

Canadian
Forces
College

Collège
des
Forces
Canadiennes



THE EVOLUTION OF LEARNING PRACTICES IN THE RCAF

LCol D.J. Butcher

JCSP 42

Master of Defence Studies

Disclaimer

Opinions expressed remain those of the author and do not represent Department of National Defence or Canadian Forces policy. This paper may not be used without written permission.

© Her Majesty the Queen in Right of Canada, as represented by the Minister of National Defence, 2016.

PCEMI 42

**Maîtrise en études de la
défense**

Avertissement

Les opinions exprimées n'engagent que leurs auteurs et ne reflètent aucunement des politiques du Ministère de la Défense nationale ou des Forces canadiennes. Ce papier ne peut être reproduit sans autorisation écrite.

© Sa Majesté la Reine du Chef du Canada, représentée par le ministre de la Défense nationale, 2016.

CANADIAN FORCES COLLEGE – COLLÈGE DES FORCES CANADIENNES
JCSP 42 – PCEMI 42
2015 – 2016

MASTER OF DEFENCE STUDIES – MAÎTRISE EN ÉTUDES DE LA DÉFENSE

THE EVOLUTION OF LEARNING PRACTICES IN THE RCAF

LCol D.J. Butcher

“This paper was written by a student attending the Canadian Forces College in fulfilment of one of the requirements of the Course of Studies. The paper is a scholastic document, and thus contains facts and opinions, which the author alone considered appropriate and correct for the subject. It does not necessarily reflect the policy or the opinion of any agency, including the Government of Canada and the Canadian Department of National Defence. This paper may not be released, quoted or copied, except with the express permission of the Canadian Department of National Defence.”

Word Count: 17 746

“La présente étude a été rédigée par un stagiaire du Collège des Forces canadiennes pour satisfaire à l'une des exigences du cours. L'étude est un document qui se rapporte au cours et contient donc des faits et des opinions que seul l'auteur considère appropriés et convenables au sujet. Elle ne reflète pas nécessairement la politique ou l'opinion d'un organisme quelconque, y compris le gouvernement du Canada et le ministère de la Défense nationale du Canada. Il est défendu de diffuser, de citer ou de reproduire cette étude sans la permission expresse du ministère de la Défense nationale.”

Compte de mots: 17 746

ACKNOWLEDGEMENTS

This paper is the result of the efforts of many and would not have been possible without their support. First, I must thank my wife Kendra and my two boys, Craig and Ryan, as they were the most impacted by my pursuit for higher education. I am grateful to each of them.

Second, the efforts of my parents-in-law, Blaine and Norma Jelley, require recognition. They took on most of the burden of a father and husband being away. I am indebted to both of them.

Finally, I am truly grateful to my academic supervisor Dr. Adam Chapnick. There should be a special award for professors whose unwavering patience helps engineers learn to write properly. I am a better writer because of this experience. Thank you.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	i
ABSTRACT	iii
INTRODUCTION	1
LITERATURE REVIEW	6
Knowledge	6
Creating Knowledge.....	8
Knowledge Management.....	14
Organizational Learning.....	21
LEARNING ORGANIZATIONS WITHIN THE RCAF.....	29
Flight Safety	32
Stewardship	34
Accountability	36
Culture	38
Quality Management	40
Stewardship	43
Accountability	45
Culture	47
Air Force Lessons Learned Programme.....	49
Stewardship	51
Accountability	54
Culture	55
PROPOSED EVOLUTION OF LEARNING PRACTICES IN THE RCAF	59
CONCLUSION.....	65
Recommendations	66
Further Research	67
BIBLIOGRAPHY.....	69

ABSTRACT

In 2009, the RCAF formally committed itself to become a learning organization. Regrettably, an analysis of recent air operations reveals that it has yet to fully achieve that goal.

This paper explores underlying theories of knowledge, knowledge creation, knowledge management and organizational learning in order to support ongoing RCAF efforts at self-improvement. In doing so, it recognizes the importance of sound stewardship practices, clear and transparent accountability structures and the establishment of a learning-friendly cultural environment. It explores these three concepts across three separate RCAF continuous improvement programs (Flight Safety, Quality Management, and Lessons Learned). Upon concluding that the RCAF lacks a defined learning process, it advocates the use of an organizational learning mental model and proposes a series of practical means of implementation.

INTRODUCTION

In 1924, the Royal Canadian Air Force (RCAF) was tasked with documenting the knowledge and experience it had gained during World War One. At that time, the knowledge was captured through “aviation policies, rules and regulations.”¹ Since then, policies, rules and regulations have evolved in response to emerging technology, safety, fiscal, and operational requirements. Undoubtedly, this evolution must continue for the RCAF to remain agile, integrated, and responsive.

Organizational learning is one of the most critical elements of such organizational health. As a result, it has been a subject of significant research, particularly since the early studies of single loop and double loop learning nearly 40 years ago.² These types of learning focus on correcting problems as they arise and putting mechanisms in place to prevent recurrence. Many programs within the RCAF use such corrective and preventative actions to continuously improve. However, these programs are typically safety-based³ and singular in purpose. Consequently, they fail to expose the RCAF to opportunities to improve in other areas, such as the ability to project air power.

This gap is well known among the RCAF leadership. In 2014, the Commander RCAF published “Air Force Vectors” with a vision of the RCAF as “an agile and integrated air force with the reach and power essential for [Canadian Armed Forces] operations.”⁴ In his discussion on agility, the Commander committed the RCAF to “maintain excellence as a learning organization.” Such ‘excellence’ has recently been pursued through the Canadian Forces

¹ William March, The Canadian Encyclopedia, "Royal Canadian Air Force," last accessed 05 March 2016, <http://www.thecanadianencyclopedia.ca/en/article/royal-canadian-air-force>.

² C. Argyris and D. A. Schön, *Organizational Learning: A Theory of Action Perspective* (Reading, MA: Addison-Wesley, 1978).

³ For example Flight Safety, Quality Management and Airworthiness (both focused on aviation safety), General Safety, Radiation Safety, etc.

⁴ Canada. Dept. of National Defence, *A-GA-007-000/AF-008 Air Force Vectors - Abridged Version*, ed. Canadian Forces Aerospace Warfare Centre, 2014), iii.

Aerospace Warfare Centre (CFAWC). The centre was created in 2005 to be a “catalyst for air power development and as a steward for air power knowledge.”⁵ A few years later, CFAWC developed the Air Force Lessons Learned Program (AFLLP) to “establish processes that add value to [the RCAF] existing body of knowledge, or attempt to correct deficiencies in areas of concepts, policy, doctrine, training, equipment or organizations.”⁶

Regrettably, an analysis of the lessons learned reports, end tour reports (ETRs) and critical topics lists (CTL) from recent air operations reveal that there are several lessons that have been observed but not learned. For example, it was observed during a 2014 operation that the RCAF needed to improve its targeting capability. This same observation, however, was made three years earlier through the AFLLP. Despite the critical importance of targeting to the projection of air power, the deficiency was not addressed between these two operations. Admittedly, the issue of targeting has received much attention since the start of Operation IMPACT (2014) from the current Chief of Defence Staff. Moreover, CFAWC (from the RCAF perspective) and other organizations such as the Canadian Joint Operations Centre (CJOC) are reviewing processes and doctrine to address this capability and doctrinal gap. Nonetheless, the nature of this critical learning failure merits further study.

I am an Aerospace Engineer in the RCAF and have spent the last 18 years managing and leading various maintenance and engineering programs. Many of these experiences centred on comprehending and ensuring compliance with the various rules and regulations that guide aviation safety and the projection of air power. Some of my most significant (and most relevant to this paper) experiences relate to implementing continuous improvement programs into the air operations environment. Most recently, I operationalized a lessons learned program for

⁵ Royal Canadian Air Force, "Canadian Forces Aerospace Warfare Centre," last accessed 04 March 2016, <http://www.rcaf-arc.forces.gc.ca/en/cf-aerospace-warfare-centre/analysis-and-lessons-learned.page>.

⁶ *Ibid.*

expeditionary air operations, an important milestone for the AFLLP. During these experiences, I have noted deficiencies, contradictions and misunderstandings in how the RCAF continuously improves its capability to project air power. These observations and recommendations for improvement (based on a combination of experience and extensive academic research) will form the basis of this paper.

In my experience, the challenges of implementing change initiatives centre on three attributes: stewardship, accountability and culture. These challenges are not new and have been identified in both Canadian Armed Forces (CAF) doctrine and the related academic literature. CAF doctrine on institutional leadership calls for senior leaders to “implement change initiatives, and engage in institutional stewardship and knowledge creation.”⁷ Academics note that “resistance to learning is often encountered from ... senior management”⁸ and “learning from past experiences implies that a key command function is to ensure that the organization becomes a learning organization.”⁹

Similar observations exist for accountability. RCAF lessons learned doctrine recognizes the accountability of senior leaders as a programme risk.¹⁰ The *Public Performance & Management Review* journal notes, “a narrow focus on performance measurement or any other single aspect of accountability cannot be expected to lead to significant organizational learning and change in the long run.”¹¹ A different kind of accountability of organizational leadership is required. The impact of culture on organizational learning is equally significant. A report to the

⁷ Canada. Dept. of National Defence, *A-PA-005-000/AP-006, Leadership in the Canadian Forces: Leading the Institution* (Canada: Canadian Defence Academy, 2007), 137.

⁸ Ted O’Keeffe, “Organisational Learning: A New Perspective,” *Journal of European Industrial Training* 26, no. 2/3/4 (2002), 137.

⁹ Richard Goette, “Cohen and Gooch” (lecture, Canadian Forces College, Toronto, ON, 26 Nov 2016), with permission.

¹⁰ Canada. Dept. of National Defence, *B-GA-005-780/AG-001 Air Force Lessons Learned Programme Manual* (Ottawa: DND Canada, 2010), 1-10.

¹¹ Dorothea Greiling and Arie Halachmi, “Accountability and Organizational Learning,” *Public Performance & Management Review* 36, no. 3 (2013), 381.

Government of Canada (GoC) on culture links culture and organizational learning: “in an organization that promotes learning, learning permeates all aspects of the organization’s culture.”¹² CAF doctrine and RCAF are more explicit: “it is important to understand how culture will have to change and how culture can be used to effect change”¹³ and “success requires the creation of an embedded organizational learning culture ... driven by strong visionary leadership.”¹⁴ I see these same challenges for the RCAF.

Other senior RCAF leaders have made related observations. In 2014, Brigadiers General (retired) Sharpe and Leversedge noted many deficiencies in knowledge management in the RCAF, in particular in terms of accountability and cultural problems that had not been dealt with effectively by the senior leadership.¹⁵ They also suggested that the lessons observed from OP MOBILE (in 2011) would not prove to be enduring.¹⁶ Time would ultimately prove them correct. The request from the Commander of the RCAF in 2016 to specifically research lessons learned from OP MOBILE and OP IMPACT suggests that there is still much to learn from these operations.¹⁷ Conversely, a Government of Canada (GoC) publication on Canadian Defence Knowledge Management had noted years earlier that the DND/CAF was already “one of the most experienced knowledge organizations in Canada.”¹⁸ This inconsistency suggests that the concepts, understanding and implementation of knowledge management and organizational

¹² Government of Canada, *A Public Service Learning Organization from Coast to Coast: Directions for the Future* Canadian Centre for Management Development, 2000.

¹³ Canada. Dept. of National Defence, *A-PA-005-000/AP-006 Leadership in the Canadian Forces: Leading the Institution* (Canada: Canadian Defence Academy, 2007), 83.

¹⁴ Canada, *Air Force Lessons Learned Programme Manual*, 1-8.

¹⁵ BGen (ret'd) Sharpe, G.E. (Joe) and Terry BGen (ret'd) Leversedge, "A Knowledge-Management Proposal for the RCAF," *The Royal Canadian Air Force Journal* 3, no. 2 (Spring 2014, 2014), 39.

¹⁶ *Ibid.*, 44.

¹⁷ Canada. Dept. of National Defence, *RCAF AIRPower Research List*, 2016, 15.

¹⁸ John Girard, "Knowledge Management in DND," in *Public Management of Defence Canada*, ed. Craig Stone (Breakout Educational Network: Toronto, 2009), 199.

learning within DND writ large, and the RCAF more specifically, are not universally understood and applied.

Solving the problems outlined thus far in this paper requires detailed analysis. This paper will therefore begin by clarifying relevant terminology. It will then summarize the relevant academic literature on knowledge, creating knowledge, knowledge management, and organizational learning. The terms stewardship, accountability, and culture will also be described in the military context. The paper will then explore these concepts across three separate continuous improvement programs in the RCAF: Flight Safety, Air Force 9000 Plus (AF9000+) and the AFLLP. That analysis will form the basis for a model that should provide some practical structure to continuous improvement to domestic and expeditionary air operations that links doctrine, training, operations, and lessons observed. This paper will conclude with a list of recommendations to implement the proposal as well as recommendations for further research.

LITERATURE REVIEW

This section will explore the concepts of knowledge, creating knowledge, knowledge management, and learning organizations.

Knowledge

The GoC defines knowledge as “an integrated collection of facts and relationships which, when exercised, produces competent performance.”¹⁹ There are a few key features of this definition. First, it includes an ‘integrated collection’ of not just ‘facts’ but also ‘relationships,’ which suggests some understanding of the relevance or context of the facts is also required. The ‘competence performance’ appears to be a jump in logic, as it implies that knowledge alone will produce results. The AFLLP definition is more instructive: “information that provides meaning and value when making decisions or determining action required is considered knowledge.”²⁰ The AFLLP refers to the Jacob Needleman’s Knowledge Pyramid model to help visualize the distinction between information and knowledge (one is built upon the other). This knowledge model is often referenced in knowledge literature and variations of the model vary from four to seven levels.

¹⁹ Government of Canada, *Termium Plus Defence Terminology Bank*, last accessed 04 March 2016, <http://www.btb.termiumplus.gc.ca/tpv2alpha/alpha-eng.html?lang=eng>.

²⁰ Canada, *Air Force Lessons Learned Programme Manual*, 6-3.

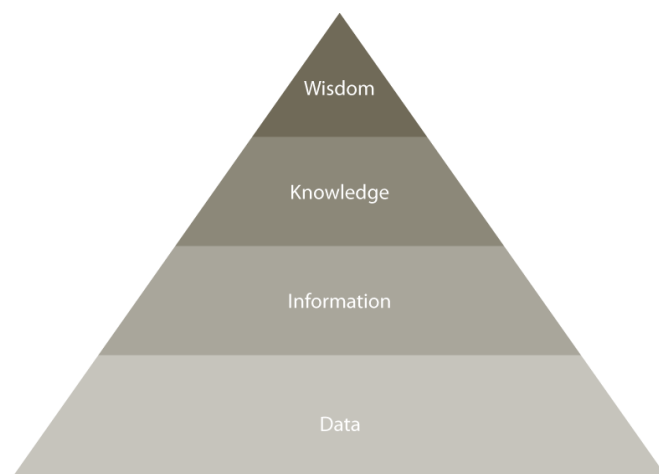


Figure 1: Jacob Needleman's Knowledge Pyramid

Source: As quoted in Canada. Dept. of National Defence, *B-GA-005-780/AG-001 Air Force Lessons Learned Programme Manual* (Ottawa: DND Canada, 2010), 6-3.

Although scholars often differ on precise definitions of knowledge and organizational learning, some categories of knowledge are broadly accepted. The two most common categories are 'explicit' and 'tacit' knowledge. The GoC defines explicit knowledge as "knowledge that consists of those facts that you are explicitly aware of."²¹ Tacit knowledge is "embedded in individual experience and not easily codified."²² The GoC definition is rather vague as it states that explicit knowledge is explicit. RCAF doctrine is more thorough. Explicit knowledge "can generally be written down in a manner which facilitates sharing of the knowledge content."²³ The RCAF definition of tacit knowledge is similar to that of the GoC: "knowledge which tends to be available only in one's mind and is generally difficult, or, in some cases, impossible to share in a codified form."²⁴ Both state that tacit knowledge is difficult to codify.

Other types of knowledge discussed in the literature include 'implicit' knowledge and 'cultural' knowledge. In the *Canadian Military Journal*, McIntyre et al define implicit

²¹ Canada, *Terminum Plus Defence Terminology Bank*, last accessed 06 March 2016.

²² *Ibid.*

²³ Canada, *Air Force Lessons Learned Programme Manual*, 6-2.

²⁴ *Ibid.*

knowledge as “that which could be expressed, but not has been.”²⁵ The GoC description of implicit knowledge differs in emphasizing that it is derived from intuition and logic – “it consists intuitively, of all the logical consequences of explicit knowledge.”²⁶ Choo, from the University of Toronto, also expands on the traditionally accepted knowledge categories, stating that an organization “possesses three kinds of knowledge: tacit... explicit... and cultural knowledge expressed in the assumptions, beliefs, and norms used by members to assign value and significance to new information and knowledge.”²⁷ Cook and Yanow also emphasize the cultural aspect of knowledge in the context of organizational learning as they feel that much of the literature on organizational learning focuses on the cognitive perspective.²⁸ Outside the organizational learning literature, the Merriam-Webster Dictionary defines knowledge as “the fact or condition of knowing something with a considerable degree of familiarity through experience, association or contact.”²⁹ This definition suggests that there are different means to obtain knowledge.

Creating Knowledge

An oft-referenced model for creating knowledge is the Nonaka and Takeuchi’s Knowledge Spiral Conversion Process, which is illustrated in Figure 2. The AFLLP, the Pigeau and McCann readings that are popular at the CAF higher learning institutions, as well as numerous other publications³⁰ refer to this model. The model defines two types of knowledge and four means of transferring the knowledge. More specifically, it defines knowledge as being

²⁵ Michael Polanyi, *The Tacit Dimension* (Garden City: Anchor, 1967) as quoted in SG McIntyre, M. Gauvin and B. Waruszynski, "Knowledge Management in the Military Context," *Canadian Military Journal* 4, no. 1 (2003), 36.

²⁶ Canada, *Terminium Plus Defence Terminology Bank*, last accessed 08 March 2016.

²⁷ Chun Wei Choo, "The Knowing Organization as Learning Organization," *Education + Training* 43, no. 4/5 (2001), 198.

