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THE FALLACY OF DISRUPTIVE TECHNOLOGIES: EXPLOITING JOINT EXPERIMENTATION BY AGILE PERSONNEL

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AIM

1.   The aim of this service paper is to propose to Director General Capability and Structure Integration (DGCSI) that implementing agile concepts will enable the Canadian Armed Forces (CAF) to exploit emerging technologies. This is aligned with *Strong, Secure, Engaged* initiative 105, in particular "mechanisms that allow Defence to develop and test ideas and then forward the most promising ones for procurement" and implementation.[1]

INTRODUCTION

2.   The complex operating environment can easily become cluttered with sensationalized claims of emerging technologies masquerading as disruptive technologies.[2] "Emerging technologies" are those technologies that are currently being conceptualized and developed. "Mature technologies" are those technologies that exist and are ready to be deployed and integrated into existing processes, organizations, and cultures. "Disruptive technologies" are mature technologies that cause significant alterations in processes, organizations, and cultures.[3] These technologies (whether emerging or disruptive) can challenge mature groups, such as the CAF, unless these groups are postured to exploit those same technologies. Nonetheless, even mature technologies such as autonomous systems and data analytics the CAF has struggled to exploit these opportunities.

3.   However, overly focusing on technologies (and platforms) neglects the human capabilities that define, acquire, integrate, operate, and exploit opportunities created by technologies. Awareness and expertise are required to exploit these technologies, as groups often struggle through wrong intuition and/or analysis simply because they don't know or have only a basic understanding.[4] For force development innovation to occur within this complex

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[1] Canada, Department of Defence, *Strong, Secure, Engaged: Canada's Defence Policy (*Ottawa: DND, 2017): 78.

[2] P. W. Singer, *Wired for War: The Robotics Revolution and Conflict in the Twenty-First Century* (New York: Penguin Press, 2009); P. W. Singer, C*ybersecurity and Cyberwar: What Everyone Needs to Know (*New York: Oxford University Press, 2014); L. Dormehl, *Thinking Machines: The Quest for Artificial Intelligence--and Where It's Taking Us Next* (New York: TarcherPerigee, 2017); A. Furey, *Pulse Attack: The Real Story Behind The Secret Weapon That Can Destroy North America*, (Lexington: Magna Carta, 2017).

[3] James Manyika *et al*, *Disruptive technologies: Advances that will transform life, business, and the global economy,* (New York: McKinsey & Company, 2013): 2, 16; Alan Webber, "Emergent v. Disruptive Technologies.", *Asymmetric Insights* (blog), 2 August 2011; Joseph L. Bower and Clayton M. Christensen. "Disruptive Technologies: Catching the Wave." *Harvard Business Review* Vol. 73, Issue 1 (January-February 1995): 43-53; Clayton M. Christensen, Michael E. Raynor, and Rory McDonald. "What is Disruptive Innovation?" *Harvard Business Review* (December 2015): 44-53.

[4] Gordon Training International, "Learning a New Skill is Easier Said Than Done", Accessed 11 October 18, http://www.gordontraining.com/free-workplace-articles/learning-a-new-skill-is-easier-said-than-done/

operating environment, the CAF must implement agile concepts. Requirements for this solution will be drawn from a first principles review of literature on future operating concepts, capability, innovation, and agility.

DISCUSSION

The Problem Space

4.   Recently, the CAF has struggled to exploit mature technologies. Two specific cases include unmanned aerial systems (UAS) and hyperspectral imaging technologies. Firstly, the CAF has experimented with micro- and mini-UAS, and has employed UAS for overseas deployments; however the CAF has never maintained nor does the CAF have a current Class II or Class III UAS. The Joint Unmanned Surveillance and Target Acquisition System (JUSTAS) project is not progressing and there is an entrenched opposition to UAS, especially when they infringe on established processes and capabilities.[5] Secondly, Hyperspectral imaging technology could be used on the current primary fixed wing search and rescue, such as the CC130H Hercules aircraft to increase efficiency and effectiveness of searches. While the technology is proven and has been validated, and existing roll-on-roll-off kits are available, no progress has been made towards implementing this technology since 2011.[6] Given the challenges experienced in maintaining credible deterrence to support a rules-based international order, a new approach is required that commences from first principles.[7]

First Principles

5.   Examining the literature on innovation, future operating concepts, capabilities, and agility, the following concepts can be deduced:

> a.   From future operating concepts indicate that the "military" is fundamentally joint and is the nation-states capability to externally apply or threaten to apply violence to exercise the influence of national power as part of a synchronized effort to

