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**Command and Control in the 21st Century:
The Human Dimension of Network Enabled Operations –
Has technology eroded our traditionally held views on Command?**

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Abstract

The so called theory that 'weapons' decide everything constitutes a mechanical approach to the question of war and a subjective and one-sided view... weapons are an important factor in war, but not the decisive factor; it is people, not things, that are decisive. The contest of strength is... a contest of human power and moral

Mao Zedong

The application of Command and Control has evolved with the technological advances of mankind. At the heart of this relationship has always been the Commander, who has the vested authority and responsibility to Command and Control his troops.

The advent of NEOps or NCW has flooded the Commander with vast amounts of information. This research paper examines the argument that Commanders suffer from information overload and have become incapable of knowing what to know in the sea of information now available to them. Further, the authority of the Commander has been put into question, as these very networks allow for instantaneous access to information, permitting decisions to be held at much higher levels, thereby removing the traditional relationship of Command and Control associated with the Commander.

The research illustrated that both counts hold true. Operators do in fact operate at a level of data saturation and NCW although identified and proven to be a tool to assist Command in mitigating risk also has the negative effect on a Commander's authority in accordance with the Pigeau/McCann 'CAR' model of command capability. NCW has allowed for the authority of the Commander to be diminished thereby placing the Commander in a potentially 'ineffectual command' situation.

Introduction

Confronted with a task, and having less information available than is needed to perform that task, an organization may react in either of two ways. One is to increase its information-processing capacity, the other to design the organization, and indeed the task itself, in such a way as to enable it to operate on the basis of less information. These approaches are exhaustive; no others are conceivable. A failure to adopt one or the other will automatically result in a drop in the level of performance.

Martin Van Creveld – Command in War

Command and Control of military forces has always been at the very foundation of most militaries. It goes without say that over time the application of Command and Control has evolved with the technological advances of mankind. At the heart of this relationship has always been the Commander, who has the vested authority and responsibility to Command and Control his troops. Throughout history, this individual has always been the critical element within this relationship.

Technological advances, more specifically the advent of Network-Enabled Operations (NEOps), also known as Network-Centric Warfare (NCW), have flooded the Commander with vast amounts of information. More than ever, the Commander has many Networks available to him providing information in varying degrees of detail. Arguments have been made that this flood of information has become too much for the Commander to process, thereby resulting in a dilution of the right information at the right time. Also, with the advent of NCW, the authority of the Commander has been put into question, as these very networks allow for instantaneous access to information, permitting decisions to be held at much higher levels, thereby removing the traditional relationship of Command and Control associated with the Commander.

Is the Commander, with the advent of NCW, being inundated with too much information to effectively perform his duties and are the very systems providing him this information also eroding the traditionally accepted Command and Control authority and responsibility which lie with him?

Although the simple and very obvious answer to this question may initially appear to be yes, this research paper will examine the human dimension of NCW in order to determine the extent to which the Commander is being provided too much information to effectively perform his duties. There has been a great deal of work done in the past few years which has helped to identify this very problem both from a Command and Control and an NCW perspective, none of which has made a direct link between the two, which is what this research paper will attempt to demonstrate. The human dimension of Network Enabled Operations, although forgotten for some time, has made resurgence and helped propel Command and Control into the twenty first century, but has it contributed to eroding the responsibilities which lie with the Commander? Again, this research paper will attempt to illustrate those correlations.

The objective of this research paper is to highlight the importance of this individual known as the Commander in relation to Command and Control in a military context. In order to accomplish this, the argument will be centered on two major themes, which will permit a greater understanding of the breadth of the problem; examining the problem from both an NCW and a Command and Control perspective. Recommendations will be proposed as part of the conclusion. The first Chapter will explore the problem, that being NEOps, in greater detail with the goal of highlighting that information is only as good as what can be processed by the individual who must ultimately make the decision. This

section of the paper will highlight NCW as still a fairly new technology, and that movement in this area has been so quick to develop that the personnel using this technology, at best, were being made aware of some new system with a rough description of how to use it and why. It will be shown that this did not make for proper integration and employment of new equipment. This chapter will also illustrate that NCW ultimately serves as another tool in the decision making toolbox for the Commander to use in order to make the difficult and timely decisions he often faces. Ultimately this chapter will seek to illustrate that the Commander is in fact not being provided with the right information at the right time.

In order to do properly demonstrate the importance of the Commander in the process, the second chapter will explore the evolution of Command and Control, highlighting the importance of the human/the individual as the decision-maker. Much research and development has been occurring in this field as well, and this research paper will attempt to synthesize this information, concentrating primarily on the Canadian approach to Command and Control, which varies somewhat by environment. The chapter will commence with by examining Command and Control from a historical perspective and then examine in greater detail emerging research on the evolution of Command and Control. The chapter will then close by linking this information with the information presented in the first chapter and drawing conclusions with reference to the effects of NEOps on the traditionally accepted responsibilities which lie with him. The paper will conclude by wrapping all of this together with a few recommendations.¹

¹For the purposes of this research paper, the terms Network Enabled Operations (NEOps) and Network-Centric Warfare (NCW) have been used somewhat interchangeably throughout the text.

Chapter 1 – The Advent of Network-Enabled Operations

NEOps has quickly become the latest rage and buzz word over the past few years, driving a host of nations to quickly adopt these new systems in order to properly integrate and form part of ‘the network’. Although at the surface, this seems simplistic to implement, in actual fact, with further exploration, its application is much more difficult. This chapter will explore the theory behind NCW, how it came to be, and how various nations have chosen to pursue its adaptation. It will illustrate how nations have come to discover limitations to the theory as well as some critical enablers which, once identified, must be acted upon in order to ensure proper implementation. The second section to this chapter will highlight human limitations in absorbing information. Although technology is in essence designed to increase human productivity, there comes a point of diminishing return, where human performance can no longer simply increase with increases in technology. It is this very point which will be explored in greater detail. In closing, this chapter will bring together the critical enabler which has become NEOps, with the limitations of human productivity, and draw partial conclusions prior to launching into the next chapter on the evolution of Command and Control.

1.1 Network-Enabled Operations Defined

The term NEOps has essentially become the Canadian version of the United States term NCW. Great Britain has adopted its own term, Network Enabled Capability (NEC),

and Australia has essentially created its own definition to the US coined term NCW. The subtleties of each will be explored in greater detail in the pages ahead.²

To date, in Canada, there is no formally approved definition of the term NEOps laid down in any doctrinal publications. There are a few proposed definitions that have yet to be fully adopted. One definition describes NEOps as “... an approach to the conduct of military operations characterized by common intent, decentralized empowerment and shared information, enabled by appropriate culture, technology and practices.”³ Another proposed definition states that NEOps “... leverages Human Capability, collaboration and virtuosity to enable intelligent adaptive improvisation and emergent innovation to achieve successful performance within a range of situations...”⁴ At the outset, both of these definitions seem almost diametrically opposed. More importantly however is the following question – What is driving nations like Canada, Great Britain and Australia to ‘re-invent the wheel’ when a perfectly good definition exists to the United States terminology for NCW? By first looking at the evolution of NCW from a US perspective, the other nations mentioned above will be compared to the original theory, and answers provided as to why nations felt the need to pursue national agendas. More specifically, it will be shown how all four nations have drawn the similar conclusion that the human aspect or dimension is critical in ensuring the proper functionality of NCW.

²Sandy Babcock, *Canadian Network Enabled Operations Initiatives*, (Ottawa: Directorate Defence Analysis, 2005), 3 - 4.

³Ibid., 4.

⁴Canada, Directorate of Strategic Human Resources, *Transformation in the CF – Concepts Toward a Theory of Human Network-Enabled Operations*, (Ottawa: Department of National Defence, 2005), 32.

1.1.1 United States Perspective: (Network-Centric Warfare)

Let's begin by defining NCW in accordance with United States Doctrine. NCW was first introduced as a concept nine years ago in the late nineties by the US Navy. The Office of Force Transformation for the Department of Defence (DoD) defined NCW in early 2005 as "...an emerging theory of war in the Information Age. It is also a concept that, at the highest level, constitutes the military's response to the Information Age."⁵ The text goes on to state that the term NCW broadly describes the combination of strategies, emerging tactics, techniques, and procedures, and organizations that a fully or even a partially networked force can employ to create a decisive warfighting advantage.⁶ Based on this definition, as shown in Figure 1-1 below, the US has placed NCW at the heart of their defined four domains of conflict. These domains are known as the Social, the Cognitive, Information as well as the Physical. NCW finds itself intersecting each of these.