²⁸ N. Cook and D. Yanow, "Culture and Organizational Learning," *Journal of Management Inquiry* 20, no. 4 (2011), 362-379.

²⁹ *Webster’s Third New International Dictionary* (Springfield, MA: Merriam-Webster, 1981).

³⁰ Including a few referenced in this paper. Google Scholar lists over 30,000 citations.

either explicit or tacit. Explicit knowledge is “easily... ‘processed’ by a computer, transmitted electronically or stored in databases.”³¹ Tacit knowledge, on the other hand, is “not easily visible and expressible... highly personal and hard to formalize[,]... [it is] deeply rooted in an individual’s action and experience, as well as the ideals, values, or emotions he or she embraces.”³² These definitions also cover most of the points from the definitions above: easily codified (explicit); not easy to codify/hard to formalize (tacit); and culture/beliefs and norms (cultural). Notwithstanding the highly personal nature of tacit knowledge, Nonaka and Takeuchi propose that tacit knowledge can be transformed into explicit knowledge. The conversion takes place through four conversion modes: socialization, externalization, combination and internalization. This process is far from simple and requires a collectivistic (as opposed to an individualistic) approach to learning.

³¹ Ikujiro Nonaka and Hirotaka Takeuchi, *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation* (New York: Oxford University Press, 1995), 9.

³² *Ibid.*, 8.

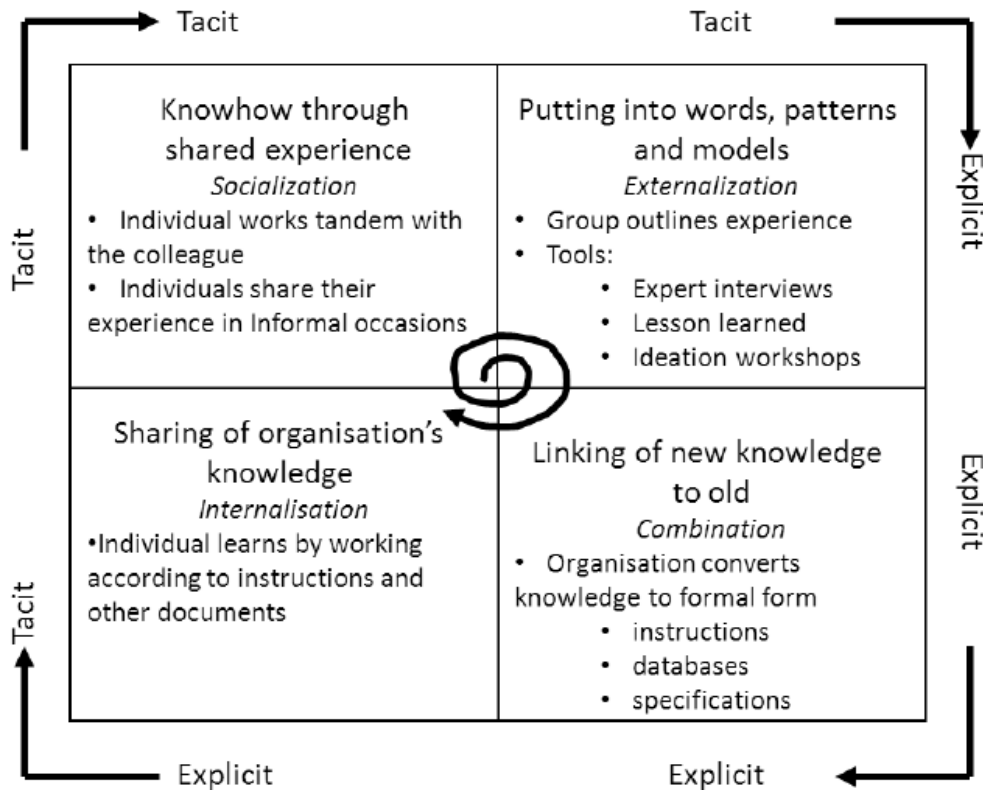


Figure 2: Nonaka and Takeuchi's Knowledge Spiral Conversion Process

Source: Ikujiro Nonaka and Hirotaka Takeuchi, *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation* (New York: Oxford University Press, 1995).

Nonaka and Takeuchi refer to the process of converting one's own tacit knowledge to the tacit knowledge of others as socialization. The process is not necessarily verbal, as this type of knowledge is often gained through apprenticeship and on-the-job-training (OJT). The "key to acquiring tacit knowledge is experience,"³³ they argue, where the information is shared from one to another with the context and associated emotions.³⁴ The externalization of knowledge (from tacit to explicit) is more challenging. While writing is a form of externalization, it is more than

³³ *Ibid.*, 63.

³⁴ *Ibid.*

that, “taking the shapes of metaphors, analogies, concepts, hypothesis or models.”³⁵ This “mode of concept conversion is typically seen in the process of concept creation and is triggered by dialogue or collective reflection.”³⁶ For example, the Nonaka and Takeuchi model itself is a form of externalization where the authors have used their tacit interpretation of knowledge and articulated a model to illustrate a spiral process of knowledge creation. That is, the process is defined by a metaphor (a spiral) and an analogy (a manufacturing style four-step conversion process).

Converting specific explicit knowledge to generalized explicit knowledge is the process of combination. It can include the simple combination of various media, conversations, meetings or computerized knowledge.³⁷ More complex combination, however, involves the “reconfiguration of existing information through sorting, adding, combining, and categorizing of explicit knowledge [which] can lead to new knowledge.”³⁸ It can ultimately take the form of formal training, undergraduate and graduate programs. Lastly, converting explicit knowledge to tacit knowledge is the process of internalization. This process is similar to ‘learning by doing’ and forms the foundation of an individual’s tacit knowledge. It is the culmination of socialization, externalization and combination and results in “shared mental models or technical know-how.”³⁹ The conversion process benefits “if the knowledge is verbalized or diagrammed into documents, manuals, or oral stories.”⁴⁰ The documentation aspect is key as it helps individuals “internalize what they experienced, thus enriching their tacit knowledge.”⁴¹

³⁵ *Ibid.*, 64.

³⁶ C.F. Graumann, “Perspective Structure and Dynamics in Dialogue” in *The Dynamics of Dialogue*, ed. I. Markova and K. Foppa (New York: Harvester Wheatsheaf, 1990) 105-126, quoted in Nonaka, *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*, 64.

³⁷ *Ibid.*, 67.

³⁸ *Ibid.*

³⁹ *Ibid.*, 69.

⁴⁰ *Ibid.*

⁴¹ *Ibid.*

The process is iterative. Each conversion builds on the last one and thus continually builds the tacit and explicit knowledge base of the individual (the upward spiral). This way of thinking is important to learning organizations as it highlights that there is more than one way to obtain knowledge and that perhaps imparting knowledge to individuals requires more than one avenue of approach. For example, how much knowledge do individuals gain when they take an on-line ‘read and answer the multiple choice questions’ course (a presentation of the *combination* of knowledge) without applying the skills (internalization/learning by doing), sharing the experiences (socialization) and reflecting (externalization) on what the knowledge really means?

Coincidentally, the Merriam-Webster definition of knowledge stated earlier shares much with the Nonaka-Takeuchi model: *internalization* (learning by doing – experience), socialization (sharing – contact), *externalization* (dialogue – contact), and *combination* (association). As well, the CAF doctrinal concept of ‘command intent’ incorporates some of the key components of Nonaka-Takeuchi methods for creating knowledge:

The two most important of these [four] mechanisms were dialogue for sharing explicit intent and socialization for sharing implicit intent. If commanders shared overt knowledge of the mission objective through dialogue and if they shared tacit knowledge on how to interpret the objective through socialization, then the likelihood of having common intent with their subordinates would be enhanced.⁴²

Although the Nonaka-Takeuchi model for knowledge creation might be popular, there are others. In knowledge building, “the organization identifies and nurtures activities that build up knowledge which strengthens the organizations distinctive core capabilities, enabling them to

⁴² Ross Pigeau and Carol McCann, "Establishing Common Intent: The Key to Co-Ordinated Military Action," in *The Operational Art: Canadian Perspectives : Leadership and Command*, ed. Allan D. English (Kingston, ON: Canadian Defence Academy Press, 2006), 92.

grow over time.”⁴³ Key aspects of knowledge building include “shared problem solving, experimenting and prototyping, implementing and integrating new processes and tools, and importing knowledge.”⁴⁴ In knowledge linking “the organization forms intimate learning alliances with other organizations in order to transfer knowledge that is embedded in the specialized relationships, work cultures and operating styles of the partner organization.”⁴⁵ These three models of knowledge creation (conversion, building and linking) share a key feature (variable): creating knowledge requires social interaction – ‘shared experiences’, ‘shared problem solving’ and ‘learning alliances.’ Applying social and psychological theories is unlike applying physical and mathematical theories where most (all) the variables are quantifiable. In his ‘knowing cycle’ model,⁴⁶ Chun Wei Choo defines knowledge creation variables as streams of experience, shared meanings, and new knowledge capabilities with an output of goal-directed adaptive behavior. In his model, the interaction of ‘sense making’ ‘decision making’ and ‘knowledge creating’ creates organizational growth (illustrated in Figure 3). That is, the end result of this “interaction between shared meaning and shared learning is the execution of a pattern of actions that moves towards goals and maintains current identity.”⁴⁷ When coupled with adapting to a changing environment the outcome of decision-making is “both goal-directed and adaptive.”⁴⁸ In other words, the process describes creating practical knowledge. However, if

⁴³ D. Leonard-Barton, *Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation*, (Boston, MA: Harvard Business School Press, 1995) as quoted in Chun Wei Choo, “The Knowing Organization as Learning Organization,” *Education and Training* 43, no. 4/5, (2001), 199.

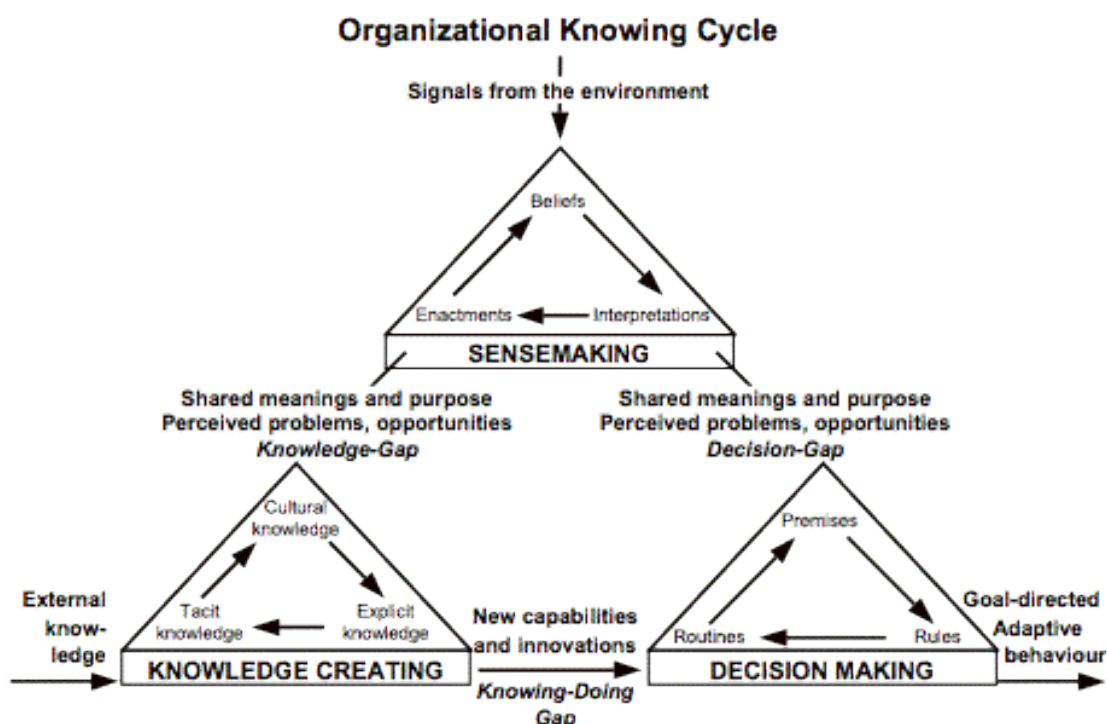
⁴⁴ *Ibid.*

⁴⁵ J.L. Badaracco, *The Knowledge Link: How Firms Compete Through Knowledge Alliances* (Boston, MA: Harvard Business School Press, 1991) as quoted in Chun Wei Choo, “The Knowing Organization as Learning Organization,” *Education and Training* 43, no. 4/5, (2001), 199.

⁴⁶ Chun Wei Choo, “The Knowing Organization as Learning Organization,” *Education & Training* 43, no. 4/5 (2001).

⁴⁷ Choo, *The Knowing Organization as Learning Organization*, 201.

⁴⁸ *Ibid.*



“90% of workplace learning is informal or incidental,”⁴⁹ or tacitly held,⁵⁰ as suggested by researchers in the field of organizational learning, then how can the uncodified collective knowledge of an organization be harnessed?

Figure 3: Choo’s Knowing Cycle

Source: Chun Wei Choo, *Knowing Cycle*, last accessed 16 March 2016, <http://choo.fis.utoronto.ca>.

Knowledge Management

According to McIntyre, Gauvin and Waruszynski, “knowledge management is a multi-disciplinary field that draws from theories in economics, sociology, philosophy and psychology.”⁵¹ Accordingly, there is no one way to view, understand, or analyze it. The GoC defines knowledge management as “an integrated, systematic approach to identifying, managing, and sharing all of an enterprise’s information assets, including databases, documents, policies and procedures, as well as previously unarticulated expertise and experience held by individual

⁴⁹ O’Keeffe, *Organisational Learning: A New Perspective*, 134.

⁵⁰ Louisa Wah, *Making Knowledge Stick*, Vol. 88 (New York: American Management Association, 1999), 27.

⁵¹ McIntyre, Gauvin and Waruszynski, *Knowledge Management in the Military Context*, 36.

workers.”⁵² This definition covers both the codified knowledge (databases, documents, policies, procedures...) as well as the uncoded, or tacit knowledge (unarticulated expertise and experience). The AFLLP does not explicitly assign a definition to knowledge management but does provide details on the requirement for a Knowledge Management System (KMS). Understanding the leap from knowledge creation to knowledge management is critical to organizational learning. A computing system is only part of the solution. In the words of a recent report by the Canadian Defence Academy (CDA) – a “KMS in an enabler not a problem solver.”⁵³ If 90% of knowledge is tacit, informal or incidental, then a database of explicit knowledge will only manage 10% of the collective organizational knowledge.

Before attempting to harness (capture) knowledge that is only accessible to the individual, and therefore not to the organization, the flow of knowledge requires analysis.

Serenko et al identify four schools of thought on intra-organizational knowledge flow:

... [in] the *social school*, rapport is the most important antecedent, including the ability to trust one another so that the knowledge recipient will use shared knowledge in an appropriate way. Within the *structural school*, knowledge is shared because the knowledge donator feels obligated to a stakeholder, such as a boss, client or shareholder. The *rational school* suggests that an intrinsic micro cost-benefit analysis determines whether knowledge is shared on a case-by-case basis. From the *incentive school's* viewpoint, economic gains are guaranteed by a reward and recognition system that compensates individuals when they share knowledge.⁵⁴

All of these approaches can be seen in Canadian public management. That is, knowledge is shared based on helping others, reporting to others, leveraging, and recognition. These processes are not easy. In 2005, Andreas Riege identified three dozen barriers to knowledge

⁵² Canada, *Terminum Plus Defence Terminology Bank*, last accessed 04 March 2016.

⁵³ Roger Vandomme, *From Lessons Identified to Lessons Learned: A Proposition for Integration of Lessons Learned into Canadian Forces Professional Development* (Kingston, ON: Canadian Defence Academy, 2010), 132.

⁵⁴ Alexander Serenko, Nick Bontis and Timothy Hardie, "Organizational Size and Knowledge Flow: A Proposed Theoretical Link," *Journal of Intellectual Capital* 8, no. 4 (2007), 611.

sharing. He broke them down into individual, organizational and technological challenges.⁵⁵ A summary of the most relevant barriers to the RCAF is provided in Table 1. Another barrier to consider is that there just may be too much information (the bottom layer of the knowledge pyramid in Figure 1). Serenko et al refer to too much information as ‘information pollution’ where “individuals are bombarded with large amounts of irrelevant information they cannot possibly process and they start ignoring incoming messages.”⁵⁶ This in turn affects the efficacy with which information is shared. Understanding the cause of these barriers will help reveal solutions that might improve knowledge management. The solutions, however, will have to include practical implementation strategies.

Level	Barrier
Individual	General lack of time to share knowledge, and time to identify colleagues in need of specific knowledge
	Low awareness and realization of the value and benefit of possessed knowledge to others
	Dominance in sharing explicit over tacit knowledge such as know-how and experience that requires hands-on learning, observation, dialogue and interactive problem solving
	Use of strong hierarchy, position-based status, and formal power (“pull rank”)
	Lack of contact time and interaction between knowledge sources and recipients
Organizational	Integration of knowledge management strategy and sharing initiatives into the company’s goals and strategic approach is missing or unclear
	Lack of transparent rewards and recognition systems that would motivate people to share more of their knowledge
	Hierarchical organization structure inhibits or slows down most sharing practices
	Deficiency of company resources that would provide adequate sharing opportunities
Technological	Lack of integration of IT systems and processes impedes the way people do things
	Unrealistic expectations of employees as to what technology can do and cannot do

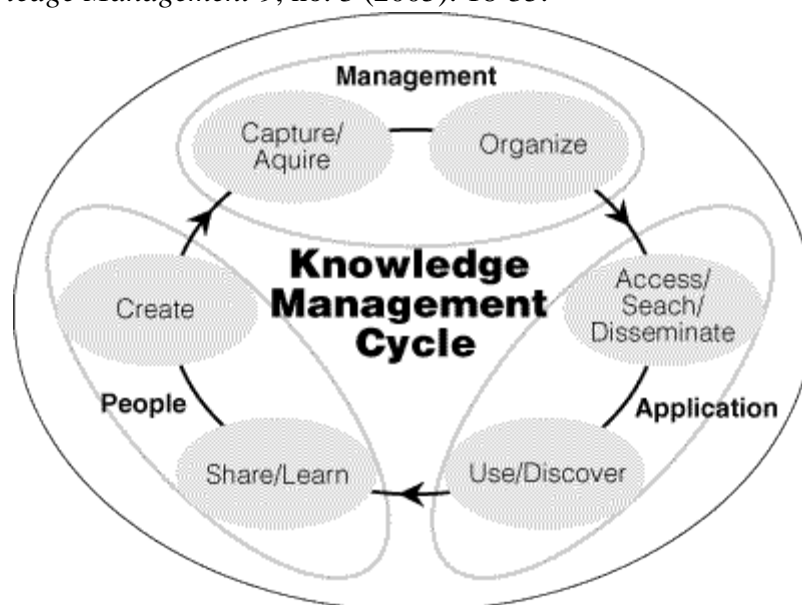
⁵⁵ Andreas Riege, "Three-Dozen Knowledge-Sharing Barriers Managers must Consider," *Journal of Knowledge Management* 9, no. 3 (2005), 18-35.

