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EXERCISE/EXERCICE NEW HORIZONS

NETWORKED OPERATIONS IN THE CANADIAN FORCES

By/par

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NETWORKED OPERATIONS IN THE CANADIAN FORCES

INTRODUCTION

Since the end of the Cold War, the leading approach to networked operations in the United States (US) has been Network-Centric Warfare (NCW). This philosophy was first developed by the US Navy and by the business community in the 1990s. However in the twenty-first-century, it started to dominate American military transformation and future command and control (C2) frameworks.¹

The US Joint Chiefs of Staff have endorsed the NCW philosophy as a way to implement Joint Vision 2010 an official view of how to organize military forces for future combat.² Dr. Allan English, with the Department of History, Queen's University, has also noted that “networked operations are currently touted as the way to fundamentally change how the US and, by extension, coalition forces will conduct operations.”³

Michael H. Thomson and Barbara D. Adams, Project Managers, Humansystems Incorporated, define NCW as “a concept of operations that seeks to maximize advances in information technology in military operations by linking all sensors, platforms, and

¹ Allan English, Richard Gimblett and Howard Coombs, *Networked Operations and Transformation: Context and Canadian Contributions*, (McGill – Queens University Press, 2007), 3.

² Mark D. Mandeles, *The Future of War: Organizations as Weapons*, (Washington, DC: Potomac Books Inc., 2005), 99.

³ Allan English and Colonel John Westrop (Retired), *Canadian Air Force Leadership and Command: The Human Dimension of Expeditionary Air Force Operations*, prepared for the Canadian Department of Defence (Ottawa: DND 2007), 141.

decision makers through an integrated system ... thereby lifting the fog and friction of war.”⁴

This network-centric concept is not just theory. It received much praise for its role in bringing about the quick defeat of the Taliban and Al Qaeda by the US-led Coalition Forces in Afghanistan after the terrorist attack on the US on September 11, 2001.⁵ For example, during OP APOLLO, networks were an important enabler to coordinate and successfully meet mission requirements during coalition ground operations in Afghanistan and during coalition naval operations in the Gulf of Oman. Dr. Paul T. Mitchell, with the Department of Defence Studies, Canadian Forces College in Toronto, noted that networks were critical to the sharing of Situation Awareness (SA) and mission planning by coalition forces during Operation APOLLO.⁶

Today, many countries are considering the NCW concept as they are transforming their military forces and future C2 frameworks. Canada’s version of NCW is Network-Enabled Operations (NEOps). However, as English points out, “NEOps has not yet been clearly defined.”⁷ To date, the best definition, according to English, “is the conduct of military operations characterized by common intent, decentralized empowerment and shared information, enabled by appropriate culture, technology and practices.”⁸

⁴ Michael H. Thomson and Barbara D. Adams, *Networked Enabled Operations: A Canadian Perspective*, prepared for the Canadian Department of National Defence (Ottawa: DND 2005), 3.

⁵ Fatima Ayub and Sari Kouvo, “Righting the Course? Humanitarian Intervention, the War on Terror and the Future of Afghanistan,” *International Affairs* 84, no. 4 (July 2008): 646.

⁶ Paul T. Mitchell, *Network Centric Warfare and Coalition Operations: The New Operating System* (New York: Routledge, 2009), 66.

⁷ Allan English and Colonel John Westrop (Retired), *Canadian Air Force Leadership and Command: The Human Dimension ...*, 133.

⁸ English, Gimblett and Coombs, *Networked Operations and Transformation...*, 6.

NCW is also a techno-centric approach to fighting war. It relies heavily on the technology and on information superiority to defeat opponents. This was emphasized by English, who stated that it “is important to remember that NCW theory is founded on an essentially technological approach to war.”⁹

One could only wonder if Canada should adopt the concept of networked operations similar to that of the US as it transforms its military and future C2 framework in order to meet interoperability issues and concepts such as *the whole of government approach to operations*.

Thesis

CF experience has shown that networks are required to enable its operations especially when dealing with coalition partners and with other government agencies. Therefore there is no doubt that the CF needs to consider networked operations, not just from a techno-centric approach, but from a more balanced approach which takes into consideration the human aspect of networked operations. This essay will demonstrate that the CF needs to pursue a more balanced approach to networked operations in order to better meet its international and domestic commitments in the future.