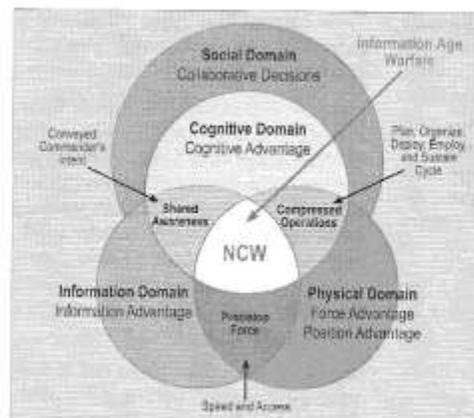


Figure 1-1: Information Age Warfare... Domains of Conflict

Source: United States, Office of Force Transformation. *The Implementation of Network-Centric Warfare*, 21.

⁵United States, Office of Force Transformation, *The Implementation of Network-Centric Warfare*, (Washington: Department of Defence, 2005), 3.

⁶Ibid., 3.

Up until 2005, the United States had yet to properly define NCW and the essence of proposed definitions prior to that put out by the DoD Office of Transformation was the first portion of the definition offered above, identifying NCW as an emerging theory of war in the Information Age.⁷ This of course begs the question as to why it took so long to tackle and turn into doctrine the emerging principles associated with NCW. The answer is surprisingly simple. The US Navy met with surprising success with NCW and their deployed forces. There were of course bandwidth limitations to their capacities, but notwithstanding this, the US Navy was able to continue to operate their two primary systems (NIPRNET and SIPRNET) at sea. This led, early on, to the development of CWAN (Coalition Wide Area Network), a system used at the outset by the US and Canada as Canada began integrating frigates into US Carrier Strike Groups (CSGs) to replace a US destroyer in order to ease the exigencies placed on the ever shrinking US Fleet. The one caveat, and in the end the driving factor, to this integration was contingent upon complete communications connectivity, which could only be successfully achieved through the development of a new classified network (CWAN).⁸ This connectivity met with great success and served as the introduction and proving grounds for Canada to NEOps. Soon after these initial successes, came the 9/11 attacks from Al Qaeda in the US. These attacks of course sparked a global response against terrorism, which came to be known as the War on Terrorism in the US, or the Campaign against Terrorism in Canada. These events sparked a surge in the need to share information quickly, and as such, this new Net-Centric

⁷Allan English, Richard Gimblett, and Howard Coombs, *Beware of Putting the Cart Before the Horse: Network Enabled Operations as a Canadian Approach to Transformation*, (Toronto: Defence R&D Canada, 2005), 1 - 2.

⁸Ibid., 33.

technology jumped to the forefront of importance as the solution to the problem. CWAN very quickly became COWAN (Coalition Wide Area Network) and soon thereafter CENTRIXS which allowed for a variety of different levels depending on security classifications. As an example, this system allowed for users to share information from a 4-Eyes (AUSCANUKUS) perspective, or the J version for operations with Japanese forces. CENTRIXS was very adaptable and allowed for great flexibility in operations with US naval assets. Given that this technology was Commercial of the Shelf (COTS) it was both accessible and relatively inexpensive to implement, which further contributed to its fast paced integration and application in the operational environment.⁹ It is for this very reason that it took until 2005 before the US started addressing the advent of NCW from a doctrinal perspective, requiring a bit of reverse engineering on their part due to four years of intense development and activity within the NCW framework.

Given the vagueness of the initial definition of an emerging theory in the Information Age, it stands to reason then that countries such as Canada, Great Britain and Australia (the 4-Eyes nations), who made the greatest use of the systems would want to adapt this concept to one that better reflected their own national needs and military cultures. We will now examine these differences and how each country took the essence of NCW and adapted it for each of their use. As we explore these differences, it will be shown that Canada is not alone in their challenges for the proper implementation of NEOps, with regards to the limitations of the human in the equation, and that in fact, as nations explored the concepts further, they are placing their emphasis on this very aspect.

⁹Ibid., 38.

1.1.2 United Kingdom Perspective: (Network Enabled Capacity)

As stated, Great Britain adopted the term Network Enabled Capacity (NEC) and described it within two separate environments, operational, and non-operational. In the operational environment, "... it will enable Shared Situational Awareness and distributed collaborative working. It will improve the integration of weapon systems, Command and Control nodes, and Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) systems to enable commanders to achieve appropriate, timely and precise effects."¹⁰ The text goes on to state that in the non-operational environment, NEC will enable better focused support from within the UK base to the operational area, and better information sharing, more decision-making and improved ways of working in the day-to-day business of Defence.¹¹ We can see based on this description that Great Britain has taken a very command centric approach to defining its Network Enabled Capability. Figure 1-2 below illustrates Great Britain's vision of the dimensions of the NEC. All three dimensions overlap and are mutually dependant, all of which will require continued development in order to achieve its full realization. This approach diverges immensely from the American model in that the UK believes that Networks, Information and People are all enablers in a greater warfighting theory, vice NCW being a new and emerging theory in its own right. The intricate take away here is the 'People' aspect and its identification as a key enabler.

¹⁰Great Britain, Ministry of Defence, *JSP 777 Edn 1 - Network Enabled Capability (NEC)*, (United Kingdom: Ministry of Defence, 2005), 2.

¹¹Ibid., 2.

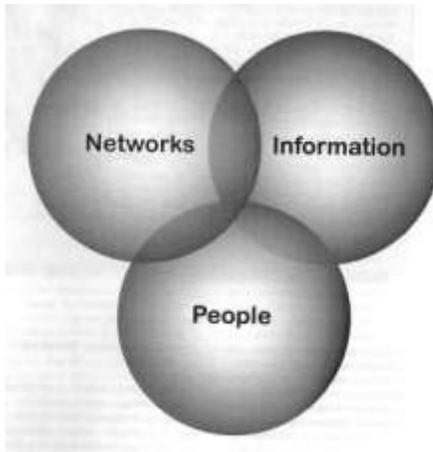


Figure 1-2: Three Dimensions of NEC

Source: Great Britain, Ministry of Defence. *JSP 777 Edn 1 - Network Enabled Capability (NEC)*, 5.

1.1.3 Australian Perspective: (Network-Centric Warfare)

Australia on the other hand kept has kept the term NCW as they develop their strategy towards full NCW development and employment. They consider ‘success’ achieved in an NCW context by “...effectively linking Command and Control, Sensor and Engagement systems via a network, to facilitate enhanced situational awareness, collaboration and offensive potential.”¹² The text goes on to state that the network would allow the right information to be accessed at the right time by the right force elements and that increases in combat power from being a networked force are derived from the quality and timeliness of shared information and through the exploitation of new system and command relationships.¹³ Figure 1-3 below illustrates the Australian concept of four key, interdependent elements coming together to establish the NCW package. The key elements identified in the figure are Command and Control systems (C2 Grid), Sensor systems

¹²Australia, Director General Capability and Plans, *NCW Roadmap*, (Canberra: Defence Publishing Service, 2005), 4.

¹³*Ibid.*, 4 – 5.

(Sensor Grid), Engagement systems (Engagement Grid) and the Network (Information Network). Of particular interest in this figure is how all of these elements are bound together under the caveat ‘Personnel Enabled’. Again, as per the example of Great Britain, the Australians are not considering NCW as a new theory of warfare but rather as an enabler to support Command in making better informed decisions with increased precision.

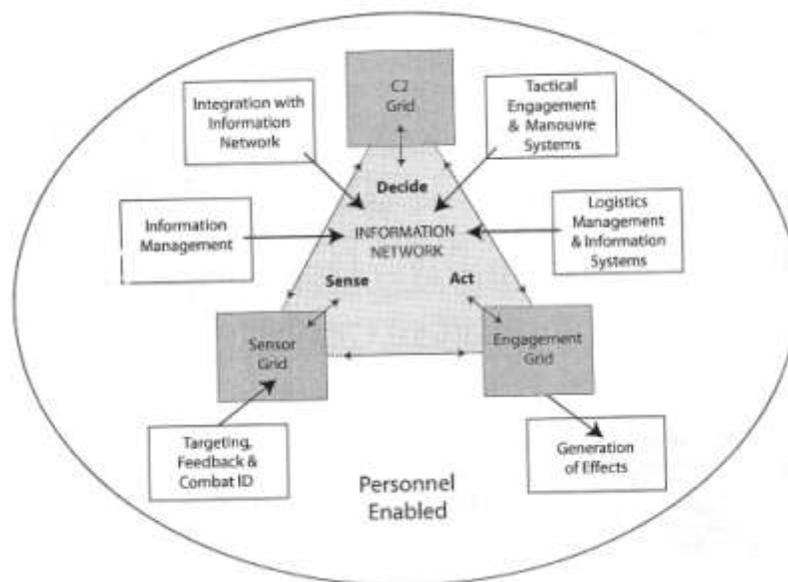


Figure 1-3: The Network Centric Warfare Package

Source: Australia, Director General Capability and Plans, NCW Roadmap, 5.