⁵⁶ Serenko, Bontis and Hardie, *Organizational Size and Knowledge Flow: A Proposed Theoretical Link*, 618.

	Lack of communication and demonstration of all advantages of any new system over existing ones
--	--

Table 1: Knowledge-sharing barriers relevant to the RCAF

Source: Andreas Riege. "Three-Dozen Knowledge-Sharing Barriers Managers Must Consider." *Journal of Knowledge Management* 9, no. 3 (2005): 18-35.



McIntyre et al also note the need for practicality. Knowledge management “should reflect a pragmatic approach that is concerned with real solutions and the ability to accurately analyse and measure applications.”⁵⁷ To enable their approach they step off the Choo Knowing Cycle and propose a Knowledge Management Cycle (KMC, Figure 3) with three guiding perspectives: management, application and people.⁵⁸

Figure 3: Knowledge Management Cycle

Source: SG McIntyre, M. Gauvin and B. Waruszynski, "Knowledge Management in the Military Context," *Canadian Military Journal* 4, no. 1 (2003), 37.

McIntyre et al then link the perspectives of their model to the quadrants of the Nonaka model.

Accordingly, ‘management’ “focuses on capturing, organizing and facilitating knowledge...

⁵⁷ McIntyre, Gauvin and Waruszynski, *Knowledge Management in the Military Context*, 36.

⁵⁸ *Ibid.*, 37.

[largely] span[ing] the externalization and combination quadrants of the Nonaka model”⁵⁹ (refer to Figure 2 for visualization). That is, management is responsible from the organizational perspective to create both conceptual knowledge and systemic knowledge. ‘Application’ “focuses on effective retrieval of relevant content through advanced searches and mining to conduct knowledge-related work and tasks and on the use of the results for discovery... [relying] on the knowledge combination portion of the [Nonaka] model.”⁶⁰ Lastly, ‘people’ “focuses on learning, sharing and collaboration... the education component of the cycle that is within the internalization quadrant, moving into the socialization portion.”⁶¹ They then go on to define the knowledge management cycle activities in Figure 3 and explicitly link the activities to the Nonaka model:

Externalization (Management)

- Capture and Acquire
- Organize

Combination (Application)

- Access, Search and Disseminate

Internalization (Application)

- Use and Discover

Socialization (People)

- Share and Learn
- Create

One of the major challenges McIntyre et al identify (under capture and acquisition of knowledge) is the integration of “information collected from a large number of heterogeneous, distributed, and disparate ‘silos’.”⁶² They then conclude that “robust, precise and timely military

⁵⁹ *Ibid.*, 37.

⁶⁰ *Ibid.*

⁶¹ *Ibid.*

⁶² *Ibid.*

KM will require technological, cognitive and socio-cultural focused solutions”⁶³ and that further research is required “in the subject areas of cognitive science, information and knowledge management technology, command and control... to formulate effective operational systems.”⁶⁴

Brigadiers General (retired) Sharpe and Leversedge have since complemented the work of McIntyre et al. In 2014, they introduced a knowledge-management proposal for the RCAF. The proposal made note of many deficiencies in RCAF knowledge management at the operational level along the lines of accountability and culture. It characterized the RCAF approach to KM “as one of missed opportunities in failing to recognize, understand and formally pass on the valuable knowledge gained from experience.”⁶⁵ The authors did note the irony, however, that the RCAF already had two successful ‘knowledge management approaches,’ namely the Flight Safety program and AF9000+ program. However, these successes were limited and did not include KM at the higher-level headquarters (RCAF Air Staff) and loss of learning opportunities from major capital procurements.⁶⁶

Sharpe and Leversedge proposed an ‘optimized’ approach to knowledge management. This approach would help gather lessons learned from across the RCAF (including staff functions) and address the issue of the dis-jointed hierarchy between those who are affected by the change and those who have the responsibility and authority for implementing it. They also proposed a simple method of “classifying issues according to the degree of control or influence that the Air Force has over them.”⁶⁷ Refer to Figure 4 for the hierarchy of influence.

⁶³ *Ibid.*, 40.

⁶⁴ *Ibid.*

⁶⁵ Sharpe and Leversedge, *A Knowledge-Management Proposal for the RCAF*, 43.

⁶⁶ *Ibid.*, 44.

⁶⁷ *Ibid.*, 46.

Figure 4: Categorization of issues as proposed by Sharpe and Leversedge

Source: BGen (ret'd) Sharpe, G.E. (Joe) and Terry BGen (ret'd) Leversedge, "A Knowledge-Management Proposal for the RCAF," *The Royal Canadian Air Force Journal* 3, no. 2 (Spring 2014, 2014), 46.

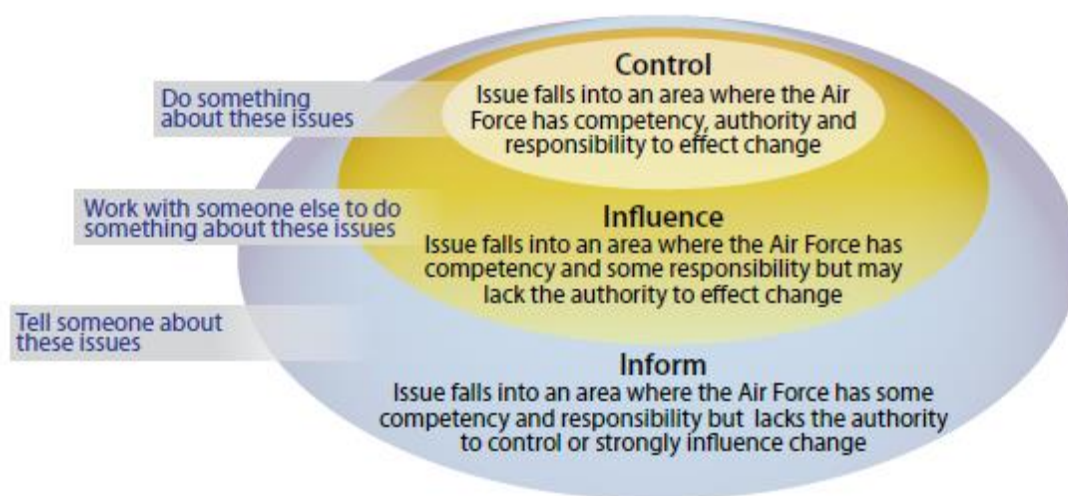
The model shares many similarities with the Pigeau and McCann⁶⁸ model for command and control in the Canadian Armed Forces. Specifically, it uses the attributes of competency, authority, and responsibility as the criteria to categorize issues:

Control:

- RCAF has competency, authority and responsibility
- Pigeau and McCann define this as balanced command and consequently the RCAF is well postured to do something about it

Influence

- RCAF has competency
- RCAF has some responsibility
- RCAF lacks authority
- Pigeau and McCann define some responsibility and lack of authority as minimal command bordering on ineffectual command



Inform

- RCAF has some competency
- RCAF has some responsibility
- RCAF lacks authority

⁶⁸ Ross Pigeau and Carol McCann, "Re-Conceptualizing Command and Control," *Canadian Military Journal* 3, no. 1 (2002), 53.

- Pigeau and McCann define some responsibility and lack of authority as minimal command bordering on ineffectual command and low level of balanced command

Categorizing the level of issue certainly has the potential to aid in resolution of knowledge gaps. But who determines that level? A junior member of the RCAF would not know whether the senior leadership of the RCAF has the competency, authority and responsibility to resolve problems. Senior members would struggle to find the time to filter through a list of pan-RCAF issues to provide a level of categorization unless they possessed the competency, authority and responsibility for the issue themselves. The authors propose the Air Force Integrated Information and Learning Environment (AFIILE) as means to apply the concept. But given that their proposal is based on Choo's knowledge cycle and Nonaka's knowledge creation model it should be apparent that AFIILE is not strong in internalization (learning by doing) and socialization (sharing experiences and developing mental models). A more robust model is required that will allow knowledge deficiencies to be observed, recorded, actioned, and followed up. Successful models already exist in the RCAF and many members have already used or been exposed to them – the Flight Safety Program and the Quality Management Program (AF9000+). However, these programs are limited in scope. A new model is required that links RCAF doctrine to training, operations, and observations that when implemented improve doctrine, the quality of training, and the effectiveness and efficiency of operations.

Organizational Learning

Learning happens everywhere not somewhere.

– Dan Pontrefact in Flat Army

In 2002, the chief of the defence staff, General Ray Henault proposed to create an environment in the CAF that “facilitates knowledge discovery, creation, innovation and which

fosters the development of a learning organization.”⁶⁹ A decade later, the Chief of Force Development noted in his summary of military implications in the future security environment that the “CAF must integrate the lessons learned from operations, exercises, and experiments at the tactical, operational and strategic levels in order to remain ready, effective, and adaptive.”⁷⁰ Two years later, Chief of Force Development reinforced the requirement to integrate lessons learned in their force development system model.⁷¹ Nonetheless, taking into consideration the recent procurement challenges within the CAF, the effectiveness of this feedback loop of lessons learned is not evident. At the operational level, in 2010 the RCAF published its doctrine, policies and procedures on organizational learning stating that the Air Force “must be a learning organization.”⁷² However, it does not describe what a learning organization should look like. As well, it is atypical in the CAF to include what are normally defined as three levels of documentation (procedures are normally derived from policy, which is normally derived from doctrine) in a single publication. The deviation, however, is understandable as there is very little written⁷³ in RCAF Aerospace doctrine about learning organizations (even though the RCAF as a whole must become one). What does a (lesson) learning organization look like? What are the components?

Clearly distinguishing knowledge management from organizational learning is a challenge as both of these concepts “often refer to each other in their definitions and practices.”⁷⁴ The GoC definition adds to the confusion – “The capability or processes used by an organization

⁶⁹ R.R. Henault and J. Judd, *Future Direction for Information Management in DND/CF* (Ottawa, Department of National Defence, 2002) as quoted in Girard, *Knowledge Management in DND*, 199.

⁷⁰ Canada. Dept of National Defence, *The Future Security Environment 2013-2040* (Ottawa: DND Canada, 2014).

⁷¹ Canada. Dept. of National Defence, *Capabilities Based Planning Handbook*, 2014, 12.

⁷² Canada, *Air Force Lessons Learned Programme Manual*, iii.

⁷³ The exception being the RCAF Shield doctrine, which states, “in order to be truly agile Shield must be enabled by an effective learning organization.”

⁷⁴ Catherine L. Wang and Pervaiz K. Ahmed, "Organisational Learning: A Critical Review," *The Learning Organization* 10, no. 1 (2003), 12.

to create, acquire, capture and share knowledge, skills or attitude.”⁷⁵ However, the GoC also notes that “organizational learning involves the intentional use of learning processes at the individual, group and system level to find new and better ways of achieving the organizational mission.”⁷⁶ These definitions are consistent with the AFLLP, although the terms ‘lessons learned’ (LL) or ‘LL program’ are used in place of the ‘organizational learning program.’

Others define learning organizations somewhat differently. Pedler et al defines a learning company “as an organization that facilitates the learning of all its members and continuously transforms itself.”⁷⁷ This definition helps differentiate between the individual (one who learns) and the organization (where transformation takes place). Garvin provides a similar definition but with focus on knowledge creation instead of individual learning – “an organization skilled at creating, acquiring, and transferring knowledge and at transforming itself to reflect new knowledge and insights.”⁷⁸ O’Keeffe expands on the distinction and points out that “it is employees within organizations rather than organizations themselves that learn”⁷⁹ and “it is the individuals that create the organisational transformation.”⁸⁰

Many contemporary models describe organizational learning. In the *Fifth Discipline*, Peter Senge describes the core disciplines (components) of the learning organization as personal mastery, mental models, shared vision, team learning and systems thinking.⁸¹ Personal mastery means “continually clarifying and deepening our personal vision, of focusing our energies, of

⁷⁵ Canada, *Termium Plus Defence Terminology Bank*, last accessed 16 March 2016.

⁷⁶ Canada, *Termium Plus Defence Terminology Bank*, last accessed 16 March 2016. For some definitions, Termium Plus expands on the definitions to provide context.

⁷⁷ Mike Pedler, Tom Boydell, and John Burgoyne. "Towards the Learning Company." *Management Education and Development* 20, no. Part 1 (1989) as quoted in O’Keeffe, *Organisational Learning: A New Perspective*, 136.

⁷⁸ D.A. Garvin, "Building a Learning Organisation." *Harvard Business Review* 71, no. 4 (July/August, 1993), as quoted in O’Keeffe, *Organisational Learning: A New Perspective*, 137.

⁷⁹ O’Keeffe, *Organisational Learning: A New Perspective*, 137.

⁸⁰ Mark Dodgson, *Technological Collaboration in Industry* (London: Routledge, 1993) quoted in O’Keeffe, *Organisational Learning: A New Perspective*, 137.

⁸¹ Peter M. Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization* (New York: Doubleday/Currency, 2006).

developing patience, and of seeing reality objectively.”⁸² Mental models “are deeply ingrained assumptions, generalizations or even pictures or images that influence how we understand the world and how we take action”⁸³ For example, the statement of military ethos (three principles and five values)⁸⁴ is an example a mental model (a compass) of how CAF members shall represent themselves. Building “shared vision involves the skills of unearthing shared ‘pictures of the future’ that foster genuine commitment and enrollment rather than compliance.”⁸⁵ It is more than just a vision statement where people “excel and learn, not because they are told to, but because they want to.”⁸⁶ The team learning discipline “starts with ‘dialogue,’ [and therefore involves] the capacity of members of the team to suspend assumptions and enter into a genuine ‘thinking together’.”⁸⁷ It also “involves learning how to recognize the patterns of interaction in teams that undermine learning.”⁸⁸ Lastly, “systems thinking is a conceptual framework, a body of knowledge and tools that has been developed... to make the full patterns clearer, and to help us see how to change them effectively.”⁸⁹ It begins with an understanding that there is an interaction between systems. For example ecosystems, financial systems, manufacturing systems, etc. where one process (cloud formation, calculating prime lending rate, and supply and demand) has an impact on other systems (ground water, mortgage rates, and the price of raw materials). In Senge’s concept, the five disciplines must develop together and systems thinking integrates the disciplines “fusing them together into a coherent body of theory and practice.”⁹⁰

⁸² *Ibid.*, 7.

⁸³ *Ibid.*, 8.

⁸⁴ Three principles – respect the dignity of all persons, serve Canada before self, obey and support lawful authority. Five values – integrity, loyalty, courage, stewardship and excellence.

⁸⁵ Senge, *The Fifth Discipline*, 9.

⁸⁶ *Ibid.*

⁸⁷ *Ibid.*, 10.

⁸⁸ *Ibid.*

⁸⁹ *Ibid.*, 7.

⁹⁰ *Ibid.*, 11.

In an extensive literature review, O’Keeffe identifies “seven characteristics of organizational learning:”⁹¹

1. Learning antecedents;
2. Environment of innovation;
3. Perceived need and learning mechanisms;
4. Executive challenge and learning processes;
5. Cultural imperative of resourcing learning;
6. Organizational wide learning; and
7. Learning organization.⁹²

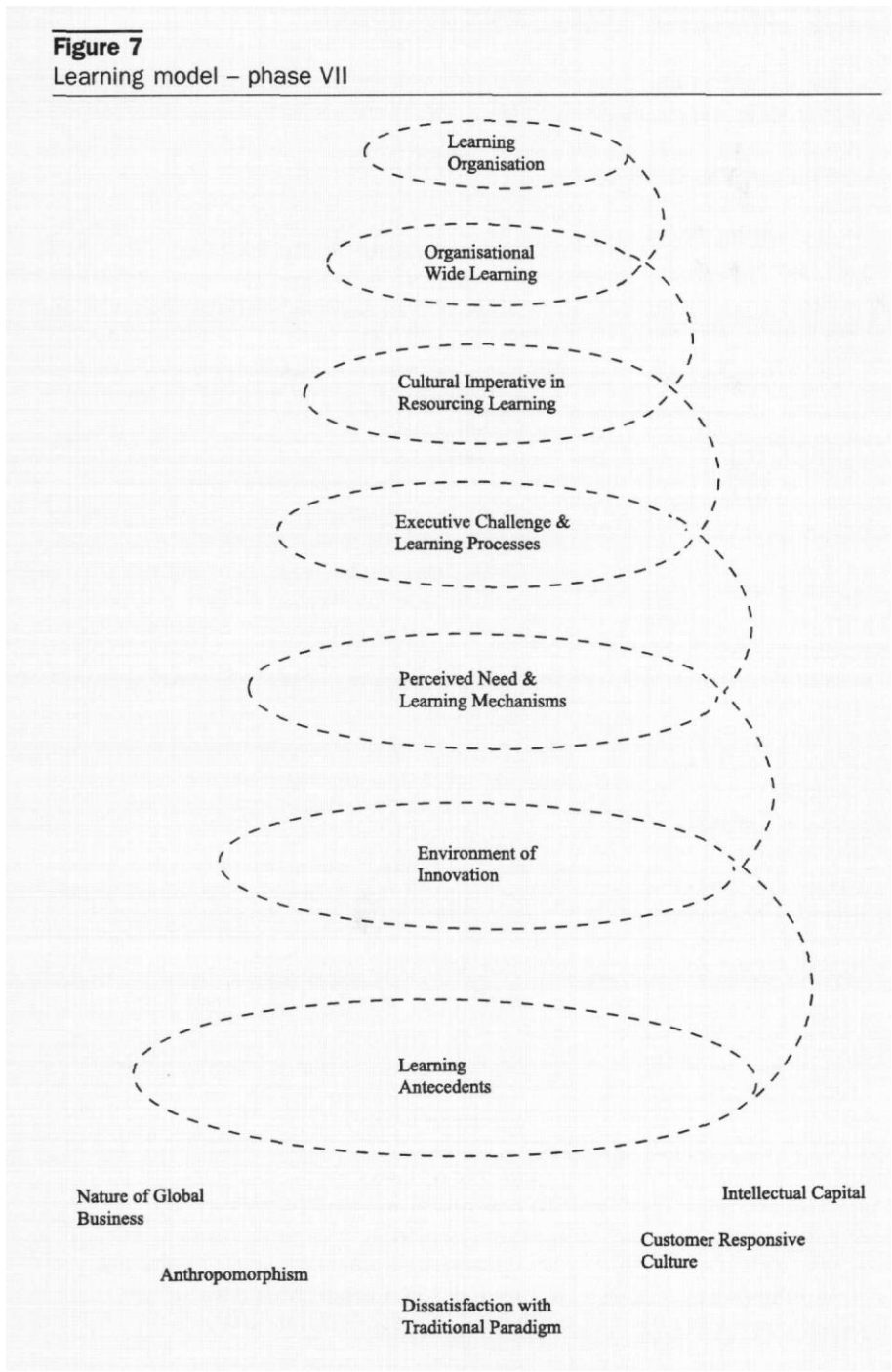
He then goes on to define each of the characteristics as a stage where learning antecedents are the foundation and learning organization is the end goal. The foundation consists of five attributes: customer responsive culture; anthropomorphism in organizations (comparing organizations to a living thing); intellectual capital; dissatisfaction with the traditional management paradigm and the nature of global business. Once the foundation is understood then the organization can progress to the next stage (environment of innovation). Figure 5 illustrates the process:

⁹¹ O’Keeffe, *Organisational Learning: A New Perspective*, 130.