First, this paper will examine the concept of NCW and the benefits it provides to networked forces. Second, this paper will discuss the critical vulnerabilities that impinge on NCW and advocate a more balanced approach in terms of the human dimension. Thirdly, this paper will highlight existing CF networked operations capabilities and areas

⁹ *Ibid.*, 12.

that require improvement. Lastly, this paper will recommend a basic roadmap for the CF to follow in order to ensure a more balanced approach to networked operations.

DEFINING THE NCW CONCEPT

The Canadian concept of NEOps and its American cousin NCW are dominating the debate on C2 and CF transformation. Even though NEOps has not yet been clearly defined by the CF, NEOps is very similar to the American concept of NCW.¹⁰ NEOps is expected “to generate increased combat power by networking sensors, decision makers and combatants to achieve shared battlespace awareness, increased speed of command, higher operational tempo, greater lethality, and increased survivability.”¹¹ Due to NCW and NEOps similarities, this portion of the essay will examine the concept of NCW and its key capabilities.

According to Mitchell, NCW focuses on the interaction of four domains of warfare: the physical domain; the information domain; the cognitive domain; and the social domain (see Figure 1).¹² According to the NCW Model, the process of sensing and interpreting data takes place as a series of interconnected domains.

¹⁰ Michael H. Thomson and Barbara D. Adams, *Networked Enabled Operations* ..., 6.

¹¹ Allan English and Colonel John Westrop (Retired), *Canadian Air Force Leadership and Command: The Human Dimension of Expeditionary Air Force Operations*, prepared for the Canadian Department of Defence (Ottawa: DND 2007), 133.

¹² Paul T. Mitchell, *Network Centric Warfare and Coalition Operations* ..., 37.

The 'physical' domain is the robustly networked military forces achieving secure and seamless connectivity and interoperability.¹³ In other words these are the communication pipes linking all users on multiple ends to the global network. This includes radio, satellite, microwave, and switching communication systems and software associated with communication equipment. Mitchell describes "the 'physical' domain "as the scene where all action takes place. It is the location where military forces manoeuvre, strike and defend themselves, and actions, being directly observed here, can be measured through direct and indirect sensing."¹⁴

The 'information' domain is the capability for military forces to share, access, and protect information to a degree that it can establish and maintain an information advantage over the belligerents.¹⁵ Mitchell sees the information domain as a virtual environment in which data are transferred and shared amongst the players through information technology residing in the 'physical' domain.¹⁶

The 'cognitive' domain is the capability of military forces to develop quality SA and share this awareness through the use of C2 systems on the master network.¹⁷ In addition, forces are able to develop a shared understanding including commander's intent and to self-synchronize their operations. According to Mitchell the 'cognitive' domain resides in the minds of the players and understanding is created through the interpretation

¹³ David S. Alberts, John J. Garstka, Richard E. Hayes, and David T. Signori, "*Understanding Information Age Warfare*, 57.

¹⁴ Paul T. Mitchell, *Network Centric Warfare and Coalition Operations* ..., 35.

¹⁵ David S. Alberts, John J. Garstka, Richard E. Hayes, and David T. Signori, "*Understanding Information...*, 57.

¹⁶ Paul T. Mitchell, *Network Centric Warfare and Coalition Operations* ..., 35.

of the data being communicated from the ‘physical’ domain through the ‘information’ domain.¹⁸ In other words, information is evaluated and judged by the players on the network, and decisions are made to achieve desired effects.

The final domain, according to Mitchell, is the ‘social’ domain, which mediates the evaluations, judgements and decisions developed in the ‘cognitive’ domain.¹⁹ In other words, this is where the players come together to interact, exchange information and make final decisions which in turn will dictate their actions during operations.