1.1.4 Canadian Perspective: (Network-Enabled Operations)

Canada, as indicated earlier, was very much at the forefront, in conjunction with the US Navy, in expanding their initial successes with Network-Enabled Operations from an inter-navy to an intra-navy initiative. As stated earlier, the initial successes in this venture were eclipsed by the attacks of 9/11 and launched the Canadian Navy and shortly thereafter the entire CF into the world of Network-Centric Operations. In the few years that followed, the CF, on the heels of the Navy, in a fashion similar to the US, built a variety of ad hoc networks to deal with the crisis of information sharing with each of our immediate

partners, but with little to no holistic implementation vision. Individual services created whatever networks they required in order to operate effectively within their environments, and even within services, the same was occurring. It is not until recently that the CF, as part of its transformation process, has looked at the sheer magnitude of networks which have been established over the past few years and attempted to commence reconciliation of these multiple systems into a nationally focussed initiative. As part of this review and with some further exploration, Canada who had initially taken the US model and theories surrounding NCW, adopted the term NEOps for all that is Net-Centric. Canada, like the other nations mentioned above, had difficulty reconciling the initial definitions and dynamics of NCW provided by the US. To this end, Canada invested in early 2005 much effort in defining its approach to both establishing NEOps in Canada from a ‘whole of government’ approach. Two separate ‘think tanks’ were assembled with a combination of Subject Matter Experts (SMEs) both military and non-military. The whole of government approach was taken to integrate Canada’s International Security and Affairs Policy of 3-D (Defence, Diplomacy and Development.)¹⁴ Also, Canada has adopted an approach to NEOps which must ensure it meets the requirements of being Joint, Intra-agency, Multinational and Public (JIMP), thereby necessitating involvement well beyond simple military applications, but include all government agencies; a daunting task to say the least, which is further contributing to the delays in developing a succinct way ahead.¹⁵ This of course comes back full circle to what was mentioned earlier about the variety of networks within the military requiring reconciliation, but must now also include and be part of

¹⁴Michael H. Thomson and Barbara Adams, *Network Enabled Operations: A Canadian Perspective*, (Toronto: Defence R&D Canada, 2005), 5.

¹⁵Allan English, Richard Gimblett and Howard Coombs, *Beware of Putting the ...*, 3.

‘Team Canada’. All of these efforts, seminars and think tanks have brought forth the latest proposed definition of NEOps as: “an evolving concept aimed at improving the planning and execution of operations through the seamless sharing of data, information and communications technology to link people, processes and ad hoc networks in order to facilitate effective and timely interactions between sensors, leaders and effects.”¹⁶ The text goes on to explain that the intended result of this process is “...an expanded awareness and comprehension of the environment, improved access to timely and relevant information, faster reaction times, better synchronization of activity, and enhanced ability to act.”¹⁷ Of importance to note here is the return of the term ‘leader’ in the proposed definition. This proposed definition also brings forward many of the tenets of the decision making model known as Boyd’s Theory.

The OODA Loop (Observe, Orient, Decide and Act) is a decision making model that has been used for some time. It was developed by Col John Boyd, a US pilot during the Korean War. Although primarily designed to assist fighter pilots to succeed in combat, this model has developed significantly within many militaries over the years and due to its simplicity has been applied in many areas of management, including within civilian business practices.¹⁸ The Canadian Forces are no exception in their use of this model for decision making processes, and have adopted a means by which to integrate NEOps into the model. The figure below depicts an evolution of Boyd’s model from the platform centric, to the integration of systems, to what is now the Network centric era of the

¹⁶Sandy Babcock, *DND/CF Network Enabled Operations Working Paper – A DND/CF Concept Paper and Roadmap for Network Enabled Operations*, (Ottawa: Defence R&D Canada, 2006), 4.

¹⁷Ibid., 4.

¹⁸Don Clark, “Performance, Learning, Leadership, & Knowledge,” <http://www.nwlink.com/~donclark/leadership/ooda.html>; Internet; accessed 25 March 2007.

Information age. The Network centric approach is based on increased interconnectivity and an ability to rapidly coordinate actions, thereby enhancing overall decision making efficiency, allowing the CF to deliver the desired effects in a much more timely fashion.¹⁹

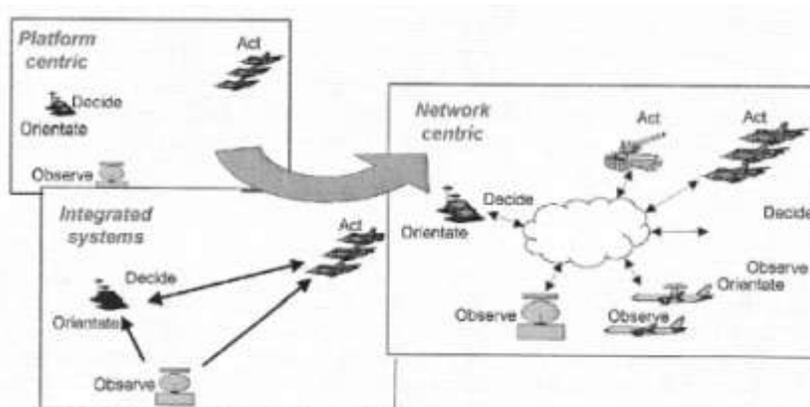


Figure 1-4: Information Age Practices

Source: Babcock, Sandy. *DND/CF Network Enabled Operations Working Paper – A DND/CF Concept Paper and Roadmap for Network Enabled Operations*, 8.

Continuing with the analogy of Boyd’s OODA loop, NEOps integrates four basic tenets associated with NCW, those being: robust networks will provide increased information sharing; increased information sharing will provide increased situational awareness; increased situational awareness will provide improved collaboration and self-synchronization; which will in turn provide significant increases in mission effectiveness.²⁰ The following figure depicts this information graphically. It is important to note here that the whole of this stems from Commander’s Intent. NEOps processes ultimately are designed to increase the speed of decision making within the Boyd’s OODA Loop with increase information and more importantly increased accuracy of information which is gained through the collaboration process. In essence, NEOps allows the Commander to

¹⁹Sandy Babcock, *DND/CF Network Enabled Operations Working Paper*..., 8.

²⁰Michael H. Thomson, and Barbara Adams, *Network Enabled Operations*..., 6.

operate inside the enemy's decision making loop, thereby ensuring absolute success in any operation.²¹

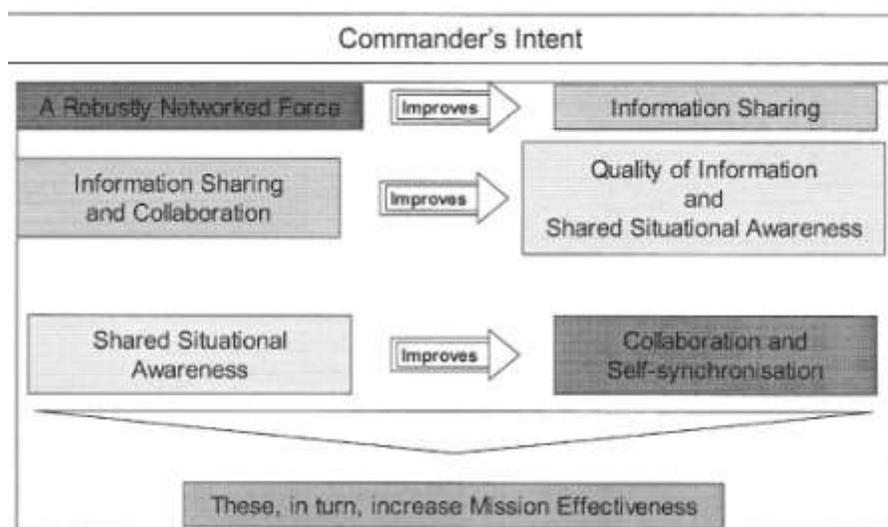


Figure 1-5: NEOps Processes

Source: Babcock, Sandy. *DND/CF Network Enabled Operations Working Paper – A DND/CF Concept Paper and Roadmap for Network Enabled Operations*, 9.