⁹² *Ibid.*

Figure 5: O’Keeffe Organizational Learning Model

Source: Ted O’Keeffe, "Organisational Learning: A New Perspective," *Journal of European Industrial Training* 26, no. 2/3/4 (2002), 139.



O’Keeffe also tabulated the descriptions of each characteristic and the contribution of each to learning effectiveness (Table 2).

Characteristics	Description	Contribution to Learning Effectiveness
Learning process	Learning is a deliberate, conscience part of strategy	Learning becomes a habit and an everyday occurrence
Learning antecedents	The building blocks of organization learning	Plan an important role in the development of learning organizations
	The increasing realization of the importance of intellectual capital as a key resource	In this information society, knowledge workers constitute the primary means by which organizations compete
	Flexible, efficient structure supporting learning systems	Reduces bureaucracy and restrictive job descriptions and encourages cross-functional cooperation
	Learning is valued, promoted in a blame-free environment	Learning becomes automatic, natural and experimentation is encouraged
Environment of innovation	The creation of knowledge is as a central to the firm from all parts of the organization	New knowledge leads to novel products/processes and facilitates the transfer of successful ideas widely
Perceived need and learning mechanisms	Where benchmarking, scenario planning and related techniques are used to scan the environment	Greater understanding of the firm's environment allows an organization to anticipate change and prepare appropriate response
Executive challenge and learning processes	Managers have difficulty releasing current assumptions or envisioning possible ideal futures	Managers develop new commitment to learning and experimenting or big picture thinking as a way of life
Cultural issues with resourcing learning	Small groups of people working closely together. Networks are effectively teams operating outside the organization	Key ways of combining not only existing knowledge of a group but also their abilities to create new knowledge
Organizational wide learning	Excellent results require productive individuals, who feel a sense of ownership and empowerment	Commitment is a two-way street, and an organization that treats its employees with respect can expect the same in return
Learning organization	Stores belief systems, memories of past events, frames of reference and values	Provides discrimination skills in order to identify future actions

Table 2: O'Keefe Characteristics of learning organization

Source: adapted from Ted O'Keefe, "Organisational Learning: A New Perspective," *Journal of European Industrial Training* 26, no. 2/3/4 (2002), 138.

Marsick and Watkins⁹³ identify three types of individual learning: formal, informal, and incidental. Formal training, as the name implies, usually takes place in highly structured environments (training institutions). The remaining 90%, however, according to Watkins and Golembiewski “is informal or incidental.”⁹⁴ Pontrefact, in *Flat Army: Creating a Connected and Engaged Organization*, makes a similar observation. He identifies learning as formal, informal and social with 10% drawn from formal courses, 20% from others (social) and 70% of learning from on the job experience (informal). Further, he calls on leaders to adjust their leadership style to reflect learning preferences and recommends equal efforts towards formal leadership, informal leadership and social leadership so that “learning is an integral part of engagement.”⁹⁵ Although his book is on the connected and engaged organization, he identifies ‘learning’ as one of the five tenets of his Flat Army.

This section discussed the concepts of knowledge, knowledge creation, knowledge management and learning organizations. Although, there is no unity in approach to knowledge and learning some common features are evident. For example, the distinction between explicit and tacit knowledge is mostly clear in the literature. Another common feature is personal cognitive capacity (personal mastery and intellectual capital) and how it is achieved (formal, informal, and incidental). Regardless of commonality, all the described features contribute to the end goal of a learning organization. As a result, these features, in proper context, should be considered in the ongoing discourse of learning practices in the RCAF.

⁹³ V.J. Marsick, and K.E. Watkins, “Looking again at learning in the learning organization: a tool that can turn into a weapon,” *The Learning Organization*, 3, no. 5. as quoted in O’Keeffe, *Organisational Learning: A New Perspective*, 134.

⁹⁴ K.E. Watkins and T. Golembiewski. "Rethinking Organization Development for the Learning Organization." *The International Journal of Organizational Analysis* 3, no. 1 as quoted in O’Keeffe, *Organisational Learning: A New Perspective*, 134.

⁹⁵ Dan Pontefract, *Flat Army: Creating a Connected and Engaged Organization* (Hoboken, NJ: Jossey-Bass, 2013), 5.

LEARNING ORGANIZATIONS WITHIN THE RCAF

This section will describe and analyze the RCAF Quality Management, Flight Safety and Air Force Lessons Learned Programmes (AFFLP). The assessment criteria for the analysis draw from the author's personal correspondence with the Canadian Forces Aerospace Warfare Centre (CFAWC).⁹⁶ In January 2015, CFAWC asked for advice on how the AFFLP could be better implemented. From experience, I defined three key leadership challenges to implementing continuous improvement programs: stewardship, accountability and culture. For 'stewardship' I defined the key leadership issues as ownership of air power information that the AFFLP program generates, accessibility and awareness of air power information requirements and the ability of the program to transform tangible information into accessible knowledge (such as a policy, process, standard operating procedures, checklist, purchase, modification, doctrine, budget, etc.). The concept of stewardship is covered in key CAF leadership doctrine where leaders have a "...special obligation ... to ensure the continued development of the institution [and] its cultures."⁹⁷ However, the 'look' of stewardship is not clearly defined in RCAF doctrine, making the analysis of the stewardship of RCAF programs somewhat nebulous. To this end, and for the purpose of analysis, program stewardship requires:

- A clear understanding of the purpose of the program;
- Clear direction on how to implement the program;
- Air personnel that are actively involved with the program;
- Results that are transparent and communicated in a manner that reaches most of the intended audience; and
- Continuous improvement of the program itself.

If these attributes are readily evident then it can be said that the program is well stewarded.

⁹⁶ Lieutenant Colonel Fortin, email to author, 14 January 2015.

⁹⁷ Canada. Dept. of National Defence, *A-AP-005-000/AP-004 Leadership in the Canadian Forces: Conceptual Foundations* (Canada: Canadian Defence Academy, 2005), 157.

Accountability as a concept should be generally understood by leaders and is defined in CAF doctrine: “A person’s obligation to take responsibility for and explain performance in relation to commitments made and results achieved.”⁹⁸ This concept of accountability is similar to the direction provided by the Chief of Defence Staff in his guidance for members of the CAF and employees of DND – “Having a *responsibility* involves having the *authority* and the obligation to act, including the authority to direct or authorize others to act. It also means being *accountable* for how those responsibilities have been carried out in light of agreed expectations.”⁹⁹ Accountability should be more than just compliance with the rules and regulations.¹⁰⁰ It should include “accountability [for the] results from organizational learning that derives from lessons that improve the definition of goals, organizational structure, standard operating procedures, and subsequent collection of data.”¹⁰¹ Further, accountability should demand “serious, far reaching and probably uncomfortable commitments and change from senior management.”¹⁰² In response to the original CFAWC query on how to improve the AFLLP the author identified the requirement of accountability for lessons learned within the existing chain of command functions similar to other continuous improvement programs in the RCAF. To this end, and from the author’s experience, program accountability requires:

- Identification of an individual who is accountable (if everyone is accountable then no one in particular is accountable);
- Clarity on what the individual is accountable for;
- Linkage between the results (or lack of results), the person accountable and the chain of command; and
- Visible and transparent results.

⁹⁸ *Ibid.*, 129.

⁹⁹ Canada. Chief of Defence Staff. *Guidance for Members of the Canadian Forces and Employees of the Department of National Defence*. 2nd ed., September 1999.

¹⁰⁰ Dorothea Greiling and Arie Halachmi. "Accountability and Organizational Learning." *Public Performance & Management Review* 36, no. 3 (2013), 377.

¹⁰¹ *Ibid.*

¹⁰² O'Keeffe, *Organisational Learning: A New Perspective*, 137

In contrast to stewardship and accountability, organizational culture “suffers from conceptual chaos.”¹⁰³ Allan English, who has long studied the Canadian military, points out that there are “very few published studies that have examined Canadian military culture and most of these have focused on the land forces.”¹⁰⁴ Moreover, Schien’s definition of culture (artifacts, espoused beliefs, basic underlying assumptions) that is often used in the military organizational culture literature “has its limitations.”¹⁰⁵ RCAF strategic guidance points out that the “airworthiness and safety framework requires both an institutional and a cultural commitment to be embraced by all air personnel.”¹⁰⁶ However, defining the ‘look and feel’ of a good culture is challenging. In response to the CFAWC request for advice, I pointed out that culture in part requires a belief in the system that is derived from taking part of the process itself and seeing verifiable success. Further, there is a significant difference between ‘saying’ that a program is important and ‘making’ a program important. For simplicity’s sake and to facilitate analysis, the following characteristics of successful culture will be used to analyze the RCAF institutional programs:

- The goal or aim of the program is generally understood by relevant air personnel;
- There is a clear commitment by air personnel to use the program for continuous improvement; and
- Non-compliant behaviour is addressed by the program.

¹⁰³ Mark Gasparotto, "Experimental Learning in the Canadian Army: Evolving from a Training to a Learning Organization" (masters thesis, Royal Roads Military College, 2014), 26.

¹⁰⁴ Allan English, *Understanding Military Culture: A Canadian Perspective* (Montreal: McGill-Queen's University Press, 2004), 87.

¹⁰⁵ *Ibid.*, 158.

¹⁰⁶ Canada. Dept. of National Defence, *A-GA-007-000/AF-008 Air Force Vectors - Abridged Version*, ed. Canadian Forces Aerospace Warfare Centre (Ottawa: DND Canada, 2014), 17.

Flight Safety

The RCAF Flight Safety Program provides an excellent example of the RCAF's ability to transform information into knowledge. Its roots go back to the creation of the RCAF Aircraft Accident Investigation Board (AIB) in 1942. Its purpose was to investigate "past aircraft accidents and to investigate new ones with a view to reducing non-operational losses."¹⁰⁷ Over time, the AIB evolved into the Directorate of Flight Safety (DFS). As well, its mandate expanded to include education and prevention. The Korean conflict caused setbacks but the program was ultimately able to regain its focus.¹⁰⁸ A few years later, a significant cultural shift occurred – the attribution of blame was no longer required as part of the accident investigation and "none of the information given to an aircraft accident investigation could be used in disciplinary proceedings."¹⁰⁹ This approach is unique among air forces¹¹⁰ and greatly enables a culture of learning from mistakes. Recently, the Chief of the Air Force recognized the "RCAF's Flight Safety Program as one of the best systems in the world with a deeply rooted safety culture developed over many years."¹¹¹ A recent international award supports this statement, recognizing the Flight Safety program of an RCAF Wing as a "model for other Wings to emulate."¹¹²

¹⁰⁷Government of Canada, "Royal Canadian Air Force: Flight Safety," last accessed 20 March 2016, <http://www.rcaf-arc.forces.gc.ca/en/flight-safety/index.page>.

¹⁰⁸ During the Korean conflict, the RCAF lost 476 aircraft and 405 air personnel. Source: "Canadian Forces Flight Safety," last accessed 02 April 2016, <http://www.rcaf-arc.forces.gc.ca/en/flight-safety/index.page>.

¹⁰⁹ Canada, "Canadian Forces Flight Safety," last accessed 20 March 2016, <http://www.rcaf-arc.forces.gc.ca/en/flight-safety/index.page>.

¹¹⁰ *Ibid.*

¹¹¹ Government of Canada, "Views on Flight Safety," last accessed 20 March 2016, http://publications.gc.ca/collections/collection_2013/dn-nd/DC2-2-2013-2-eng.pdf.

¹¹² Aviation.ca, "14 Wing Greenwood wins international flight safety award," last accessed 21 March 2016, <http://www.aviation.ca/200701304128/news/canada/military/4128-14-wing-greenwood-wins-international-flight-safety-award?Itemid=99999999>.

Currently, the purpose of the RCAF Flight Safety Program is to “enhance combat-effectiveness by preventing the accidental loss of aerospace resources.”¹¹³ The program is based on five principles: the prevention of occurrences, the expectation that airmen and women will freely report occurrences, voluntary acknowledgement of errors and omissions, the non-attribution of blame and a just culture.¹¹⁴ This approach allows the quick identification of “effective measures that will either prevent or reduce the risk of similar occurrences.”¹¹⁵ To enable the transformation of information to knowledge, the program analyzes causes of accidents and incidents. After identifying such causal factors, preventative measures are developed to avoid reoccurrence. Such measures most often result in changes to publications, procedures, training, practices, etc. In terms of knowledge management, the program often transforms information into procedural knowledge (i.e. step-by-step processes common to RCAF flight and technical manuals). The Flight Safety team also provides awareness of the incident and resolution (in most cases) to the chain of command. The team updates most RCAF air operations personnel on a regular basis through publications and mandatory briefings (externalization and combination of knowledge). The Directorate of Flight Safety (DFS) runs the program and the entire chain of command is responsible for ensuring the program is in place. Furthermore, the chain of command and individual squadron members are accountable for implementing (and in many cases identifying) preventative measures. Finally, a key feature of the program is self-reporting, which is largely enabled by an open culture of safety. How well the Flight Safety program addresses the key leadership issues of stewardship, accountability and culture will be discussed below.

¹¹³ Canada, *Canadian Forces Flight Safety*, last accessed 02 April 2016.

¹¹⁴ *Ibid.*, last accessed 19 Apr 2016.

¹¹⁵ *Ibid.*

Stewardship

The purpose of the Flight Safety program is clear. Moreover, it is reinforced at the highest levels of the CAF. As one former chief of the defence staff once said, “The Flight Safety Program helps ensure that the air missions of the Canadian Forces are accomplished at an acceptable level of risk.”¹¹⁶ The program principles in the Flight Safety Manual amplify the purpose with easily understood descriptions. The purpose of the program is also linked upwards to the overall RCAF goal of airworthiness risk management and sideways to parallel programs of technical and operational risk management.¹¹⁷ As a result, the purpose of the program is congruent with higher-level organizational objectives and complementary to other programs while lacking any unnecessary redundancies.

Flight Safety for the Canadian Forces (the ‘Flight Safety Manual’) is the ‘how-to’ book that describes program implementation and sustainment. It details the roles and responsibilities of the all members of the RCAF, those with specific Flight Safety tasks as well as those of leaders and commanders. How these roles and responsibilities are carried out is also explained in detail, including the methods, frequency and reporting lines. The Flight Safety Manual specifies education and training requirements, prevention activities and how to promote the program. A unique feature of the promotion program is awards that recognize people and organizational contributions to flight safety. Examples of awards include the ‘Good Show’ and ‘For Professionalism’ for outstanding and superior contributions, respectively. These awards are typically presented in front of the individual’s superiors, peers and subordinates (if any), and citations are published in the *Flight Comment* magazine.

¹¹⁶ General Hillier, Chief of Defence Staff, as quoted in the Canada. Dept. of National Defence, *A-GA-135-001/AA-001 Flight Safety for the Canadian Forces*. 7th ed. (Ottawa: DND Canada, 2013).

¹¹⁷ Canada, *Flight Safety for the Canadian Forces*, 1-5/6.

The majority of personnel actively and directly engaged in air operations have some degree of familiarity with the program. They have either submitted a flight safety report themselves, been involved with gathering information for a flight safety investigation, been involved with the process (i.e. quarantining parts or an aircraft) or have seen others engaged in these activities. From experience, there is normally no hesitation to submit a report or engage the flight safety team in flight safety concerns.

The results of the program are transparent and frequently communicated through multiple media. Promotional briefings take place on a regular basis through the Director of Flight Safety annual brief (normally briefed at the Wing level) as well as more frequent squadron level and flight level briefings. Content normally includes trends in the field of flight safety and recent incidents. Furthermore, the program contributes to the *Flight Comment* magazine, published three times a year, *Debriefing Pamphlets*, published monthly, and *Flash Pamphlets*, published on a one-time basis to address critical flight safety issues¹¹⁸ (i.e. bogus parts, improper techniques, etc.).

Continuous improvement is also a component of the program. Normal feedback takes place through the chain of command while comprehensive bi-annual surveys “provide the chain of command with credible advice on how to better accomplish the mission.”¹¹⁹ I can also attest that performance metrics (PMs) are monitored to ensure the program continues to improve. For example, units will typically have metrics for open and closed reports within a reporting period, as well as how long the reports are taking to complete. These metrics are also assessed across the RCAF and form a key component of the annual report. Further, the Flight Safety Manual

¹¹⁸ *Ibid.*

¹¹⁹ *Ibid.*, 4-4/5.

recommends the use of a balanced score card as a means for performance measurement.¹²⁰ The balanced score card, however, uses a traffic light system (red, yellow, green) and therefore is mostly a qualitative assessment tool.

