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LOGISTICS: REDUCING FRICTION THROUGH UNDERSTANDING, INTEGRATION, AND OWNERSHIP

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**LOGISTICS: REDUCING FRICTION THROUGH
UNDERSTANDING, INTEGRATION, AND OWNERSHIP**

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ABSTRACT

An operationally focused and robust logistics capability is critical to an agile, expeditionary force. However, the Canadian Armed Forces (CAF) may not be operating at its optimal effectiveness because of a chronic lack of focus on logistics. Expanding on Clausewitz's concept of 'friction,' this paper examines how the interrelated factors of logistics understanding, integration, and strategic ownership contribute to this lack of focus, thereby reducing the effectiveness of logistics and therefore the entire organization. The lack of understanding is explained through the themes of commander interest; protection of the logistician's domain; and the perception that logisticians are an impediment to the mission. The lack of integration is understood by examining technology, business processes and structures, and the balance between effectiveness and efficiency. The lack of ownership is caused by a stagnation of process improvement resulting from the absence of a single process owner and the absence of a unified vision among logisticians.

Using historical links to logistical concepts to provide context to the systemic issues, the author draws from logistics theorists and historians like Vego, Eccles, Tuttle, and van Creveld. Works from contemporary Canadian and allied logisticians also help to frame the problem, while examples from mission after action reports, government audits, and other CAF and Department of National Defence (DND) resources are used to support the discussion. Incorporating his experience as a CAF logistician, the author attempts to explain why logistics is systemically overlooked and provides deductions that may be used to further understand the problem in order to improve the effectiveness of logistics and reduce friction within the DND/CAF.

1. INTRODUCTION

Friction, as we choose to call it, is the force that makes the apparently easy so difficult.

- Carl von Clausewitz, *On War*

The opening words of Clausewitz speak to the complexity of war, where seemingly simple and straight forward tasks become monumental when encountering uncertainty and chance. Clausewitz uses the term friction to explain the factors that distinguish “real war from war on paper,” explaining that:

The military machine—the army and everything related to it—is basically very simple and therefore seems easy to manage. But we should bear in mind that none of its components is of one piece; each part is composed of individuals, every one of whom retains his potential of friction.¹

Clausewitz was speaking about logistics. However, a chronic lack of focus on logistics impairs the Canadian Armed Force’s (CAF) ability to conduct operations more effectively. While Canada can be proud of mission accomplishments over the past decades, these missions could have been conducted in a more effective and efficient manner with an increased focus on resolving systemic logistical challenges and friction.

Historians and theorists have written about warfare throughout history. One of the most widely quoted, and influential military theorists, is early 19th Century German general Carl von Clausewitz. His central themes, including centres of gravity, “fog of war”, and “friction” as the factor that differentiates theory from reality, are the basis for

¹ Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1984), 119.

military study today.² While the importance Clausewitz personally placed on logistics is often debated, logistics figures prominently in his description and examples of the concept of friction in *On War*.³

Fewer theorists and historians have emphasized the critical role logistics has played in the success or failure of military campaigns. Through these historical analyses of battles and commanders, a common theme emerges. That is, in spite of the importance of logistics in winning battles or campaigns, commanders and their staffs tend to focus on weapons and tactics, often at their peril. Dr. Milan Vego of the Joint Military Operations Department at U.S. Naval War College provides historical context of lack of command involvement in his chapter on “Operational Logistics,” published in *Joint Operational Warfare*. Vego observes that operational commanders and their staffs often divorce themselves from logistical planning and decision-making, effectively delegating responsibility for support and sustainment to the logistician.⁴

Rear Admiral Henry Eccles has also made major contributions to the study of logistics. In *Logistics in the National Defense* (1959), and *Military Concepts and Philosophy* (1965), he draws from his observations and experience in the U.S. Navy during World War II to explore logistics, command psychology, and bureaucracy as three

² *Ibid.*

³ *Ibid.*, 119-120.

⁴ Milan N. Vego, “Operational Logistics,” in *Joint Operational Warfare* (Newport, RI: Naval War College, 2007), VIII-78.

dimensions of strategy. In these works, he provides logistical insights into military planning factors as they link a nation's grand strategy to the battlefield. Explaining that logistics is the link between the strategic and tactical levels of conflict, Eccles warns, "the commander must understand logistic cause-and-effect principles in order to make such decisions wisely."⁵ As the founding head of what is now the Department of Strategy and Logistics at the U.S. Naval War College, his influence continues to permeate the teachings of logistics to U.S. Navy leaders.⁶

U.S. Army General William G.T. Tuttle provides contemporary perspective of logistics with *Defense Logistics in the 21st Century*. Tuttle suggests that a new logistics framework, with a greater emphasis on effectiveness, would provide long-term efficiency to better support the national strategy. With the objective of ensuring timely sustainment to commanders while minimizing logistics "foot print" in battle spaces, Tuttle cites accountability, continuously shared knowledge, contracted logistics support outside the battle spaces, comparative advantage through coalition logistics, and simplicity in planning and operations as the five supporting principles.⁷

⁵ Henry E. Eccles, *Military Concepts and Philosophy*, (Rahway, New Jersey: Rutgers University Press, 1965), 259.

⁶ Scott A. Boorman, "Fundamentals of Strategy: The Legacy of Henry Eccles," *Naval War College Review* Vol. 62, No. 2, (Spring 2009): 97. <http://wwin.w.usnwc.edu/getattachment/654f6e40-1637-42e2-9e2e-0a3992a84181/Fundamentals-of-Strategy--The-Legacy-of-Henry-Eccl.aspx>

⁷ William Tuttle, *Defense Logistics for the 21st Century*, (Annapolis, MD: Naval Institute Press, 2005), 8.

Martin van Creveld's *Supplying War: Logistics from Wallenstein to Patton* provides an investigative look at the transformation of logistics and sustainment through military campaigns since 1700. An Israeli military historian and theorist, van Creveld provides a rare understanding of logistics by a non-logistician. Offering that logistics is precisely the "friction" of war that Clausewitz was referring to, he suggests that "it is surprising that the majority of books on military history manage to pay lip service to [logistics] and yet avoid making serious study of it."⁸ Building on van Creveld's interpretation of Clausewitzian friction, one could also include other sources of friction found within logistics. These include friction points such as the interaction between logisticians and commanders, the dilemma between efficiency and effectiveness, procedural integration between supporting and supported elements of the force, and unity of purpose. Another major source of friction are the organizational barriers that inhibit procedural integration and unity of purpose, known as "functional silos" or "stovepipes." This phenomenon is not specific to military organizations and is a concern for corporations and other government organizations. As the term describes:

[Stovepipes] are vertical structures built on narrow pieces of a process...[where people] involved in a process look inward to their department and upward toward their boss, but no one looks outward toward the customer. The contemporary performance problems that companies experience are the inevitable consequences of process fragmentation.⁹

⁸ Martin van Creveld, *Supplying War: Logistics from Wallenstein to Patton*, 2nd Edition, (Cambridge: Cambridge University Press, 2004), 231.

⁹ Michael Hammer and James Champy, *Reengineering the Corporation: A Manifesto for Business Revolution*. New York: Harper Collins Publishers, 1993), 66.

Major-General Julian Thompson of the Royal Marines, a student of van Creveld, builds on the historical case studies found in *Supplying War*. Thompson's frustration with the lack of focus on logistics is evident in the preface of *The Lifeblood of War: Logistics in Armed Conflict*, where he concedes, "I have no reason to believe that logistics will ever have much military sex-appeal, except to serious soldiers, but this book is written in the hope that I am wrong."¹⁰ This comment demonstrates an understanding that there are very few soldiers who grasp the importance of logistics and even fewer who study it.

From a Canadian perspective, John Conrad's *What the Thunder Said: Reflections of a Canadian Officer in Kandahar* provides a first-hand account of the challenges encountered by logisticians supporting combat operations in 2006. From his experience as Commanding Officer of the National Support Element in Kandahar, Conrad explains, "Military logistics in Canada is viewed with near disdain."¹¹ Although there is an abundance of literature that speak to the existence of this symptom, little has been written on why this systemic lack of attention exists, or how it could or should be addressed to improve military effectiveness.

Other Canadian logisticians have provided unique insights on CAF and Department of National Defence (DND) logistics through papers and articles. Chris Zimmer's 2008 Masters of Defence Studies thesis argued Canada's Defence Supply

¹⁰ Major-General Julian Thompson, *The Lifeblood of War: Logistics in Armed Conflict*, (London: Brassey's, 1991), xvi.

¹¹ John Conrad, *What the Thunder Said: Reflections of a Canadian Officer in Kandahar*, (Kingston: Canadian Defence Academy Press, 2009), 39.

Chain (DSC) was designed with a procurement and materiel life cycle focus and therefore is at odds with the customer (command) focus and agility required in an expeditionary force. Citing substandard service delivery over three decades, Zimmer analyzed the DSC through five core principles of supply chain management adopted in the private sector: (1) view the supply chain as a strategic asset; (2) develop an end-to-end process architecture; (3) design the organization for performance; (4) build the right collaborative model; and (5) use metrics to drive business success.¹² Zimmer concluded that a transformation of DND's supply chain was required.

Adam Zima also focused on shortcomings of the CAFs supply chain in his 2013 paper, *A Canadian Revolution in Military Logistics – Improving the CF Operational Supply Chain through Benchmarking*. Citing criticisms by the Auditor General of CAF logistics support for troops in Afghanistan, Zima argued that in order to improve supply chain effectiveness, the CAF should look to its allies, who have transformed their logistics organizations and systems in recent years.¹³

Throughout the body of literature reviewed, the lack of focus on logistics is clear, and is supported by the fact that logistics is rarely discussed unless something goes wrong. Therefore, internal and external government audit reports, as well as mission after

¹² Major Chris Zimmer, *'For Want of a Nail the Campaign was Lost' DND's Supply Chain: A State of Performance Paralysis*, (Masters of Defence Studies, Canadian Forces College, 2008). Zimmer quotes Shoshanah Cohen and Joseph Roussel, *Strategic Supply Chain Management: The Five Disciplines for Top Performance*, (New York: McGraw Hill, 2005).

¹³ Major S.A. Zima, *A Canadian Revolution in Military Logistics – Improving the CF Operational Supply Chain Through Benchmarking* (Masters of Defence Studies, Canadian Forces College, 2012), 79.

action reports, provide accounts of logistical problems experienced by Canadian and allied forces. In particular, government audits from the U.S., Australia, and the United Kingdom (UK) have highlighted similar issues to those identified in Canada regarding logistics education, systems, and organizations. Mission after action reports provide specific examples and details provide context that supports the problem areas discussed.

Canada's military allies have experienced similar challenges and gaps in the attention placed on logistics, as documented through their experiences in Afghanistan and Iraq over the past decade. These forces have responded by embarking on aggressive and innovative projects that seek to address the need for cohesive and synchronized sustainment systems in both garrison and deployed operations. Meanwhile, Canadian logistical structures and systems remain fragmented, often leaving their success or failure dependent on ad hoc coordination by determined individuals. Thus, the lack of focus on logistics that threatens to impede CAF operations arises from three interrelated issues: *Understanding, Integration, and Ownership* (see Figure 1).

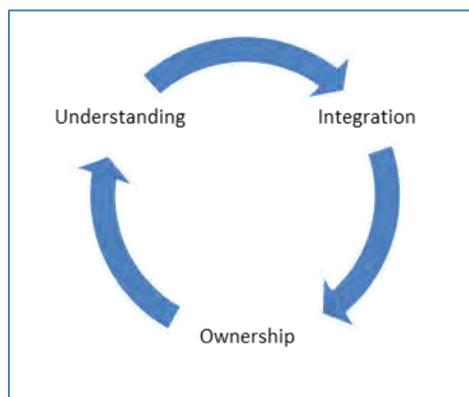


Figure 1: Key Issues in DND/CAF Logistics

A general lack of understanding and failure to consider logistical implications by some commanders prevents logistics from being ‘command-led.’ This lack of understanding stems from three main themes: (1) Logistics is outside the commander’s focus and interest; (2) Logistics tends to be viewed as a “black art”; and (3) Logisticians are, at times, viewed as an impediment to the mission.

The lack of integration in logistical systems and procedures makes it difficult for logisticians to meet expectations and thus maintain credibility in the eyes of commanders. The importance of reducing friction through integration can be understood through examination of: (1) The role of technology in enabling logistical processes within DND/CAF and allied militaries; (2) The logistical business processes and structures related to logistics within both the military and private sector; and (3) The balance between operational effectiveness and fiscal efficiency, described in conjunction with the consequences of neglecting logistical systems.

The lack of strategic-level ownership in logistics reinforces an environment that does not promote integration or understanding and therefore will not evolve. This stagnation is caused by: (1) Complicated processes that become even more confusing if they are not practiced, or if they are different between training and operations; (2) The absence of a single process owner who has the ability to coordinate and align processes from “factory to foxhole”; and (3) A lack of common vision and unity of effort within DND/CAF logistics.

These three interrelated themes combine to create the conditions for a chronic lack of focus logistics. Consequently, the DND/CAF can improve the effectiveness of logistics by improving understanding among commanders and non-logisticians, improving integration of logistics systems and procedures, and improving ownership mechanisms to make logistics more agile and effective in operations, thereby reducing friction throughout the organization.

2. UNDERSTANDING

Logistics is a critical component of planning and execution of operations and must be command-led. However, Eccles identified, “a common tendency of some commanders to concern themselves almost entirely with so-called ‘operational’ matters (either strategic or tactical) at the expense of concern over those logistical matters which form the very basis for operations.”¹⁴ So why do some experienced commanders fail to take logistics seriously? The multifaceted problem appears to relate back to a simple lack of understanding about the role and importance of logistics. There are a number of contributing factors related to this lack of understanding. Permeating all factors is accessibility and perceived applicability of information that logisticians present to commanders. However, to cultivate understanding, logisticians need to be able to articulate challenges or risks in ways understood by the commander. Equally, the commander must be willing and able to understand the logistical concerns, and how they may impact the mission. To do this, logisticians must be able to speak in the lexicon of their colleagues, focusing on the effect the commander is seeking.

In some cases, logistics may be outside the expertise, and therefore outside the focus and interest, of the commander. John Whiteclay Chambers II, author of *Major Problems in American Military History*, sums up this attitude among commanders: “At best, logistical considerations and logisticians are seen as unwelcome, if necessary, adjuncts to strategic planning and the management of ‘important’ problems such as

¹⁴ Henry E. Eccles, *Logistics in the National Defense*, (Harrisburg, PA: Stackpole, 1959), 20.

tactical doctrine.”¹⁵ As a result, some commanders discount the requirement for logistical analysis and planning because it is outside their focus and interest, or the courses of action seem to be simple and without logistical implications.

In other cases, the logistician puts a cloak around logistics in order to protect it from those who are thought not to understand it well enough. This tendency to treat logistics as a “black art” is a defensive mechanism to avoid “uninformed meddling” or criticisms about bureaucracy that is beyond the logistician’s control.¹⁶

An additional phenomenon is that logisticians are sometimes viewed as an impediment to the mission. Commanders must understand that sometimes, regulatory structures and logistical procedures serve a legitimate purpose and are unavoidable. However, the existence of some overly complicated and bureaucratic procedures that seemingly lack common sense undermine the credibility of logisticians when communicating to commanders.

In all such cases, greater understanding of logistical factors by the commander could result in greater attention and commitment of resources toward critical logistical

¹⁵ John Whiteclay Chambers II, "Logistics," *The Oxford Companion to American Military History*, (New York: Oxford University Press, 1999), 400.

¹⁶ Colonel Win L. Fowles, “Military Logistics: What is it and Who Cares Anyway?” *Australian Defence Force Journal* No. 127, (Nov/Dec 1997): 6.

issues early enough that the commander can positively affect the outcome. A more active engagement by logisticians in improving commander understanding is also critical.