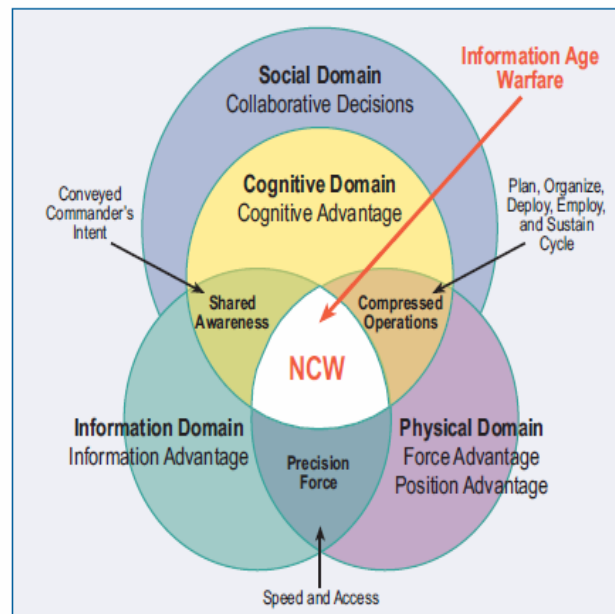


Figure 1- NCW Domains.

Source: Office of Force Transformation, *The Implementation of NCW*, 20

¹⁷ David S. Alberts, John J. Garstka, Richard E. Hayes, and David T. Signori, “*Understanding Information...*”, 57.

¹⁸ Paul T. Mitchell, *Network Centric Warfare and Coalition Operations* ..., 35.

¹⁹ *Ibid.*, 36.

The combined effect of the four domains allows networked forces to share SA and self-synchronization resulting in an advantage through information superiority over their opponents. Networked forces are also able to conduct information operations (IO) across the four domains to achieve synchronized effects in each of these domains.²⁰ IO are actions taken in support of objectives that influence decision makers by affecting the information and information systems (IS) of others while protecting one's own information or IS.²¹

NCW Benefits

NCW provides many benefits to countries with networked forces such as: the ability to achieve interoperability with other mission partners; the ability of individual unit commanders to synchronize their unit's individual efforts in order to mutually support other units to achieve the mission; the ability to share information in order to establish battlefield awareness; the ability to achieve a much faster and more effective warfighting style with smaller forces; and the ability to synchronize to fires.²²

While an element of the US-led Coalition Force in 2001 under Operation APOLLO, Canadian interoperability was critical in meeting mission requirements. Interoperability allowed networked coalition forces to share information, to have collaborative workings, and to establish a coalition common operating picture (COP). In

²⁰ David S. Alberts, John J. Garstka, Richard E. Hayes, and David T. Signori, "*Understanding Information...*", 58.

²¹ David Potts, "*The Big Issue: Command and Combat...*" 256.

²² Michael H. Thomson and Barbara D. Adams, *Networked Enabled Operations* ..., 8.

2005, Second Lieutenant Jessica M. Davis, intelligence officer, sharing her experiences in Afghanistan in the *Canadian Military Journal*, stressed that “the ability to communicate effectively with ... other military forces and people at home will be critical to providing intelligence and maintaining support for operations” and that the CF “must be on the cutting edge of these technologies.”²³

According to Vice Admiral Cebrowski, US Navy, NCW enables a shift from attrition-style warfare to a much faster and more effective warfighting style characterized by the new concepts of speed of command and the ability of a well-informed force to organize and coordinate complex warfare activities.²⁴ Therefore, network connectivity enables a shift from attrition-style warfare to a much faster and more effective warfighting style. This style of warfare is characterized by efficient access to relevant information, rapid decision making and the application of appropriate action and timely effects. Forces will be more dispersed and there will be a shift in emphasis from direct to more precision focus fire.²⁵

The large massing of conventional forces has been transformed into a massing of effects. Manoeuvre has become less about being able to get a sizable force and resources somewhere quickly and more about being able to have small networked forces move

²³ Second Lieutenant Jessica M. Davis, “From Kosovo to Afghanistan: Canada and Information Operations,” *Canadian Military Journal*, vol 6, issue 3 (Autumn 2005): 41.

²⁴ Arthur K. Cebrowski and John H. Garstka, “Network-Centric Warfare: Its Origin and Future.” US Naval Institute Proceeding (January 1998); <http://all.net/books/iw/iwarstuff/www.usni.org/Proceedings/Articles98/PROcebro.wski.htm>; Internet; accessed 28 January 2009.