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[5] Gary Schaub, "JUSTAS for all? Innovation and UAVs in the Canadian Forces." *Defence Studies* 15, no. 2 (2015): 124-142; Danny Garrett-Rempel, "Will JUSTAS Prevail? Procuring a UAS Capability for Canada." *Royal Canadian Air Force Journal* Vol. 4, no. 1 (Winter 2015): 19-31; Conrad Edward Orr, "Can Unmanned Aircraft Systems meet Canadian Air Power Needs?" *Royal Canadian Air Force Journal* Vol. 5, no. 3 (Summer 2016): 15-28; C.F. Palmer, "No longer hiding behind Arctic Ice – An Unmanned Aircraft System for the Canadian Arctic." (Joint Command and Staff Programme, Canadian Forces College, 2017); R.D. Freeman, "An Overview of Potential Non-Traditional Remotely Piloted Aircraft System Roles" (Joint Command and Staff Programme, Canadian Forces College, 2018); R.D. Freeman "The Aurora Replacement: The Viability of Drones as Maritime Patrol Aircraft" (Joint Command and Staff Programme, Canadian Forces College, 2018).

[6] Lavoie, David. "Imaging Technology for Search and Rescue." *Royal Canadian Air Force Journal* Vol. 6, no. 1 (Winter 2017): 15-45; Author is professionally aware of trials dating back to 2008 for existing roll-on-roll-off kits that were developed for use by the U.S.

[7] Canada, *Strong, Secure, Engaged*: 50.

achieve national objectives within the context of the rules-based international order. The human nature of conflict is an enduring theme vice being about places, technologies, platforms, domains, elements, or services;[8]

b. "Capability" is the combination of a nation-states' strategic resources, conversion capability, and combat proficiency. These capability components are comprised of thirteen variables. Two pertinent variables to exploit technology are capacity for innovation and Combat, Research, Development, Test &Evaluation Institutions;[9]

c. "Innovation" is a non-linear change initiated from bottom-up experimentation. Innovation is supported by a receptive culture that recognizes the inherent biases and/or filters rooted in the nation-state's context. Change, transformation, re-

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[8] Canada, "TERMIUM PLUS 'War'", Accessed 11 October 18, http://www.btb.termiumplus.gc.ca/tpv2alpha/alpha-eng.html?lang=eng&i=1&srchtxt=War&index=alt&codom2nd_wet=1#resultrecs; North Atlantic Treaty Organization. Multinational Capability Development Campaign. *Understanding Hybrid Warfare*. (Brussels: NATO, 2017): 26; J. Vance. Speech. Canadian Global Affairs Institute Conference: One Year of Strong, Secure, Engaged. Ottawa, Canada, 7 June 2018; Department of National Defence, B-GJ-005-000/FP-001, *CFJP 01: Canadian Military Doctrine*. (Ottawa: DND Canada, 2011): 2-1; United Nations. "Charter of the United Nations and Statute of the International Court of Justice.", Accessed 11 October 2018,(http://www.un.org/en/charter-united-nations/:Article 1 Paragraph 1; North Atlantic Treaty Organization. Multinational Capability Development Campaign. *Understand to Prevent: The military contribution to the prevention of violent conflict*. (Brussels: NATO, 2014): 3, 116; United Kingdom. Ministry of Defence. *Joint Concept Note 1/17 Future Force Concept*. (Swindon: Development, Concepts, and Doctrine Centre, 2017): v, 11; United States. Department of Defense. *Joint Doctrine Note 1-18 Strategy*. (Washington: Joint Force Development, 2018): I-4; New Zealand. New Zealand Defence Force. *Face the Future: Concepts on Force Design*. (Wellington: Adaptive Warfighting Centre, 2018): 8; Australia. Department of Defence. *2016 Defence White Paper*. (Canberra: Department of Defence, 2016): 13, 23; United States. Department of the Navy. *The Marine Corps Operating Concept: How an Expeditionary Force Operates in the 21st Century*. (Washington: Department of the Navy, 2016): 24.