Logistics outside the Commander's Focus and Interest

Why should a commander be interested in logistics? Put simply, a commander is accountable for all logistics decisions made within their command in the same way that they are accountable for tactical decisions, fire support decisions, or any other decision.¹⁷ Therefore, the commander must remain focused on understanding the strengths and weaknesses of logistics resources. They must also have a sense of how their operational decisions may affect the support of that plan. Finally, they must have an appreciation for the logistical constraints (e.g. time, regulations, or availability of personnel and equipment) within which they must operate.

This problem is not specific to Canada. A provocative Australian explanation of the problem suggests that even when logistics was known as “war administration,” it was still viewed as an uninteresting, yet necessary, function of command. However, as the term, logistics is now equated with support personnel themselves such as transporters, suppliers, and repairers, it has been wrongly seen as “beneath the peacetime warrior’s dignity to deal with or even understand.”¹⁸ It is also noteworthy that most monographs on the subject of logistics open with a recognition that, although critical, logistics is

¹⁷ *Ibid.*, 7.

¹⁸ *Ibid.*, 6.

perpetually ignored by commanders in favour of “the more glamorous tactics and strategy.”¹⁹ Vego contends that “[despite] operational commanders and their staffs bear[ing] the prime responsibility for all aspects of logistical support and sustainment of all subordinate forces in a theater...all too often, operational commanders and their staffs believe that their supply officer or logistician alone is responsible for logistics.”²⁰ As an example, Vego suggests that Field Marshal Erwin Rommel, during his first foray as an operational commander during the World War II African Campaign, “lacked the concept of synchronization and the sequencing of actions with the establishment of a logistical base and lines of operations.”²¹ Repeatedly reaching beyond his sustainment abilities, he failed to synchronize with and fight within his logistical resources; thus, he continually pushed beyond the reach of his logistical support.²² Failing to accept his logistical responsibilities and understand the inherent constraints, Rommel blamed logistics for his lack of resources, specifically fuel, instead of acknowledging his own role and the role of the enemy.

Commanders at all levels must have a firm grasp of logistics, ranging from the over-arching principles to the specific opportunities and threats within their command. However, logistics is underrepresented in CAF senior leadership education and training. For example, the ten month long Joint Command and Staff Programme (JCSP) delivered by Canadian Forces College includes only one period of course time that is partially

¹⁹ Thompson, *The Lifeblood of War...*, 3.

²⁰ Milan N. Vego, “Operational Logistics...,” VIII-78.

²¹ *Ibid.*, VIII-85.

²² *Ibid.*, VIII-85.

dedicated to logistics.²³ Entitled ‘The Operational-Level Sustain Function,’ the single lecture-discussion attempts to provide a whirlwind tour of operational sustainment, without providing the foundations or impressing upon these current and future leaders the importance of understanding logistics. Compressing three logistics lectures that were provided in the previous year into one, the subject matter expert is limited to 60 minutes. When approached about the lack of logistics or sustainment in the curriculum, a senior member of the directing staff quipped, “that’s why we have logisticians on the course...to impart your knowledge on your classmates.”²⁴ Likewise, the National Security Program (NSP) does not provide any insight into DND or CAF logistical and supply chain organizations or challenges.²⁵ If logistics is indeed nine-tenths of war as van Creveld contends,²⁶ one wonders why it is not taught more to CAF leaders.

A prime example of the pitfalls of a lack of command understanding is found in *Projecting Power – Canada’s Air Force in 2035*. *Projecting Power* envisions that in the future “the traditional specialty occupations of logistic, engineering and support systems will evolve into one general weapons system support occupation.”²⁷ While the purpose of

²³ Canadian Forces College. “Joint Command and Staff Programme” <http://www.cfc.forces.gc.ca/226-eng.html> (last modified 20 November 2013). The aim of the JCSP is to prepare selected senior officers of the Defence Team for command and/or staff appointments in a contemporary operating environment across the continuum of operations in national and international settings

²⁴ Conversation with a senior JCSP directing staff, September 2013.

²⁵ Canadian Forces College. “National Security Programme” <http://www.cfc.forces.gc.ca/119/187/312/331-eng.pdf> (last modified 20 November 2013). The aim of NSP is to prepare selected military, public service, international and private-sector leaders for future responsibilities within a complex and ambiguous global security environment.

²⁶ van Creveld, *Supplying War...*, 231.

²⁷ Canadian Forces Aerospace Warfare Centre, *Projecting Power: Canada’s Air Force 2035*, edited by Dr. Andrew B. Godefroy, (Trenton: CFAWC, 2009), 77.

this conceptual document is to facilitate and stir debate, such statements demonstrate wholly naïve and dangerous views by some senior officers that neither logistics nor engineering issues will be complicated enough to require specialists in the future. This attitude by senior officers perpetuates the tendency to discount logistics and other support specialties as critical enablers.

Throughout the JCSP and NSP courses, as well as the vision of the future of the CAF is the consistent theme of pursuing a robust, agile, responsive, flexible, and affordable force. However, it is not lost on logisticians that this type of force can only be accomplished through a common understanding of the need for integrated and coordinated logistics, through all levels of command, by both logisticians and non-logisticians. With a greater understanding of logistical principles and considerations, commanders can seize opportunities that can enable them to reach their objectives more effectively.

Like the military, private-sector logistics has not historically been the focus of management. In contrast to the DND/CAF, however, globalization of the world's economy, inventory cost, and the speed of information exchange, have made logistics a buzzword and a prime focus of Chief Executive Officers in the private sector. As a result, the Master of Business Administration (MBA) is being embraced by executives and is becoming a very common post-graduate degree with the themes of operations, process management theory, human resource management, and financial management theory. In

the business world, 'operations' often encompasses the logistical processes of supply chain management and distribution whereas in the military environment, these subjects are the preserve of logisticians. Rooted in the national economy with the end product lying in the operations of combat forces, Eccles equates logistics to military economics.²⁸

With greater commander understanding, logisticians can gain the access and trust that will ensure that they are involved early in the planning process. If commanders and staffs do not have an appreciation of logistical foundations and constraints, critical logistical considerations may be assumed away, not sufficiently resourced, or not be exercised.

Logistics as a Black Art

Logisticians have a tendency to perpetuate the notion that logistics is a "black art" best left to them because "warriors are incapable of understanding even if they wanted to."²⁹ In Canada, lack of command interest, has resulted in logistics becoming a staff-oriented system that operates in the background. To this end, logistical issues rarely draw the attention of the commander, resulting in logisticians making decisions and accepting risk on behalf of the commander. To a degree, logisticians like it this way because it is more expeditious and allows them a certain degree of freedom to operate without question. However, therein lies the risk: Commanders who do not understand the logistics

²⁸ Eccles, *Logistics in the National Defense*... 17.

²⁹ Fowles, "Military Logistics: What is it and Who Cares Anyway?" 6.

challenges within their command will not fight to keep resources if they do not understand the challenges and risks of losing them. Therefore, logisticians who are inclined to make decisions on behalf of the commander for the sake of expedience also risk the commander not fully appreciating the issues surrounding their decision.

Some believe it is the logistician's responsibility to determine the logistical implications of a plan after the commander has developed it. For example, Tuttle suggests logisticians should:

Understand *how* the campaign plans they must support are developed and what risks are ingrained in those plans because of deployment and sustainment processes. Logisticians must examine the draft plans carefully for such assumptions and analyze risks that might accompany them.³⁰

However, there are potentially fatal flaws with relying solely on this reactive approach. The approach can only be successful if three conditions are met: (1) There must be enough detailed planning on paper for the logistician to understand all assumptions and factors considered by the commander; (2) The logistician must have the time and resources to examine each detail; and (3) The logistician must be able to articulate the challenges so that the plan can be modified or risks can be mitigated. In crisis planning, realistically this approach could only be accomplished by having the ability to read the mind of the commander or planner as all assumptions (e.g. of the enemy, environment, or of own forces) would not be sufficiently documented in time to inform support planning. Hence, it is far more constructive to adopt Fowles' perspective that suggests the

³⁰ Tuttle, *Defense Logistics for the 21st Century...*, 5.

commander is the force's chief logistician.³¹ That is, it is imperative that the commander have a foundation in logistical principles, capabilities, and constraints in order to remain more attuned to the situation and be better prepared to lead a mission. This situational awareness, however, is highly dependent on the relationship between the commander and the logistician.

A 'complex adaptive systems' approach can support breaking down traditional barriers between logisticians and commanders, focusing on relationship building and mutual understanding.³² To illustrate this point, Antulio Echevarria's description of U.S. civil-military relations during the Rumsfeld era provides a noteworthy parallel to the relationship between commanders and logisticians.³³ Echevarria says that in the early 2000s, the U.S. military had a reputation in Washington of not being forthright, cooperative, or progressive, thereby causing friction between the U.S. Armed Forces and the Department of Defense (DoD). Because of this friction, and his own biases, Secretary of Defense Rumsfeld had a tendency to dismiss the advice he received from his generals because he believed that their traditional thinking did not apply to the situation of the day. What resulted was a lack of mutual understanding between the commander, who dismissed the advice of his experts, and the generals who were not able to articulate their concerns in a way that the commander regarded as relevant. Relating this example to a commander-logistician perspective, it is critical that the logistician continually work to

³¹ Fowles, "Military Logistics: What is it and Who Cares Anyway?" 6.

³² Christopher R. Papparone, Ruth A. Anderson, and Reuben R. McDaniel Jr., "Where Military Professionalism Meets Complexity Science," *Armed Forces & Society* Vol. 34, No. 3 (April 2008): 438.

³³ Antulio J. Echevarria II, "Operational Concepts" (lecture, Canadian Forces College, Toronto, ON, 28 March 2014).

build trust, credibility, and mutual understanding in order to better-inform the leader of the opportunities, challenges, and risks faced. This approach is also helpful in preventing the logistician from being viewed as an obstacle standing in the way of the commander.

Logisticians Viewed as an Impediment to the Mission

While deployed to Kandahar as part of Operation ARCHER in 2006, Lieutenant-Colonel John Conrad recalls being reminded by senior Canadian officers that “the support ‘tail’ couldn’t be permitted to ‘wag the dog’ on an operation as important as this one.”³⁴ This comment demonstrates the lack of understanding among non-logisticians of the link between logistical capability and the effectiveness of a fighting force. This mentality, a key source of friction between non-logisticians and logisticians, could be a product of their experiences of having to deal with seemingly overly restrictive or redundant logistics-related regulations and processes. In some cases, these sources of friction are regulations that are based on federal statutes or diplomatic agreements; however, sometimes procedures are overly complex due to legacy procedures that simply have not been updated or due to the antiquated systems employed. These systems and processes frequently do not meet the commander’s expectations of responsiveness, either by impeding the logistician’s ability to provide key information, or by imposing unwelcome time or resource constraints on the commander.

³⁴ Conrad, *What the Thunder Said...*, 98. The “support tail” is a common phrase used to describe the non-combat components of a force that provide support and administration.

This mentality could also be a product of the constant desire to reduce the “tooth-to-tail ratio,” that is, to maximize the “fighting force” while minimizing the footprint and numbers of so-called “support” personnel. This arbitrary means of apportionment, comparing the number of personnel directly engaged in front-line operations against how many it takes to support them, has resulted in politically motivated and oft times unsubstantiated assessments of the effectiveness and agility of a fighting force. As observed by van Creveld, reducing the logistics footprint seems to be stubbornly aimed at making do “with the smallest number of supporting troops” instead of producing “the greatest possible fighting power.”³⁵ In spite of this, there is a growing trend of sending smaller numbers of well-equipped front line troops who remain heavily reliant on a reliable support chain that reaches back to Canada. Thus, as weapons systems become more complex, but fewer in numbers, the gradual shift from tooth to a longer and more complex tail appears to be the cost of doing business in today’s operational environment.³⁶ Therefore, it is necessary in increasing understanding of the importance of logistics that there is a greater appreciation that modern, technologically advanced fighting forces are more reliant on robust sustainment.

When there is a lack of appreciation for the challenges that exist in sustaining a force, logistical capabilities are often minimized in favour of capabilities that are seen as more critical in the short-term. If these resource-minimizing measures are employed without understanding risks or implications, serious gaps in capability can occur. While it

³⁵ van Creveld, *Supplying War...*, 235.

³⁶ Geoffrey Till, *Seapower: A Guide for the 21st Century*, (London: Frank Cass Publishers, 2004), 119.

is the logistician's responsibility to articulate the consequences or risks of limiting support resources, a greater understanding of logistics by commanders would allow for more-informed dialogue and options analysis. Recent Canadian operations demonstrate the importance of appropriate focus on and positioning of logistics capabilities early in the planning and execution of a mission.

For example, in the case of Operation (Op) HESTIA,³⁷ Canada's military response to the 2010 earthquake in Haiti, minimizing of logistical capabilities meant that no coordinated prioritization of personnel and equipment movement during the initial phases of the operation. This lack of coordination and understanding of logistical support requirements led to failures in providing basic requirements such as a forklifts and shelters. Forklifts had been removed from planned loads of the first few aircraft in favour of other supplies, resulting in personnel in Haiti having to unload those supplies by hand.³⁸ Another example indicates that in the first few days of the operation, military personnel slept in the shade of helicopters as basic shelter requirements were also left off planned loads due to lack of effective prioritization.³⁹ Citing these and other issues, a joint lessons learned report for Op HESTIA recognized that "better management and control of strategic airflow would have led to greater operational effectiveness earlier,"

³⁷ Canadian Armed Forces, "Past Operations (Americas)," last accessed 28 April 2014, <http://www.forces.gc.ca/en/operations-abroad-past/op-hestia.page> Op HESTIA was the CAF participation in humanitarian operations conducted in response to the catastrophic earthquake that struck Port-au-Prince, Haiti, on 12 January 2010.

³⁸ Canadian Armed Forces, Joint Lessons Learned Report (JLLR) 01/10: Operational and Strategic Lessons – Op HESTIA, 3350-1 (Joint LL Team Leader), 12 April 2010, 6/9.

³⁹ *Ibid.*, 6/9.

and recommended improving understanding across staffs and departments in Ottawa of airflow procedures.⁴⁰

In 2011, similar issues were experienced when Canada deployed forces to intervene in the civil war in Libya. Op MOBILE⁴¹ was hastily planned and deployed, with Canadian aircraft enroute to Italy without a support system in place and before it was even determined which airfield the units would be based at. Although this rapid deployment provided a positive strategic effect, with Canadian fighter aircraft flying operational missions just a few days after receiving their orders to deploy, support components struggled to ensure the mission was effectively sustained due to a lack of deliberate planning and direction.

Furthermore, because developed airfields were chosen, a decision was made that the Royal Canadian Air Force's (RCAF) expeditionary support component, the Mission Support Element (MSE), would not be required. Thus, the logistical tail could be minimized. This resulted in the mission adopting an ad hoc structure more commonly used for deploying to planned exercises at established air force bases. As a result, the small logistics cadre was expected to support multiple units at several geographically separated operating locations. The Task Force (TF) Lesson Finding Report concluded: "There was unfamiliarity on the part of TF members, and some senior [Air Force]

⁴⁰ *Ibid.*, 2/9.

⁴¹ Canadian Armed Forces, "Past Operations (Middle East)," last accessed 28 April 2014, <http://www.forces.gc.ca/en/operations-abroad-past/op-mobile.page> Operation MOBILE was the CAF participation in the international response to the civil war in Libya, February 2011 - October 2011.

leadership...with the amount of support required to sustain a mission of this length and distant distributed locations.”⁴²

It was eventually recognized that a more robust support framework was required, but not before fuel and ammunition shortages, local labour disruptions, and contracting issues threatened to disrupt the operation. Strategic-level lessons learned identified “delay in establishing a [National Command Element/National Support Element] hindered mission execution and oversight of the theatre,” and noted that this systemic shortcoming had been repeated in the past and was “not without historical precedent in recent experience.”⁴³ Greater command understanding, as well as increased engagement between commanders and logisticians during the planning and preparation of the mission, could have resulted in greater emphasis on the deployment of a logistics structure of appropriate size and composition to meet the challenges of conducting operations from more than four locations. Once again, the speed of deployment brought great strategic effect for the CAF and Government of Canada; however, better understanding by commanders and planners of the importance of integrating logistics early in the process could have ensured a more effective deployment phase.

