as a failure of the army's force development abilities. Nor should its subsequent role as a supporting actor in NATO's grand strategy be construed to mean that it could not innovate or adapt. In 1945, no Allied army yet appreciated the influence nuclear weapons would have on the modern battlefield. For several years, both NATO and Warsaw Pact ground forces perceived atomic weapons as just larger forms of artillery. Even the advent of thermonuclear doomsday devices in the early 1950s was slow to change this perception. It became a military problem to solve unlike any before it, and there was no choice but to figure out a way to weather its potential storm and live to fight on.

The design and creation of a professional modern army prepared to fight the battles of a conventional--nuclear war was a massive and complex intellectual undertaking. Having not directly witnessed the destructive power of atomic devices against Japan, Canadian Army planners initially found this weapon's introduction and the challenges it would soon pose to future land forces to be an abstract problem. Thus, developing solutions was not an emotionally driven process, nor were the final decisions solely political in nature. Cold War systems builders were extensions of their smaller and more politically cliquish wartime predecessors, to be sure, but the size of the Cold War--era organizations and the collaborative nature of their complex project activity precluded any single individual from wielding omnipotence over the conception, design, building, and management of any part of the Cold War army. Finally, as the science and technology of the period evolved, so did the tools that could be applied to solve the problems that emerged. And it was perhaps this ability to innovate and adapt more than any other attribute that truly separated modern land forces from their peers and adversaries during the first decade of the Cold War.