[9] T. Balasecicius. "Is It Time To Bring Back Threat-Based Planning?", Accessed 2 October 2018, (http://mackenzieinstitute.com/is-it-time-to-bring-back-threat-based-planning/); Technical Cooperation Program. "Guide to Capability-Based Planning", Accessed 2 October 2018, (https://www.acq.osd.mil/ttcp/reference/docs/jsa-tp-3-cbp-paper-final.doc); Michael Fitzsimmons. "Whither Capabilities-Based Planning?" *Joint Force Quarterly : JFQ* no. 44 (2007): 105; H. Ergas. "Australia's defence: a review of the 'reviews'." *Agenda: a journal of policy analysis and reform*, 19 (1) (2012): 66; Stuart Beare. *Championing the Joint Force: A Job for the Public and our Political Leaders - Not just Military Professionals Alone* (School of Public Policy, University of Calgary, 2015): 8; Canada. Department of Defence. *Report on Transformation 2011*. (Ottawa: DND, 2011): Section 5-3; W.J. Loder. "Threats to Future Planning: Challenges of Capability-Based Planning," (Joint Command and Staff Program, Canadian Forces College, 2016): 2; Kathleen H Hicks. "Bad Idea: Arguing Over Capabilities- vs. Threat-based Planning", Accessed 2 October 2018, https://defense360.csis.org/bad-idea-arguing-capabilities-vs-threat-based-planning/; Ashley J. Tellis *et al*, *Measuring National Power in the Postindustrial Age*. (Santa Monica, CA: RAND Corporation, 2000): 27-28, 137, 144, 152-157; Canada, "TERMIUM PLUS 'Capability'", Accessed 11 October 18," (http://www.btb.termiumplus.gc.ca/tpv2alpha/alpha-eng.html?lang=eng&i=1&srchtxt=capability&index=alt&codom2nd_wet=1#resultrecs); Department of National Defence, B-GJ-005-000/FP-001, *CFJP 01: Canadian Military Doctrine:* 2-7.

engineering, transformation, and the revolution in military affairs (RMA) have all been used as synonyms for innovation;[10] and

d. "Agile" is changing, learning, and adapting within less time when confronted with a challenge. Success in confronting the challenge is exclusively contingent upon having agility. Agile can refer to organizations or people and have a specific meanings within the military. When agile concepts are applied to an organization, the organization can be identified by the characteristics strategy, structure, process, people, and technology.[11]

6.   From the concepts of military, capability, innovation, and agile, the complex operating environment is characterized as systems-of-systems.[12] Not only must the military understand the application of violence, but also the national objectives and the rules-based international order. The military must design a capability to meet the required effects and must be at the forefront of innovation to counter evolving challenges. Based on this systems-of-systems, there is a shift from the old paradigm of organizations as machines to the new paradigm of organizations as

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[10] Canada, "TERMIUM PLUS 'Innovation'", Accessed 11 October 18, http://www.btb.termiumplus.gc.ca/tpv2alpha/alpha-eng.html?lang=eng&i=1&srchtxt=innovation&index=alt&codom2nd_wet=1#resultrecs; Canada. Department of Defence. *White Paper on Defence. (*Ottawa: Queen's Printer, 1964): 7; John F Price Jr.. "US Military Innovation." *Air & Space Power Journal* 28, no. 5 (2014): 128, 131-132; Michael B Siegl. "Military Culture and Transformation." *Joint Force Quarterly : JFQ* no. 49 (2008): 103, 105; Adam Grissom. "The Future of Military Innovation Studies." *Journal of Strategic Studies* 29, no. 5 (2006): 919; Andrew Hill and Stephen Gerras. "Systems of Denial: Strategic Resistance to Military Innovation." *Naval War College Review* 69, no. 1 (2016): 110, 130; George M Dougherty. "Promoting Disruptive Military Innovation: Best Practices for DOD Experimentation and Prototyping Programs." *Defense AR Journal* 25, no. 1 (2018): 4, 6, 10; Chris Smith. "On Future Thinking and Innovation: How Military Concept Writing can unwittingly suppress Innovation" *Australian Army Journal*, Volume XIV, No 1 (Autumn 2018): 137; Canada. Department of National Defence. DCIEM No. CR2001-047. *Understanding Military Culture: A Canadian Perspective. (*Toronto: DCIEM, 2001): 111 to 112; Canada. Department of Defence. *White Paper on Defence.* (Ottawa: Queen's Printer, 1964): 12; Grissom. "The Future of Military Innovation Studies": 917; Gary Schaub. "JUSTAS for all? Innovation and UAVs in the Canadian Forces." Defence Studies 15, no. 2 (2015): 136.