For logisticians to support operations effectively, they must be integral to the entire planning cycle, constantly coordinating their support efforts with all other elements

⁴² Canadian Armed Forces, *Op MOBILE/Task Force Libeccio – FE - Lesson Finding Report A2-02Q, AF113*, 27 Apr 2012.

⁴³ Canadian Armed Forces, “Synopsis of Issues Raised in Phase I of Op MOBILE” Strategic Lessons Learned (Ottawa: CAF, February 2012), 2/5.

of the force. The RCAF's *Project Laminar Strike - Canada's Air Force: Post Op ATHENA*, linking lessons learned to a future vision for the RCAF, recognizes the systemic problem that logisticians are frequently left out of the planning cycle. "Without the opportunity to plan operational support," the document acknowledges, "logisticians are left to be reactive vice proactive in response to operationally important situations."⁴⁴ This inability to plan limits overall effectiveness and usually just meets the basic needs.⁴⁵

Canada is not the only military force that struggles with setting the conditions for having a robust logistics network. During Op IRAQI FREEDOM, U.S. ground forces experienced the same tendency to deploy combat forces first, delaying the arrival of logistics personnel until later in the deployment, which resulted in disruptions to operations.⁴⁶ As was the case in the smaller scale Canadian examples, the combination of minimizing the logistics footprint, as well as hastily sending supplies without sufficient preparation, resulted in inefficient packaging. U.S. Government Accountability Office (GAO) reported: "Because of the shortage of support personnel in theater, the forces experienced delays in receiving, storing, and distributing supplies."⁴⁷ The lack of logistical infrastructure, notably incomplete Radio Frequency Identification (RFID) materiel tracking systems, caused even greater delays as shipments had to be opened so that contents could be verified manually, sorted, and re-palletized at theatre distribution

⁴⁴ Canadian Forces Aerospace Warfare Centre, *Project Laminar Strike, Canada's Air Force: Post Op ATHENA*, (Trenton: CFAWC, 2011), 89.

⁴⁵ *Ibid.*, 89.

⁴⁶ United States, Government Accountability Office, *GAO-07-807 Defense Logistics: Efforts to Improve Distribution and Supply Support for Joint Military Operations Could Benefit from a Coordinated Management Approach*, (Washington, DC: GAO, June 2007), 6.

⁴⁷ *Ibid.*, 6.

points.⁴⁸ The U.S. Air Force (USAF) also noted that the original deployment flow prioritized “shooters” ahead of logistical support, which adversely impacted the mission. These negative effects on the operation eventually “convinc[ed] theater commanders of the importance of sufficient logistics connectivity early in the deployment flow.”⁴⁹ Incidentally, this lesson was also observed a decade earlier during Op DESERT SHIELD/DESERT STORM, where the “decision to deploy maximum combat power at the expense of deploying logistics support...limited the overall operational development of the theater.”⁵⁰ As a result, the DESERT STORM theatre support structure became severely strained and, “showed early signs of fatigue after only 100 hours of intense combat.”⁵¹ The situations outlined above could have been avoided if commanders and staffs had a better appreciation and understanding of logistics. By recognizing that the early establishment of logistical enablers in theatre is critical to mission success, informed commanders can ensure greater effectiveness of the deployed force.

Key Deductions

Commanders and staffs must have a greater understanding of logistical implications. Similar to other topics requiring common professional competence, such as law of armed conflict and strategic policy formulation, commanders must have a strong foundation in logistics to understand how sustainment challenges are interrelated with the

⁴⁸ *Ibid.*, 7.

⁴⁹ John T. Jacobs et al, *Logistics Reachback*, (Ft. Belvoir, VA, DTIC, May 2003), 9.

⁵⁰ Douglas Craft, *An Operational Analysis of the Persian Gulf War*, (Carlisle, PA: U.S. Army War College, 1992), 19.

⁵¹ *Ibid.*, 20.

mission they are trying to accomplish. Commanders do not need to be experts in DND/CAF logistical systems and procedures, nor should they be burdened with the details; however, as they are accountable for all logistics decisions made within their control, they must at least understand enough about logistics to know what questions to ask.

By the same token, treating logistics as a black art encourages commander lack of interest and understanding and is usually counter-productive to the logistician's cause. Knowing that it is easier to influence a plan when there is regular and open communication, logisticians must be persistent and remain engaged with commanders and staffs rather than waiting to be called upon. To do so, logisticians must demonstrate an understanding of the commander's aim by speaking in operational terms. In finding this middle ground, logisticians have the opportunity to build trust, explain the logistical challenges, and provide alternatives that are still acceptable to the commander. By working with commanders and staffs to improve processes, logisticians can take greater steps to ensuring ensure common understanding and reducing friction.

Commanders, staffs, and logisticians must understand the reasoning behind manning levels and fighting force to support ratios; appreciating that speed, agility, effectiveness, and sustainment of fighting power is reliant on coordinated, efficient, and robust logistics. Logisticians must fight the perception that 'the tail is wagging the dog,' by working to meet the commander's aim without being perceived as being needlessly

bureaucratic. Project Laminar Strike, challenges the support community to maintain relevance: “the Air Logistics Branch needs to be viewed as truly supporting the operations; it must be a centre of subject matter expertise that determines the most suitable methods to sustain operations.”⁵² By ensuring manning levels and policies are intuitive, defensible, and anchored in common sense, logisticians can rationalize the necessity of accountability in resource management, while remaining operationally focused. Logistics must be at the forefront of planning and must keep pace with the speed of operations expected in today’s world. Thus, logisticians must work to be viewed as an enabler, rather than an impediment to the mission.

⁵² Canadian Forces Aerospace Warfare Centre, *Project Laminar Strike...*, 89.

3. INTEGRATION

A lack of integration in logistics is both a symptom and a cause of the lack of understanding. As Vego notes, the introduction of technology into the command and control process has increased the need for compatibility of equipment and standardized procedures: “automated information systems should be capable of providing rapid, reliable, and secure information interchange throughout the chain of command.”⁵³ This system integration is necessary to provide commanders with critical information regarding the readiness of their forces and the feasibility of operational plans. Integration is also significant in the friction analogy provided by Clausewitz, who describes the military machine as simple and seemingly easy to manage, except that it “is composed of individuals, every one of whom retains his potential of friction.”⁵⁴ That is, organizations, and the people in them, are a significant source of friction.

Unfortunately, a lack of logistics integration in the DND/CAF leads to bureaucratic systems and procedures that impair the force’s ability to conduct operations more effectively. Three main aspects inform this discussion: technology; business processes and structures; and the balance between business efficiency and operational effectiveness. First, technology can be a key enabler or vulnerability in logistical processes of CAF and allied forces. Governmental audits from Canada, the U.S., UK, and Australia cite problems that have led these allied militaries to embark on ambitious supply chain modernization projects. Second, although technology can enable an

⁵³ Vego, “Operational Logistics...,” VIII-19.

⁵⁴ Clausewitz, *On War...*, 119

organization, business processes and structures are equally important and must be evaluated continually to ensure they are relevant, responsive, and effective. Problems encountered on recent missions suggest better integration of logistical processes is needed to provide greater responsiveness, particularly in rapid deployments.

Understanding the difference between private sector measures of effectiveness compared to those of the military also provides insight into applying business innovation to the military environment. Third, an examination of the balance between operational effectiveness and fiscal efficiency is important in understanding the how operational and materiel accountability consequences of neglecting logistics capabilities.

Technology

Uninformed investment due to lack of understanding of logistics leads to poor logistical integration. In recent years, technological advances have resulted in procurement of highly specialized weapons systems and platforms that boast network-enabled connectivity. Unfortunately, these significant investments have not necessarily been complemented with commensurate improvements in modernizing the logistical systems that can harness their full potential. For example, the \$17.1 billion initiative by the Canadian Government to “transform the mobility and logistical capabilities of the Canadian Forces”⁵⁵ was focused on large platforms, such as the CC-130J, Joint Support Ship, and vehicles, but not on the logistical enablers that facilitate integration of these and other platforms in order to be more effective in the long-term. With a lack of logistical

⁵⁵ Martin Shadwick, “Road to Mobility,” *Canadian Military Journal*, (Autumn 2006): 94. <http://www.journal.forces.gc.ca/vo7/no3/doc/commenta-eng.pdf> (accessed April 5, 2014)

foresight, the original CC-177 project failed to include material handling equipment or a load planning system required to load the aircraft safely and efficiently. Similar to other allied forces, such as the U.S. Army, new weapon systems are “burdened with disconnected, outdated, and inefficient ‘legacy’ logistics systems that cannot keep up with new operational war fighting concepts.”⁵⁶

Integration of technology provides a critical component of effective sustainment; the ability to track materiel shipments, otherwise known as In-Transit Visibility (ITV). When ITV fails, sustainment efforts become a burden on the force, not an enabler. During the allied invasion of Normandy in 1944, “many vessels arrived at the far shore with their contents unknown to shore personnel” and dozens of supply ships had to be called forward and unloaded in order to find a specific type of artillery shell required by the battle group.⁵⁷ During the British deployment to the Falkland Islands in 1982, ships were already underway when it became clear that forces would encounter an opposed, not administrative landing. Equipment on the ships needed to be re-organized enroute; however, contents of the containers were not clearly marked, which contributed to delays and resulted in increased vulnerability of the force once they had reached the beachhead.⁵⁸ The U.S. Army also estimated that if an effective method of tracking the

⁵⁶ Greg H. Parlier and Fred Gluck, "Transforming Army Supply Chains: Analytical Architecture for Management Innovation," *Air Force Journal of Logistics*, 32/33, no. 4/1 (2009): 64.

⁵⁷ Eccles, *Logistics in the National Defense...*, 166.

⁵⁸ Thompson, *The Lifeblood of War...*, 249-280.

location and content of sea containers had existed in 1990, they would have saved approximately \$2 billion dollars in the early days of Op DESERT SHIELD.⁵⁹

More recently, in 2007, the U.S. GAO examined joint theatre logistics in Iraq and Afghanistan due to an insufficient capability to provide support to ground forces, both Army and Marine Corps, related to stock shortages and timely delivery of supplies.⁶⁰ Seeking to address long-standing weaknesses in asset visibility and distribution of supplies within the theatre of operations, the GAO recalled that the same problems were identified previously during Op DESERT STORM and throughout the 1990s. Their 2007 findings pointed to fragmentation and duplication of effort in joint theatre logistics and singled out materiel distribution and asset visibility as two critical areas for U.S. DoD to focus on.

Even with the massive scale in which the U.S. operates, these examples provide interesting insights; however, it is worthwhile to look at smaller militaries for solutions to problems of a similar scale to Canada. In the high intensity operations that have characterized the wars in Afghanistan and Iraq, the UK experienced similar supply chain challenges of sustaining an expeditionary force thousands of kilometres from its home shores. In reports to government, the UK National Audit Office (NAO) cited failures to move consignments through the UK supply chain effectively and on time due to

⁵⁹ John T. Jacobs et al, *Logistics Reachback...*, 18.

⁶⁰ United States, Government Accountability Office, *GAO-07-807 Defense Logistics...*, 1.

segmentation of the supply chain and lack of reliable information regarding stocks.⁶¹ This failure caused a lack of confidence in the system and resulted in increased air shipments due to units stockpiling supplies in theatre, thereby, increasing the cost of the operation while also reducing the agility of the force.⁶² Similar to the challenges experienced by Canada, data systems were not compatible, contradictory data existed across systems, and visibility was inconsistent.

Acknowledging the need for renewal of logistical systems, UK Ministry of Defence (MoD) initiated the Future Logistics Information (FLIS) project, awarding Boeing Defence UK a 10-year, £700 million contract to be the Ministry's Future Logistic Information Systems project partner and single accountability point for delivery of logistics information services within its Logistics Network Enabled Capability (LogNEC) suite.⁶³ Consolidating and rationalizing 270 legacy logistics information systems, previously operated by 50 separate contractors, the project is predicted to improve data disaster recovery capability and is aimed at "streamlining and optimising [UK MoD's] end-to-end Logistics Information System into an agile and effective capability that

⁶¹ United Kingdom, National Audit Office, "MOD: The use of information to manage the logistics supply chain," *Report by the Comptroller and Auditor General*, (London: NAO, March 2011), 7. <http://www.nao.org.uk/report/mod-the-use-of-information-to-manage-the-logistics-supply-chain/> (accessed 25 March 2014)

⁶² *Ibid.*, 25.

⁶³ Boeing, "LogNEC Delivery Partnership," 2010, <http://www.boeing.co.uk/Products-Services/Boeing-Defence-UK/LogNEC-Delivery-Partnership> (accessed 25 march 2014)

underpins the support chain.”⁶⁴ NAO, however, has been skeptical of the FLIS project’s ability to resolve the enormity of MoD’s supply chain information capability shortfall.⁶⁵

The U.S. and UK experiences provide insight into the logistics challenges of allied forces operating in similar environments. The CAF also looks to Australia as a good comparison due to its similarities in size with respect to population, GDP, and military. Australia’s recent operational experience in South West Asia has been subject to many of the same supply chain effectiveness challenges experienced by the CAF and other allies. Sustainment issues in East Timor, then again in Iraq and Afghanistan, catalyzed a political turning point that ignited the Australian Defence Force’s (ADF) logistical transformation.⁶⁶ Recognizing that “*a robust, flexible and responsive logistics system is at the heart of the ADF’s capability,*” the Government of Australia’s 2009 Defence White Paper committed to improving the ADF’s logistics infrastructure network, as well as optimizing the use of technology in order to attain the standard of logistics support required for the future.⁶⁷

In August 2010, Australia began to implement the Defence Logistics Transformation Program (DLTP), a program designed to reduce costs and improve

⁶⁴ *Ibid.*

⁶⁵ United Kingdom, National Audit Office, “MOD: The use of information...,” 7.

⁶⁶ Rob O’Neill, “Rescue Plan for Defence Supply System,” *Sydney Morning Herald*, (Sydney: Dec 7, 2004), <http://www.smh.com.au/news/Next/Rescue-plan-for-defence-supply-system/2004/12/06/1102182189488.html>

⁶⁷ Australia, Department of Defence, *Defending Australia in the Asia Pacific Century: Force 2030*, (Canberra: 2009), 123.
http://www.defence.gov.au/whitepaper2009/docs/defence_white_paper_2009.pdf (accessed Sep 18, 2013),

service levels, through rationalization of management overhead and reduction of logistics sites in Australia.⁶⁸ As part of Joint Project 2077 – Logistics for the Warfighter, the Military Integrated Logistics Information System (MILIS) was released, providing improved visibility and accountability over ADF assets. Other aspects of the project are providing “deployable logistics capabilities designed for use in a communications-interrupted environment.”⁶⁹ According to Mincom’s CEO, the ADF’s MILIS “can serve as a best practices model for other defense organizations...as they move away from ‘stovepipe’ custom applications and mature their joint-logistics capabilities.”⁷⁰ A senior ADF logistician agrees that, although there have been some delays in timelines, as well as signs of “change fatigue” within units, the majority of the program has been successfully implemented.⁷¹ These investments and reforms represent significant acknowledgements on the part of allied nations that logistical systems must be capable of enabling expeditionary operations while demonstrating responsible resource management. Still, they only begin to reach the levels of efficiency and systems integration in the business processes of innovative supply chain and distribution corporations.