²⁵ Michael H. Thomson and Barbara D. Adams, *Networked Enabled Operations* ..., 22.

successfully on a nonlinear battlefield. The massing of firepower has been replaced by precision guided weapons, made possible by networked sensors and information.²⁶

No where was this more evident than in Afghanistan in 2001 where a small size networked coalition force, combined with air support and precision guided munitions, were able to defeat the Taliban on the battlefield. For example, the battle of Mazar-e-Sharif was, in the words of the US Secretary of Defence, a combination of the ingenuity of the US Special Forces, the most advanced, precision-guided munitions in the US arsenal delivered by US Navy, Air Force, and Marine Corps crews, and the courage of valiant one-legged Afghan fighters on horseback.²⁷

That said, one can clearly see the focus of NCW is on the ‘physical’ domain and on the ‘information’ domain. The next section will provide examples of how NCW is compromised by paying less attention to the ‘cognitive’ domain and the ‘social’ domain.

NCW VULNERABILITIES AND SHORTFALLS

The American version of transformation is primarily concerned with using technological advances to enhance US war fighting capabilities resulting in combat advantage through information superiority over opponents. In other words, the US places more emphasis on the ‘physical’ and the ‘information’ domains of NCW and pays less attention to the other two domains. This former emphasis indeed proved successful during Desert Storm and during the US-led Coalition against the Taliban in Afghanistan

²⁶ David S. Alberts, *Information Age Transformation: Getting to a 21st Century Military*, 19.

²⁷ *Ibid.*, 36.

in 2001. However, some historians like Dr. English question the basic foundations of networked operations.²⁸ According to English, “the sun may already be setting on networked operations as post-hostilities campaigns in Afghanistan and Iraq challenge some of its basic tenets.”²⁹ This portion of the essay will examine the vulnerabilities facing NCW that impact CF culture and C2.

Culture

As English points out, each nation’s military and each service within that military has its own war-fighting paradigm based on its culture.³⁰ These cultural settings in which forces operate are problematic for a number of detractors of NCW and its Canadian cousin NEOps. The latter favour a more specific type of command-by-influence, or mission command, as a key to future networked operations.³¹

For example, the Air Force has a problem with the notion of self-synchronization and mission command or command-by-influence called for by NCW.³² This concept of operation is emphasized more by land forces than air forces. Air operations rely on command-by-plan to execute their missions and tasks and are coordinated through the Combined Air Operation Centre (CAOC) in the theatre of operation. The CAOC is a

²⁸ English, Gimblett and Coombs, *Networked Operations and Transformation...*, 4.

²⁹ *Ibid.*, 5.

³⁰ *Ibid.*, 13.

³¹ Allan English and Colonel John Westrop (Retired), *Canadian Air Force Leadership and Command: The Human Dimension ...*, 133.

³² *Ibid.*, 139.

networked air force entity that adheres to the joint air tasking cycle which governs the many processes and warfighting elements to conduct operations. The management of the joint air tasking cycle is accomplished through a networked C2 system with associated applications and linked capabilities which enable the Air Force Commander to affect the outcome of air operations.³³ English indicates that air forces in the foreseeable future “will rely on command-by-plan and in, certain cases, such as when a command decision could have important political repercussions, even by command-by- direction.”³⁴ Therefore, this concept is not fully accepted, as currently defined, by all three services in the Canadian Forces (CF).³⁵

CF culture also promotes human intelligence (HUMINT) as one of the means to gather information on enemy activities which complements technological means such as sensors. However, HUMINT, part of the human dimension, is not even considered by the American concept of NCW. According to Thomson and Adams, “human intelligence, obtained in part through human networking, will be key to achieving an information advantage in the future battlespace.”³⁶ The US is also starting to agree that the human dimension of networked operations is more important in some circumstances than information gathering by technical means which NCW promotes.³⁷

³³ English, Gimblett and Coombs, *Networked Operations and Transformation...*, 69.

³⁴ *Ibid.*, 70.

³⁵ Allan English and Colonel John Westrop (Retired), *Canadian Air Force Leadership and Command: The Human Dimension ...*, 142.

³⁶ Michael H. Thomson and Barbara D. Adams, *Networked Enabled Operations ...*, 17.

³⁷ Allan English and Colonel John Westrop (Retired), *Canadian Air Force Leadership and Command: The Human Dimension ...*, 100.