[11] Canada, Department of National Defence, *Air Force Vectors*. 1st Edition. (Ottawa: Director Air Force Development, 2014): 34-36; J. Bruce. "Enough About Agile Firms – We Need Agile People, " Accessed 2 October 2018. https://www.forbes.com/sites/janbruce/2018/09/25/enough-about-agile-firms-we-need-agile-people/#1c8ce96e194b; Darrell K. Rigby *et al*. "Agile at Scale," Accessed 2 October 2018. https://hbr.org/2018/05/agile-at-scale; ; Marius S Vassiliou, David S. Alberts, and Syed Shah. "Mission Success: Assured Communications and Agile Organizations." *in Proceedings of the 2016 IEEE International Carnahan Conference on Security Technology*. IEEE, 2016; Anthony H. Dekker, "Measuring the Agility of Networked Military Forces," *Journal of Battlefield Technology* Vol 9, No 1 (2006): 6;

[12] MITRE Corporation, *Systems Engineering Guide,* (McLean: MITRE, 2014): 392; NATO. *Understand to Prevent: The military contribution to the prevention of violent conflict*: 3.

living organisms.[13] Therefore, to succeed in the complex operating environment of systems-of-systems, a new paradigm is required.

Agile Concepts

7.   However the standard paradigm shift for many militaries and governmental organizations is to create more complexity through more policy, processes, and procedures, vice less complexity, which institutionalizes the organization, thus making innovation impossible.[14] At the core of conflict, organizations, and capabilities are people.[15] The military is simply a group of people and the military is an embodiment of the people's approach.[16]   Being agile is changing, learning, adapting within less time when confronted with a challenge. The military requires not only agile people but agile organizations, and it requires a mindset change.[17] Agile concepts must be embedded throughout the military, so that the military is postured to exploit technologies, whether they are emerging, mature, or disruptive.

8.   The application of agile concepts to the military results in organizations capable of rapid innovation. An empirical study verified that rapid innovation can occur within a military when there are expert people with the requisite authority, responsibility, and accountability (ARAs) and who are supported by a receptive culture and supporting organizational structures.[18] Agile organizations can be identified by the characteristics of strategy, structure, process, people, and technology. For the military:

> a.   "Strategy" is the mindset shift from institutionally serving the nation-state in war to professionally exploiting opportunities for all stakeholders through *Führen mit Auftrag* (leading by tasks);[19]

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[13] Wouter Aghina *et al*. "The five trademarks of agile organizations," Accessed 2 October 2018. https://www.mckinsey.com/business-functions/organization/our-insights/the-five-trademarks-of-agile-organizations

[14] Australia. The Senate. *Procurement procedures for Defence capital projects Final Report*. (Canberra: Senate Printing Unit, 2012): 209; Ashley J. Tellis *et al*, *Measuring National Power in the Postindustrial Age*: 154-155.

[15] J. Bruce. "Enough About Agile Firms – We Need Agile People"; Ashley J. Tellis *et al*, *Measuring National Power in the Postindustrial Age*: 154-155.Bruce.

[16] "Enough About Agile Firms – We Need Agile People".

[17] Darrell K. Rigby, Jeff Sutherland, and Andy Noble. "Agile at Scale," Accessed 2 October 2018. https://hbr.org/2018/05/agile-at-scale; Ashley J. Tellis *et al*, *Measuring National Power in the Postindustrial Age*: 154-155; Marius *et al*, "Mission Success: Assured Communications and Agile Organizations"; Vance. Speech; Wouter Aghina *et al*. "The five trademarks of agile organizations."

[18] George M Dougherty. "Promoting Disruptive Military Innovation: Best Practices for DOD Experimentation and Prototyping Programs." *Defense AR Journal* 25, no. 1 (2018): 6; Canada, *Report on Transformation 2011*: Section 5-3.

[19] Wouter Aghina *et al*. "The five trademarks of agile organizations"; Jens Küster, APOJ 16-2,. *"Führen mit Auftrag": Mission Command from a German Point of View* (Fort Leavenworth: The Army Press, 13 May 2016): 1, 3-5.

b. "Structure" is the mindset shift from commanding and leading a hierarchy to a network of tailored fit-for-purpose teams with the necessary ARAs;[20]

c. "Process" is the mindset shift from detailed planning by the senior ranking member and risk avoidance to bottom-up prompt iteration and experimentation and risk management;[21]

d. "People" is the mindset shift from a constrained rules and regulations based occupations and training to a flexible creative interdisciplinary roles;[22] and

e. "Technology" is the mindset shift from prioritized isolated methods to integrated real-time lean practices.[23]

9. Implementing agile concepts through the application of the mindset shift in strategy, structure, process, people, and technology yield the requirements for a design solution so that a military is capable of achieving rapid innovation. Aspects of the design can then be assessed against the agile organization characteristics to determine the soundness of the design. Drawing from the concepts of military, capability, innovation, and agile within the complex operating environment, a design could incorporate a number of different design elements.