Accountability

If standards and regulations are not revised in six months, it is proof that no one is seriously using them.

– Ronald Moen and Clifford Norman, Evolution of the PDCA Cycle

At the highest level, the Chief of the Air Staff “is responsible for Flight Safety policy in DND/CF.”¹²¹ Similarly, “accident prevention is the responsibility of commanders at all levels and involves monitoring the control, conduct and support of air operations.”¹²² At the individual level the “success of the FS Program is reliant upon “buy in” and a commitment to the program by all personnel associated with DND / CF flying operations.”¹²³ This concept of responsibility to flight safety is strengthened in other documentation as well. For example, recent strategic guidance to the RCAF highlights the flight safety program as an institutional responsibility.¹²⁴ However, it is RCAF doctrine that differentiates between responsibility and accountability and points out that the Commander 1 CAD is accountable to Commander RCAF for flight safety.¹²⁵

Regrettably, these job descriptions do not provide practical guidance to those who are actively engaged in air operations at the squadron level. Fortunately, the flight safety requirements are expanded at the wing and squadron level in the form of Wing Flight Safety Programs, Wing Standing Orders and Quality Management procedures. These orders and

¹²⁰ *Ibid.*, 6-2/3.

¹²¹ *Ibid.*, 1-2/6.

¹²² *Ibid.*, 2-3/10.

¹²³ *Ibid.*, 1-3/6.

¹²⁴ Canada, *Air Force Vectors*, 12.

¹²⁵ Canada, Dept. of National Defence, *B-GA-401-000/FP-001 Canadian Forces Aerospace Command Doctrine*. (Trenton, ON: Canadian Forces Aerospace Warfare Centre, 2012).

procedures define individual responsibilities, accountabilities, and how the program should be followed. The 8 Wing Flight Safety Program and Wing Standing Orders on Flight Safety reporting illustrate this point.¹²⁶ At the squadron level, the Manual of Aerospace Procedures (MAP) defines the accountabilities, responsibilities and processes for squadron members. 436 (Transport) Squadron Flight Safety Procedures¹²⁷ and Flight Safety Incident Reporting¹²⁸ Work Instruction provide an example. Of note, these procedures have been revised four and six times respectively in the last six years indicating that the process owners and approving authorities are regularly reviewing and improving them. To those involved with Flight Safety, there is very little ambiguity as to who does what and how it should be done.

The development and implementation of effective preventive measures is a critical component of the Flight Safety program.¹²⁹ Preventive measures transform the information that is generated from flight safety incidents to air power knowledge (similar to the combination and internalization of knowledge in the Nonaka and Takeuchi model). The transformation is aided by someone at the unit level¹³⁰ who is close to the issue and has some leadership responsibility. These accountabilities are visible at the Squadron and Wing Commander level as well as to external organizations such as 1 CAD and the Directorate of Flight Safety through annual reports¹³¹ and the Flight Safety Occurrence Management System (FSOMS). FSOMS is a knowledge management tool “that enables FS staff to monitor occurrences and hazards, analyze

¹²⁶ Colin Keiver, *8 Wing Flight Safety Program*, signed 11 Aug 2015.

¹²⁷ 436 Sqn, 436 (T) Sqn AWI 4.09 FS 03 rev 4 20 Jun 14.

¹²⁸ 436 Sqn, 436 (T) Sqn GWI 4.13 436 027 rev 6 11 Feb 15.

¹²⁹ Canada. Dept. of National Defence, *2014 Annual Report - Airworthiness Investigative Authority and Flight Safety Program's Activities*, (2014).

¹³⁰ *Ibid.*, 31.

¹³¹ Such as the 2014 FS Annual Report.

trends and track the implementation of corrective actions.”¹³² Despite the visible accountability structure, the program somewhat suffers a lag in preventative measures actually being implemented in a timely manner.¹³³

As a result of the robust policy, clearly defined individual and leadership responsibilities, and oversight by the chain of command, there is good accountability in the management of flight safety related knowledge. This is also evident outside of the RCAF. In his article on Canadian defence knowledge management, John Girard, a former Director of Knowledge Management for DND, points specifically to the RCAF Flight Safety program as “one of Defence’s most successful knowledge management programs.”¹³⁴

Culture

Flight Safety is prominent in the RCAF air operations community. The well-defined promotion program, award system and leadership support contribute to its prominence. In the last annual report on Airworthiness and Flight Safety, the Director of Flight Safety highlighted “the continued dedication and professionalism demonstrated by all FS personnel across the country. The FS Team at Wing and Unit level continues to bring about positive changes to the FS Program.”¹³⁵ The overall downward trend in RCAF accident rates¹³⁶ supports the Director’s praise.

Culture also plays a critical role. The foundation of the ‘just culture’ is based on a ‘reporting culture’ of “free and open sharing of critical safety information between managers and

¹³² Royal Canadian Air Force, “Dossier - FSOMS – An Integral Part of Your Flight Safety Program,” last accessed 12 Apr 2016, <http://www.rcaf-arc.forces.gc.ca/en/flight-safety/article-template-flight-safety.page?doc=dossier-fsoms-an-integral-part-of-your-flight-safety-program/hnocfo0n>.

¹³³ Canada, *2014 Annual Report - Airworthiness Investigative Authority and Flight Safety Program's Activities*, 30.

¹³⁴ Girard, *Knowledge Management in DND*, 210.

¹³⁵ Canada, *2014 Annual Report - Airworthiness Investigative Authority and Flight Safety Program's Activities*, 3.

¹³⁶ *Ibid.*

operational personnel... without the threat of punitive action.”¹³⁷ However, a ‘reporting culture’ is not a blame-free culture and leaders must be able to “differentiate between acceptable and unacceptable acts.”¹³⁸ Likewise, “the workforce must know and agree on what is acceptable and what is unacceptable behaviour.”¹³⁹ The reason for the distinction is clear, as “an environment of impunity, the argument holds, would neither move people to act prudently nor compel them to report errors or deviations. After all, if there is no line, then ‘anything goes’.”¹⁴⁰ A ‘just culture,’ then, “recognizes that, in certain circumstances, there may be a need for punitive action and defines the line between acceptable and unacceptable actions or activities.”¹⁴¹ Other authors support the concept of just culture as well. Professor James Reason defines a just culture as “an atmosphere of trust in which those who provide essential safety-related information are encouraged and even rewarded, but in which people are clear about where the line is drawn between acceptable and unacceptable behaviour.”¹⁴²

The effect of the culture is not directly measurable, but there are indicators. The most recent Airworthiness and Flight Safety reports indicate that “the rate of reporting occurrences... where there is no damage or injuries remained high... which is seen as supporting a good reporting culture.”¹⁴³ This can also be seen as clear commitment by air personnel to use the Flight Safety Program as a tool for continuous improvement and knowledge management. Admittedly, the program is not perfect. Although it is great at generating occurrence reports, it often fails to follow through on processing effective

¹³⁷ Canada, *Canadian Forces Flight Safety*, last accessed 12 April 2016.

¹³⁸ Sidney Dekker, *Just Culture; Balancing Safety and Accountability*, 2d Ed. Vol. 27. (Portland: Ringgold Inc, 2012), 16.

¹³⁹ Canada, *Canadian Forces Flight Safety*, last accessed 12 April 2016.

¹⁴⁰ Dekker, *Just Culture; Balancing Safety and Accountability*, 16.

¹⁴¹ Canada, *Canadian Forces Flight Safety*, last accessed 12 April 2016.

¹⁴² James Reason, *Managing the Risks of Organizational Accidents* (Brookfield, VT: Ashgate, 1997), 195.

¹⁴³ Canada, *2014 Annual Report - Airworthiness Investigative Authority and Flight Safety Program's Activities*, 25.

preventive measures.¹⁴⁴ These two observations suggest that flight safety culture might be stronger at the lower ranks (those generating the occurrence reports) than the senior ones (those responsible for ensuring that effective preventive measures are developed and implemented).

Overall, the RCAF Flight Safety program is an excellent example of an effective approach to knowledge management. The program is well stewarded in that it is understood, the direction on how to implement its plan is clear, air personnel are actively involved in its relevant processes and its results are transparent and communicated in multiple forms. Further, the accountability structure is clear and, for the most part, there is linkage and visibility between results and the chain of command. The culture, based on the concept of a ‘just culture,’ is well defined and generally understood, as indicated by the reporting of incidents where there is no damage. Still, the program would benefit from a stronger commitment from leadership to approve and implement the preventive measures.

Quality Management

There are other programs in the RCAF that can also transform information into air power knowledge. The RCAF Quality Management program is based on the RCAF publication *A Quality Standard for Aerospace Engineering and Maintenance (QSAEM)*.¹⁴⁵ The standard is an adaptation of the International Organization for Standardization (ISO) 9000 family of standards for Quality Management. Over one million organizations and companies spanning 170 different countries currently use the ISO 9000 family of standards.¹⁴⁶ The name of the RCAF program

¹⁴⁴ *Ibid.*, 3.

¹⁴⁵ Canada, Dept. of National Defence, *C-05-005-P11/AM-001 A Quality Standard for Aerospace Engineering and Maintenance (QSAEM)* (Ottawa: DND Canada, 2008).

¹⁴⁶ International Organization for Standards, “ISO 9000 Quality Management,” last accessed 20 April 2016, http://www.iso.org/iso/home/standards/management-standards/iso_9000.htm.

reflects the ISO standard and the air force's unique requirements: Air Force 9000 Plus (AF9000+).

In 1996, AF9000+ was introduced into squadron level maintenance activities. As a result, the former Aircraft Maintenance Inspection Team audits used for periodic quality control inspections were replaced by internal and external audits in line with the more universal ISO standard for Quality Management. The basic concept of the AF9000+ was based on Plan-Do-Check-Act (PDCA)¹⁴⁷ continuous improvement cycle developed by Deming (“revered around the world as a pioneer in the quality management revolution”¹⁴⁸) in the early 1950s. In the context of the RCAF, the PDCA concept is described as follows:

PLAN — “Say what you do”

... by documenting the processes used locally in the performance of maintenance related activities, in a Manual of Aerospace Procedures (MAP).

DO — “Do what you say”

... by performing maintenance related activities in accordance with the MAP and maintaining the appropriate records to prove compliance and conformance.

CHECK — “Check it”

... by auditing and using appropriate performance indicators to identify non-compliances, non-conformances and associated airworthiness deficiencies.

ACT — “Act on any difference”

... by performing root cause analysis for any identified noncompliances or non-conformances and applying corrective and preventive measures.¹⁴⁹

Implementing the AF9000+ program was a challenge for the RCAF. The Auditor General of Canada Report in December 2000 declared that “although 48 [RCAF] organizations... have set dates for achieving AF 9000 Plus registration, only one squadron has achieved registered

¹⁴⁷ PDCA has since been replaced with PDSA where ‘Study’ is now used instead of ‘Check.’

¹⁴⁸ Senge, *The Fifth Discipline*, xi.

¹⁴⁹ Joern Nissen, “AF9000 Plus Transformation Project - The Way Ahead,” Flight Comment (Summer 2005), 14.

status. Planned registration dates for most organizations continue to be deferred.”¹⁵⁰ Five years later, problems persisted. External quality audits of RCAF aircraft maintenance discovered “sizeable holes in the AF9000 Plus safety net... [and] elevated risk levels... due to the quality of aircraft maintenance.”¹⁵¹ To address the problem, 1 CAD created the AF9000 Plus Transformation Project. Initial analysis by the project team determined deficiencies in “accountability and management oversight; personnel resources (manning); Standardization of Maintenance Assurance Practices...; clarity of the P11 Quality Standard; [and] Senior Management Awareness.”¹⁵² Later, the project team identified five priorities for the RCAF: reinforcing accountability of the chain of command, improving staffing levels, improving internal auditing, improving the quality and accessibility of training, and simplifying the Quality Standard (QSAEM).¹⁵³ Currently, all organizations that perform maintenance activities on CAF aircraft have either full or provisional accreditation certified by an independent agency.¹⁵⁴

The Quality Management program no longer explicitly links the Plan-Do-Check-Act cycle to RCAF aircraft maintenance practices. However, the principles of documenting what we do, performing maintenance in accordance with the documentation, auditing both documentation and performance of maintenance and performing root cause analysis of observations from audits remain fundamental. The current version of the QSAEM (2008) identifies that continuous improvement – “a state of being achieved when actions taken to reduce and/or remove systemic inefficiencies to improve the quality of the product and/or service, are considered to be a natural,

¹⁵⁰ Office of the Auditor General of Canada, 2000 December Report of the Auditor General of Canada: Chapter 32—National Defence—Defence Support Productivity: A Progress Report, last accessed 26 April 2016, http://www.oag-bvg.gc.ca/internet/English/parl_oag_200012_32_e_11219.html.

¹⁵¹ Nissen, *AF9000 Plus Transformation Project - The Way Ahead*, 14.

¹⁵² *Ibid.*, 15.

¹⁵³ *Ibid.*, 15 and 17.

¹⁵⁴ Canada, Dept. of National Defence, C-05-005-001/AG-001 Technical Airworthiness Manual (Ottawa: DND Canada, change 7) Part 3, para 3.1.1.1.

normal part of the every day practices of the unit”¹⁵⁵ – as the fundamental principle of quality system management.¹⁵⁶ The QSAEM expands on the definition stating that the state of continuous improvement exists when it “becomes second nature, an automatic reaction to perceived or measured problems [and] the emphasis... should be on preventing nonconforming products rather than only correcting noted deficiencies.”¹⁵⁷ The examination of stewardship, accountability and the culture of the RCAF Quality Management program follows.

Stewardship

The purpose of the quality management program is generally understood within the RCAF aerospace engineering and maintenance (AEM) community. The importance of ‘continuous improvement’ is clearly articulated in the QSAEM (the guiding document for quality management in the RCAF). Basic occupation training in the AEM community includes the purpose of quality management in the conduct of aircraft engineering and maintenance activities.¹⁵⁸ Finally, at the squadron level the purpose of the program is reinforced through regular management review meetings (MRMs) that are required to maintain quality management program registration status. This requirement is verified by an independent agency at least every two years.

The program’s implementation process is not as clearly understood. Although the QSAEM lists the 20 different requirements for the ISO9000 based quality management program it does not define how they should be implemented. Organizations that perform maintenance activities must use their own interpretation of the 20 elements and then define the processes that

¹⁵⁵ Canada, QSAEM, 1-2.

¹⁵⁶ Canada, *QSAEM*, The QSAEM actually states that continuous improvement is “one of the fundamental principles.” However, the QSAEM does not state any other principles. The author infers that continuous improvement is the fundamental principle. This inference is consistent with the author’s quality management experience.

¹⁵⁷ *Ibid.*, 1-2 to 1-3.

¹⁵⁸ It is part of the qualification standard for the RCAF air technician and aerospace engineer occupations.

meet the element requirements. From the author's experience the end product is dependent on the individuals that are providing the advice (regulatory and auditing authorities), supporting agencies such as National Defence Quality Assurance Representatives, command understanding and involvement, aerospace engineering and maintenance leadership and experience. As a result of this dependency, some of the deficiencies observed by the Transformation Project in 2005 persist to this day. The recent loss of accreditation status of an operational RCAF squadron due to systemic quality issues best illustrates this point.¹⁵⁹

Aerospace engineering and maintenance personnel are involved with the quality management program in that the processes that they follow in the performance of maintenance activities are defined in the organizational Manual of Aerospace Procedures (MAP). The MAP is squadron specific and is reviewed by two separate second party auditing authorities before it is approved. To maintain the continuous improvement cycle of the program itself, the maintenance or engineering organization is obliged to conduct internal audits to ensure continued alignment between higher-level airworthiness requirements and standards as well as conformity to the process by personnel. Information generated by AF9000+ is both transparent and communicated in a manner that reaches most of the intended audiences. The results of internal audits are available to all squadron members and more specifically to those who need to be involved with the change process (i.e. those responsible for corrective and preventative actions). The process of developing corrective actions, preventative actions and making changes to existing policies and procedures is similar to the 'combination' and 'internalization' of knowledge in the Nonaka and Takeuchi model. Over time, the new knowledge will be 'socialized' through formal and informal training and experience, further perpetuating the expansion of knowledge. As well, the results of

¹⁵⁹ Royal Canadian Air Force, *Record of Airworthiness Risk Management (RARM) CF188-2013-011 409 Sqn AMO Accreditation*, 08 Nov 2013.

external audits are communicated to the organization's leadership, the chain of command, including Commander 1 CAD and the Technical Airworthiness Authority staff in National Defence Headquarters.

The Quality Management program is also capable of improvement. That is, how the program is conducted is also reviewed and adjusted as required. Examples include recent changes to link the quality management program to the corrective and preventative actions generated by Flight Safety investigations and the requirement for quality objectives for organizational quality management programs to be SMART objectives (specific, measurable, attainable, realistic, and time bound).¹⁶⁰

Accountability

Who is accountable for what is also well defined. The QSAEM dedicates a section to management responsibility including 'shall' statements for the unit commanding officer. Specifically, the Commanding Officer "shall define and document the unit's: quality policy...; quality objectives; products and services...; and commitment to quality."¹⁶¹ The section also defines the unit's chain of command responsibilities, stating that they "shall ensure that: the quality policy is understood...; increase awareness [of quality policy and objectives] by unit personnel; and training... is provided to all unit personnel."¹⁶²

Likewise, individual responsibility is well articulated – "every individual is responsible for the quality of his or her work, identifying/reporting apparent deficiencies, and suggesting ways to improve the QMS [quality management system]."¹⁶³ The QSAEM also notes that "[t]he concept of Continuous Improvement means that finding a fault does not indicate a weakness in

¹⁶⁰ Royal Canadian Air Force, 1 Cdn Air Div Direction on the AF9000 Plus Program, A4 MAINT 024 131357Z JUL 11.

¹⁶¹ Canada, *QSAEM*, 4-1-1.