As a partial conclusion to this section on the advent of Network-Enabled Operations, the important take away from the history and developmental approach of various nations to the concept of NCW is that they have all drawn similar conclusions with regards to the human dimension of NCW. Although there has been some collaboration between them, all four nations have come to the same conclusion that the human aspect or dimension is critical in ensuring the proper functionality of NCW. The focus of follow-on development of NCW must now concentrate on integrating this essential aspect, and ensure that systems are designed to make certain that the flow of information provided to the users can be properly processed in order to be properly translated into action. Although not originally conceived as such, NCW has become a critical enabler to the decision-making

²¹Ibid., 9.

cycle in order to ensure the increased speed and accuracy of the cycle. Both of these themes will be explored further in the following section on human limitations.

1.2 Human Limitations

As described in the previous section, NCW although initially believed to have been an emerging theory in the Information Age in its application to Warfare, has become with further analysis, more of an important enabler to assist the Commander in the decision-making process. As such, NCW has become a critical tool in the Commander's toolbox to assist in greater situational awareness, which in essence should result in better and more timely decisions on the battlefield. One could easily argue that more of this technology equates to better and greater situational awareness, which again makes for better decisions. A classic case of a vicious circle or a cat chasing its tail, but does it culminate into a point of saturation?

This section will explore the limitations of technology vis-à-vis increases in human performance and make an assessment as to where the Canadian Forces currently stand with reference to this issue and the implementation of NEOps. The approach taken here will not be purely from a military perspective, but also reflect upon the civilian perspective since NEOps proper, from a technological standpoint, very closely resembles that used in standard civilian business practices, thus creating a direct parallel between civilian technological practices and those now being introduced to the Commander with the advent of NCW on the battlefield. The section will conclude with a wrap up of the key issues presented in the first chapter and how they relate with one another before launching into the follow-on discussion on Command and Control.

1.2.1 Slaves of Technology

Has society as we know it become unable to ‘live’ without a cell phone complete with instant messaging and web browsing? Has email become so second nature that Canada Post or any other hard copy non-electronically delivered correspondence has been dubbed ‘*snail mail*’? The answer to both of these questions is unfortunately emphatically yes.

Technological increases are changing our world at an unprecedented rate, and we often find ourselves struggling to keep up, not only from a technological point of view, but also financial, as each new technological advance renders the former somewhat obsolete, necessitating an upgrade or a complete replacement.²² Although not the only research conducted in this area, a particular study examined the rising numbers of employees carrying their cell phones, laptops and PDAs while on holidays in order to ‘stay in touch’ with the office while away supposedly enjoying themselves. Not surprisingly, 54 per cent said they were ‘overwhelmed by pervasive communications,’ and more than 90 per cent indicated that ‘excessive communication created negative effects on their lives.’²³ Despite these alleged negative effects, some we can all relate to, we tend to ‘rush’ to purchase the latest gadgets or high-tech services to satisfy our self-perpetuating high-tech fix, thereby becoming further dependant on these very products, which supposedly make our lives easier. We have, as a society, become so dependant on technology, that when something

²²Laura Hess, “Slaves To Technology,” <http://www.inlighttimes.com/archives/2000/12/hess.htm>; Internet; accessed 26 March 2007.

²³Nizamuddin Siddiqui, “Slaves of Technology,” <http://www.dawn.com/weekly/review/archive/050526/review5.htm>; Internet; accessed 26 March 2007.

breaks, our very ability to function and communicate properly come into question.²⁴ It has been suggested that technological advances which started out as aides to our existence have become vital to our everyday lives, but that this dependency is a double edged sword. It goes without say that technological advances have assisted a great many people with a variety of different physical dependencies live quite normal lives. These of course are excellent examples of technology contributing or assisting people who would otherwise be unable to, lead quasi normal lives despite their physical limitations. In contrast however, these very same technological advances have caused the remainder of society to now be equipped with the telecommunications capabilities which would ‘rival world leaders’, as we individually become walking communication centers, as one mere example.²⁵ Is it truly required to be equipped with such sophisticated means of communications, or have we just become acclimatized over the years to having instant communications at our fingertips – a situation which becomes self-propelling. The more you get, the more you want.

Technological advances are therefore inevitable, and by definition, are designed to move technology forward, and to cause an improvement in knowledge.²⁶ The key or perhaps the crux here of course is the term ‘improvement.’ If all of these technological advances are designed to make our lives easier and ‘improve’ our lives, then why do the results of a survey conducted by Desjardin Financial Security indicate that more than 80 percent of Canadian workers who make use of mobile technology report that it adds ‘stress

²⁴ZDNet.co.uk, “Technology addiction make us unwitting slaves,” <http://www.zdnet.co.uk/misc/print/0,1000000169,39116893-21000001c,00.htm>; Internet; accessed 26 March 2007.

²⁵Doug MacLean, “Dependency on Technology,” http://news.digitaltrends.com/print_talkback27.html; Internet; accessed 26 March 2007.

²⁶Webster’s Dictionary, *The New Lexicon of the English Language – Encyclopedic Edition*, (New York: Lexicon Publications, Inc., 1987) 12.

to their lives' rather than delivering on the promise to streamline and simplify their lives.²⁷ If technology isn't delivering on its promise to streamline and simplify, then why do we continue to delve eyes wide open deeper into the technological abyss? Two opinions are postulated on this very issue. The first, although at first may seem quite flippant, holds a modicum of truth to it...perhaps we would have seen this coming if we weren't so busy checking our messages. The unfortunate truth behind this simple statement carries with it a lot of weight. What is the first thing you do when you come home? Check your messages? Check your email? To further illustrate this point; how many times a day do you check your email? Even as students at the College, there is a need to issue both staff and students who are living off campus with a remote access token which allows access to the College network – allowing access to email as well as the research facilities of the research center. All of these capabilities of course have been developed based on some perceived need, and to make matters worse, each of these capabilities is sorely missed when the systems become inoperative for whatever reason. These very systems are now available to military units through the advent of NCW, and deployed units are now capable of all the capabilities mentioned above – essentially causing militaries to become slaves to these technologies as well.

The second opinion offered is simply that we love our gadgets. Once we embark on the information highway it is difficult if not impossible to go back, making navigation on this new highway very tricky.²⁸ The reporter goes on to postulate that many people are still

²⁷Paula Brook, "Technoslaves are spreading rudeness – We're stressed out, and losing our manners," <http://www.canada.com/components/print.aspx?id=f89df762-f8ef-444a-9849-ce64268a99e0&k=51058>; Internet; accessed 26 March 2007.

²⁸Ibid.

at the ‘honeymoon stage’ of their love affair with their gadgets and that after a few years we learn to assert control over them rather than vice versa.....until of course the next gadget comes out and captures our minds and our hearts.

1.2.2 Military Context

Where does all of this leave us then? As suggested in the previous section, the advent of NCW and its application in military warfare is directly correlated to the society which we have become. Standard business practices have moved to a very large dependency on computers, networks, wireless applications with a heavy reliance on email and the internet. Business executives equally make use of these technologies in their day to day dealings of their respective companies – making maximum use of information in their decision-making process. It is only natural that the military leaders migrate to the use of such tools – which in the case of the Canadian military context has come to be known as NEOps. “The organizing principle of network-centric warfare has its antecedent in the dynamics of growth and competitions that have emerged in the modern economy.”²⁹ However, the one fundamental difference between the military Commander and his civilian Executive counterpart relying on similar technologies to make critical and timely decisions is the sheer volume of information that can now be made available to that military Commander, which was previously unavailable in such an instantaneous manner.