Design Elements

10. Implement professional licensing best-practices. This would be similar to those implemented by the provincial engineering regulatory bodies (e.g., Professional Engineers Ontario). This would ensure distinction between a member's professional responsibilities and their technical expertise. As a member of the "Profession of Arms", a person has the authority to apply violence and accepts unlimited liability within the bounds of the Law of Armed Conflict. [24] They must be experts in conflict, the purpose of the military within the rules-based international order, how the military fits into the different systems-of-systems, and the Canadian context. [25] This includes a recognition that both war and peace are now joined permanently as are prevention and pre-emption— we will have little or no warning.[26] The best-practices include putting the responsibility on the member for their own continuing professional self-development.

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[20] Wouter Aghina *et al*. "The five trademarks of agile organizations; Canada, *Report on Transformation 2011*: Section 5-3.

[21] Wouter Aghina *et al*. "The five trademarks of agile organizations; Dougherty. "Promoting Disruptive Military Innovation": 6,13.

[22] Wouter Aghina *et al*. "The five trademarks of agile organizations.

[23] Wouter Aghina *et al*. "The five trademarks of agile organizations.

[24] Canada. Department of Defence. *Duty with Honour: The Profession of Arms in Canada.* (Ottawa: DND, 2003): 4.

[25] S.R. Atkinson, James Moffat., *The Agile Organization : From Informal Networks To Complex Effects And Agility*. (Washington: CCRP, 2005): 191.

[26] *Ibid*., 194.

Only through this will members become "Profession of Arms" experts and able to instinctively relate emerging technologies to the military effect and the mission impact. This satisfies the agile characteristic of strategy.

11.   Provide the ARAs to support bottom-up experimentation. An empirical study found that for technological innovations, 12 out of 17 were developed independent of an expressed requirement.[27] This was support by internal funding as this approach does not need to convince external stakeholders of the value of the experimentation, *i.e.*, that the solution is viable.[28] The required ARAs are critical to building the receptive culture. This satisfies the agile characteristic of structure.

12.   Form a joint experimentation establishment that would be the centre for prototyping, experimenting, and adapting the organization. It would support the employment and maintenance of technical expertise. This would also provide a central point-of-contact for defence scientists, other government departments (OGDs), and industry to synchronize activities. This establishment would be headed by a Major-General/Rear Admiral. This satisfies the agile characteristic of process.

13.   Implement agile test and evaluation (T&E) concepts in order to address the criticism that T&E is often viewed as an impediment to the acquisition process. This includes concepts such as that cost must be viewed as a design constraint and that capability is an iterative process.[29] T&E is critical to ensuring that only capabilities that meet requirements be fielded. This satisfies the agile characteristic of process.

14.   Maintain technical expertise in-house to relate emerging technologies to the military effect and the mission impact. This is the value of the military professional. There has been a tendency to outsource non-core military functions due to lower advertised cost. However, the successful civilian company lowers costs through the recruiting of military personnel without factoring in human recapitalization costs. This leads to higher future costs and an unhealthy dependence.[30] This also deprives the military of technical experts who are able to exploit emerging technologies. This satisfies the agile characteristic of process and people.

15.   Employ and incentivizing technical expertise to maintain the expertise within the military. The skillsets required to exploit emerging technologies require expert sophistication

[27] Dougherty. "Promoting Disruptive Military Innovation": 6.

[28] *Ibid*., 10.

[29] United States. Defence Acquisition University. "Agile Acquisition & Project Management." Accessed 2 October 2018, https://www.dau.mil/acquipedia/Pages/ArticleDetails.aspx?aid=6875fa43-196b-4674-aefd-16a93a2a0120

[30] Australia. Australian National Audit Office. *Audit Report No. 57 2010-11 Performance Audit, Acceptance into Service of Navy Capability*. (Barton: Australian National Audit Office, 2011): 203.

and are not necessarily those same skillsets valued in the past.[31] The payback period needs to be the primary criteria when determining training investments. If members on the 25-year pension plan are releasing on average at the 15-year mark and the availability for a member's primary technical duties during employment may be as low as 30% during their time in uniform, it does not make sense to up to eight years training a member at the beginning of their careers.[32] Additionally, there is limited value in having a culture that rewards being a jack-of-all trades but master of none (*e.g.*, aeronautical engineers who are variously employed as project managers, in space organizations, but then are also expected to instruct basic training). Technical expertise must also be incentivized financially. The sole purpose of the military cannot be just to build future leaders, but also future technical experts and there must be financial incentives for those technical experts. This satisfies the agile characteristic of people.