These examples from allied forces highlight the consequences of a military not having visibility of its equipment in transit. In today’s environment, these weaknesses can

⁶⁸ Australia, Department of Defence, “Defence Logistics Transformation Program” *Statement of Evidence to the Parliamentary Standing Committee on Public Works*, (Canberra, June 2012)

⁶⁹ Australia, Department of Defence, “Joint Project (JP) 2077 – Logistics for the Warfighter,” last accessed 29 April 2014. <http://www.defence.gov.au/dmo/coo/jp2077/phases.cfm>

⁷⁰ BusinessWire, “Australian Defense Force Successfully Deploys First Fully Integrated Military Logistics System with Mincom Elipse” (Denver, August 18, 2010), <http://www.businesswire.com/news/home/20100818006437/en/Australian-Defense-Force-Successfully-Deploys-World%E2%80%99s-Fully#.Uumes08o6-U> (accessed 29 Jan 2014)

⁷¹ Colonel Simon Tuckerman, Commander 1st Joint Movements Group, ADF, email correspondence with author, 15 April 2014.

be mitigated through the integration of technology that can enable the near-real-time tracking of freight.⁷² Unfortunately, the numerous systems used for logistics-related purposes in the Canada are not well integrated. Therefore, rather than simplifying and enabling visibility, they contribute to the complicated nature of piecing together partial data from various sources to provide situational awareness for command, planning, and conduct of operations.

In 2008, the Canadian Office of the Auditor General (OAG) identified ITV as one of the numerous shortcomings in National Defence support for overseas deployments. As an example, the OAG identified that even though equipment being shipped to Afghanistan was tracked in-transit, upon arrival at the destination, supply technicians were required to sift manually through plane loads of supplies.⁷³ The lack of integration of local databases resulted in inefficient redundancy produced conflicting information on expected arrival dates, locations of stock held, and priorities for re-ordering supplies. To make matters worse, local tracking increased the risk of input errors, resulting in unnecessary delays, which further stressed the logistics system. This inability to predict when materiel would arrive undermined the credibility of the entire supply chain system, resulting in constant phone and email inquiries and hasteners. Frequently, phone calls were placed directly back to Canada to increase the priority of a specific item to ensure it

⁷² Total Asset Visibility (TAV) encompasses all the information about a specific part/object from manufacture to disposal, while In-Transit Visibility (ITV) refers to the near-real time tracking of an object during movement. The general term visibility is used to encompass both TAV and ITV unless otherwise mentioned.

⁷³ Auditor General, *Support for Overseas Deployments – National Defence*. Report of the Auditor General of Canada to the House of Commons (Ottawa: Public Works and Government Services Canada, May 2008), 11.

was placed on the next flight. Although these hasteners for individual items may have avoided short-term impact to one aspect of the operation, the frequency at which hasteners occurred routinely resulted in other similarly high priority requirements being removed from priority lists and aircraft load plans, which negatively affected other aspects of the operation. Because of their distrust of the supply system, some units would ship “important” items directly to theatre without going through the appropriate channels, resulting in a loss of overall theatre visibility as critical parts and equipment could not be tracked.⁷⁴ Lessons learned by from the Joint Task Force Afghanistan Air Wing during Op ATHENA also identified the weaknesses in supply chain decision-support tools, stating that logistics support must develop at a rate equal to operational capability and that “sustainment operations should not be a continuous crisis-management exercise.”⁷⁵

These shortcomings in visibility and integration in the supply chain are well recognized within the CAF logistics community, in particular, the lack of automated information technology (AIT) and reliance on manual input, which provides inaccurate and time-affected data.⁷⁶ Unfortunately, these shortcomings are not specific to the Afghanistan mission and contribute to the perception that CAF logistics is not responsive enough for today’s operations.

⁷⁴ Zima, *A Canadian Revolution in Military Logistics...*, 35. Also corroborated by author’s experience.

⁷⁵ Canadian Forces Aerospace Warfare Centre, *Project Laminar Strike...*, 59.

⁷⁶ Zima, *A Canadian Revolution in Military Logistics...*, 31.

Positive steps are being taken to address some of the technological integration gaps. Defence Resource Management Information System (DRMIS) is a cornerstone tool of an integrated Enterprise Resource Planning strategy that encompasses financial records, materiel acquisition and support systems, workforce management, and materiel life cycle management.⁷⁷ Once fully implemented, DRMIS will replace Mincom (MIMS) as DND's supply chain enterprise resource management system.

In addition to the DRMIS initiative, in April 2013, Director-General Materiel Systems and Supply Chain (DGMSSC), initiated a series of AIT working groups with an aim to gather requirements to “develop a major capital omnibus project to make effective use of AIT to address deficiencies...based on OAG audit observations, lessons learned, and direct observation.”⁷⁸ With a mandate to identify, analyze and provide recommendations on AIT requirements, the Working Groups will provide advice and guidance to ADM(Mat) on how to optimize the use of AIT as a strategic corporate resource. Still in the initial definition stage, the project is planned to cost \$900M over 10-12 years.⁷⁹ While these steps towards renewal are encouraging, and will increase situational awareness for commanders, increased integration cannot be accomplished by AIT alone, nor should it be focused solely on the traditional supply chain. All business processes and structures must be refined in order to improve integration and reduce friction.

⁷⁷ Department of National Defence, ADM(Mat), “Defence Resource Management Information System,” 2014, <http://drmis-sigrd.mil.ca> (DIN, accessed 24 March 2014)

⁷⁸ Department of National Defence, ADM(Mat), “Automatic Identification Technology (AIT) Requirements Gathering Options,” (presentation, DIN, May 9, 2013), 5.

⁷⁹ *Ibid.*, 5.

Business Processes and Structures

According to Tuttle, “[logistical] processes are complex enough that logisticians and [leadership] should do all they can to simplify them...not add more bureaucratic complexity.”⁸⁰ When logistical processes are overly complicated and time-consuming, and when they are not well understood, they become friction points between supported and supporting elements. Compounding the problem, these frictions often occur during the most critical and time-sensitive stages of an operation, such as mounting and deployment. The stages of an operation are defined by Canadian joint doctrine as planning, preparation (mounting), buildup, (deployment), execution (sustainment), termination (redeployment), reconstitution, and analysis.⁸¹ Added in parenthesis, there are certain activities within these stages that are of particular interest in the discussion of logistics friction. “Mounting” describes preparations in anticipation of an operation, whereas “deployment” is actual the relocation of forces to the area of operations.⁸² “Sustainment” is the ongoing logistical support and replenishment that occurs during an operation, while “redeployment” is the repatriation of forces back to their originating units.

Mounting and deployment activities during crisis operations are extremely stressful and time sensitive. Moreover, insufficient logistics planning during rapid

⁸⁰ Tuttle, *Defense Logistics for the 21st Century...*, 17.

⁸¹ Department of National Defence, B-GL-005-400/FP-001, *Canadian Forces Joint Publication CFJP 4-0 Support* (Ottawa: CJOC, 2014), 4-2.

⁸² *Ibid.*, 5-1.

deployments that results from a lack of command understanding is exacerbated by complicated and time-consuming processes during mission mounting. Current mounting procedures for the deployment of a unit or task force involve a ground-up approach whereby, after receiving the commander's intent, the Task Force staff develops a Table of Organization and Equipment (TO&E) that is provided to the Task Force Movements Officer (TFMO) who, on behalf of the commander, ensures the personnel and equipment are prioritized and moved to destinations effectively. In order for this process to work, staff and subordinate units must be able to provide early identification of what equipment will be required and in what order. They must also be able to provide detailed information about numbers, size, and weight so that lift requirements can be accurately calculated. This process requires lead-time, as well as deliberate planning and forethought so that integration of information can occur.

According to operational units with a focus on ensuring materiel accountability and tracking, such as 3 Canadian Support Unit, the greatest challenge for hasty deployments is the speed at which materiel mounting can be completed.⁸³ The lack of pre-planned deployment scales, insufficient identification of materiel requirements at the unit level, and the lack of common tools make preparation a time consuming and often ad hoc process.⁸⁴ UMSTs from deploying units must be completed accurately in order for an integrated Task Force Movement Table (TFMT) to be developed by the TFMO, thus ensuring the commander's equipment priorities are satisfied. Unfortunately, master

⁸³ 3 Canadian Support Unit, *Recommendations on Total Asset Visibility (TAV) for Humanitarian Operations and Disaster Relief Briefing Note for Comd CFJSG*, (Montreal: 3 CSG, 1 Dec 2010), 1.

⁸⁴ *Ibid.*, 4.

mounting instructions and equipment lists prioritized for deployment, known as Unit Movement Staff Tables (UMST), have not been maintained within the CAF.

This problematic friction point between deployment doctrine and reality has been observed repeatedly, documented in after-action reports and “lessons learned” from nearly every short-notice deployment in recent memory. Op RENAISSANCE 13-01, the Humanitarian Aid and Disaster Relief (HADR) mission to the Philippines following Typhoon HAIYAN, is no exception.⁸⁵ The Canadian Forces Warfare Centre (CFWC) lessons learned drawn from Op RENAISSANCE 13-01 state that “a TFMT is one of the most important movement documents required for any Op/Ex.”⁸⁶ However, during Op RENAISSANCE 13-01, UMSTs were incomplete and no TFMT was provided, creating “numerous planning and reporting issues...as it was not known exactly what [had already been shipped and what] was left to deploy.”⁸⁷ During this humanitarian mission, this lack of situational awareness, or “fog of war,” originated from poor integration and understanding of logistical processes on the part of the deploying units. “Of particular concern,” the lessons learned document adds, “was the [amount of] work imposed on the Task Force Movements Officer because the call-forward process was not well understood.”⁸⁸ Reports from Op MOBILE also point to multiple problems with

⁸⁵ Canadian Armed Forces, “Past Operations (Op RENAISSANCE 13-1)” last accessed 28 April 2014, <http://www.forces.gc.ca/en/operations-abroad/op-renaissance.page>

⁸⁶ Canadian Forces Warfare Centre, *Op RENAISSANCE 13-01 Lessons Learned Report, 3350-Op RENAISSANCE (CFWC A&LL)* (Ottawa: CFWC, 5 February 2014), Annex B, 6/15.

⁸⁷ *Ibid.*, Annex B, 6/15.

⁸⁸ *Ibid.*, Annex B, 10/15.

deployment readiness and recommend standardization and improvement to deployment pack-up kit checklists.⁸⁹

This systemic issue points to both the need to improve processes and supporting tools, as well as the need to improve personnel education at all levels for those who may be called upon to determine equipment requirements for a short-notice deployment. How this information is shared also becomes a point of friction. During the various stages of a mission, the same basic logistical information with slight variations is required by numerous sections at all levels of command, while the sources of the information itself are spread across several independent sources, or stovepipes. As a result, unit TO&Es, passenger manifests, flight information, airlift tasking messages, supply stock information, and materiel movements tracking information are manually integrated in Excel spreadsheets to give individuals their own comprehensive view. These individual views are then communicated through emails that are amended and forwarded multiple times. Once again, time-affected information is subject to errors or confusion due to conflicting versions as attempts are made to reach everyone who might need this information.

Information security is also a necessary but challenging consideration when integrating processes and sharing information. In a military environment, large databases

⁸⁹ Canadian Armed Forces, *Op MOBILE/Task Force Libeccio – FE - Lesson Finding Report A2-02Q, AF113*, 27 Apr 2012, 4.

containing flight information or sustainment requirements can be highly sensitive and are inevitably classified as SECRET. Currently, logistics-related programs operate on both classified and unclassified networks, making integration of information difficult and limiting situational awareness. While the coordination of information across these logistics and movements systems is extremely difficult in garrison, it becomes nearly impossible in a deployed environment. In order to maintain ITV when deployed, technicians who prepare documentation and receive shipments must have access to centralized supply chain systems; however, these systems are difficult to deploy due to a lack of sufficient bandwidth required to operate the necessary programs.

To be responsive and remain relevant, movements and supply chain systems must be able to operate in austere environments, away from the Main Operating Base. Thus, these logistics systems must be flexible, resilient, distributed, and shared across multiple platforms. Furthermore, the need to protect information must be balanced with the need for flexible and reactive systems that enable operations worldwide. Without means of reliable military communication, deployed personnel continue to resort to GMail or other non-secure means to transmit time-sensitive information regarding flights, cargo, and logistics requirements for the sake of convenience and speed.

Effective information sharing and integration is critical in air mobility operations where flight schedules, passenger manifests, and aircraft load plans are constantly being updated. The manual integration of these updates must then be transmitted to a variety of

groups who require different aspects of the information. In this environment, time-affected data once again becomes a burden rather than an enabler. This was identified during the sustainment stage of Op MOBILE when, “on numerous occasions aircraft arrived without warning, up to 3 – 4 hours before published itinerary...[and] at other times, aircraft were delayed up to 24 hours with no notification,” hindering operations.”⁹⁰

In this instance, a shared air mobility operations system that integrated passenger manifests, freight details, load planning information, and updated flight scheduling would have provided an extremely effective and efficient means of ensuring dissemination of common information required by flying squadrons, operations centres, movements personnel, and customers at origin and all destinations. Such a system would have also reduced the number of repetitive and often conflicting communications in email chains, tasking messages, and local tracking spreadsheets while providing a holistic view that could have helped planners to optimize available lift capability. Recognizing that such tools are common among commercial airlines and courier companies such as FedEx, a senior air mobility pilot remarked: “Canada is significantly behind the times when our ‘master movements document’ is an excel spreadsheet on the OSCOM website.”⁹¹

Although the CAF may not be able to attain a commensurate level of efficiency and visibility of multi-national corporations, there is still much that can be done within departmental constraints.

⁹⁰ Colonel A. Pelletier, *Task Force LIBECCIO (TFL) & Air Coordination Element (ACE) – Op MOBILE Roto 0 & 0A – End of Tour Report*, 31 Aug 11, Annex G, 37/55.

⁹¹ Lieutenant-Colonel Colin Keiver, Commanding Officer, 436 Squadron Trenton, email correspondence with author, 7 Dec 2011.

Logistical processes and organizations must adapt to the speed of information and commander expectations, while ensuring this operational focus is sustainable given personnel and resource constraints. This requirement is particularly important in time-sensitive operations and when political constraints leave little room to manoeuvre. For example, in 2011, the Mission Transition Task Force (MTTF) was responsible for termination of Op ATHENA, the redeployment of Canadian troops and equipment from Kandahar, as well as the transition to a training mission, Op ATTENTION, in Kabul.⁹² Constrained by a non-negotiable mission end-date set by the Government of Canada, the MTTF was faced with extremely tight timelines in which to accomplish the mission. Recognizing that DND/CAF's logistical processes and systems for repatriating equipment back to Canada were not responsive enough to deliver on the required date, the MTTF was forced to mitigate materiel accountability risks by developing its own system to maintain visibility and integrate internal logistical processes.

Much like other examples from CAF operations, the strategic effect of the mission was achieved; however, there was significant friction as the secondary effects were not always well received by stakeholder units, and Customs and Border Safety Agency (CBSA) officials, back in Canada. Time pressures, coupled with the requirement to enter data multiple times into multiple tracking systems that were not well suited to an austere environment, contributed to inaccuracies and conflicting information. Consequently, customs declarations and documentation did not always match the

⁹² Canadian Armed Forces, "Past Operations: The Mission Transition Task Force," last modified 17 September 2013, <http://www.forces.gc.ca/en/operations-abroad-past/op-athena-closure.page>.

contents of crates and sea containers returning to Canada. In some cases, valuable time and resources were wasted searching for weapons and other sensitive equipment that were rumoured to have been delivered, but had not left the theatre. In other cases, customs documentation travelled by ship to the Port of Montreal for equipment that returned to Canada by air via Trenton.⁹³ While these occurrences caused confusion and box-by-box searches for sensitive items, more critically, they caused CBSA agents to question the credibility of all customs documentation returning from Afghanistan. The logistical challenges experienced during this operation clearly demonstrate that under austere conditions and severe time constraints, logisticians need intuitive procedures and technological systems that enable efficiency and accuracy.