Notwithstanding this, how and where does the human fit into the mix of NCW? This was explored extensively and generally concluded upon in the first section of the

²⁹Erik J. Dahl, “Net-Centric Before Its Time,” *Naval War College Review* 58, 4, (Autumn 2005): 128.

chapter that in fact the human is key in successfully making NCW function properly. “Despite military advances in military technology and the improvements in combat effectiveness that it promises, armed conflict ultimately remains a human endeavour.”³⁰ More that ever, the human dimension of Command remains critical in military applications, despite technological changes and advances. New technologies effectively allow us to collect and distribute massive amounts of data, and although these technologies have in the past and continue in the present to be fixated on hardware, bandwidth, baud rates, with wires and electrons, a shift has taken place with the realization of the importance of the human in this overall synergy.³¹ But why collect such vast amounts of data if it is impossible to decipher and understand it? It has been suggested that the brain spends up to 45 per cent of its random access memory on the visual section of the brain, and since all of the inputs being referred to are visual in nature, it stands to reason that the only way to increase the speed of the brain would be with a different type of vision. This solution is not viable in the foreseeable future; therefore, the only way to create space would be to reduce the inputs of little importance, an issue which will be explored in greater detail further on in the paper.³²

From a military perspective, there are two major reasons to collect such vast amounts of data collection: to target enemy forces and to facilitate decision-making.³³

³⁰Orrick White, *Network Centric Operations – Challenges associated with the human-in-the-loop*, (Ottawa: Defence R&D Canada, 2005), 1.

³¹Alan Zimm, Commander U.S. Navy (Retired), “Human Centric Warfare,” *Proceedings*, (May 1999): 28.

³²Lance Winslow, “Visual Limits of the Human Brain Processing Speed,” <http://ezinearticles.com/?Visual-Limits-of-the-Brain-Processing-Speed&id=28223>; Internet; accessed 3 April 2007.

There is no denying that both of these reasons are quite valid, but neither begins to address the fundamental problem of how to process/digest these vast amounts of data into manageable amounts. Data saturation is a continual, real-life problem, acknowledges Alan Zimm, Commander US Navy (Retired).³⁴ This is the crux of the issue and one of the most difficult problems Commanders now face which is ‘to know what to know’ in this minefield of information, with the full knowledge of course that they cannot know it all.

“In July 1988, the Vincennes – already under attack by Boghammers – shot down an Iranian Airbus it mistakenly believed to be a hostile track. In this stressful and data-crowded situation, for more information to have been effective, it would have to have been the exactly right information, identifiable as such, provided in a 2-minute, 22-second window.”³⁵

The example illustrated above is but one case in point of the potential results of data saturation, which in this case unfortunately resulted in a poor decision by the Commander, culminating in the deaths of all civilians onboard the airbus. The Americans are not the only one’s to realize that data saturation has been and continues to occur. Defence Research and Development Canada (DRDC) – Atlantic has been working on the data saturation issue. In discussion with Dr. Ross Graham, Director General of Defence Research and Development Canada – Atlantic, during an informal discussion about the topic, he confirmed that research is being conducted by DRDC in these areas. The figure below, supplied by Dr. Graham in a subsequent email, graphically illustrates a generic data saturation model used by their organization to demonstrate the effects of data saturation on individual operators. The ‘x’ axis identifies time in years, and the ‘y’ axis the increasing challenge on individual operators. As technology has advanced over the years and

³³Alan Zimm, Commander U.S. Navy (Retired), “Human Centric Warfare...”, 28.

³⁴Ibid., 29.

³⁵Ibid., 30.

produced faster computers and increased methods and means of communications, in a warfare setting this has directly translated into increased amounts of sensors, displays and more systems, all of which can be operated by fewer operators. The NEOps related information is labelled in blue and illustrates that with increased bandwidth came the ability to network computers and better information management – further increasing the strain on the individual operators. The graph of course provides a simple depiction of increased strain on the operator with the various additions of inputs upon the operator. How each operator reacts to these increased stresses will inevitably vary from person to person. As mentioned earlier, although this problem has been identified, and viable solutions, such as those indicated in the figure (better operator interfaces, increased data fusion, intelligent software assistants and decision support matrices) become reality, only then will we be able to bridge the gap of the demands of networked systems on individual operators in a military setting, and hope to reduce the overload on individual operators.³⁶



Figure 1-6: Sensor Operator Information Overload

Source: Received by Email from Dr. Ross Graham, Director General DRDC Atlantic, Thursday 29 March, 2007.

³⁶Doctor Ross Graham, Director General DRDC Atlantic, discussion with author, 28 March 2007.

“We would not dream of acquiring a gun system without knowing what calibre bullet to use, how fast we could load it, how big the magazine is, and the overall rate of fire, yet we do not have a useful understanding of what information we should put into human decision makers, how fast we can load them, how much they can retain and recall, and the rate of fire of decisions.”³⁷

This quote draws a direct parallel to any form of military procurement. All procurements are investigated extensively to ensure that they meet the exact requirements identified at the outset for the end user in order to ensure a certain capability is acquired. Why is it then that this was not done at the outset with the introduction of NCW? This question was addressed earlier, but resurfaces here. This rapid acquisition of new technology, without fully analysing its implications has resulted in collecting too much data and dumping it on the decision maker. This, as discussed earlier, not only increases stress, but also contributes to the deterioration of command processes which invariably lead to poor decisions. The end result becomes the increased likelihood of another incident like the Vincennes, resulting in innocent lives lost.

As a partial conclusion to this section, we have seen that technological advances have led to increased stress in the workplace and on the home front both within the civilian sector as well as within the military sector. The dependency which has been created on all the modern equipment and the ‘I need to be connected all the time’ attitude which has plagued society has also infiltrated the military in the form of NCW. The fundamental difference between the civilian and military aspect to this problem stems from the fact that there are many more sensors available to the military Commander. From the Strategic level right down to the tactical level, the amount of data which can be made available to the

³⁷Alan Zimm, Commander U.S. Navy (Retired), “Human Centric Warfare...”, 31.

Commander is staggering, making it very difficult for him and his team to ‘know what you need to know’ in a virtual sea of data. It has also been shown that individual operators have limitations as to how much data each can process. Although difficult to recognize and quantify the amount of information which can be processed by each individual, the fact remains that the networked environment has created additional stresses on the operator which preclude him or her from performing optimally. Figuratively speaking, each operator’s individual stresses perpetuates itself into a large cobweb (known as the common operating picture) of potential half-processed information presented to a Commander whom must ultimately make a decision, good or bad. In today’s techno-crazy world, the Commander must be aware of these stresses and attempt to compensate as best he can with the team he is provided, however the Commander is only human as well.

As explained in the Figure 1-6, there are means by which to mitigate these stresses and the CF has commenced making advancements in that direction. The first item of better operator interfaces can be simply addressed with better workspace ergonomics. This simple task of presenting the information and making it easier to manipulate and bring forward, essentially becomes the first step taken through a variety of projects in order to increase operator productivity. The remainder of the recommendations to better ease the workload faced by the operator are all areas which are still under development, but the mere fact that the CF is looking into these areas proves beyond doubt the importance attached to the human in the decision-making process, something which has eluded Canada and a few of its allies for a few years now, with the introduction of NCW. With this in mind – the human or rather the Commander as the central key in the decision-making

process – we will in the next chapter explore the evolution of Command and Control over the years and the effects, if any, that NCW has had of its development.

In concluding this chapter we have explored the nebulous world of NCW. Through a careful review of various countries approach to introduce the concepts of NCW within their own militaries, we have been able to conclude that each of these nations are now placing greater emphasis of the human dimension of NCW, placing this at the forefront of their research for immediate implementation and application. We have also been able to rule out NCW as an emerging theory in the Information Age, but rather better described it as a critical enabler allowing the Commander to gain greater situational awareness in order to make quicker decisions with greater fidelity. Was the human dimension an oversight with the introduction of NCW? The research definitely supports that hypothesis. The mere fact that it was not considered from the outset illustrates this case in point. Notwithstanding this, it was also illustrated that researchers initially thought that NCW would become a military version of what have become known as common business practices in the civilian sector. As such, there was no anticipation of the volume of data which would become instantaneously available to the Commander from a variety of different sources. As a result, it has become quite simplistic, having provided the Commander the appropriate tools which reside within NCW, to ensure that he is accessible at all times, twenty-four and seven. This situation is no different than the civilian employee taking his electronic tools on ‘holidays’ with him to ensure he can ‘stay in touch’ with the office, or perhaps worse, allowing the office to ‘stay in touch’ with him. This is the very area which will be examined in greater detail in the next chapter. Has the

Commander's traditionally accepted responsibilities associated with Command and Control become eroded with the advent of NCW advances in technology?

Chapter 2 – The Evolution of Command and Control

A perfect general, like Plato's republic, is a figment of the imagination.