16.   Implement competitive internal personnel management policies to optimize the expertise with the employment vice assuming that an occupational code will have the required expertise. This will allow ARAs by senior officers to be assigned consummate with expertise, and enable future growth of experts that can learn and adapt. This satisfies the agile characteristic of people.

17.   Review acquisition criteria that were defined in the 1992 Defence Policy.[33] These criteria are not suitable for the complex operating environment and need to be revised. This satisfies the agile characteristic of technology.

18.   Centralize service/element requirements staff and service/element warfare centres. Capability must be developed in a joint context. The skillset required for experimentation is the same skillset required for initiating capability development changes.[34] The requirements staff and element warfare centres should be part of the joint experimentation establishment. This satisfies the agile characteristic of technology.

Design Solution

19.   To change a military requires implementation of the design aspects through forming of a joint experimentation establishment and generating agile personnel. This will provide a military with the expert people with the requisite authority, responsibility, and accountability, who are enabled by supporting organizational structures and culture to carry out rapid innovation.

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[31] Vance. Speech.

[32] Author is professionally aware that initial data analytics results show this decrease in years of service upon release and it is known within the human resources community. Availability numbers are from an unpublished studies completed at the Aerospace Engineering Test Establishment in 2014 for the Maintenance Section and in 2018 for the Evaluation Branch.

[33] Canada. Department of Defence. *Canadian Defence Policy.* (Ottawa: DND, 1992): 13.

[34] MITRE, *Systems Engineering Guide*: 419; Australia. *Procurment procedures for Defence capital projects*: 202.

20.   Form a joint experimentation establishment. This establishment, which would also centralizes requirements staff and element warfare provides a hub for force development activities that also groups in Defence Research and Development Canada, OGDs, such as the National Research Council, and industry within a joint construct to solve deficiencies for Canada's capability to externally apply or threaten to apply violence to exercise the influence of national power as part of a synchronized effort to achieve national objectives within the context of the rules-based international order. This establishment would be headed by a Major-General/Rear Admiral. The establishment would re-inforce that cost is a design constraint and that capability is an iterative process. Additionally, it would embed the required receptive culture. Selected personnel would transition through the establishment from and to the field units, re-energizing the establishment and distributing the lessons learned.

21.   To generate agile personnel, there must be a clear separation between a member's professional competences and their technical expertise. The professional competences enable an understanding of the joint environment and how emerging technologies can be applied to military effect. This is distinct from a member's technical expertise which relates to how well emerging and mature technologies are understood. This includes the limitations, the constraints, the effects on other systems, how systems are integrated, the limits of certain methodologies, and qualifying the risks involved. Technical expertise is only built by employing members in that technical environment. It is sustained by rewarding the expertise. The CAF cannot have this expertise unless it is maintained in-house. Technical expertise is further maintained and exploited by matching expertise with the employment vice assuming a certain occupation has the required expertise. This is supported by ARAs that enable bottom-up experimentation.

CONCLUSION

22.   Agile concepts must be implemented in the CAF to address existing deficiencies. This can be accomplished by forming a joint experimentation establishment and generating agile personnel. This design solution meets the five agile characteristics of strategy, structure, process, people, and technology. Rapid innovation can occur within the CAF regardless of the complex operating environment of systems-of-systems. A joint experimentation establishment operated by agile personnel will provide the capability envisioned by *Strong, Secure, Engaged* initiative 105 to test and evaluate ideas and then capitalize on those that are the most promising. Regardless of the sensationalized claims, the CAF can be positioned to exploit emerging, mature, and disruptive technologies.

RECOMMENDATION

23.   It is recommended that DGCSI implement agile concepts to exploit technologies specifically by:

a.   Forming a joint experimentation establishment. This would include providing the ARAs to support bottom-up experimentation, implementing agile T&E concepts, maintaining technical expertise in-house, reviewing acquisition criteria, and centralizing all Level 1 requirements staff and element warfare centres; and

b.   Generating agile personnel. This would include implement professional licensing best-practices, employing and incentivizing technical expertise, implementing competitive internal personnel management policies, and rotating selected personnel through the joint experimentation establishment.

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