Another shortfall of NCW is the lack of information sharing among the stakeholders. Information sharing might not be completely transparent among the stakeholders due to lack of relationship building vertically and horizontally within an organization or within a coalition by the key players. In other words, networks might be open or closed to some stakeholders during operations especially when dealing with non-coalition partners and civilian organizations. According to Thomson and Adams, there needs to be a large culture shift in how the military operates with those outside its sphere of influence regarding information sharing.³⁸ Once again, the human dimension plays a key role in building a proper COP in a networked environment.

Command and Control

Another critique of NCW is that its implementation will have adverse consequences on interpretation resulting in degraded C2. English argues that the assumption of fusing information into a COP is not guaranteed among all stakeholders. SA does not inevitably lead to shared appreciation on how to act on the information, since different people will assess the information differently based on experience, education, personality, and culture.³⁹ Technology-based COP can also hinder the creative abilities of subordinates within the framework of a commander's intent. In order to counter this potential shortfall, subordinates must be given the authority and autonomy

³⁸ Michael H. Thomson and Barbara D. Adams, *Networked Enabled Operations ...*, 15.

³⁹ English, Gimblett and Coombs, *Networked Operations and Transformation...*, 99.

they need to create, within the commander's intent, original solutions to the problem confronting them.⁴⁰

The relationship between technology and the exercise of command is also an issue. Command "is a mission-oriented human endeavour performed within the limits of a commander's personal attributes and that this requires creativity and intuition to make sound decisions in a NCW environment."⁴¹ As well, technological advances will never remove the fog of war from operations. Only the human dimension could have direct influence on the fog and friction of war by having commanders make quick and sound decisions that limit uncertainty. Therefore, networks will not remove the fog or friction of war, but it will fall upon commanders to make the final decisions in the face of uncertainty during operations.⁴² The *CF Strategic Operating Concept (2004)* also reaffirms that it will be implausible to remove all of the fog and friction of war through networks. HUMINT will be the key to achieving an information advantage in future conflicts obtained through human networking.⁴³

CANADIAN FORCES NCW CAPABILITIES

Since the end of the Cold War, the CF has made great progress in developing NCW capability in order to better meet its international and domestic commitments. This capability progressed from stove-pipe systems to integration through national projects.

⁴⁰ *Ibid.*, 100.

⁴¹ *Ibid.*, 103.

⁴² Michael H. Thomson and Barbara D. Adams, *Networked Enabled Operations ...*, 17.

⁴³ *Ibid.*, 107.

This section of the essay will briefly discuss NCW capabilities in the CF and examine areas that could be improved.

NCW Capabilities and Organizations

The Assistance Deputy Minister (ADM) stood up Information Management Group (IMG) in the mid 1990s in order to oversee the Department of National Defence (DND) and the CF's IS requirements at the strategic level, while the IS requirements for CF bases were decentralized to the environmental chief of staffs (ECS). IMG became responsible for the Department Wide Area Network (DWAN), an administrative network, and the TITAN, a strategic level C2 system.

However, TITAN had certain limitations when it came to the tactical level such as providing effective SA for deployed forces, providing the right planning tools for staffs, and linking weapon platforms and Intelligence Surveillance Reconnaissance (ISR) from the ECS. Therefore, the various ECS pursued their own tactical systems to meet their own particular operational requirements. The different tactical level Command and Control Information Systems (C2IS) of the ECS included the Army's Land Command Support System (LCSS), the Air Force Command and Control Information System (AFCCIS), and the Navy's Maritime Command and Operational Information Network Mark III (MCOIN III).⁴⁴

⁴⁴ L.J. Palmer, *Integrated Command and Control System Project: Joint Common Operating Picture Functional Way Ahead Option Analysis*, (NDHQ: file 789), 29 Mar 08.

As the ECS created their own C2 stand-alone stove-pipe systems, the CF realized that to conduct effective joint operations and participate in US-led coalition warfare, it should also follow suit like its American ally and integrate strategic, operational, and tactical C2 systems into one global network. Specific direction for C2 system integration was provided by the Chief of the Defence Staff and the Vice Chief of the Defence Staff.⁴⁵ The latter stated that “an integrated, fully functional and interoperable C2IS is fundamental to realizing our transformational vision and supporting Canadian Joint Task Forces in operations both at home and abroad.”⁴⁶ Therefore, IMG initiated the Integrated Command and Control System (IC2S) project in 2007 to effectively integrate C2 systems of maritime, air, land and special operations forces to produce an integrated Joint SA and a COP of the battlespace.