The U.S DoD and Australian Defence Force (ADF) have recognized similar challenges with creating a common operating picture from multiple sources of information, standing up national military logistics and movement fusion centres to “provide interoperability, synchronization, and alignment of DoD-wide, end-to-end distribution.”⁹⁴ U.S. Transportation Command (USTRANSCOM) is also developing Agile Transportation for the 21st Century (AT21) to provide increased integration of logistics and movements tracking and control systems.

⁹³ 2 Air Movements Squadron, *2 Air Movements Squadron After Action for Kandahar Mission Closure*, (Trenton: 8 Wing, 28 March 2012), Annex A.

⁹⁴ Booz&Co, *Australian Defence Force 1st Joint Movements Group Organisation Review Final Report*, (Canberra: Booz&Co July 2012), 102.

Industry once looked to the military as a model for developing organizational efficiency; now it is the other way around. Comparing CAF movements systems and procedures to industry leaders such FedEx and Wal-Mart, commanders now ask why a personal package can be tracked anywhere in the world on their smartphone, but the military cannot find an aircraft part shipped from Montreal to Trenton. Likewise, a commercial flight can be booked using a smartphone, but military systems have not been integrated to this level of responsiveness. While it must be recognized that military systems, political constraints, and economies of scale make it very challenging to compare the military to commercial companies, there are certainly areas for improvement.

Leading corporations that deliver logistics effects such as FedEx, UPS, and Wal-Mart have been using AIT technologies for years, including RFID and barcode systems that integrate with global positioning system enabled aircraft and vehicles to provide near-real-time tracking of shipments. Frederick W. Smith, founder of FedEx, was known to say: “the information about a package is as important as the delivery of the package itself.” As an example from industry, point-of-sale terminals at grocery and department store checkout counters automatically trigger the re-ordering of a product from the distribution centre or even from an integrated supplier or manufacturer. Another example is the use of computer algorithms in warehousing systems that automatically move stock bins of popular items closer to the loading dock so that forklift travel time is reduced when the truck arrives. These types of integrated systems can provide decision-makers

with near-real-time information and business intelligence from which trends and analysis regarding opportunities and threats can be deduced.

Multi-national corporations have enormous capacity and capability, but more importantly, they have become experts in logistical agility. After Hurricane Katrina hit New Orleans in 2005, Wal-Mart delivered 1,500 truckloads of merchandise and enough food for 100,000 meals, providing a lifeline to victims of the disaster.⁹⁵ Hailed as a model for logistical efficiency and disaster planning, the company delivered necessities including water, fuel, and toilet paper to evacuees. In fact, Wal-Mart was already preparing and loading trucks before the hurricane made landfall, while state and federal officials were criticized for their slow and insufficient response to the disaster.

Countless ideas can be drawn from process improvements and technological innovation within industry. However, one must look critically at the differences between the scale of corporations, as well as the routine interaction between established nodes that most civilian companies benefit from compared to the austere environment of an operational mission. In private industry, this routine interaction has meant that information is the substitute for inventory as Just-in-Time (JIT) inventory methods have all but replaced stockpiling, leading to reduced overhead and inventory costs. Integrated technological systems and

⁹⁵ Michael Barbaro and Justin Gillis, "Wal-Mart at Forefront of Hurricane Relief" *The Washington Post*, Tuesday September 6, 2005. <http://www.washingtonpost.com/wp-dyn/content/article/2005/09/05/AR2005090501598.html>

disciplined stock management provide agility to be able to react quickly to changing priorities and correct inefficiencies.⁹⁶ However, JIT inventory management depends on robust lines of communication with measurable and predictable consumption rates, which are not always possible in the military environment.

During operations, it is critical to keep buffer stocks in to mitigate the risks of enemy action, transportation related delays, or even labour disruption.⁹⁷ Thus, JIT is optimized for business efficiency and not necessarily for the battlefield where supply chain disruptions could mean the difference between life and death. For this reason, owing to their experience in Iraq and Afghanistan, the United States Marine Corps (USMC) has shifted their focus away from JIT. In the development of their Global Combat Support System (GCSS-MC), the USMC examined commercial logistical best practices in customer relations, order tracking, and distribution. Although the USMC had been attracted to business efficiency trends in the past, this time they ignored anything that did not directly translate into operational effectiveness on the battlefield: “Wal-Mart doesn’t have to move its stores every three days and tell their distributors where the stores went...there is a dividing line between a business and Marines maneuvering on a battlefield.”⁹⁸ An Australian analysis of ADF business practices also cautioned

⁹⁶ Tuttle, *Defense Logistics for the 21st Century...*, 11.

⁹⁷ *Ibid.*, 281.

⁹⁸ Arthur Brill Jr., “Marine Corps Plans to Revamp Outmoded Logistics System,” *Sea Power* Vol 47 Issue 2, (April 2004): 14.

against the same pitfalls, recognizing that high-tech tracking methods utilized by DHL and FedEx are not as easily implemented in austere environments or networks where nodes are constantly moving or changing, or subject to possible disruption.⁹⁹

Continually striving for efficiency and precision, businesses have turned to continuous improvement programs such as Six Sigma to minimize defects in manufacturing and have expanded them to include process improvement in human resources, customer service, and sales. Six Sigma consists of an intensive training process and uses a five-phase system: Define, Measure, Analyze, Improve, and Control.¹⁰⁰ The key to successful implementation of these programs is understanding when such a system will or will not be appropriate in a military context. For example, the USMC used Six Sigma to accelerate repair cycle times of Amphibious Assault Vehicles, and to streamline their Urgent Universal Needs Statement process, thus reducing the process duration from 129 to 87 days and bringing procurement cycle to a low of 45 days.¹⁰¹ When using methods such as Six Sigma within an operational environment, it is critical that performance metrics are meaningful and strike the appropriate balance between efficiency and effectiveness. For example, in the vehicle maintenance domain, a metric such as

⁹⁹ Booz&Co, *Australian Defence Force 1st Joint Movements Group Organisation Review...*, 97.

¹⁰⁰ Andrew Chappell and Helen Peck, "Risk management in military supply chains: Is there a role for six sigma?" *International Journal of Logistics: Research & Applications* 9, no. 3 (September 2006): 254.

¹⁰¹ Defense AT&L, "Logistics in a Changing Environment: Supporting Marine Expeditionary Units," *Defense AT&L Interview*, (Defense Acquisition University, July-Aug 2008), 4.

“availability at the gate” that is used by airlines could potentially provide a more accurate picture of effectiveness than the current DND/CAF method of counting the number of days a vehicle is in maintenance, or “off road,” without measuring if the vehicle was required during that period.

The underlying principles of Six Sigma and other continuous improvement methods can be effective if used sensibly, keeping in mind that operational effectiveness and the potential vulnerability to the war fighter must remain the primary measurements. Canada and its allies have recognized that the purpose and goals of the private sector are fundamentally different from the public sector and that industrial management theory cannot always be directly applied to defense processes. However, if adapted appropriately, some private sector initiatives can provide increased efficiency without sacrificing operational effectiveness.

Balance between Effectiveness and Efficiency

In order to keep pace with technology, a modern military must invest wisely in capabilities that provide the greatest benefits in balancing effectiveness and efficiency. Decisions on what to invest in or what to cut are based on how much risk a commander is willing to accept. However, during peacetime, logistics is often the first place that militaries attempt to find financial and structural efficiencies as they fight to maintain what they consider to be core capabilities. As logisticians have historically been unable to

articulate how cuts to logistics directly affect the effectiveness of the entire force; therefore, logistics has become a popular source of economic efficiencies. This constant friction is described by Eccles as the “duality in the nature of logistics,” between “business efficiency and combat effectiveness.”¹⁰² Articulating these risks has been particularly difficult when threats or expeditionary operations have not been imminent, as demonstrated during the Cold War period of the 1960s to the 1990s.

Following integration of Canada’s armed services in 1968, the logistics systems of the three services were combined in an effort to eliminate duplication and find financial savings. With economic and political motivations, rather than operational effectiveness, as the drivers of the amalgamation the initiative failed to integrate logistics functions in an operationally focused manner.¹⁰³ Citing “too much management, too little command,” Brigadier-General E. Leslie said of the efficiency initiatives of the day: “on the cost efficiency question, the military faces human and technical problems not met in the commercial world, not the least of which is that war [is] the only truly valid test of military cost/effectiveness.”¹⁰⁴ Although focused on the desire among DND/CAF to apply private sector efficiency principles to a military environment, General Leslie’s comment also acknowledges the overall problem of lack of command and ownership of logistics.

¹⁰² Eccles, *Military Concepts and Philosophy...* 76.

¹⁰³ Joseph George Marc Potvin, “The Integration of the Canadian Forces Logistics System and its Effect on the Operational Capabilities of the Canadian Military,” (University of Manitoba Thesis, Winnipeg, 1996), 115.

¹⁰⁴ BGen E. Leslie, “Too Much Management, Too little command,” *Canadian Defence Quarterly* (winter 1972): 32, quoted in Lieutenant-Colonel Michael Rostek, “Managing Change Within DND,” Chapter 9 of *The Public Management of Defence in Canada* edited by Craig Stone, (Toronto: Breakout Educational Network, 2009), 221.

Again in the 1990s, functional review and efficiency initiatives such as Management Command and Control Re-engineering (MCCR) and D2000 were established to “focus resources on operational capability by reducing resources assigned to headquarters and achieving dramatic performance improvements by re-engineering processes.”¹⁰⁵ These initiatives included organizational restructuring and headquarters personnel reductions, process re-engineering, business planning and financial reforms, strategic information management, and alternate service delivery initiatives such as the Supply Chain Project (SCP). In a static peacetime environment with pressure to reduce personnel and capital investment costs, there was a tendency to want to think in terms of garrison support and contracting for services rather than maintaining robust capabilities that are required for deployed operations. During these periods of cost and personnel reductions, it was particularly difficult for logisticians to describe the operational risks of resource and personnel cuts in a way that commanders could understand. Inevitably, commanders succumbed to budgetary pressures focused on short-term efficiencies to cut costs, which consequently reduced capacity and redundancy, but in some cases increased the total resource expense as there was less coordination and centralized oversight. Referred to by Tuttle as, “the many colors of money,” the complexity of finding efficiency in different budget allocations often results in saving money in one way, but while spending it in another.¹⁰⁶ In other words, efforts to find short-term efficiencies in

¹⁰⁵ Department of National Defence, *NDHQ 99: Review of restructuring and re-engineering*, (Ottawa: Chief Review Services, 2001), 2. <http://www.crs-csex.forces.gc.ca/reports-rapports/pdf/2001/P0031-eng.pdf>. (accessed 21 Apr 2014)

¹⁰⁶ Tuttle, *Defense Logistics for the 21st Century...*, 18.

part of the organization sometimes resulted in unintended consequences in other parts of the organizations, requiring greater expenditure of funds overall.

As part of the department-wide Defence Renewal initiative, materiel acquisition, storage and distribution systems are once again being examined for optimization in terms of both effectiveness and efficiency in DND/CAF.¹⁰⁷ With the stated goal of being able to reinvest savings elsewhere in the Defence Team, this initiative will likely be met with some skepticism as critics make parallels with the cost cutting exercises of decades past. In the early 2000s, for example, the implementation of short-term efficiencies and cuts to military and civilian logistics positions created risks and responsibility gaps without rationalizing processes or reducing expectations. These false efficiencies were only evident after positions and resources were lost.

In the past, the repeated campaigns to find efficiencies in Canadian military logistics have not translated to improvements in operational capability because savings are seldom reinvested, if realized.¹⁰⁸ This reality was also experienced in the U.S. DoD as “policies and practices during [the 1990s and early 2000s] have had unfortunate consequences when the time came to support military campaigns.”¹⁰⁹ Tuttle suggests that this emphasis on finding short-term savings by arbitrary reductions has conditioned logisticians to keep a low profile to protect existing resources and not to push boldly to

¹⁰⁷ Department of National Defence. ADM(PA). *Defence Renewal Charter: Department of National Defence and Canadian Forces* (Ottawa: ADM(PA), October 2013), 2.

¹⁰⁸ Zimmer, ‘For Want of a Nail the Campaign was Lost’..., 42.

¹⁰⁹ Tuttle, *Defense Logistics for the 21st Century...*, x.

take advantage of the sweeping changes in logistics practices embraced by industry.¹¹⁰ In Canada, this situation has created a cadre of skeptical logisticians who fear change and see any new “efficiency” initiative as an attack on operational effectiveness.

During this period, U.S. DoD’s experience in seeking logistical efficiency over effectiveness was remarkably similar to Canada’s. In the DoD, numerous studies and improvement initiatives were focused on finding efficiencies and immediate cost-savings, commonly known as “low-hanging fruit.” Suggesting that slashing costs without appropriate attention to effectiveness was counterproductive, Tuttle’s response to this approach was that “these savings can come only from transforming the DoD process of force projection and sustainment to produce more effective ways to support campaigns.”¹¹¹ For example, during Op IRAQI FREEDOM, U.S. forces experienced the weaknesses of logistic systems that had been eroded through efficiency initiatives over the previous decade, precisely what Tuttle had warned against. Lieutenant-General Christianson, senior U.S. logistician in Iraq, recalled that “most of the difficulties I can attribute to the fact that we fought a 21st century war with a mid-20th century logistics structure.”¹¹²

Military logistics has always struggled with finding an appropriate balance between operational effectiveness and resource efficiency. In 1959, Eccles stated that,

¹¹⁰ *Ibid.*, 291.

¹¹¹ Tuttle, *Defense Logistics for the 21st Century...*, 320.

¹¹² Roger W. Kallock and Lisa R. Williams, “DoD’s Supply Chain Mandate: From Factory to Foxhole” *Supply Chain Management Review* V.8, No. 4 (May/June2004): 47.

Financial considerations should not override considerations of combat effectiveness – in peace or war, understanding of basic log[istic] principles is essential to the task of providing maximum combat effectiveness.¹¹³

A few years later, perhaps as a reflection of the fiscal environment of the time, Eccles seemed to offer a more balanced view by stating:

High military commanders must be keenly aware that *good business management should permeate the entire logistic structure*. Furthermore, at times economic considerations must out-weigh military considerations.¹¹⁴

Nevertheless, if Eccles' suggestion of *good business management* is conducted with appropriate measures of effectiveness, risk management in mind, efforts to increase efficiency can lead to greater agility and economy of effort without sacrificing effectiveness.

Key Deductions

Technological solutions must be rationalized with information security. Keeping in mind the most critical nodes in the supply chain are often those deployed in austere locations without robust communication backbones, it is important that portable systems can be operated efficiently in all environments. The “last tactical mile,” as it is called, is most critical in ensuring supplies are readily available for the war fighter at the tactical level. Use of compartmentalized, encrypted, and web-enabled applications that use minimal bandwidth, but effectively safeguard and extend access to mission data, must be explored to provide the balance between accessibility and security.

¹¹³ Eccles, *Logistics in the National Defense...*, 49.

¹¹⁴ Eccles, *Military Concepts and Philosophy...*, 76.

Mounting, deployment, and airlift processes are a few examples where commanders of supported forces expect streamlined, agile, and responsive processes. This objective can be partially accomplished through the development of standardized tools that integrate all aspects of deployment planning would provide units and logisticians a commonly accepted format with which to share information. Employing standardized tools and processes does not mean a rigid, “one size fits all” approach; rather, it involves the development of planning tools that can be used universally and more easily understood. Processes must be modernized to meet commander expectations, while enabling the DND/CAF to provide the increased level of accountability expected of a government department. If procedures and doctrine are not responsive enough to meet reasonable commander expectations, they must be changed. Identifying and improving inefficient processes will provide a stimulus to reduce the friction between stakeholders.

Logistical systems must be able to respond effectively to commander expectations. The question of private to public comparison, “why can’t military logistics perform like airlines, FedEx, or Wal-Mart?” continues to gain a louder voice as web and wireless technologies eclipse those systems being employed in DND/CAF supply chain operations. It is recognized that Canada does not always have the capability or scale to operate like the private sector, and that some technical innovations that are successful in industry cannot be replicated in security sensitive or austere environments. Thus, logisticians must ensure that they manage expectations and increase understanding across the force.