¹⁶² *Ibid.*

¹⁶³ *Ibid.*

the system, rather it indicates the strength of the system which, self-evaluates and effects improvements.”¹⁶⁴ To make this happen the QMS must be “an integral part of a unit and the way that they conduct operations.”¹⁶⁵ As identified above, leadership plays a key role in making continuous improvement a central theme to the performance of aircraft maintenance.

These accountability features, however, only identify the ‘what’ to ensure accountability. To this end, every corrective and preventative action plan developed in response to an observation requires the identification by name the accountable person. If the action plans are designed in response to an external audit then both the senior maintenance manager¹⁶⁶ and the commanding officer need to review and approve them. As well, the organization MAP identifies a process owner for each engineering and maintenance process. Typically, process ownership aligns with organizational function and should be assigned to the lowest reasonable rank (someone who is close to the action that is being performed yet has some degree of leadership responsibility). Further, the QSAEM defines process owner responsibilities.¹⁶⁷ Combined, these features make clear who is accountable for what.

The quality management system also includes second party audits and establishes the involvement and accountability of the chain of command. Audit findings and action plans with names on them are communicated through existing chain of command structures including Wing Commanders, Deputy Commander 1 CAD and Commander 1 CAD as well as the RCAF airworthiness regulative authority (similar to the role of Transport Canada in civil aviation). There is clear linkage between results, persons accountable and the chain of command.

¹⁶⁴ *Ibid.*

¹⁶⁵ *Ibid.*

¹⁶⁶ The senior maintenance manager (SMM) is the individual accountable for airworthiness related activities within a maintenance organization. Accountability is clearly defined in the QSAEM and Technical Airworthiness Manual and is assigned in writing after a comprehensive interview.

¹⁶⁷ Canada, *QSAEM*, 4-9-2.

Culture

The QSAEM explicitly states that the Commanding Officer shall “create a culture within the unit which recognizes the importance of the QMS [Quality Management System].”¹⁶⁸ Furthermore, the Quality Manager shall assist the commanding officer and shall “promote and facilitate a culture of continuous improvement within the unit.”¹⁶⁹ However, the QSAEM does not state how the Commanding Officer and Quality Manager will instill such a culture. The result of their efforts is therefore largely dependent on effective leadership. In this context, evaluating culture is challenging; yet, it is evaluated. In a recent risk assessment of a maintenance organization, the regulatory authority for technical airworthiness points to a lack of ‘culture’ as being a root cause of poor tool control functions within the squadron.¹⁷⁰ Furthermore, the risk assessment asserts that increases in the quantity of errors reflected a change in culture.¹⁷¹ The cumulative result of poor culture and repeated non-compliance resulted in the reduction of status of the organization and the need for additional oversight (as compared to other maintenance organizations) by the regulative authority. Commander 1 CAD ultimately signed the action items identified in the risk assessment, including those with cultural references, as complete. The time from issue identification to resolution took 15 months.

1 CAD assesses organizational culture in other squadrons as well. Recently, it audited an operational squadron to ensure compliance to the QSAEM as well to “obtain an awareness as the quality culture within”¹⁷² it. The audit later determined that as result of the number of

¹⁶⁸ *Ibid.*, 4-1-2.

¹⁶⁹ *Ibid.*, 4-1-3.

¹⁷⁰ Royal Canadian Air Force, *Record of Airworthiness Risk Management (RARM) CF188-2013-011 409 Sqn AMO Accreditation*.

¹⁷¹ *Ibid.*

¹⁷² Royal Canadian Air Force, 436 (Transport) Squadron Aircraft Maintenance Standardization and Evaluation Team Registration Audit 17-21 June 2013, 1633-6-1-2523 (AM Eval), 02 July 2013.

observations that a healthy culture was not evident. A few months later, the squadron was able to reverse the observation by focusing on stewardship, accountability and continuous improvement.

The program requires the senior leadership to set quality management objectives each quarter.¹⁷³ A review of 10 quality management programs indicates that the only four RCAF maintenance and engineering organizations have clearly stated quality objectives. Furthermore, only two organizations have SMART objectives.¹⁷⁴

Criticisms of program culture in recent audits suggests that air personnel still do not completely understand the aim of the program nor is there a clear commitment to use the program for continuous improvement. The airworthiness risk assessment for progressive non-compliance to the quality requirements and the previous recommendations to improve indicates that the quality management program does not adequately address non-compliant behaviour. In fact, another means (a risk assessment by an external organization) had to be used. Lastly, many squadrons do not list true quality objectives for their squadron as per AF9000+ program requirements. In all, a culture of continuous improvement is not yet universal in the RCAF engineering and maintenance community.

In summary, the AF9000+ quality management program generally meets both the stewardship and accountability criteria. Culture, on the other hand, is an area requiring improvement. Personnel must enhance their commitment to the program and the program itself and must better address non-complaint behaviour. Stronger stewardship and accountability structures may help manage this deficiency.

¹⁷³ Canada, *QSAEM*, 1-4 and 4-1-4.

¹⁷⁴ The list of the relevant programs is available upon request

Air Force Lessons Learned Programme

The Air Force Lessons Learned Programme is relatively new. Its origins can be traced to a Defence Administrative Orders and Directive¹⁷⁵ issued by Deputy Chief of Defence Staff (DCDS) in 2004. At that time, the DCDS envisioned “the implementation of a vigorous LL [lessons learned] process [that] ensures accountability through the use of a feedback loop, thereby minimizing the repetition of errors.”¹⁷⁶ He also expected the process to result in “a tangible change in attitude, capability and behaviour.”¹⁷⁷ He even provided direction on how to draw out lessons learned in the operational context and detailed the responsibilities of the environmental chiefs of staff and other Level 1 advisors.¹⁷⁸

Later, in 2009, the RCAF developed the Air Force Lessons Learned Programme (AFLLP) manual and a campaign plan for programme implementation.¹⁷⁹ The manual complies with the higher-level DCDS directive, North Atlantic Treaty Organization (NATO) Lessons Learned policy and programme,¹⁸⁰ and DND Joint Doctrine for Lessons Learned.¹⁸¹ More specifically, it includes doctrine, policy and procedures for transforming information into air power knowledge in the RCAF. Basically, the policy for the AFLLP is a commitment “to good governance, organizational learning, and continuous improvement through a centrally managed LL programme implemented in a decentralized and coordinated manner across the chain of

¹⁷⁵ Canada. Dept of National Defence, Defence Administrative Orders and Directive 8010-0 Lessons Learned, 04 April 2004.

¹⁷⁶ *Ibid.*

¹⁷⁷ Canada, *Air Force Lessons Learned Programme Manual*, 1-10.

¹⁷⁸ Canada. Dept of National Defence, Defence Administrative Orders and Directive 8010-1 Operational Lessons Learned Process, 04 April 2004.

¹⁷⁹ Mario Fortin, "Lessons Learned: The Air Force on its Way to Continuous Improvement," *The Royal Canadian Air Force Journal* 4, no. 2 (Spring 2011), 56.

¹⁸⁰ Canada. *Air Force Lessons Learned Programme Manual*, 1-10.

¹⁸¹ Fortin, *Lessons Learned: The Air Force on its Way to Continuous Improvement*, 56.

command at all levels.”¹⁸² A five-step process for organizational learning anchors the lesson learned concept for RCAF:

Step 1: Preparation. Develop lessons learned collection and analysis plans. Includes the development of the RCAF Critical Topics List (CTL).

Step 2: Collection. Collect observations in accordance with the lessons learned and CTL collection plan.

Step 3: Analysis. This step involves the analysis of both the collection process and change required.

Step 4: Endorse and Direct Change. In this step, the change authority approves, modifies or rejects the recommendations.

Step 5: Act of Change. As the name implies, this step involves implementing change. Once the change is validated it is deemed a ‘lesson learned.’¹⁸³

The 2009 AFLLP Campaign Plan proposed four phases of implementation.¹⁸⁴ Phase 1 involved establishing the core elements of the AFLLP - the development of a lessons learned battle rhythm, provision of command guidance, development of knowledge warehouse database and staffing of key positions - with an estimated completion date of June 2010. Phase 2 established the RCAF lessons learned battle rhythm concentrating on commander engagement and completion in June 2011. Phase 3 involved the validation and analysis of the program and completion in December 2012. Phase 4 involved the incorporation of recommended changes and a steady state of continuous improvement.¹⁸⁵

In spring of 2011, CFAWC reported on AFLLP progress. Phase 1 was near completion and phase 2 was about to begin¹⁸⁶ (a year behind schedule at this point). Later, in summer 2014,

¹⁸² Canada. *Air Force Lessons Learned Programme Manual*, 1-3.

¹⁸³ Canada. *Air Force Lessons Learned Programme Manual*, 2-8.

¹⁸⁴ Royal Canadian Air Force, *Air Force Lessons Learned Campaign Plan (AFLLCPP)*, 3000-1 (CO CFAWC), 7 July 2009.

¹⁸⁵ *Ibid.*

¹⁸⁶ Fortin, *Lessons Learned: The Air Force on its Way to Continuous Improvement*, 65.

an update in the RCAF Journal noted that “establishing a pan-RCAF battle rhythm has been slow-going”¹⁸⁷ and that few results had stemmed from the overall process¹⁸⁸ (from lesson identification to endorsing and directing change).

Upon reflection, some progress was made. In 2011, CFAWC performed an analysis of the RCAF involvement with Operation HESTIA¹⁸⁹ (Haiti Earthquake response in January 2010). In 2012, the RCAF published updated command doctrine that has some roots in the RCAF lessons learned process. Later, in 2013, the CFAWC released a comprehensive report on lessons learned from Operation MOBILE (military intervention in Libya in 2011). Unfortunately, many of recommendations from the report did not progress from the ‘analysis stage’ to the ‘endorse and direct change’ stage. The RCAF’s ongoing deficient targeting capability (critical for the RCAF’s to project air power) provides the best example. In 2011, the Canadian Task Force Commander for Op MOBILE reported that for most of the operation, Canada was not able to develop its own target packages and that the targeting process took too long even with coalition support. Three years later, the RCAF made a similar observation.¹⁹⁰

Stewardship

RCAF doctrine for lessons learned states that “commanders and commanding officers at all levels shall implement the AFLLP within their area of responsibility.”¹⁹¹ This statement is consistent with CAF doctrine on stewardship, which requires institutional leaders to “ensure adequate operational capability and the professional conduct of operations [and to] constantly

¹⁸⁷ Dax Chambers, “The Royal Canadian Air Force Lessons Learned Programme.” *Royal Canadian Air Force Journal* 3, no. 3 (Summer 2014), 8.

¹⁸⁸ *Ibid.*

¹⁸⁹ *Ibid.*, 7.

¹⁹⁰ Royal Canadian Air Force, 1630-1 (ATF-I Comd) Op IMPACT Roto 0 End Tour Report, 24 Apr 2015.

¹⁹¹ Canada, *Air Force Lessons Learned Programme Manual*, 1-13.

extend the boundaries of professional knowledge.”¹⁹² Nonetheless, the few results of the AFLLP reported by CFAWC in 2014 indicate that commanders ‘at all levels’ have not yet embraced the program. Moreover, program implementation has not achieved Phase 2 of the 2010 AFLLP campaign plan (commanders engaged in the AFLLP battle rhythm). A 2015 review of recent air operations (Operations MOBILE¹⁹³ and REASSURANCE¹⁹⁴) provides further evidence. After the reports were completed, there was no clear ownership of air power information or any tracking of progress.¹⁹⁵ It appears that the AFLLP five-step process halted somewhere between step two and step three (the observations were observed and some in-theatre analysis was provided, but no further action was taken). Those responsible for endorsing and directing change either were not aware of or did not engage their responsibilities to the AFLLP. This observation is consistent with past observations on lessons learned in the CAF where in certain cases the organizational leadership is “challenged to effect positive and lasting procedural change.”¹⁹⁶ A later report on lessons learned in the CAF also noted that senior leadership support is a key enabler to organizational learning but is often neglected.¹⁹⁷

The AFLLP is clear on how organizational learning takes place in the RCAF and by the summer of 2014, CFAWC had trained over 150 personnel in the process.¹⁹⁸ However, that number by itself has no intrinsic value – it is an output of the program not an outcome of the program. CFAWC reports on the AFLLP process in 2011 and 2014 further explained the five-step process. Yet, as was made clear during the lessons learned review in 2015 there were no

¹⁹² Canada, *Leadership in the Canadian Forces: Conceptual Foundations*, 115.

¹⁹³ Royal Canadian Air Force, 1630-1 (Comd TF LIB) End Tour Report - Task Force Libeccio 07 November 2011.

¹⁹⁴ Royal Canadian Air Force, 141028_1711a_Copie de ATF REASSURANCE consolidated LL Matrix v3, 15 September 2014.

¹⁹⁵ Royal Canadian Air Force, Annex O to 1630-1 (ATF-I Comd) Op IMPACT Roto 0 End Tour Report, 24 April 2015.

¹⁹⁶ Andrew Godefroy, *Lessons learned about lessons learned: an analysis of policies, organizations, and processes in the Department of National Defence and the Canadian Forces* (Canada: Canadian Defence Academy, 2009), 3.

¹⁹⁷ Vandomme, *From Lessons Identified to Lessons Learned*, 113.

¹⁹⁸ Chambers, *The Royal Canadian Air Force Lessons Learned Programme*, 8.

examples from recent operations of any observation following all five steps. Although the process is explicit (there are five-steps), there is no clear direction on how to implement it in real world air operations. Still, the fact that deployed commanders generated the reports is a positive indication that there is active involvement at some levels of command (even if after deployment there is little indication of such involvement.)¹⁹⁹ In 2014, Brigadiers General (retired) Sharpe and Leversedge reported similarly: “the RCAF does not have a coordinated and consistent approach to knowledge management and lessons learned at the strategic, operational and tactical levels”²⁰⁰ Low manning levels of key staff across the RCAF air wings and other organization does not help.

Without demonstrable and verifiable successes, implementing the program will continue to be a challenge. Recently, however, the program has gained some visibility. In early 2015, 1 CAD identified change authorities for the observations raised from Op IMPACT through the AFLLP. In turn, updates were provided to those who generated the reports demonstrating that their continuous improvement ideas for the projection of air power are being considered by higher headquarters. This had a positive effect on the lessons learned program for the operation where “demonstrating the initial success of the program was critical to sustaining success.”²⁰¹ CFAWC has since developed a centralized database for managing lessons identified from air operations. This has the potential to help the program move from the second implementation phase (establish battle rhythm) to the third phase (validation and analysis of the AFLLP). Once complete, and with sustained active involvement of command, the AFLLP should be able to achieve a state of continuous improvement of the program itself.

¹⁹⁹ RCAF, *Annex O to 1630-1 (ATF-I Comd) Op IMPACT Roto 0 End Tour Report*.

²⁰⁰ Sharpe and Leversedge, *A Knowledge-Management Proposal for the RCAF*, 45.

²⁰¹ RCAF, *Annex O to 1630-1 (ATF-I Comd) Op IMPACT Roto 0 End Tour Report*.

Accountability

You can only measure 3 percent of what matters.

– Peter Senge, *The Fifth Discipline*

AFLLP doctrine and policy define, in great detail, individual responsibilities of the Air Staff, Division, Wing, and Unit Lessons Learned Officers. The AFLLP manual also describes the terms and activities of the Lessons Learned Change Manager and Change Authority as those involved with the review, coordination, approval and implementation of the change itself.²⁰² However, a review of recent lessons learned reports reveals that there was no one was accountable for lessons observed through the AFLLP. The lack of accountability contrasts sharply with Flight Safety and Quality Management continuous improvement programs in the RCAF where observations raised as a result of an accident, incident, audit, or self-reporting hold the leader accountable to a higher leadership and an auditing agency. Brigadiers General (retired) Sharpe and Leversedge noted this as well – “a systematic method to capture, analyse and integrate lessons learned based on staff experience is almost entirely lacking within the Air Staff.”²⁰³ This was also observed during Op IMPACT where the Air Task Force Commander recommended that the “AFLLP be reviewed for possible improvement to tracking [lessons observed], identification of change managers and leaders, accountability of change managers and leaders and validation of change (and reassessment for further improvement if required).”²⁰⁴ As stated earlier, accountability requires ‘doing’ as well as ‘saying’ and may require uncomfortable commitments from RCAF leaders. In other words, leaders must be seen making continuous improvement a central theme for air operations.

²⁰² Canada, *Air Force Lessons Learned Programme Manual*, 2-5.

²⁰³ Sharpe and Leversedge, *A Knowledge-Management Proposal for the RCAF*, 44.

²⁰⁴ RCAF, *Annex O to 1630-1 (ATF-I Comd) Op IMPACT Roto 0 End Tour Report*, 13.

Nevertheless, many of the observations raised by commanders to improve the effectiveness and efficiency in projecting air power were transferred to the CAF's Knowledge Management System (KMS). Since "KMS is an enabler not a problem solver,"²⁰⁵ leadership must now advance potential areas for improvement through the five-step process. Without aligning accountabilities within existing chain of command structures (similar to Flight Safety and Quality Management), the AFLLP will continue to under-achieve.

For those outside of the RCAF lessons learned community there is currently little visibility of the results of the Air Force Lessons Learned Programme. Recent articles in the RCAF Journal focus on structure, process, job descriptions, overviews, and a proposal for a better way of learning in the RCAF.²⁰⁶ Although this dialogue is beneficial for ongoing discussion on how the RCAF *should* learn, it does little to demonstrate that it *is* learning. The program would greatly benefit from tangible and positive reports.

Culture

The Air Force Lessons Learned Campaign Plan (2009) and the Air Force Lessons Learned Programme Manual (2010) make numerous references to culture. The AFLLP manual describes Air Force culture as one of the three interdependent components of the program (along with the lessons learned operating environment and the lessons learned process.)²⁰⁷ It considers organizational learning culture to be "driven by strong visionary leadership, adequate resource allocation, and proactive change management."²⁰⁸ And it draws parallels to the RCAF Flight Safety program by supporting the idea of a 'just culture,' that lies "between a non-punitive

²⁰⁵ Vandomme, *From Lessons Identified to Lessons Learned*, 113.

²⁰⁶ Fortin, *Lessons Learned: The Air Force on its Way to Continuous Improvement*; Chambers, *The Royal Canadian Air Force Lessons Learned Programme*; and Sharpe and Leversedge, *A Knowledge-Management Proposal for the RCAF*.