Frederick the Great in his Instructions for Generals

Command and Control is an age old concept which dates back to approximately 500 B.C. and the earliest of writings on warfighting found in Sun Tzu's The Art of War. Of course, as with everything, the concept has evolved over time. This type of progress is inevitable and as a general guideline, tends to improve with time, although this may not always be the case.

In this chapter we will carefully examine the concept of Command and Control as it has evolved throughout the centuries. The chapter will commence with a brief definition and explanation of exactly 'what is a commander' in order to ensure that there is a collective understanding in what is meant when the term 'Commander' is used. With this definition in mind, we will then explore the concept of Command and Control from a historical perspective. This will help solidify not only how Command and Control has evolved throughout the centuries, but also highlight its importance with respect to the Commander. This will serve as a stepping stone to the next section which will then explore the latest research and development conducted by the Defence Research and Development Canada – Toronto office and their attempts at re-defining Command and Control from a scientific point of view. The chapter will then conclude with a brief review of the highlights of the chapter and an assessment of the impact of Network-Enabled operations on the Commander as it relates to Command and Control, and more specifically, whether the advent of Network-Enabled Operations has in fact diluted the authority and

responsibility of the Commander from a Command and Control perspective. First off, let's commence by defining what is a Commander?

2.1 What is a Commander?

The objective of this section is to define exactly what is meant by the term 'Commander' as it relates to Command and Control. In order to be able to properly ascertain if in fact the Commander's Command and Control authority and responsibility is being diluted, we must first off properly understand what exactly is meant by the term. In the previous chapter, the analogy associated with the importance of the Commander was introduced and it is appropriate here as we commence our examination of Command and Control to ensure that we properly understand exactly 'What is a Commander?'

There are a number of varying definitions associated with the term Commander, as this term can represent either an individual/person or a position held by an individual. It can be known as "a person who commands, especially a commanding officer", or referred to as a commissioned rank within many navies of the world and the person who holds this rank.³⁸ Webster's online dictionary, although somewhat similar to the definition mentioned above, also includes: "A chief; one who has supreme authority; a leader; the chief officer of an army or any division of it."³⁹ Key to remember as we elaborate on the definition of a Commander is the inclusion of the terms 'authority' as well as 'leader'.

³⁸Ask.com, "Dictionary entries for 'commander,'" <http://www.ask.com/reference/dictionary/ahdict/16298/commander>; Internet; accessed 10 April 2007.

³⁹Webster's Dictionary, "Definition of Commander," <http://www.webster-dictionary.net/definition/commander>; Internet; accessed 10 April 2007.

Dr Ross Pigeau and Carol McCann, from DRDC – Toronto, have conducted a substantial amount of research in re-defining Command and Control which will be examined in greater detail in a follow-on section of this chapter. As part of their research that have also tackled the task of properly defining ‘What is a Commander?’, and it is therefore pertinent to include this portion of their research efforts here. They have concluded and as such defined a commander as a *position/person combination lying on the balanced command envelope with special powers to 1) enforce discipline and 2) put military members in harm’s way.*⁴⁰ They go on to list three important components associated with their definition. The first is that a commander is a combination of both an official position within a military organization and the person who fills that position. The second component is that this combined definition of a Commander must lie on the Balance Command Envelope (BCE), a term which will be further elaborated in a follow-on section of this chapter, in order to ensure a safe and effectual Command. The third component is that the Commander must be able to make full use of the unique powers associated with the position that governments assign to their militaries. We can very quickly see that these three components are closely integrated within their assigned definition for a Commander, and that from a purely military point of view, the Pigeau/McCann definition synthesizes and encapsulates in greater detail the responsibilities and inherent risks associated with the position and the person ultimately known as the Commander.

⁴⁰Ross Pigeau and Carol McCann, “What is a Commander?” in *Generalship and the Art of the Admiral: Perspectives on Canadian Senior Military Leadership*, ed. Bernd Horn and Stephen J. Harris, 79-104 (St-Catharines: Vanwell Publishing Limited, 2001), 91.

2.2 Command and Control – the Historical Perspective

In this section we will map out the historical roots of Command and Control, tracing back its origins and exploring the concepts development throughout the centuries. In doing so, the objective is to illustrate the importance of Command and Control which was placed squarely on the Commander's shoulders and the responsibility and the authority which came with it. This section will also highlight the fact that the Commander is key in ensuring the proper functioning of Command and Control of his unit or assigned units. By tracing the history of Command and Control over the course of centuries, we will be better placed to make an assessment as to whether or not the Commander's authority and responsibility has been diluted in today's technologically advanced world of Network-Enabled Operations, and the flood of information associated with it.

2.2.1 Command and Control – the Beginnings

We will commence our historic overview of Command and Control by exploring the earliest written works which made mention of this concept. In doing so, it will be shown that the essence of Command and Control from these initial beginnings struck the appropriate chords for a lingering philosophy that would last well over a millennia. The first military writer and theorist dates back to 500 B.C., and can be found in Sun Tzu's writings on the Art of War. Although his work was unknown to the western world for well over a one thousand years, once published in Paris by a Jesuit missionary to Peking in 1772, his work quickly became known amongst military circles and has influenced and helped shape military thinking since.

In the *Art of War*, he covers a wide range of warfare related topics from the strategic through to the tactical levels. As part of his theories relating to Command and

Control, he stated that there were five fundamental factors to be thoroughly studied in war. Those are: moral influence, weather, terrain, command and doctrine. Two of these factors directly apply in our study of Command and Control. The first being moral influence; Sun Tzu elaborates further to mean that which causes people to be in harmony with their leaders, so that they will accompany them in life and onto their deaths without fear of mortal peril. This factor speaks volumes of Command influence and trust. It also lays testament to the importance of Command leadership in order to properly lead troops into battle. Equally, it also touches on the definition of Commander in that ‘harmony’ with the leaders in many ways entails a properly disciplined force, which the Commander must enforce.

The second of these factors of course is command; which Sun Tzu elaborates to mean the general’s qualities of wisdom, sincerity, humanity, courage and strictness.⁴¹ Even in the earliest of writings, we see some similarities in the terminology used in describing Command by Sun Tzu, and the definition of a Commander mentioned in the previous section. Courage and strictness directly link to the enforcement of discipline and the ability of the Commander to put military members in harms way. Equally, wisdom, sincerity and humanity relate to his first factor of moral influence. A Commander who possesses these qualities of wisdom, sincerity and humanity will have significantly more credibility in the face of his troops and as such set the example and allow him to exert moral influence more readily.

Sun Tzu also touches on control in his writings. He defines control as *to control many is the same as to control few. This is a matter of formations and signals.* The spread

⁴¹Sun Tzu, *The Art of War*, trans. Samuel B. Griffith, (New York: Oxford University Press, 1971), 63-65.

of armies at the time necessitated the use of flags and banners in order to ensure officers and men knew when they were being ordered to advance or retreat.⁴² Sun Tzu goes on to further state: “The Book of Military Administration says: ‘As the voice cannot be heard in battle, drums and bells are used. As troops cannot see each other clearly in battle, flags and banners are used.’”⁴³ The relevance of these writings represent the first indication that communication on the battlefield (although rudimentary and limited to line of sight) was of essence in order to control the actions of troops and to coordinate the efforts as per the Commander’s intentions. These signals were also used as a means to relay and update movements as the battle unfolded. This use of control is the first written example of how control is a measure to support Command in making appropriate decisions. This quote is also of particular interest as not only does it reinforce the use of signals to control actions on the battlefield, but it also clearly indicates that this use of signals was laid out in a Book of Military Administration which would pre-date Sun Tzu’s own work. From this one can therefore stipulate that Command and Control and the thought and importance placed in it have emerged since mankind has decided to wage war.

In conclusion to this section we have seen that the first laid down definition associated with Command and Control in 500 B.C. incorporated critical aspects which are still pertinent today. Also and most importantly, we have illustrated the importance of communication as a means of exercising control. The use of flags and sounds to control the movements of troops on the battlefield is the first indication of the importance of communication in order to properly exercise both Command and Control of one’s troops.

⁴²Ibid., 90-91.

⁴³Ibid., 106.