That said, DND/CAF logistics must also continually evaluate business processes and structures to ensure they are relevant, responsive and effective. It must also continue to look for ways to exploit operationally beneficial innovations and narrow the gap between the levels of service provided by industry and military logistics. In the past, the philosophical differences between private industry and the military operations have not been fully considered when attempting to apply industrial innovations efficiency models and systems. However, employing appropriate measures of effectiveness that consider operational effectiveness will ensure that logistics remains focused on the primacy of operations.

DND/CAF must continually balance fiscal efficiency while remaining operationally focused. In today's environment of fiscal reductions, logisticians must be able to articulate risks of shortsighted savings initiatives that could lead to being hollowed-out in terms of operational capabilities. Logisticians must be able to measure and provide accurate and time-relevant details rather than relying solely on qualitative assessments. While experience-based intuition can be useful, it must be supported with facts, figures, and rationale that address the commander's primary concerns of operational effectiveness. By contrast, logisticians must also distinguish between those risks that can be accepted by a commander and those risks that may have wider-reaching consequences or break statutory laws.

Logistics renewal must focus on operational effectiveness and integration to realize efficiencies. In previous initiatives, financial savings has taken priority over process improvement, leaving many logisticians to feel that efficiencies were generated through increased individual workloads or at the expense of operational effectiveness. Furthermore, the goal of many initiatives to redistribute cost savings does not offer grass-roots incentive or latitude to find ways to work smarter between directorates, sections, and units as each fight to retain resources without greater appreciation for the common good. A program that encourages stakeholders with a sense of urgency and a primary goal of increasing effectiveness would have greater potential to energize logisticians and other stakeholders who basically want the same things. In order for such a program to be successful, it cannot happen in the background; it must be part of a greater transformation that transcends traditional, compartmentalized thinking so that new technologies are not just overlaid across outdated management structures. In order to realize real efficiencies in operations, manpower, and equipment, one must look past 'colors of money,' as Tuttle warns, and focus on increased integration.

While increased integration will no doubt create efficiencies, the primary goal must be about working smarter and providing clarity and consistency so that commanders and staffs are able to focus on other critical tasks. Greater focus on cooperation and understanding will also help to expose outdated logistical procedures that are left over from legacy systems. Procedures and doctrine need to be harmonized across elements and also need to account for national and international regulations at all levels, regardless of the urgency of a crisis. Greater integration between systems will provide greater

situational awareness and accuracy, while having the potential to increase efficiency and reduce friction.

4. OWNERSHIP

Lack of ownership of logistical processes contributes to lack of common understanding and integration. Without clear ownership by a single coordinating agency over DND/CAF logistical processes, it is difficult to make improvements, resulting in complicated processes that are not always optimized for effectiveness or efficiency. Ownership issues experienced within DND/CAF logistics can be examined from three main aspects: Lack of consistency between training and operations; Absence of a single process owner; and Lack of common vision among logisticians.

The lack of consistency between training and operations increases confusion and weakens understanding by logisticians and non-logisticians alike. Consequently, examples of procedural differences between exercises and operations demonstrate friction points that have the potential to threaten the agility of the fighting force and jeopardize achievement of the commander's intent. This lack of consistency is perpetuated by the lack of centralized coordination within DND/CAF logistics.

The absence of a single process owner, or Strategic J4, contributes to the lack of understanding regarding logistical responsibilities among commanders and staff, as well as an inability to make real improvements to logistical processes. Examination of the evolution of central coordinating organizations of supply chain operations in the U.S., UK, Australia, and Canada inform the discussion regarding the need for a strategic J4.

Finally, this absence of centralized coordination results in a lack of common perspective or vision that weakens unity of effort among logisticians. Understanding of logistics focus within the environmental services (i.e. the Royal Canadian Navy (RCN), Canadian Army, and the RCAF), as well as Australia's example, informs the discussion of how a coordinated strategic logistics vision could reduce friction among logisticians in the diverse organizations within DND/CAF.

Train as You Fight

'Train as you fight' is an axiom in the CAF and other militaries, emphasizing the necessity of realistic and rigorous training that replicates or simulates the conditions a soldier would encounter in operations. Developing skills and knowledge through collective training so that can be consistently applied during operations is critical to success in operations; however, this slogan has not translated well in the logistics world. During exercises, materiel, such as ammunition and vehicles, is often pre-positioned far in advance of the conduct of training so that logistics-related delays and expenses do not impede the training objectives of the fighting force. This situation creates a false view of reality among commanders, staffs, and logisticians as the training fails to simulate the friction experienced in operations. Even logisticians fail to include logistics-related training objectives because they often lack both personnel and equipment resources for training. Realistic simulation of logistics during exercises would provide opportunities to practice and refine logistical processes, while increasing awareness of commanders, thus increasing effectiveness during operations when it really counts.

When training exercises fail to simulate logistics processes, those involved gain a false sense of security. Compounding this situation is the fact that planning and procedures for mission mounting and deployment vary widely between exercises and operations. As an example, in the months leading up to Op PODIUM, the CAF contribution to the Vancouver 2010 Olympics security element, units experienced confusion over the changing procedures and responsibilities of support agencies during different phases of the operation.¹¹⁵ During the preparatory exercises held around Vancouver prior to the event, all logistical support and transportation were the responsibility of the force generators (the Army, Air Force and Navy). However, during the operation, responsibility for movement and much of the support shifted to the Joint Task Force Support Element (JTFSE), through Joint Task Force Games HQ, to Canada Command, and was coordinated centrally by Canadian Operational Support Command (CANOSCOM). This difference in structure between how the formations were supported during training and how they were supported while conducting operations created confusion over resource management requirements, as well as the management of contracts for non-military equipment and service providers. Thus, the clear and consistent delineation of responsibilities and process ownership is important in ensuring unity of effort.

Inconsistencies in procedures and standards between exercises, planned operations, and crisis operations often create confusion and friction at the most

¹¹⁵ Department of National Defence. Canadian Special Security Event (CSSE) Lessons Learned Staff Action Directive, (Ottawa: Canada Command, 31 January 2011), Annex A

inopportune moments. In deliberately planned missions such as Op PODIUM, Op NANOOK, Ex RIMPAC, or JOINTEX, there are opportunities to resolve and understand these differences in the months of planning and coordination that occur.¹¹⁶ By contrast, recent operational deployments such as Op HESTIA (Haiti) and Op MOBILE (Mediterranean) have happened so rapidly that almost no logistical planning occurred during the condensed warning and preparation phases, and logistical support seemed to be an afterthought.¹¹⁷ This lack of planning resulted in reactionary logistics efforts during the deployment and execution phases and placed significant stress on the CAF logistics system.¹¹⁸ Whether logistics was indeed an afterthought in these operations, or logistical and deployment procedures were simply not agile enough to be responsive to commander expectations, closer alignment of logistics processes between exercises and operations would encourage greater effectiveness and understanding.

Well-understood and well-exercised procedures are critical to ensuring effective and efficient planning, mounting, and deployment in operations. Differences in airlift responsibilities between exercises and operations also serve to mystify logistics, creating the potential for confusion during short-notice operations. 1 Canadian Air Division (1 CAD), the RCAF's operational headquarters, oversees the process of requesting, approving, and employing RCAF aircraft, based on Chief of Defence Staff (CDS) priorities. However, the effect delivered to the customer is a logistical one and is

¹¹⁶ More information regarding each of these operations and exercises can be found at: <http://www.forces.gc.ca/en/operations-exercises/index.page>

¹¹⁷ Author's experience as Commanding Officer, 2 Air Movements Squadron, 2010-2012.

¹¹⁸ *Ibid.*

therefore worthy of discussion within the scope of logistics understanding, integration, and ownership.

In order to request air mobility resources to move personnel and equipment from one point to another, individual units must submit a “Request for Effect” (RFE) through their respective Regional Canadian Joint Task Force (RCJTF) Headquarters. Both exercise and administrative requests are then prioritized in accordance with the strategic prioritization of operations, exercises, cadets, etc. then forwarded to 1 CAD where they are supported if resources are available. Although 1 CAD attempts to maximize utilization by tasking the same mission to serve more than one request, this endeavour is manual and labour intensive. Since unit requests must be submitted far in advance, they are often based on less accurate planning figures to absorb changes in the exercise or to guarantee a type of aircraft. In addition, there is no formal feedback system, or structured performance measurement system to determine the effectiveness or efficiency of the employment of the aircraft, or even if the best suited type of aircraft was used. Thus, the lack of centralized coordination over the entire airlift process results in suboptimal optimization.

From the requesting unit’s perspective, even if the airlift is approved, it may still be cancelled in the event of a higher priority mission. If RCAF airlift is unavailable, the unit must find other alternatives to accomplish the training objective, meaning the unit must weigh the importance of their requirement against unforeseen and increased

expense of contracting airlift at the last minute. The unit is then introduced to the often misunderstood and confusing process of chartering contracted airlift.

A lack of centralized coordination of airlift within the CAF has also resulted in differing responsibilities for contracting airlift between exercises and operations that can lead to confusion and potential problems. For operations and some training events outside North America, contracting airlift is the responsibility of CJOC. However, for exercises within North America and some training exercises outside Canada, the responsibility of drafting the Statement of Work reverts to the deploying unit or formation, and is heavily dependent on the TFMO, who may not have any experience in contracting airlift. Potential problems emerge when individual units become responsible for drafting highly technical airlift contracts with high dollar values. Compounding this problem are the current procedural and doctrinal gaps with respect to dangerous goods, passenger processing and handling of contracted airlift within the CAF that would benefit from greater centralized oversight and control.

Among the RCAF's most closely guarded tenets of aerospace power is centralized control. RCAF doctrine purports that "centralized control ensures the most efficient use of limited aerospace assets, and permits one commander to confirm all of the requirements and then assign or reassign resources to specific missions, based on

changing circumstances and priorities.”¹¹⁹ This observation is true and applies to air mobility operations, but to take this concept one-step further, it could be argued that the current system of airlift tasking does not provide a universal view of CAF-wide air mobility resources, requirements, or changing operational priorities. In 2012, a working group on airlift prioritization, with representatives from 8 Wing Trenton, 1 CAD, CANOSCOM, and Strategic Joint Staff (SJS) concluded that:

There are several organizations involved in setting the prioritization of both [force employment and force generation] airlift but there is not one organization with a complete, holistic view of all mission and load components....This leads to inefficient and sometimes ineffective use of strategic airlift. It was agreed that the CF may be better served if there was one organization that performed holistic airlift prioritization.¹²⁰

As reflected in this statement, there is recognition among stakeholder organizations that the current system for prioritization and allocation of airlift resources could be improved with increased centralized oversight.

Strategic J4 – The Logistics Single Process Owner

These preceding examples illustrate friction points that complicate logistical processes, creating miscommunication and frustration among stakeholders. Some friction points exist due to differences in functional responsibilities between units and environmental services, while others seem to persist solely due to traditional stovepipes

¹¹⁹ Chief of the Air Staff, B-GA-400-000/FP-000, Canadian Forces Aerospace Doctrine, (Winnipeg: 2 Canadian Air Division, 2010), 29.

¹²⁰ Canadian Force Aerospace Warfare Centre, *Record of Discussion: CFAWC/CANOSCOM Prioritization of Airlift Support Working Group*, (Trenton: Canadian Forces Aerospace Warfare Centre, 17-18 April 2012). The author was an attendee of this working group and retains a copy of the minutes of the meeting.

and structures. According to Tuttle, these cultural differences between services and defence agencies result in “organization-centric approaches, which result in inefficiencies due to negotiated accommodation that no one accepts, but all decide they can live with.”¹²¹ This approach is also the recipe for lack of accountability, vaguely defined metrics for judging success, and inevitably, finger pointing.¹²²

In 2006, General Hillier’s Transformation sought to breakdown traditional environmental and interagency cultural barriers with the stand-up of four joint headquarters: Canadian Expeditionary Command (CEFCOM), Canadian Special Operations Forces Command (CANSOFCOM), Canada Command, and Canadian Operational Support Command (CANOSCOM).¹²³ Formed from Hillier’s vision of having “one dog to kick” for all operational support issues, CANOSCOM was modeled after USTRANSCOM. CANOSCOM was responsible for many of the same functions as its U.S. counterpart, such as materiel distribution and personnel movement and supply depots as well as joint air and sealift coordination for overseas operations. However, key differences reduced CANOSCOM’s relative capability. In contrast to USTRANSCOM, CANOSCOM was only responsible for support to operations and a handful of exercises, it lacked control of airlift resources, and it did not have complete control over transportation, supply and distribution process or related policies. At the strategic level, Associate Deputy Minister (Materiel) (ADM(Mat)) retained functional authority for

¹²¹ Tuttle, *Defense Logistics for the 21st Century...*, 18.

¹²² *Ibid.*, 17.

¹²³ Michael K. Jeffery, *Inside Canadian Forces Transformation: Institutional Leadership as a Catalyst for Change*, (Kingston: Canadian Defence Academy Press, 2009), 31.

Materiel Acquisition and Support (MA&S) as well as responsibility for all materiel and movements policies, processes, training standards, compliance and oversight.¹²⁴

The overall result of Hillier's Transformation was a positive shift from a staff-centric Deputy Chief of Defence Staff (DCDS) group to a decision-making (command-centric) organization.¹²⁵ However, what was absent in the standup of CANOSCOM was a true "Strategic J4" where CAF logistics effectiveness, movements discipline, and policy could be centrally monitored and commonly managed within DND/CAF. Although CANOSCOM provided focused support to operations in an impressive manner, it still lacked two things: ownership and control. It had neither control over the entire logistical process and resources, nor did it have the ownership and mandate to bring about real change in logistical policies and processes.

The latest evolution of CAF transformation has resulted in the amalgamation of CANOSCOM, CEFCOM, and Canada COM into the Canadian Joint Operations Command (CJOC) in 2012. With this new organization, the concept of "one dog to kick" has been lost as the single focal point for operational sustainment, CANOSCOM, has been decentralized and spread throughout CJOC. Within CJOC, the J4 Logistics (a Colonel), encompasses Movements, Supply, Transport, Foods, and Electrical and Mechanical Engineers staff functions with the multitude of other support organizations

¹²⁴ Department of National Defence, ADM(Mat), *Materiel Acquisition & Support Business Transformation Program Charter Version 7.0*, (Ottawa: DND, 2011), 2.

¹²⁵ Department of National Defence. *Evaluation of Functional Responsibilities in Support of CF Transformation* (Ottawa: Chief of Review Services, December 2006), 27.

including Communications, Medical, Construction Engineers, and Joint Operations Support Group (CFJOSG) dispersed throughout the Command.

Led by a Brigadier-General, CFJOSG has a wide scope of responsibility in the planning, executing and delivery of theatre activation and deployable support capabilities through operational units responsible for deployed communications, postal, health services, military police, and movement control.¹²⁶ CFJOSG also controls Canadian Materiel Support Group (CMSG), a formation that includes all DND/CAF supply and ammunition depots. The relocation of supply and ammunition depots out of ADM(Mat) in 2006 with the creation of CMSG was a concerted effort to address sustainment problems and improve logistical responsiveness to the Afghanistan mission. This re-organization represented high-level recognition that DND/CAF's approach to logistics needed to change, however, still does not increase the ability to improve department-wide processes.