²⁰⁷ Canada, *Air Force Lessons Learned Programme Manual*, 1-6.

²⁰⁸ *Ibid.*, 1-8.

culture and one of sanction and punishment.”²⁰⁹ The campaign plan also draws implicit parallels to the Air Force Quality Management program (AF9000+), noting that an effective lesson learned culture requires a commitment to continuous improvement.²¹⁰ That ‘cultural objective’ will be achieved “through the identification and rectification of issues, adoption of successful practices, full transparency of process and wide dissemination of relevant information, action plans and results.”²¹¹ To this end, the Commanders of the Canadian Air Divisions and all Wing Commanders are called upon to “contribute to the establishment of an air lessons learned culture.”²¹² RCAF Air Force Vectors, published in 2014, reiterates the concept of continuous improvement and calls out to RCAF leaders – “the pace of modern combat operations demands... a mindset of continuous improvement [and] we must all develop a culture that accepts ongoing dynamic evolution for continuous improvement as fundamental to the successful application of airpower.”²¹³ The Air Force Lessons Learned Programme should be a key enabler of this RCAF strategic objective.

The program did not start well. At the completion of the Canadian efforts in Libya in November 2011, the Task Force Commander reported: “the process of assembling LL [lessons learned] products was negatively impacted by the lack of awareness, by all members of the TF [Task Force], of the LL process [and an] inordinate amount of time was consumed explaining the LL concept.”²¹⁴ According to the campaign plan, the program should have achieved a steady state (phase 2) by that point and be in the analysis and validation phase (phase 3).

²⁰⁹ *Ibid.*

²¹⁰ RCAF, *Air Force Lessons Learned Campaign Plan*, 2.

²¹¹ *Ibid.*

²¹² RCAF, *Air Force Lessons Learned Campaign Plan*, 18-19.

²¹³ Canada, *Air Force Vectors*, 43.

²¹⁴ RCAF, *1630-1 (Comd TF LIB) End Tour Report - Task Force Libeccio*. 3.

Later, in 2014, Brigadiers General (retired) Sharpe and Leversedge observed that “the RCAF has not yet developed a broad-based ‘learning’ organizational culture.”²¹⁵ Less than a year later, 25% of the initial observations from Op IMPACT were repeat observations from previous deployments²¹⁶ with no signs of progress. Nevertheless, the review and analysis of past and present lessons learned in air operations by CFAWC suggest that some RCAF personnel understand the aim of the program. Achieving the state of continuous improvement as called upon by the RCAF strategic vision and the AFLLP campaign plan requires the commitment of leaders to lessons learned on par with their commitment to Flight Safety and Quality Management. Furthermore, as Senge points out, leadership commitment to a learning organization must move from simple compliance to genuine commitment.²¹⁷ If “the only thing of real importance that leaders do is create culture”²¹⁸ then the role of the leader cannot be overstated. A key enabler is addressing non-compliant behaviour (non-action) and aligning the accountability of lessons learned with existing chain of command structures. These measures will assist the ‘tangible change in attitude, capability and behaviour’ called for by the DCDS in his initial guidance.

In sum, the Air Force Lessons Learned Program has struggled to transform tangible information into accessible air power knowledge. First, the program has suffered from insufficient stewardship. The program’s purpose is not well defined to those outside the lessons learned community and there is little evidence of noticeable results. Second, the accountability structures are weak, particularly when compared to other continuous improvement programs in the RCAF. As previously noted, similar comments were made about the AF9000+ nine years

²¹⁵ Sharpe and Leversedge, *A Knowledge-Management Proposal for the RCAF*, 43.

²¹⁶ 7 of the 27 UNCLASSIFIED Air Task Force – Iraq observations (ATF-I CPAP 001-003, 006-029) submitted with *1630-1 (ATF-I Comd) Op IMPACT Roto 0 End Tour Report*.

²¹⁷ Senge, *The Fifth Discipline*, 9.

²¹⁸ Edgar Schein, *Organizational Culture and Leadership 4th ed.* (San Francisco: Jossey-Bass, 2010), 11.

after its introduction to the RCAF (deficiencies in ‘management oversight’ and ‘accountability’). Had the AFLLP drawn from the lessons learned in implementing the Quality Management program they would have realized some of the real world challenges and timelines for change management. As a result of these two shortcomings, the program does not currently have a well-defined and effective link with air operations. Lastly, although there is some recent compliance to the program requirements the idea of a culture of continuous improvement in air operations is not yet mature. Without strong stewardship and accountability, instilling a culture of continuous improvement will remain a challenge. Renewed efforts by the RCAF, while noteworthy, are unlikely to succeed until the program is better integrated with air operations, training, and doctrine.

PROPOSED EVOLUTION OF LEARNING PRACTICES IN THE RCAF

Based on the results of recent air operations, the RCAF's Knowledge Management System, as currently applied, is largely a misnomer. It does not significantly contribute to air power knowledge in a meaningful way. The reason is not so much the repository itself, but what is done with the information. It is still unclear who owns the data and who is accountable for transforming it into knowledge. Accordingly, the RCAF needs to develop a model that embeds continuous improvement within its training processes and operations. That model should link to broader RCAF guidance such as doctrine and strategic direction (for example, RCAF Strategic Vectors and Commander RCAF's Flight Plan).

As discussed earlier, successful continuous improvement models already exist in the RCAF (Flight Safety and Quality Management). However, these programs are limited in scope and are unable to meet the larger air power knowledge development objective. The Air Force Lessons Learned Programme was intended to fill this gap but has not yet been embraced by the RCAF. Moreover, a review of RCAF aerospace doctrine²¹⁹ finds very few linkages of lessons learned to aerospace doctrine. In fact, some of the publications are devoid of any reference to lessons learned, despite its critical importance.

Linking learning to doctrine in the RCAF can be aided by the development of a mental model. Mental models are one of the five core disciplines identified by Senge in his book on the practices of successful learning organizations. They are also a component of the knowledge creation spiral (internalization) developed by Nonaka and Takeuchi. Furthermore, a 'system thinking' approach, as proposed by Senge, can help integrate different learning systems. The RCAF requires a learning model that takes into consideration: doctrine; training institutions;

²¹⁹ As described in the B-GA-400 series of publications for RCAF Aerospace Doctrine.

operations; and observations for continuous improvement that are derived from the operational and training environments. Fortunately, such a model exists. Canadian Army doctrine conceptually links doctrine, training, operations, the army learning process, and its importance to force generating excellent soldiers and leaders.²²⁰ A mental model of the Canadian Army learning process is included below.

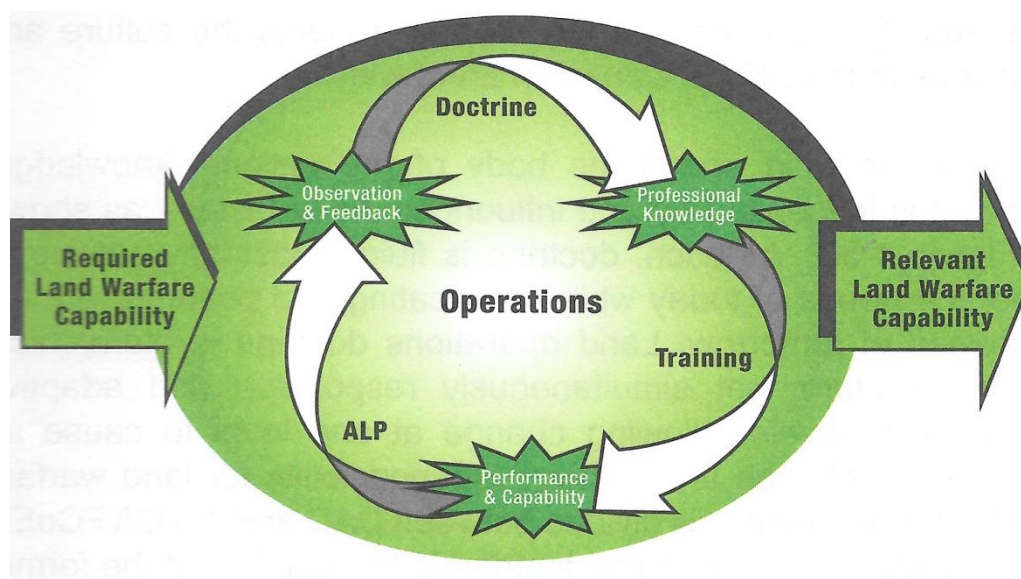


Figure 6: Canadian Army Learning Process

Source: B-GL-300-008/FP-001 Doctrine, Training, ALP and Operations (2014). Figure 4-5-1.

In 2014, Lieutenant Colonel Mark Gasparotto examined learning practices in the Canadian Army and proposed an improved model that better links the concepts of doctrine, training, operations, and lessons observed (D-T-O-LO).²²¹ His model also linked other important features of learning in the CAF context: senior commander critical topics lists; the capability

²²⁰ Canada, Dept. of National Defence, *B-GL-300-008/FP-001 Training for Land Operations* (Ottawa: DND Canada, 2014), 4-5-1.

²²¹ Gasparotto, *Experimental Learning in the Canadian Army: Evolving from a Training to a Learning Organization*.

development process; and after action reports generated from training and operations. Lieutenant Colonel Gasparotto's adaptation of the Canadian Army model is included below.

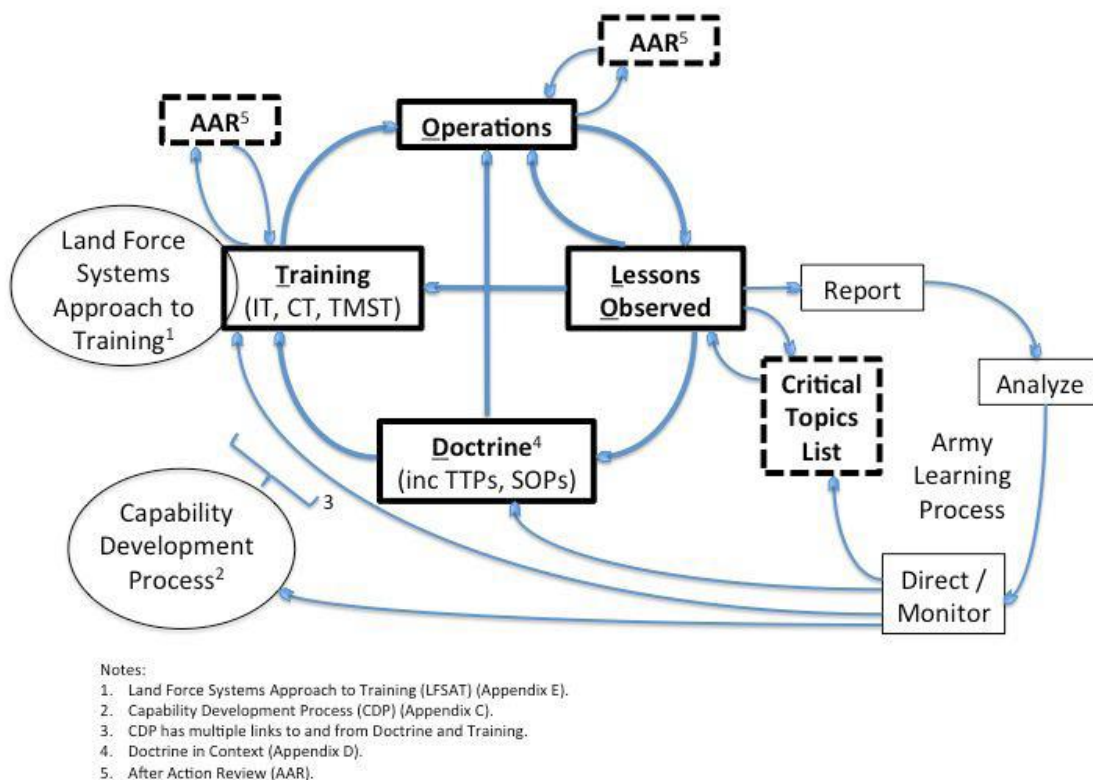


Figure 7: Proposed model for the Canadian Army

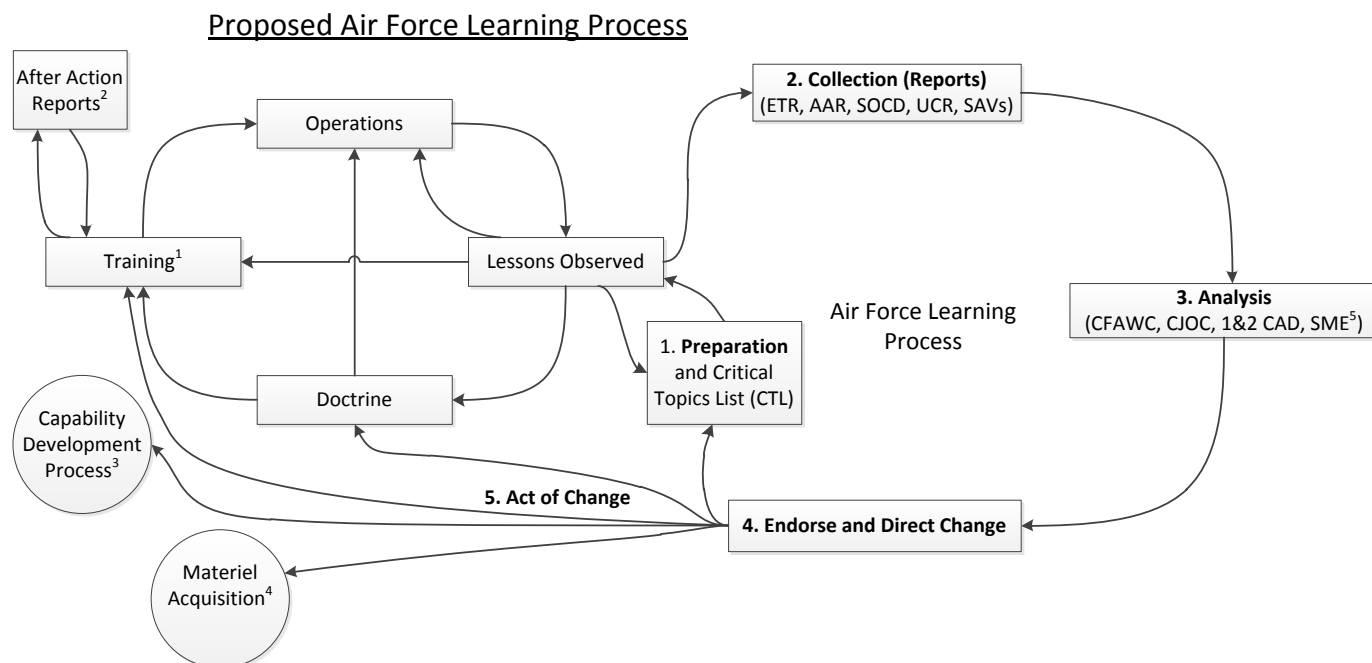
Source: Mark Gasparotto, "Experimental Learning in the Canadian Army: Evolving from a Training to a Learning Organization" (masters thesis, Royal Roads Military College, 2014), 20 adapted from Source: B-GL-300-008/FP-001 Doctrine, Training, ALP and Operations (2014).

Looking to the Canadian Army for guidance should not be a surprise – RCAF aerospace doctrine of command, sense, shape, move, and sustain is based on the Canadian Army's five combat functions.²²² The Army concept was chosen as a 'blue print' for RCAF doctrine as it was perceived to be more advanced than previous RCAF doctrine.²²³ Therefore, it would not be much

²²² Aaron Jackson, "The Emergence of a "Doctrinal Culture" within the Canadian Air Force: Where it came from, where it's at and where to from here? Part 2: Towards a Doctrinal Culture within the Canadian Air Force," *The Royal Canadian Air Force Journal* 4 no. 2 (Fall 2009), 41.

²²³ *Ibid.*

of a jump to embrace the Army Learning Process and conceptual mental models to improve the Air Force Learning Process. Such a model could look like:



Air Force Lessons Learned Process

1. Preparation
 2. Collection (including After Action Reports)
 3. Analysis
 4. Endorse and Direct Change
 5. Act of Change
- These steps are highlighted in bold

Notes

1. Includes RCAF Managed Readiness Plan (MRP)
2. Also part of Step 2 of the Lessons Learned Process
3. Through Chief Force Development
4. For example, materiel required to satisfy SOCDs, UCRs, etc.
5. Subject Matter Experts (Technical, Academic, Experience)

Figure 8: Proposed Air Force Learning Process

Source: Author's adaptation of a Gasparotto's proposed model for the Canadian Army²²⁴

For the model to be practical, the 'arrows' require a description (i.e. what they look like in real life) and a means of quantitative or qualitative measurement. These descriptions and means of assessment will aid in operationalizing the concept and are summarized as follows:

²²⁴ Gasparotto, *Experimental Learning in the Canadian Army: Evolving from a Training to a Learning Organization*.

Arrow	What they look like	They work when
Doctrine to Training	<ul style="list-style-type: none"> • Policy (i.e. Flight Safety, Quality Management, Air Force Lessons Learned) • Observer/Controller/Trainer (OCT) checklists for operational level training events (i.e. joint events such as Maple Resolve) • The execution of Contingency Plans (CONPLANs) for potential operations 	<ul style="list-style-type: none"> • Operational level training material/courses make reference to doctrine • Changes in doctrine result in a review of operational level training material to ensure alignment • During operational level training events, explicit links to doctrine are made consistently • OCT observations from operational level training events are provided to the institutions responsible for action
Training to Operations	<ul style="list-style-type: none"> • Standard Operating Procedures (SOP) • Techniques, Tactics and Procedures (TTPs) • Other documented best practices 	<ul style="list-style-type: none"> • SOPs, TTPs, and best practices are frequently reviewed for improvement (making this a component of the ETR process would help)
Operations to Lessons Observed	<ul style="list-style-type: none"> • After Action Reports (AAR) <ul style="list-style-type: none"> ◦ Including ‘in-theatre’ exercises • End Tour Reports (ETR) • Statements of Operational Capability Deficiency (SOCD) • Unsatisfactory Condition Reports (UCR) • Observations from Staff/Technical Assisted Visits (S/TAV) 	<ul style="list-style-type: none"> • Leaders communicate the importance of the process and set aside time for it to take place • There is meaningful reflection on how we can do better (and then something is done about it) • AAR, ETR, CTL and other reporting processes for Air Force Operations are formalized, understood, and followed
Lessons Observed to Doctrine	<ul style="list-style-type: none"> • Improved doctrine • RCAF doctrine is aligned with CAF Joint doctrine • Ongoing discussion and debate about RCAF doctrine (communicated in such forums as RCAF INFORM and RCAF Journal) 	<ul style="list-style-type: none"> • The continuous improvement of air operations is part of the RCAF culture • ‘Commander’s intent’ on organizational learning is ‘common intent’ among RCAF personnel²²⁵
Lessons Observed to Training	<ul style="list-style-type: none"> • Improved CONPLANs • Improved TTPs, SOPs, other checklists • Improved AAR processes 	
Lessons Observed to	<ul style="list-style-type: none"> • Improved TTPs, SOPs, other checklists 	

²²⁵ In the Pigeau and McCann sense of commanders intent and common intent

Operations	<ul style="list-style-type: none">• Improved AAR processes• Improved preparedness for follow-on rotations for ongoing operations	
-------------------	---	--

Table 3: Operationalizing the Air Force Learning Process

The above table is by no means exhaustive. Its purpose is to contribute to the discourse on the RCAF as a learning organization.