2.2.2 Command and Control – European Classic Centuries

As we continue to progress with our chronological walk through history examining Command and Control as it pertained to the Commander, our next look is at the era of European Classic Centuries. In this section we will examine in greater detail some of the more classically held views on modern military strategy which emanated from the likes of Machiavelli, Napoleon, Clausewitz, Jomini, and in the latter stages of the nineteenth century, Moltke. The objective of this section will be to illustrate that although a great deal of thought has been placed into strategizing and theorizing about the Art of War, little attempt has been made to formally write down a definition associated with Command and Control. Rather, it will be shown that throughout this era, Command and Control will have passed from a more centralized approach to a more decentralized ‘Mission Command’ or ‘Auftragstaktik’ approach to warfare.

Although there have been a great deal of theorists and strategist throughout this era, their theories and philosophies on war are found strangely lacking from a Command and Control perspective. The concept is embedded within their overall philosophies, taking Command and Control somewhat for granted. As we work our way through the various theorists, highlights of their predominant philosophy on Command and Control will be brought forward and compared to Sun Tzu’s original thoughts on the subject. Comparisons will also be drawn in concert with the definition of a Commander suggested at the outset of the chapter.

Niccolo Machiavelli

In the early sixteenth century, Niccolo Machiavelli, an Italian philosopher, wrote some works on military strategy. Although his works dealt primarily with political science,

he did in fact state that: “War is the most essential activity of political life.”⁴⁴ He goes on to theorize about wars and how they should be short and sharp, and how everything must be done to ensure victory. In order to do this, the military campaign must be a well planned and coordinated operation. From there, he further postulated that: “Command, therefore, must be in the hands of one man. If the state is a monarchy, the ruler himself ought to be the Commanding general. But republics too should entrust their army in wartime to one commander who should have unlimited authority...”⁴⁵ Further on in the text he explained the importance of training and discipline as a key to military success. The most important philosophy of Machiavelli with reference to military affairs is the law of December 1505, known as the *Ordinanza* which provided for a conscript militia of ten thousand troops. This conscript army would be made up of various local districts of Tuscany, all under Florentine rule, with an ultimate goal of bringing all of this under a unified Command.⁴⁶ We can see that although there is a period of approximately two thousand years between Sun Tzu and Machiavelli, that there are striking similarities in the focus of one man as the Commander and the requirement for strict discipline in order to properly control the troops, a very centralized approach to the concept on Command on both counts.

Napoleon Bonaparte

The next individual to stand out significantly from a military standpoint as we progress through the European Classic centuries was more of a great tactician than a great

⁴⁴Felix Gilbert, “Machiavelli: The Renaissance of the Art of War,” in *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, ed. Peter Paret, 11-31 (Princeton: Princeton University Press, 1986), 24.

⁴⁵*Ibid.*, 25.

⁴⁶*Ibid.*, 18-19.

theorist or strategist. Napoleon Bonaparte emerged in the early nineteenth century as the leader of the French Army and eventual Emperor of France. His approach to Command was very centralized with an extremely hands-on approach to controlling his troops. His philosophy and application of war very much resembled that of Machiavelli in the sense that as Head of State and the Supreme Commander of his armies, he operated in an ideal environment of non-friction between the political and military levels of authority. This allowed him a very rapid decision making process on the battlefield as there was no requirement to consult higher authority for direction as he was that authority. This provided him with tremendous flexibility in the employment of his armies which greatly contributed to his initial successes.⁴⁷ His application of Command was what set him apart from many of his predecessors. “The separation of the army into largely self-sufficient commands, which in the Revolutionary Wars often meant the fragmentation of effort, was continued by Napoleon; but he imposed much firmer central control on the dispersed commands,…”⁴⁸ This approach allowed him to apply a rapid mobility and concentration of force which proved to be a revolutionary tactic in warfare. These dispersed commands required of course greater measures of control. In order to offset this, he expanded his staff. This permitted him to retain his required control of constantly larger and more widely dispersed forces. The more ground he took, the more he expanded his staff to ensure his control measures mentioned above were maintained in place, continuously allowing him this increased mobility and concentration of force.⁴⁹ Ultimately, with the

⁴⁷Peter Paret, “Napoleon and the Revolution in War,” in *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, ed. Peter Paret, 123-142 (Princeton: Princeton University Press, 1986), 129.

⁴⁸Ibid., 127.

⁴⁹Ibid., 125.

appropriate control measures in place, Command's can grow immeasurably to suffice the needs of the mission.

As we can see, from the period of Machiavelli to Napoleon, there is no great fundamental earth shattering differences presented in the aspects of Command and Control, with the exception that Napoleon expanded his control measures with his dispersed forces by increasing his staff, thereby assuring a very centralized control of all of his forces. The same measures of Control as those identified by Sun Tzu are still in play at this stage, with the exception of the increased staff and the more widely dispersed troops – which ultimately introduced the need for control beyond the line of sight. When compared to the definition of a Commander offered at the beginning of the chapter, Napoleon certainly fell within that that context.

Karl von Clausewitz/Antoine-Henri Jomini

The next great strategists emerged in the early nineteenth century during the same period as Napoleon, with Karl von Clausewitz and Antoine-Henri Jomini. Both authors are considered modern military thinkers as well as the founders of modern strategy, as each introduced the art of the 'manoeuvrist approach' to modern warfare. Both authors have undisputedly earned the title; however, it is interesting to note that neither founder laid a concrete definition to the concepts of Command and Control in either of their works.

Clausewitz, in particular, made no direct mention of Command in his book 'On War', nor did he associate a definition to the concept. His theories and strategies however have an inherent aspect of Command and Control associated within them in order to make them successful. The 'manoeuvrist approach' inherently involved a form of centralized command, similar to that used by Napoleon, in order to prove effective. It also required

extensive control measures in order to ensure proper execution, and it is these control measures which appear to have changed over time.

Jomini, on the other hand, spent much time identifying the inherent difficulties of the 'Prince' (meaning the Head of State) in selecting the appropriate general to lead his army.⁵⁰ This lays credence to the importance Jomini associated with choosing the right Commander. Although he explained in a fair amount of detail the inherent qualities a Commander should possess to Command the army, as well as the means by which to select this individual, he made no direct mention of the Commander in the use of his strategies nor did he directly define Command. Much like Clausewitz, the concept of Command appeared embedded in many of the theories and strategies presented in the 'manoeuvrist approach' which inherently required a centralized approach to Command and effective control measures in place in order to properly coordinate the desired effects on the battlefield at the desired decisive point. This coordination again is the largest single most development in the concept of Command and Control since the earliest writings identified in Sun Tzu.

Interestingly, Jomini, Clausewitz, Napoleon and Machiavelli had very similar attitudes towards Command and Control which primarily stem from a very centralized approach to Command and distinct control measures in place for battlefield coordination by a selected leader (either the head of state or a carefully selected general), who ultimately had the decision making power (authority) and the responsibility for the action on the battlefield. This in essence is truly no different than what was originally proposed by Sun Tzu, with developments and changes only in control measures which primarily dealt with

⁵⁰ Antoine Henri Jomini, *The Art of War*, (London: Greenhill Books, 1996), 56-57.

increased complexity in the coordination and synchronization of activities on the battlefield. All of the selected leaders of this era to date fit very well within the definition of a Commander identified at the beginning of the chapter.

Helmuth von Moltke (Dawn of the Industrial Age)

In the latter stages of the nineteenth century, as an adaptation to the start of the industrial age, General Helmuth von Moltke, a Prussian soldier, built upon Napoleon's tactic of a swift and decisive battle to destroy the enemy. A self-proclaimed disciple of Clausewitz, Moltke was very quick to realize that the improved firearms, transportation and communication, combined with the ability of nations to raise much larger armies required a dramatic change in strategy, tactics, command and organization.⁵¹ This portion of this section will concentrate on Moltke's view and changes with reference to Command.