Another step towards increasing logistics ownership and oversight was the creation of the Logistics Branch Integrator (LBI) to increase the operational focus of personnel training within the Logistics Branch. Endorsed by Armed Forces Council in 2008, the LBI has become the central link between the environmental services and logistics occupations to ensure personnel management policy and individual training and

¹²⁶ Department of National Defence, "Canadian Forces Joint Operational Support Group." <http://www.forces.gc.ca/en/operations-support/cfjosg.page> (accessed 28 March 2014).

education meet the needs of commanders. According to the Logistics Branch website, “The new governance will also serve to reinforce sound management practices, and collaborative efforts to establish strategic direction and to strengthen accountability.”¹²⁷ Although the small LBI directorate has made strides in ensuring logistics training and the personnel management framework meet the needs of commanders, it does not have control over business process or systems decisions, limiting its ability to effect change in those areas.

Consequently, logistics within DND/CAF is comprised of numerous organizations with their own mandates, issues, and priorities. Each of these stakeholders controls aspects of logistical processes and systems, with no central coordinating authority to provide strategic vision, governance, or oversight. By contrast, each of Canada’s principal allies have a singular strategic head of logistics that provides strategic logistics advice to CDS equivalents, while performing governance and logistics leadership roles as the “single process owner” for end-to-end sustainment.

From his analysis of U.S. sustainment during and after World War II, Eccles advocated a fourth service dealing with the logistics needs that were common to the Navy, Army and Air Force.¹²⁸ This idea was finally realized when several DoD transportation agencies were consolidated as USTRANSCOM in 1987. Much like the

¹²⁷ Department of National Defence, “Logistics Branch Governance Framework,” 2013. <http://www.forces.gc.ca/en/caf-community-branches-logistics/governance-framework.page#>

¹²⁸ Eccles, *Logistics in the National Defense...*, 200.

experience of CANOSCOM in 2006, the fledgling USTRANSCOM lacked operational control of strategic movement resources, logistical processes, or exercise support. This issue was resolved in 1992, when USTRANSCOM's mission was expanded to air, land, and sea transportation in time of peace and time of war, instituting a level of consistency and standardization in the interaction with the other commands. Recognizing the need for increased accountability and efficiency within joint logistics, Secretary of Defense Rumsfeld designated Commander USTRANSCOM as the "Distribution Process Owner" in 2003, with the vision of improving efficiency and interoperability, while removing duplication of effort and blurring of responsibilities with other organizations.¹²⁹ USTRANSCOM is now the process owner for strategic movement and asset visibility, while the U.S. forces and combatant commands control their own operational processes in separate, but compatible, supply systems.

Although slow to get started, the UK has also recognized the need to modernize its logistics command and control structure. Integrating independent Royal Air Force, Royal Navy, and British Army supply chains as recently as 2000, the UK's materiel and distribution is governed by Director General Joint Supply Chain (DG JSC). The Chief of Defence Materiel (CDM) is the logistics process owner and is responsible for "designing and maintaining Joint Supply Chain processes that support the end-to-end logistics processes."¹³⁰ However, many other agencies are still involved, including Defence and Supply Chain Operations and Movements (DSCOM) that is responsible to provide

¹²⁹ United States, Government Accountability Office, *GAO-07-807 Defense Logistics...*, 9.

¹³⁰ United Kingdom, Ministry of Defence, *JSP 886 Defence Logistics Support Chain Manual Vol 1*. (2012), 4.

strategic transport and movements in peacetime and operations as well as policy governance. As part of DSCOM, the Defence Logistics Operations Centre co-ordinates with Defence Equipment and Support (DE&S), the UK equivalent to Canada's ADM(Mat). At the operational level, Permanent Joint Headquarters (PJHQ) J4 is responsible for logistic aspects of planning, deployment, and sustainment in a manner similar to CJOC's J4. However, the UK supply chain and movements organizations continue to experience issues, including the fragmentation of the operational management of the end-to-end supply chain due to the number of agencies involved, a lack of business intelligence strategy outlining critical information requirements, and lack of focus on best-practices, performance management, and training.¹³¹ While Canada can learn from USTRANSCOM and UK approaches to end-to-end logistics processes, Australia's Joint Logistics Command provides a model in addressing many of the concerns outlined above.

Australia's transformation into a centralized logistical command provides excellent insight from a comparable military force in size and structure. Suffering from a crisis in confidence due to problems with operational effectiveness and materiel accountability in the early 2000s, the Australian Commander Joint Logistics (CJLOG) was appointed. At the rank of Major-General, CJLOG can be traced back to 2004, the same time that the CAF was experiencing similar concerns regarding responsiveness and ownership over sustainment of deployed operations. In response to these concerns, Joint Logistics Command was separated from the Defence Materiel Organization and placed

¹³¹ United Kingdom, National Audit Office, "MOD: The use of information...", 7-9.

directly under the Vice Chief of Defence Force. Since 2004, the responsibilities of CJLOG have continued to grow, becoming the Defence-wide Business Process Owner for Logistics Management and the role as the Defence Strategic J4 was formalized in 2008. The most comprehensive logistics organization of all allied nations, CJLOG's responsibilities include strategic planning, coordination, implementation, and synchronization of logistics support, logistics governance and compliance, joint logistics information system capability management, and overseeing logistics training.¹³² CJLOG also controls warehousing for the entire ADF, domestically and abroad.

The U.S., UK, and Australia have all made concerted efforts to reduce organizational friction and increase operational effectiveness by ensuring that the end-to-end process of military supply chain management is coordinated and directed by a central authority. Although this idea of a single process owner for logistics has been discussed in Canada, it has not yet been implemented.

Strategic Logistics Vision

Canada's allies have embraced logistics as an important part of modernization strategies. In 2011, a Chief of Review Services (CRS) evaluation of Canada's Land Force Readiness and Training observed the importance that Australia and the U.S. Army had placed in modernizing sustainment capabilities, citing both the Government of Australia

¹³² Australia. Chief of Defence Force. *Chief of Defence Force Directive to Commander Joint Logistics: The Defence Strategic J4*, CDF Directive No 06/2010, 27 May 2010, 1.

2009 Defence White Paper and the 2010 U.S. Army Modernization Strategy.¹³³ Both documents recognized the need for investment and transformational improvements in logistical processes, a message that is noticeably absent from Canadian documents. In contrast, according to CRS, the Land Force recognized the need to engage all contributing stakeholders, develop workable plans, and manage operational sustainment risk.¹³⁴ This guarded approach of incremental improvement pointed to the lack of ownership and the inability of individual environments to affect change to logistical processes. It also demonstrated a lack of vision with respect to how to effectively sustain the joint CAF force of tomorrow. To understand this perspective, it is helpful to explore the visionary documents published by the environmental services.

The CAF advocates an increased focus on joint warfare, integrating the efforts of each environmental service toward a common goal of fostering “jointness in command and control as well as logistics and intelligence, including the development of deployable joint headquarters capable of exercising national command and logistics support of Main Contingency Forces.”¹³⁵ With this in mind, the RCN, Canadian Army, and the RCAF have each developed vision and doctrinal documents that reflect an increased focus on joint concepts. Not surprisingly, however, each focuses on sustainment within their own environment, and mainly at the tactical level where there is the most visible interface

¹³³ Department of National Defence, *Evaluation of Land Force Readiness and Training*, (Ottawa: Chief of Review Services, March 2011), 53.

¹³⁴ *Ibid.*, 53.

¹³⁵ Department of National Defence. *Shaping the Future of the Canadian Forces: A Strategy for 2020*, (Ottawa, DND, June 1999), 9. <http://www.cds-cemd.forces.gc.ca/str/index-eng.asp> (accessed 5 April 5, 2014)

with operational capabilities (i.e., Forward Logistics Sites (FLS) and at-sea replenishment; Combat Service Support (CSS); and Mission Support Element (MSE) respectively). However, joint sustainment linkages spanning the strategic through operational level to enable the tactical level are not discussed at all. Thus, this inability of the environmental services to articulate how they fit into, and can enable a joint logistics environment, points to the lack of strategic ownership and vision within CAF logistics. Thus, the Logistics Branch continues to be fragmented across the environmental services, as well as occupations and specialties.

Likewise, joint doctrine publications discuss the transactional responsibilities of each environment within joint logistics capabilities such as the Joint Task Force Support Component (JTFSC).¹³⁶ Again, there is no broad articulation of how logisticians in each environmental service, joint, and corporate (i.e., ADM(Mat)) contexts inter-relate and can work toward common goals of improving the effectiveness and efficiency of their discipline. This leads to further misunderstanding as logisticians are caught between their joint and environment specific worlds.

It could be argued that logisticians in each of the existing organizations should serve only one vision, that of their commander. The reality is, however, that increased integration and coordination of the policies and initiatives that affect all logisticians

¹³⁶ Department of National Defence, *CFJP 4-0 Support...*, 5-2

would increase the effectiveness of each environmental service they serve. Moreover, reducing logistics friction points can enable increased integration and joint collaboration. Without a strategic vision and unity of purpose, however, logisticians at the tactical and operational levels are left attempting to understand or explain new logistics initiatives without having supporting resources in place. Moreover, without situational context provided by a strategic logistics vision, and an understanding of why change is being implemented, logisticians at the operational and tactical levels suffer from change fatigue and are not able to provide optimal support to improvement efforts. Without strategic logistics strategy, there is no coordinated understanding or concept of where DND/CAF logistics is today and how it will provide the support expected of it in the future: robust, agile, flexible, relevant, and decisive logistics.¹³⁷

In contrast, following the 2009 Australian Defence White Paper, The Australian Defence Strategic Logistics Strategy was developed “to shape and provide the visibility throughout Defence of the challenges to be faced in the logistics environment.”¹³⁸ This statement articulated the specific need to increase situational awareness of logistics among all members of the Australian Defence Force. By articulating challenges, while concurrently re-affirming a focus on joint operations and effectiveness, a coordinated vision of DND/CAF logistics, can increase understanding among commanders and logisticians.

¹³⁷ Canadian Forces Aerospace Warfare Centre, *Project Laminar Strike...*, 89; *Designing Canada's Army of Tomorrow* also refers to a “highly integrated, adaptive, and flexible sustainment system,” 62.

¹³⁸ Australia, Vice Chief of Defence Force, *Australian Defence Strategic Logistics Strategy 2010-2015*, (ADF: Joint Logistics Command, Nov 2010), 1.

Key Deductions

Commanders and logisticians must take every opportunity to exercise logistics capabilities in the manner in which they are expected to function during operations: train as you fight. An increased effort to incorporate realistic, logistics-related contributions into exercises at all levels can reduce friction by providing commanders, staffs, and logisticians the opportunity to work together to integrate and refine operational processes, and to understand each other's constraints. Although the recent shift to larger scale joint exercises such as JOINTEX, RIMPAC, and NANOOK has provided more opportunities to exercise the whole of CAF logistics, there is still more that can be done. Tabletop exercises or verifications that assess the readiness of operational units to deploy would provide commanders, units, and TFMOs the opportunity practice the deployment process.

Along the same theme as train as you fight, process disparities between exercises and operations also have the potential to cause confusion and friction during the most critical phases of operations. Processes must be agile enough to meet commanders' expectations equally in times of peace and in crisis, while maintaining a consistent level of resource accountability and reflecting current risk assessment practices. DND/CAF must also ensure systems and procedures are aligned with customs, environmental, and international dangerous goods regulations, regardless of the exercise or operation.¹³⁹ If

¹³⁹ It is understood that in some circumstances, ministerial authorities and waivers are required. However, the circumstances in which these authorities are employed and the processes used must be presented more clearly as they are inevitably required during crisis operations.

processes must be different between exercises and operations, clear, common sense delineation is required.

Alignment of processes and increased coordination at the strategic level would permit greater economy of effort in airlift. Co-location of the RCAF airlift tasking section and dangerous goods specialists with a strategic-level J4 Movements organization could improve communication, reduce duplication of effort, and provide much needed oversight to contracted airlift. This coordinated approach would also make the complicated request processes for RCAF and contracted airlift more intuitive for customers as airlift requirements, regardless of exercise, operation, or customer could be reviewed, prioritized, and coordinated by a single organization.

The need for a strategic J4 organization to serve as the single process owner for logistics has long been a topic of discussion within DND/CAF. To embed a strategic J4 into the DND/CAF successfully requires understanding among the environmental services and other stakeholders within the organization that a J4 organization would not necessarily reduce autonomy and could have the potential to increase support effectiveness within a joint environment. The strategic J4 would also serve as the logistics branch champion for increasing understanding and integration between logistics elements, as well as within DND/CAF, inter-governmental agencies, and allied forces. It is important that this organization be seen as the central coordinating authority for all logistics activities, among military and civilian members, both within the CAF and ADM(Mat) organization. Therefore, an argument could be made that the strategic J4

should be nested under the Vice Chief of Defence Staff (VCDS), as that organization that is responsive to both the CDS and the Deputy Minister. From this position, the strategic J4 would have the ability to develop a strategic logistics vision for DND/CAF.

By demonstrating the direct link between operational effects and all DND/CAF logistical enablers, a strategic logistics vision could provide common understanding and greater unity of effort. With support and commitment of leaders throughout the chains of command in ADM (Mat), CJOC, and all environmental services, a well-articulated communication strategy could serve to increase understanding and align the efforts of logisticians throughout the CAF and DND. Equally important, it could serve to identify the how effective logistics support should be delivered in the future, shifting from a reactive to a proactive and visionary mindset.

5. CONCLUSION

Analysis of DND/CAF logistics highlights the lack of focus on logistics. This lack of focus creates friction and impairs the CAF's ability to conduct operations more effectively. In order to reduce friction and provide more effective support to operations, logistical understanding, integration, and ownership must be improved.

To do this, commanders and staffs must gain a greater understanding of logistical implications through training and increased engagement by logisticians. They are accountable for all logistics decisions made within their control, therefore they must be proactive in seeking to understand how logistical constraints may affect their mission. Logisticians must also be proactive in engaging commanders and their staffs, enabling them to make informed decisions based on improved logistical knowledge and awareness. In doing so, logisticians can fight the perception that they are not operationally focused.

Without this common understanding, logistics technology and procedures have not been integrated as well as they could be, creating complicated and misunderstood processes. This lack of integration contributes to the commander's lack of knowledge and interest in logistical issues and makes it difficult for logisticians to clearly articulate the logistical implications of commander's decisions. It is evident that a logistics system that is not agile and responsive, particularly during key stages of a mission, will lack credibility with the commander and therefore becomes both a symptom of the problem as well as a cause. To remedy this issue, technology can provide improved situational

awareness and decision support to the commander and staff. However, although integration can be enabled by technology, it cannot be solved through technology alone. Therefore, logistics integration should be focused on harmonizing procedures and doctrine across elements, transcending traditional stovepipes. If balanced correctly, renewal aimed at increasing operational effectiveness and responsiveness can lead to greater efficiency without sacrificing effectiveness.

The lack of strategic ownership within DND/CAF logistics creates a situation where there is little stimulus for improvement in understanding, integration, or renewal. One example is the tendency not to exercise logistics capabilities, which perpetuates complicated processes and responsibilities that are not aligned optimally for operations. In order to harmonize inconsistencies between exercises and operations, logistics must be coordinated across the department with a unified purpose and effort. A strategic J4 within the VCDS organization could serve as a single focal point and process owner for logistics activities such as supply chain operations. A strategic J4 could guide the formulation of a strategic logistics vision that provides understanding and unity of effort to logisticians in all organizations within DND/CAF. A strategic vision would also provide a means to articulate how logistics should best support operations in the future.

With the benefit of understanding each other's similar experiences through more than a decade of expeditionary warfare, Canada and its allies now have the opportunity to learn from each other's lessons and prepare for the next crisis. Reacting to suboptimal performance of their respective supply chains in (effectiveness) and materiel

accountability (resource efficiency) while supporting operations over the last decade, Canada's allies have made concerted efforts to transform their logistics systems, with regard to technology and processes.

The UK MoD's "Logistics Network Enabled Capability Project," the ADF's "Military Integrated Logistic Information System," and a number of systems in the U.S. DoD have been initiated to enable end-to-end management of their respective supply chains. While there has been recent renewal and investment in the DND/CAF, it has been focused on "low-hanging fruit" and incremental improvements, limiting the opportunity to breakdown traditional stovepipes. By contrast, key allies have transformed their logistical structures to create a single process owner who has the scope to make real improvements in the integration of systems and processes.