CONCLUSION

This paper discussed the evolution of learning practices in the RCAF. A comprehensive review of the concepts of knowledge, knowledge creation, knowledge management and organizational learning aided the discussion. There are some linkages between these concepts and existing DND and RCAF literature but not enough to assess or characterize the RCAF as a learning organization. Notwithstanding, there are many established learning practices in the RCAF, some of which date back to the creation of the service in 1924, and have evolved through the Flight Safety, Quality Management and most recently, the Air Force Lessons Learned Program. The contributions of these programs to RCAF learning were therefore examined in detail.

The analysis centred on effectiveness in stewardship practices, accountability structures and the existence of a learning-friendly cultural environment. These criteria draw from both the author's personal experience of implementing continuous improvement programs as well as academic literature and CAF leadership doctrine, all of which emphasize the importance of stewardship, accountability and culture to organizational learning. This paper found that the safety-based programs of Flight Safety and Quality Management contribute to the continuous improvement of air operations. By contrast, the much younger Lessons Learned Program (introduced in 2009) requires significant improvements, particularly at the levels of management, accountability and personnel.

The most significant conclusion from the analysis is that the RCAF lacks a defined learning process. An organizational learning mental model would therefore be particularly beneficial. Fortunately, the Canadian Army has already developed a doctrinal model. Given the strong similarities between the Army and Air Force doctrine, adapting such a model should not

be particularly onerous. Further, it should prove to be mutually beneficial as the Air Force and Army could share their lessons learned on organizational learning itself. This collaboration, along with the implementation of the more detailed recommendations identified in this paper should help the RCAF achieve its Air Power objective.

Recommendations

Among the three attributes examined in this paper, stewardship was by far the most deficient. As a result, most of the recommendations for organizational learning fall under this rubric. All of the recommendations identified in this paper are summarized as follows:

Stewardship

1. Define the Air Force Learning Process in RCAF doctrine;
2. Define the RCAF links between doctrine, training, operations and lessons observed;
3. Update RCAF doctrine to include more links to lessons learned, organizational learning, capability development, critical topics list and the after action review process;
4. Define the RCAF doctrine change process;
5. Review RCAF doctrine for congruency with CAF joint doctrine (particularly for the Task Force concept);
6. Provide more RCAF Observer/Controller/Trainers (OCT) for joint operational level exercises:
 - a. This pool of RCAF personnel should be drawn from those with recent and relevant operational experience; and
 - b. Formalize the OCT reporting process and link to the Air Force Learning Process.
7. Develop a leader's guide to the after action review process (or adopt an existing guide);
8. Review, and update as necessary GoC and AFLPP definitions related to knowledge and organization learning. Continued discourse on learning practices in the RCAF will benefit from some common (and coherent) definitions;
9. Consider a broader, more joint, approach to lessons learned given the increasing emphasis on joint operations; and
10. Consider practical and meaningful measures of effectiveness (MoE) for program implementation;
11. Increase leadership emphasis on the RCAF as a learning organization. A possible MoE for this recommendation is when air personnel (maybe just leaders as the first

MoE) can answer the following questions regarding lessons learned or organizational learning:

- a. What is organizational learning?
- b. Why we should do it?
- c. Who does it? (everyone)
- d. How does it work?
- e. When do we do it? (always)
- f. Where is it done? (everywhere)
- g. What does it look like when it works?

Accountability

1. Align the accountability for lessons observed to existing chain of command structures;
2. Make accountability of lessons observed important; and
3. Make better use of the existing Personnel Evaluation Reports (PERs) to emphasize the importance of organizational learning (i.e. update the PER rubric and annual feedback to leaders on their role in organizational learning).

Culture

1. Adopt a ‘good show award’ similar to the Flight Safety program – people take notice of the things that are important to the commander. Giving a lesson learned good show award in front of an audience will encourage others to become involved and submit their ideas;
2. Appeal to the pathos, ethos, and logos of the Air Force personnel. That is, the individual must be persuaded that this is the right thing to do emotionally (we should do this), ethically (we need to do this) and logically (it makes sense); and
3. Use the Personnel Development Record (PDR) system as a means to communicate the expectations of individuals for their role in organizational learning.

Further Research

Undoubtedly, evolving learning practices will aid the RCAF to achieve its vision of an agile, integrated and responsive Air Force. Moreover, such an evolution does not need to be complex nor must it involve grand implementation plans. What’s more, the RCAF has experience implementing specific learning programs. A comprehensive review of these

experiences (what worked, what did not work) may provide some insight on how to better implement a more inclusive Air Force learning program going forward. As well, further research in ‘cognitive science, information and knowledge management technology,’ should assist the RCAF in better understanding contemporary thinking about organizational learning. Combining the lessons from RCAF learning experiences with the current body of theory would help the RCAF develop its own ‘coherent body of theory and practice’ for organizational learning. That new understanding will no doubt be forced to evolve over time, but such is the nature of a learning organization.

BIBLIOGRAPHY

- 436 (Transport) Squadron, "Flight Safety Incident Reporting (GWI 46 027 Rev 6)."
- 436 (Transport) Squadron, "Flight Safety Procedures (AWI 4.09 FS 03 Rev 4)."
- 8 Wing Trenton, "8 Wing Flight Safety Program," 11 August 2015.
- Argyris, A., Schön, D.A. *Organizational Learning: A Theory of Action Perspective*, Reading, MA: Addison-Wesley, 1978.
- Aviation.ca, "14 Wing Greenwood wins international flight safety award," Accessed 21 March 2016, <http://www.aviation.ca/200701304128/news/canada/military/4128-14-wing-greenwood-wins-international-flight-safety-award?Itemid=99999999>.
- BGen (ret'd) Sharpe, G.E. (Joe) and Terry BGen (ret'd) Leversedge. "A Knowledge-Management Proposal for the RCAF," *The Royal Canadian Air Force Journal* 3, no. 2 (Spring 2014, 2014): 39.
- Canada. Department of National Defence. *1630-1 (Comd TF LIB) End Tour Report - Task Force Libeccio*, 07 November 2011.
- Canada. Department of National Defence. "2014 Annual Report - Airworthiness Investigative Authority and Flight Safety Program's Activities."
- Canada. Department of National Defence. *A-AP-005-000/AP-004 Leadership in the Canadian Forces: Conceptual Foundations*, Canadian Defence Academy, 2005.
- Canada. Department of National Defence. "AF9000 Plus Transformation Project - the Way Ahead." Flight Comment, 2005.
- Canada. Department of National Defence. *A-GA-007-000/AF-008 Air Force Vectors - Abridged Version*, edited by Canadian Forces Aerospace Warfare Centre 2014.
- Canada. Department of National Defence. *A-GA-135-001/AA-001 Flight Safety for the Canadian Forces*. 7th ed. 2013.
- Canada. Department of National Defence. *Air Power Research List* 2016.
- Canada. Department of National Defence. *Annex O to 1630-1 (ATF-I Comd) Op IMPACT Roto 0 End Tour Report*, 24 Apr 2015.
- Canada. Department of National Defence. *A-PA-005-000/AP-006 Leadership in the Canadian Forces: Leading the Institution* Canadian Defence Academy, 2007.

- Canada. Department of National Defence. *B-GA-005-780/AG-001 Air Force Lessons Learned Programme Manual* 2010.
- Canada. Department of National Defence. *C-05-005-P11/AM-001 A Quality Standard for Aerospace Engineering and Maintenance (QSAEM)*.
- Canada. Department of National Defence. *Canadian Forces Aerospace Command Doctrine (B-GA-401-000/FP-001)*. Trenton, ON: Canadian Forces Aerospace Warfare Centre, 2012.
- Canada. Department of National Defence. "Canadian Forces Aerospace Warfare Centre." Accessed 03/04, 2016, <http://www.rcaf-arc.forces.gc.ca/en/cf-aerospace-warfare-centre>.
- Canada. Department of National Defence. "Canadian Forces Aerospace Warfare Centre Analysis and Lessons Learned." Accessed 03/04, 2016. <http://www.rcaf-arc.forces.gc.ca/en/cf-aerospace-warfare-centre/analysis-and-lessons-learned.page>.
- Canada. Department of National Defence. *Capabilities Based Planning Handbook*. Ottawa: DND Canada, 2014.
- Canada. Department of National Defence. *Capability-Based Planning Handbook* June 2014.
- Canada. Department of National Defence. *Copy of 141028_1711a_Copie De ATF REASSURANCE Consolidated LL Matrix v3 15 sept 14*.
- Canada. Department of National Defence. *Defence Administrative Orders and Directive 8010-0 Lessons Learned* 2004.
- Canada. Department of National Defence. *The Future Security Environment 2013-2040 National Defence and the Canadian Forces*, 2014.
- Canada. Department of National Defence, "C-05-005-001/AG-001, Technical Airworthiness Manual (TAM) Change 7."
- Canada. Department of National Defence. "*B-GL-300-008/FP-000 Training for Land Operations*, 2014.
- Chambers, Dax. "The Royal Canadian Air Force Lessons Learned Programme." *Royal Canadian Air Force Journal* 3, no. 3 (Summer 2014): 7.
- Choo, Chun Wei. "The Knowing Organization as Learning Organization." *Education & Training* 43, no. 4/5 (2001): 197-205.
- Conley, Devin and Eric Ouellet. "The Canadian Forces and Military Transformation: An Elusive Quest for Efficiency." *Canadian Army Journal* 14, no. 1 (2012): 71.

- Cook, N. and D. Yanow. "Culture and Organizational Learning." *Journal of Management Inquiry* 20, no. 4 (2011): 362-379.
- Dekker, Sidney. *Just Culture; Balancing Safety and Accountability, 2d Ed.* Vol. 27. Portland: Ringgold Inc, 2012.
- Dodgson, Mark. *Technological Collaboration in Industry.* London: Routledge, 1993.
- English, Allan D. *Understanding Military Culture: A Canadian Perspective.* Montreal: McGill-Queen's University Press, 2004.
- Fortin, Mario. "Lessons Learned: The Air Force on its Way to Continuous Improvement." *The Royal Canadian Air Force Journal* 4, no. 2 (Spring 2011): 55.
- Garvin, D. A. "Building a Learning Organisation." *Harvard Business Review* 71, no. 4 (July/August, 1993): 78.
- Garvin, David A. "Building a Learning Organization." *National Productivity Review* 13, no. 1 (1993): 150.
- Gasparotto, Mark. "Experimental Learning in the Canadian Army: Evolving from a Training to a Learning Organization." Masters Thesis, Royal Roads Military College, 2014.
- Girard, John. "Knowledge Management in DND." In *Public Management of Defence Canada*, edited by Stone, Craig: 2009, Chapter 9, 213, Breakout Educational Network in association with the School of Policy Studies, Queen's University, Toronto, 2009.
- Godefroy, Andrew B., Canadian Defence Academy. Directorate of Learning and Innovation. Lessons Learned Division, and Canada. Department. of National Defence. *Lessons Learned about Lessons Learned: An Analysis of Policies, Organizations, and Processes in the Department of National Defence and the Canadian Forces.* Kingston, Ont.: Canadian Defence Academy, 2009.
- Goette, Richard. "*Cohen and Gooch*" Lecture, Canadian Forces College, Toronto, ON, 26 November 2015, with Permission.
- Government of Canada. *A Public Service Learning Organization from Coast to Coast: Directions for the Future:* Canadian Centre for Management Development, 2000.
- Government of Canada. "Royal Canadian Air Force Flight Safety." Accessed 03/16, 2016. <http://www.rcaf-arc.forces.gc.ca/en/flight-safety/index.page>.
- Government of Canada, "Views on Flight Safety," Accessed 20 March 2016, http://publications.gc.ca/collections/collection_2013/dn-nd/DC2-2-2013-2-eng.pdf

- Government of Canada. "Termium Plus Defence Terminology Bank." Multiple accesses January – May 2016, <http://www.btb.termiumplus.gc.ca/tpv2alpha/alpha-eng.html?lang=eng>.
- Graumann, C. F., ed. *The Dynamics of Dialogue*. Perspective Structure and Dynamics in Dialogue, edited by Markova, I. and K. Foppa. New York: Harvester Wheatsheaf, 1990.
- Greiling, Dorothea and Arie Halachmi. "Accountability and Organizational Learning." *Public Performance & Management Review* 36, no. 3 (2013): 375-379.
- Henault, R. R. and J. Judd. "Future Directions for Information Management in DND/CF." Department of National Defence, Ottawa.
- International Standards Organization. "ISO 9000 Quality Management." Accessed 04/13, 2016, http://www.iso.org/iso/home/standards/management-standards/iso_9000.htm.
- Jackson, Aaron P. "The Emergence of a "Doctrinal Culture" within the Canadian Air Force: Where it Came from, Where it's at and Where to from here? Part 2: Towards a Doctrinal Culture within the Canadian Air Force." *Royal Canadian Air Force Journal* 2, no. 4 (Fall, 2009): 34.
- Lewis, William. "Leadership: The Air Dimension." *Royal Canadian Air Force Journal* 2, no. 1 (Winter, 2009): 6.
- March, William. "Royal Canadian Air Force." The Canadian Encyclopedia. Accessed 05 March 2016, <http://www.thecanadianencyclopedia.ca/en/article/royal-canadian-air-force>.
- Marsick, V. J. and K. E. Watkins. "Looking again at Learning in the Learning Organization: A Tool that can Turn into a Weapon." *The Learning Organization* 6, no. 5 (1999): 207.
- McIntyre, SG, M. Gauvin, and B. Waruszynski. "Knowledge Management in the Military Context." *Canadian Military Journal* 4, no. 1 (2003): 35.
- Mercer, Ralph. "A Networked Vision: From Knowledge Scribes to Knowledge Workers." *Royal Canadian Air Force Journal* 2, no. 4 (Fall, 2009): 59.
- Merriam-Webster. *Merriam-Webster's Collegiate Dictionary*. 11th ed. Springfield, Massachusetts, USA: Merriam-Webster, Inc, 2005.
- Moen, Ronald and Clifford Norman, Profound Knowledge Products, "Evolution of the PDCA Cycle." Accessed 30 March 2016, <http://pkpinc.com/files/NA01MoenNormanFullpaper.pdf>.
- Nissen, Joern. "AF9000 Plus Transformation Project - the Way Ahead." *Flight Comment* (Summer, 2005).
- Nonaka, Ikujiro and Hirotaka Takeuchi. *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. New York: Oxford University Press, 1995.

- Office of the Auditor General of Canada. *2000 December Report of the Auditor General of Canada, Chapter 32—National Defence—Defence Support Productivity: A Progress Report*, 2000.
- O'Keeffe, Ted. "Organisational Learning: A New Perspective." *Journal of European Industrial Training* 26, no. 2/3/4 (2002): 130-141.
- Pedler, Mike, Tom Boydell, and John Burgoyne. "Towards the Learning Company." *Management Education and Development* 20, no. Part 1 (1989): 1.
- Pigeau, Ross and Carol McCann. "Establishing Common Intent: The Key to Co-Ordinated Military Action." In *The Operational Art: Canadian Perspectives: Leadership and Command*, edited by English, Allan D. Kingston, ON: Canadian Defence Academy Press, 2006.
- Pontefract, Dan. *Flat Army: Creating a Connected and Engaged Organization*. Hoboken, NJ: Jossey-Bass, 2013.
- Reason, James. *Managing the Risks of Organizational Accidents*. Brookfield, Vt: Ashgate, 1997.
- Riege, Andreas. "Three-Dozen Knowledge-Sharing Barriers Managers Must Consider." *Journal of Knowledge Management* 9, no. 3 (2005): 18-35.
- Rostek, Michael. "Managing Change within DND." Chap. Chapter 9, In *Public Management of Defence in Canada*, edited by Stone, Craig, 213. Toronto: Breakout Educational Network in association with the School of Policy Studies, Queen's University, 2009.
- Royal Canadian Air Force. "AIRPower Research List 2016."
- Schein, Edgar H. *Organizational Culture and Leadership*. San Francisco: Jossey-Bass, 2010.
- Senge, Peter M. *The Fifth Discipline: The Art and Practice of the Learning Organization*. New York: Doubleday/Currency, 2006.
- Serenko, Alexander, Nick Bontis, and Timothy Hardie. "Organizational Size and Knowledge Flow: A Proposed Theoretical Link." *Journal of Intellectual Capital* 8, no. 4 (2007): 610.
- Smith, Elizabeth A. "The Role of Tacit and Explicit Knowledge in the Workplace." *Journal of Knowledge Management* 5, no. 4 (2001): 311.
- Vandomme, Roger, *From Lessons Identified to Lessons Learned: A Proposition for Integration of Lessons Learned into Canadian Forces Professional Development*. Kingston, ON: Canadian Defence Academy, 2010.
- Wah, Louisa. *Making Knowledge Stick*. Vol. 88. New York: American Management Association, 1999.

Wang, Catherine L. and Pervaiz K. Ahmed. "Organisational Learning: A Critical Review." *The Learning Organization* 10, no. 1 (2003): 8-17.

Watkins, K. E. and T. Golembiewski. "Rethinking Organization Development for the Learning Organization." *The International Journal of Organizational Analysis* 3, no. 1.