The aim of the IC2S project is “to develop and implement an IS that will enable the CF to effectively conduct operations in the future global security environment.”⁴⁷ CF IC2S provides commanders and decision makers, at the operational and strategic levels, the ability to execute C2 within a collaborative environment working with other stakeholders in an operational environment.⁴⁸

The IC2S project will network environmental systems at the lowest tier of military operations and provide the links for tactical and operational commanders to communicate with higher authority at the strategic level. At the tactical level, IC2S will

⁴⁵ General Rick Hilliar, *CDS Directive - CF Integrated Command & Control Information System*, (NDHQ: no file), 4 Aug 06.

⁴⁶ Lieutenant-General W.J. Natynczyk, *VCDS Direction - CF Integrated Command and Control Information System*, (NDHQ: file 2700-1 (CFD), 18 Sept 06).

⁴⁷ IC2S Pre-Definition Study Team 3, *OGD, Interagency and Public ...*, 1.

⁴⁸ *Ibid.*, 2.

reach down to deployed forces which are being serviced by environmental C2 systems such as MCOIN, AFCCIS, and LCCS. Any environmentally specific applications residing on these environmental systems would also become standard within the IC2S environment. IC2S will not replace C2 systems linked to ISR capabilities currently employed by the Army, the Navy, and the Air Force but instead be open to interface and consolidation within the networked environment.⁴⁹

Areas for Improvement

Networked operations need to be a joint Communication and Electronic (C&E) effort and should be managed from the top. Major-General A.G. Hines, Canadian Forces J6, points out in his letter, that "... this doctrine is being called Network Operations in the EM Battlespace ... it will require concerted collaboration between the C&E community and national level agencies ... to be fully validated."⁵⁰

C&E efforts need to be focused towards the establishment of common standards, policies, structure, procedures, doctrine and training in order to ensure C&E units effectively execute the functions of networked operations. These functions include network availability, information assurance, and information dissemination management.

Therefore it is crucial that the efforts of the C&E community in the future become integrated at all levels through a series of multi-layered Network Operation Centres

⁴⁹ Stephen McCarthy and Andrew Wyskurz, *Integrated Command and Control System Project: Interim To Be Architecture and Roadmap Report* (NDHQ: file 1026), 31 March 2007.

⁵⁰ Major-General A.G. Hines, *Transforming the Network Fight*, (NDHQ: no file), 14 Jun 08.

(NOC) to effectively configure, manage, maintain, and secure the network. A NOC should not only exist at the strategic level but also at the operational and tactical levels just like its cousin, Network Service Center (NSC), in the US.⁵¹

The NOC will integrate Computer Network Operations (CNO), EW, and Signal Intelligence capabilities in order to protect the network and ensuring the functions of information assurance are not compromised by belligerents. From a security perspective, these three capabilities under the umbrella of networked operations carry out the operational functions of sense, shield, and act against enemy systems and nodes targeting the network which need to be integrated.

Canada's current NCW capability is focused on the 'physical' and on the 'information' domains while ignoring the 'cognitive' and 'social' domains of networked operations. The next section will propose a roadmap for the CF to follow in order to ensure a more balanced approach to networked operations is devised in the future.

A MORE BALANCED APPROACH

Even though there is a general acceptance in the CF that military operations should take advantage of technology in order to maximize the information edge, the Canadian naval and land force experience, specifically the land force stabilization efforts in post-conflict Afghanistan and the Navy's command of coalition operations off the coast of the Arabian Peninsula, reinforces the argument that a more balanced approach

⁵¹ United States, Department of Defence, *The United States Army's Concept of Operations: LandWarNet ...*, 68.

needs to be taken when developing the concept of networked operations in the future.⁵² The CF needs to invest in the human dimension just like it has done in the technological aspect of NCW. This portion of the paper will recommend that further studies need to be done on networked operations to ensure the concept meets ultimately CF requirements. Lastly, this section will also recommend doctrinal review and changes to education and training for CF personnel.