Australia is at the forefront of logistics transformation and has grasped the three-pronged approach of understanding, integration and ownership. Equally important to process renewal and investment in technology, the 2009 Australian Defense White paper raised the profile of military logistics to the Government-level and highlighted the critical importance logistics plays in the success of operations. This awareness provided the momentum to develop the *Australian Defence Strategic Logistics Strategy*, and the sense of urgency to sustain major change initiatives to this day. These transformational improvements would not have been possible without strategic-level leadership and ownership of the entire supply chain process from end-to-end. Canada would stand to

benefit from further analysis of the ADFs implementation of these structural transformations and capabilities.

The CAF can improve the effectiveness of logistics, by improving understanding among commanders and non-logisticians, improving integration of logistics systems and procedures, and improving ownership mechanisms to make logistics more agile and effective in operations, thereby reducing friction throughout the organization.

BIBLIOGRAPHY

- Australia. Chief of Defence Force. *Chief of Defence Force Directive to Commander Joint Logistics: The Defence Strategic J4*. CDF Directive No 06/2010. 27 May 2010.
- Australia. Department of Defence. “At a Glance: Joint Project 2077 – Logistics for the Warfighter.” Last modified March 2011. <http://www.defence.gov.au/dmo/coo/jp2077/>
- Australia. Department of Defence. “Defence Logistics Transformation Program” *Statement of Evidence to the Parliamentary Standing Committee on Public Works*. Canberra: June 2012.
- Australia. Department of Defence. *Defending Australia in the Asia Pacific Century: Force 2030*. Canberra: 2009. [http://www.defence.gov.au/whitepaper2009/docs/defence white paper 2009.pdf](http://www.defence.gov.au/whitepaper2009/docs/defence_white_paper_2009.pdf)
- Australia. Vice Chief of Defence Force. *Australian Defence Strategic Logistics Strategy 2010-2015*. Canberra: Joint Logistics Command, Nov 2010.
- Barbaro, Michael and Justin Gillis, “Wal-Mart at Forefront of Hurricane Relief” *The Washington Post*, Tuesday September 6, 2005. <http://www.washingtonpost.com/wp-dyn/content/article/2005/09/05/AR2005090501598.html>
- Boeing. “LogNEC Delivery Partnership.” 2010. <http://www.boeing.co.uk/Products-Services/Boeing-Defence-UK/LogNEC-Delivery-Partnership>
- Boorman, Scott A. “Fundamentals of Strategy: The Legacy of Henry Eccles.” *Naval War College Review* Vol. 62, No. 2 (Spring 2009) <http://www.usnwc.edu/getattachment/654f6e40-1637-42e2-9e2e-0a3992a84181/Fundamentals-of-Strategy--The-Legacy-of-Henry-Eccl.aspx>
- Booz&Co. *Australian Defence Force 1st Joint Movements Group Organisation Review Final Report*. Canberra: Booz&Co, July 2012.
- Burt, Colonel Greg and Shawn McKnight. “Defence Strategy Management and the Defence Management System.” Chapter 2 in *The Public Management of Defence in Canada* edited by Craig Stone. Toronto: Breakout Educational Network, 2009
- Brill Jr., Arthur. “Marine Corps Plans to Revamp Outmoded Logistics System,” *Sea Power Vol47 Issue 2*. (April 2004).
- BusinessWire. “Australian Defense Force Successfully Deploys First Fully Integrated Military Logistics System with Mincom Ellipse.” Denver, August 18,

2010. <http://www.businesswire.com/news/home/20100818006437/en/Australian-Defense-Force-Successfully-Deploys-World%E2%80%99s-Fully#.Uumes08o6-U>

Canada. 3 Canadian Support Unit. Briefing Note for Comd CFJSG “Recommendations on Total Asset Visibility (TAV) for Humanitarian Operations and Disaster Relief (HODR)” (Montreal: 3 CSG, 1 Dec 2010)

Canada. Auditor General. *Support for Overseas Deployments – National Defence*. Report of the Auditor General of Canada to the House of Commons. Ottawa: Minister of Public Works and Government Services Canada. May 2008. http://www.oag-bvg.gc.ca/internet/docs/aud_ch_oag_200805_02_e.pdf

Canada. Canadian Armed Forces. *Joint Lessons Learned Report (JLR) 01/10: Operational and Strategic Lessons – Op HESTIA*. 3350-1 (Joint LL Team Leader). 12 April 2010.

Canada. Canadian Armed Forces. *Op MOBILE/Task Force Libeccio – FE - Lesson Finding Report A2-02Q, AF113*. 27 Apr 2012.

Canada. Canadian Armed Forces. “Past Operations.” last accessed 28 April 2014 <http://www.forces.gc.ca/en/operations-abroad-past/index.page>

Canada. Canadian Army. *Designing Canada’s Army of Tomorrow: A Land Operations 2021 Publication*. Kingston: Directorate of Land Concepts and Designs, 2011. http://publications.gc.ca/collections/collection_2012/dn-nd/D2-282-2011-eng.pdf

Canada. Canadian Forces Aerospace Warfare Centre. *Record of Discussion: CFAWC/CANOSCOM Prioritization of Airlift Support Working Group* (Trenton: Canadian Forces Aerospace Warfare Centre, 17-18 April 2012)

Canada. Canadian Forces College. “Programmes at the Canadian Forces Staff College” <http://www.cfc.forces.gc.ca/248-eng.html> (last modified 15 April 2014).

Canada. Canadian Forces Warfare Centre, *Op RENAISSANCE 13-01 Lessons Learned Report, 3350-Op RENAISSANCE (CFWC A&LL)*. Ottawa: CFWC, 5 February 2014.

Canada. Department of National Defence. ADM(Mat). Defence Resource Management Information System. 2014. <http://drmis-sigrd.mil.ca> (DWAN, accessed 24 March 2014)

Canada. Department of National Defence. ADM(Mat). *Materiel Acquisition & Support Business Transformation Program Charter Version 7.0*. Ottawa: DND, 2011

- Canada. Department of National Defence. ADM(PA). *Defence Renewal Charter: Department of National Defence and Canadian Forces*. Ottawa: ADM(PA), October 2013.
- Canada. Department of National Defence. A-GA-007-000/AF-008, *Air Force Vectors*. Ottawa: Director General Air Force Development, 2014.
- Canada. Department of National Defence. B-GA-400-000/FP-000. *Canadian Forces Aerospace Doctrine, 2nd Ed.* Winnipeg: 2 Canadian Air Division, 2010.
- Canada. Department of National Defence. B-GA-406-000/FP-001, *Canadian Forces Aerospace Sustain Doctrine*. Trenton, ON: Canadian Forces Aerospace Warfare Centre, Feb 2011.
- Canada. Department of National Defence. B-GH-005-000/FP-001. *Canadian Forces Joint Publication: Canadian Military Doctrine*. Ottawa: CDS, 2009.
- Canada. Department of National Defence. B-GH-005-000/FP-001. *Canadian Forces Joint Publication: CFJP 3.0 Operation*. Ottawa: CDS, 2010.
- Canada. Department of National Defence B-GL-300-004/FP-001, *Sustainment of Land Operations*. Kingston, ON: Chief of the Land Staff, Dec 2010.
- Canada. Department of National Defence. B-GL-005-400/FP-001, *Canadian Forces Joint Publication CFJP 4-0 Support*. Ottawa: CJOC, 2014.
- Canada. Department of National Defence. B-GN-007-000/AG-001, *Securing Canada's Ocean Frontiers: Charting the Course from Leadmark*. Ottawa: Directorate of Maritime Strategy, 2005.
- Canada. Department of National Defence. "Canadian Forces Joint Operational Support Group." <http://www.forces.gc.ca/en/operations-support/cfjosg.page> (last accessed 28 March 2014).
- Canada. Department of National Defence. "Canadian Special Security Event (CSSE) Lessons Learned Staff Action Directive, Annex A." Ottawa: Canada Command, 31 January 2011.
- Canada. Department of National Defence. *CFSS DRMIS Initiative – Blueprint for Supply Chain Information (SCI): Material Management and Inventory Reporting, Version 1.0F*. Ottawa: DND, 2011.
- Canada. Department of National Defence. *Evaluation of Functional Responsibilities in Support of CF Transformation*. Ottawa: Chief of Review Services, December 2006. <http://www.crs-csex.forces.gc.ca/reports-rapports/pdf/2006/P0781-eng.pdf>

- Canada. Department of National Defence. *Evaluation of Land Force Readiness and Training*. Ottawa: Chief of Review Services, March 2011.
- Canada. Department of National Defence. *Leadmark: The Navy's Strategy for 2020*. Ottawa: Directorate of Maritime Strategy, 2001.
- Canada. Department of National Defence. "Logistics Branch Governance Framework." 2013. <http://www.forces.gc.ca/en/caf-community-branches-logistics/governance-framework.page#> (accessed 6 April 2014)
- Canada. Department of National Defence, *NDHQ 99: Review of Restructuring and Re-engineering*. Ottawa: Chief Review Services, 2001.
<http://www.crs-csex.forces.gc.ca/reports-rapports/pdf/2001/P0031-eng.pdf>.
(accessed 20 April 2014)
- Canada. Department of National Defence. *Project Laminar Strike: Canada's Air Force: Post Op ATHENA*. Edited by Colonel D.W. Lowthian and Captain S.R. Harrison. Trenton, ON: Canadian Forces Aerospace Warfare Centre, 2011. http://airforceapp.forces.gc.ca/CFAWC/eLibrary/pubs/Project_Laminar_Strike_e.pdf
- Canada. Department of National Defence. *Projecting Power: Canada's Air Force 2035*, edited by Dr. Andrew B. Godefroy. Trenton, ON: Canadian Forces Aerospace Warfare Centre, 2009. http://airforceapp.forces.gc.ca/CFAWC/eLibrary/pubs/Projecting_Power-Canadas_Air_Force_2035_e.pdf
- Canada. Department of National Defence. *Shaping the Future of the Canadian Forces: A Strategy for 2020*. Ottawa: DND, June 1999.
<http://www.cds-cemd.forces.gc.ca/str/index-eng.asp>
- Chambers, John Whiteclay II. "Logistics." *The Oxford Companion to American Military History*. New York: Oxford University Press. 1999.
- Chappell, Andrew, and Helen Peck. "Risk management in military supply chains: Is there a role for six sigma?." *International Journal of Logistics: Research & Applications* 9, no. 3 (September 2006): 253-267.
- Clausewitz, Carl von. *On War*. Edited and translated by Michael Howard and Peter Paret. Princeton: Princeton University Press, 1984.
- Conrad, John. "We Three Hundred: Logistics Success in the New Security Environment." *In Harm's Way: The Buck Stops Here: Senior Military Commanders on Operations*. Chap. 14. Edited by Colonel Bernd Horn. Kingston: Canadian Defence Academy Press, 2007.

- Conrad, John. *What the Thunder Said: Reflections of a Canadian Officer in Kandahar*. Kingston: Canadian Defence Academy Press, 2009.
- Craft, Douglas W. *An Operational Analysis of the Persian Gulf War*. Carlisle, PA: U.S. Army War College, 1992.
- Defense AT&L. "Logistics in a Changing Environment: Supporting Marine Expeditionary Units." *Defense AT&L Interview*. Defense Acquisition University. (July-Aug 2008).
- Eccles, Henry E. *Logistics in the National Defense*. Harrisburg, PA: The Stackpole Company, 1959.
- Eccles, Henry E. *Military Concepts and Philosophy*. Rahway, New Jersey: Rutgers University Press, 1965.
- Echevarria, Antulio. "Operational Concepts." Lecture, Canadian Forces College, Toronto, ON, 28 March 2014.
- Fowles, Colonel Win L. "Military Logistics: What is it and Who Cares Anyway?" *Australian Defence Force Journal* No. 127 (Nov/Dec 1997).
- Hammer, Michael and James Champy. *Reengineering the Corporation: A Manifesto for Business Revolution*. New York: Harper Collins Publishers, 1993.
- Jacobs, John T., et al. *Logistics Reachback*. Ft. Belvoir, VA: Defense Technical Information Center, May 2003.
- Jeffery, Lieutenant-General (Retired) Michael K. *Inside Canadian Forces Transformation: Institutional Leadership as a Catalyst for Change*. Kingston: Canadian Defence Academy Press, 2009.
- Kallock, Roger W., and Lisa R. Williams. "DoD's Supply Chain Mandate: From Factory to Foxhole" *Supply Chain Management Review* V.8 No. 4 (May/June 2004).
- O'Neill, Rob. "Rescue Plan for Defence Supply System." *Sydney Morning Herald*. 7 December 2004. <http://www.smh.com.au/news/Next/Rescue-plan-for-defence-supply-system/2004/12/06/1102182189488.html>
- Paparone, Christopher R., Ruth A. Anderson, and Reuben R. McDaniel Jr. "Where Military Professionalism Meets Complexity Science." *Armed Forces & Society* Vol. 34, No. 3 (April 2008): 433-449. <http://afs.sagepub.com/content/34/3/433.full.pdf>

- Parlier, Greg, PhD. "Transforming U.S. Army Logistics: A Strategic "Supply Chain" Approach for Inventory Management," *Institute of Land Warfare Papers*. Arlington, VA: Association of the U.S. Army, 2005.
- Pelletier, Colonel A. *Task Force LIBECCIO (TFL) & Air Coordination Element (ACE) – Op MOBILE Roto 0 & 0A – End of Tour Report*. 31 Aug 11.
- Potvin, Joseph George Marc. "The Integration of the Canadian Forces Logistics System and its Effect on the Operational Capabilities of the Canadian Military." University of Manitoba Thesis, Winnipeg, 1996.
- Shadwick, Martin. "Road to Mobility." *Canadian Military Journal*. (Autumn 2006). <http://www.journal.forces.gc.ca/vo7/no3/doc/commenta-eng.pdf>
- Till, Geoffrey. *Seapower: A Guide for the 21st Century*. London: Frank Cass Publishers, 2004.
- Thompson, Major-General Julian. *The Lifeblood of War: Logistics in Armed Conflict*. London: Brassey's, 1991.
- Tuttle, William G.T. Jr. *Defense Logistics for the 21st Century*. Annapolis, MD: Naval Institute Press, 2005.
- United Kingdom. Ministry of Defence. *JSP 886 Defence Logistics Support Chain Manual Vol 1. Ver 2.4* (2012). https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48863/JSP886_Vol1_Part1_Intro2JSC-v24-U.pdf
- United Kingdom. National Audit Office. *The use of information to manage the defence logistics supply chain: Forty-third Report of Session 2010-12. Report by the Comptroller and Auditor General*. London: NAO, 2011. <http://www.nao.org.uk/report/mod-the-use-of-information-to-manage-the-logistics-supply-chain/>
- United States. Government Accountability Office. *GAO-07-807 Defense Logistics: Efforts to Improve Distribution and Supply Support for Joint Military Operations Could Benefit from a Coordinated Management Approach*. Washington, DC: GAO, June 2007. www.gao.gov/cgi-bin/getrpt?GAO-07-807
- Van Creveld, Martin. *Supplying War: Logistics from Wallenstein to Patton, 2nd Edition*. Cambridge: Cambridge University Press, 2004.
- Vego, Dr. Milan N. "Operational Logistics," in *Joint Operational Warfare*. Newport, RI: Naval War College, 2007.

Zima, Major S.A. *A Canadian Revolution in Military Logistics – Improving the CF Operational Supply Chain through Benchmarking*. Toronto: Canadian Forces College Masters of Defence Studies Thesis, 2012.

Zimmer, Major Chris. *'For Want of a Nail, the Campaign was Lost' - DND's Supply Chain: A State of Performance Paralysis*. Toronto: Canadian Force College Masters of Defence Studies Thesis, 2008.