Detailed Study of NCW

This concept, as currently defined, is not officially accepted by all three services in the CF, therefore the Canadian military should be cautious when developing networked operations in isolation especially when using the US concept of NCW as its basis.⁵³ In order to ensure that networked operations support future CF transformation, a more detailed scientific investigation is required to see how CF culture, doctrine, organizations, C2, and *the whole of government approach to operations* interact with emerging technologies. The investigation should also determine how transformation based on networked operations might affect the future roles that Canada will play in international affairs, and the impacts it might have on CF operations.⁵⁴

Furthermore, the development of networked operations should not be done in isolation without input from other-government-departments (OGD) especially when the

⁵² Allan English and Colonel John Westrop (Retired), *Canadian Air Force Leadership and Command: The Human Dimension ...*, 134.

⁵³ Allan English and Colonel John Westrop (Retired), *Canadian Air Force Leadership and Command: The Human Dimension ...*, 142.

⁵⁴ English, Gimblett and Coombs, *Networked Operations and Transformation...*, 141.

CF is adopting *the whole of government approach to operations*. OGD advice and support is crucial to further develop networked operations.⁵⁵ As English points out, networked operations should be rooted in the Canadian context and based on Canadian experiences and needs.⁵⁶

Doctrine

The Canadian military should also see itself as a doctrine-based organization that uses technology to increase its capabilities of networked operations, and not have technology drive fundamental change in the manner in which the CF will conduct operations.⁵⁷ In other words, the CF should reflect how technology will support the user and enable warfighting doctrine so Canada's small military can operate in today's complex environment. Doctrine should also reflect that the CF views the human aspect of network operations as one of the key enablers to networked operations.

Training and Education

Once doctrine is developed, the CF needs to develop realistic training using a synthetic environment in order to test commanders and staffs common understanding of the NCW battlespace. In addition, commanders will learn how to exercise effective C2,

⁵⁵ *Ibid.*, 15.

⁵⁶ *Ibid.*, 143.

⁵⁷ *Ibid.*, 137.

promote common intent by building relationships between the commander and his subordinates in a networked environment. Commanders will also learn to avoid pitfalls such as micro-management of networked forces which goes against certain command philosophies practised by the CF. Lastly, commanders and staff need not to focus only on the information displayed by the computer screen by sensors but to consider other sources such as HUMINT.⁵⁸

Training should also teach staff how to filter large quantities of information before it reaches decision makers. It is important to acknowledge that there is a limit to what the human mind can process. Thomas Barnett, professor and senior decision researcher at the US Naval War College, indicates that the COP could put much strain on commanders at all levels with information overload thus affecting decision making.⁵⁹ This could only be avoided through proper individual and collective training at CF Schools.

With transformation, commanders are also expected to understand how networked operations affect the military profession and the operational art of war.⁶⁰ Commanders and staffs who will be working with networked operations should have a comprehensive understanding of how and why this concept was created and how it will shape the military and the operational art of war in the future. Therefore education becomes crucial in further developing and preparing the CF officer corps for networked operations in the future.

⁵⁸ *Ibid.*, 105.

⁵⁹ *Ibid.*, 98.

⁶⁰ *Ibid.*, 7.

CONCLUSION

There is no doubt that the CF needs to consider networked operations, not just from a techno-centric approach, but from a more balanced approach which takes into consideration the human aspect of networked operations. The CF needs to balance the technology and the human dimension of networked operations. At the moment, Canada is leaning more towards the technology and not paying much attention to the human synergy required for networked operations.

To fully achieve the potential of networked operations, the CF should concentrate on the skill and willpower of its personnel, reinforced by training, education, doctrine, organization, leadership, and culture. In other words, by investing in the 'cognitive' and the 'social' domains of NCW, the CF will gain the full potential of networked operations as portrayed in Figure 1 at the start of the paper. This balanced approach will allow commanders to exercise effective C2 and the ability to properly plan, organize, and direct forces during operations.

However, in order to ensure that networked operations support future CF transformation and C2 frameworks, a more detailed scientific investigation is required to determine how CF culture, doctrine, organizations, C2, and *the whole of government approach to operations* interact with emerging technologies. Once this interaction is determined, a proper networked operations definition should be established by the CF satisfying all services within the CF and OGD.

As English points out at the start of the paper, the CF should be cautious when developing networked operations especially when using the US concept of NCW as its

basis. NCW is a techno-centric approach to fighting war. It relies heavily on the technology and on information superiority to defeat opponents. One must remember that the network merely enables the activity and should not be the sole focus.

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