Moltke's conceived the idea that by attacking on multiple fronts simultaneously combining movement and converging multiple armies in a decisive battle would be the key to a swift victory. This became known as the envelopment tactic. He quickly realized that to execute his plan, the control of different armies converging over separate routes would be a difficult obstacle to overcome. The problem was that the initial concentration of armies required a very centralized command and control, while the movement of the separate armies to execute the envelopment required a decentralized execution. His solution to this was that the 'High Command' should limit itself to providing general instructions to its subordinate commanders outlining the general objectives, and the specific mission to achieve, allowing the Commanders to work out the details, this of

⁵¹Gunther E. Rothenberg, "Moltke, Schieffen, and the Doctrine of Strategic Envelopment," in *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, ed. Peter Paret, 296-325 (Princeton: Princeton University Press, 1986) 297.

course could only work if the entire Staff was working from a common doctrine.⁵² This became known as ‘Auftragstaktik’ or ‘Mission Command’. Although not a perfect system, the advent of the telegraph allowed some measures of control by the high command, however it made it increasingly difficult to coordinate all activities and on some occasions, High Command would assume direct control of engagements. Overall the envelopment theory of Moltke proved highly successful and served as a stepping stone for follow-on engagements in the Great War as well as the Blitzkrieg tactic of World War II.⁵³

As we can see, General Moltke introduced in the late nineteenth century the first radical change to the concept of Command and Control using a decentralized approach to gain victory in a swift and decisive battle. His reliance on his Commanders and the authority and responsibility which he vested in them was far greater than in any other previous era, and as such required a common operating doctrine to ensure a means of control to ensure that faced with similar problems his Commanders would react in a similar fashion.

In conclusion to this section, we have explored Command and Control during what has been considered by many as the Classic European Centuries and some of the more prominent figures associated with that era. Although there had been some developments on the tactical front in waging wars, the essence of Command and Control presented by Sun Tzu in the previous section remained valid with one exception. It is only with the advent of the industrial age with increased movement capability by railroad, and increased communication capability by telegraph that Command and Control took a fundamental

⁵²Ibid., 300-301.

⁵³Ibid., 304.

shift to a more decentralized approach in what Moltke termed ‘Auftragstaktik’. This shift placed greater responsibility on subordinate commanders, provided them with the requisite authority and responsibility to engage their men in battle in accordance with established doctrinal procedures. This push down of authority and responsibility from higher Command greatly resembles the definition associated with a Commander presented at the beginning of the chapter. Next we will explore how navies operated their ships with respect to Command and Control and how the aspect of ‘Mission Command’ described by Moltke was similar in many ways to orders provided to Naval Commanders.

2.2.3 Command and Control - Naval Commanders at sea

Naval Commanders have traditionally held a different approach to Command and Control than that of armies due to the nature of the environment in which they worked. Naval Commanders, also referred to as Captains, often received their direction/orders from higher Command prior to sailing and proceeded with their mission. Commanders as such were provided with a great level of latitude in their approach to executing their mission, an approach not terribly different to that described by Moltke with his ‘Auftragstaktik’. It is this very aspect which will be covered in greater detail here, that Naval Commanders have essentially practiced a decentralized approach to Command throughout the centuries. Communications advances have permitted increased versatility and certainly attempted to centralize the Command role of Commanders at sea, but these advances have not been able to remove all levels of uncertainty of putting a ship to sea, and the circumstances which the Commander faces on a regular basis.

The decentralized approach to Command from a naval perspective can be traced as far back as Nelson and one can easily argue that this approach has existed since man commenced conducting warfare at sea. As Clausewitz dubbed, war is but the extension of politics by another means, therefore these ship became instruments of the political powers, with no means of centralized control once they set sail. The uncertainty of conducting operations at sea even given the latest technological advances still fit well into what Clausewitz dubbed as the ‘fog of war’.⁵⁴

Throughout the centuries as Fleets increased in size, it became increasingly difficult to coordinate the actions of the vessels at sea. As such, tactics developed and evolved with time, and in order to properly execute these signals, use of visual and auditory signals were designed. This officially became the first means by which to control the movements of formations for tactical purposes, and this signaling became the means by which the Admiral could retain and direct his vessels into battle – indicating a very centralized execution. Notwithstanding this, individual Commanders were left to their own vices on how they would execute their orders received by signal flags.⁵⁵ Large comparisons can be drawn here to what was demonstrated earlier in this chapter with Sun Tzu and his application of Command and Control in particular with the execution and use of signals to control the effects on the battlefield.

As technological advances continued, the telegraph is the next instrument to have a profound effect on Command and Control from a naval perspective, especially the advent

⁵⁴Michael A. Palmer, *Command at Sea – Naval Command and Control since the Sixteenth Century*, (London: Harvard University Press, 2005) 16.

⁵⁵*Ibid.*, 207.

of the wireless telegraph. The wireless telegraph now meant that for the first time in history, ships at sea could be contacted by authorities ashore. As expressed by Palmer; “This operational use of wireless telegraph transmissions marked the advent of a new era in naval warfare. Navies had invaded the ether.”⁵⁶ Although this introduced an aspect of centralization to the Command of warships, the Commander still exercised full control over his ship and this wireless technology simply allowed for further direction and situational reports to be exchanged between units at sea and National Commands.

Throughout the two world wars and years that followed communication advances continued with the same effect as the wireless telegraph. Slowly but surely as technology continued to progress, more and more aspects of Command centralization were being introduced in a naval context further reducing the naval Commanders flexibility of action. Much of these developments were spurred based on the requirement for increased coordination of naval assets for engagements at sea. The communication advances unfortunately also had the less desirable impact of being accessible to the higher commands, thereby allowing this centralization to take place. The communications advances referred to here span from inter-ship HF radio, to UHF data sharing between units provided by new sensors such as radar, to full blown satellite connectivity allowing internet connectivity, instantaneous email and chat. Each of these communication advancements has allowed higher commands to exercise a greater degree of control over ships at sea, thereby increasing their ability to exercise a centralized Command over what was once a completely decentralized Command environment.⁵⁷ Notwithstanding this, the element of

⁵⁶Ibid., 229.

friction and the ‘fog of war’ as purported by Clausewitz still apply for today’s naval Commanders, thereby still necessitating some aspects of decentralization to their Commands.

The Canadian Navy defined Command in their Maritime Command Orders issued by the Chief of the Maritime Staff as follows: “Command of a ship is the authority vested in the CO for the direction, co-ordination and control of the ship and her company.”⁵⁸ The text goes on to separate the elements of control into three specific meanings; control of the ship, control of fighting equipment and sensors, and control of tactical employment. Control of the ship is defined as follows: “... the responsibility vested in the CO to give direction and orders to the OOW concerning the handling of the ship including ship manoeuvring and navigation.”⁵⁹ Control of fighting equipment and sensors is defined as: “...the responsibility vested in the CO over the employment of such equipment.”⁶⁰ Control of tactical employment is defined as: “... the responsibility vested in the CO over the actions of his own ship and/or other ships and aircraft under his Tactical Command or Tactical Control.”⁶¹ The text goes on to outline the means by which the CO may delegate each of these elements of control under various circumstances. This is really the most comprehensive laid down definitions applying directly to Command and Control that we have seen since Sun Tzu first put out his thoughts in the ‘Art of War’. Equally interesting

⁵⁷W.J. Holland Jr., Rear Admiral U.S. Navy (Retired), “Where Will All the Admirals Go?” *Proceedings*, (May 1999): 36.

⁵⁸Canada, Chief of the Maritime Staff, *Maritime Command Orders Volume 1, 4-15*, (Ottawa: Department of National Defence) 1.

⁵⁹*Ibid.*, 1.

⁶⁰*Ibid.*, 2.

⁶¹*Ibid.*, 2.

is the use of terminology such as ‘authority’, and ‘responsibility’, two terms closely related to the definition of a Commander identified at the beginning of the chapter. The definitions adopted by the Canadian Navy certainly emphasize the importance of the Commander with reference to his Command, but also advocate a very decentralized approach to Command and Control, which as seen earlier, technological advances have somewhat diluted.

As we have seen in this section, the naval environment and their approach to Command enjoyed a long period of decentralization. With the advent of the industrial age and the never ceasing technological advancements which now permit at sea units to operate as though they were next door, naval Command and Control has taken a turn towards a more centralized approach. We also examined the Canadian Navy’s definition of Command and Control in the 20th century, a definition which still stands today. In the following section, we will see this natural human tendency to gravitate towards a more centralized approach as we explore Command and Control in the 20th century. We will also see that the technological impact was not limited solely to the navy, but has had a similar impact on the remainder of armed forces.

2.2.4 Command and Control – the 20th Century

Having examined Command and Control throughout the ages, this section will examine the 20th century. By all rights, the 20th century was the century of perpetual technological advancements. Few theories on Command and Control emerged with the exception of some research conducted at the very end of the century which will be explored in greater detail in the following section. Notwithstanding this, the never ceasing technological advancements, in particular in the communications sector had a tremendous impact on the control and more importantly the coordination of operations on the

battlefield. As mentioned in the previous section, these technological leaps permitted tactical and operational planning to attain levels which previously could not have been conceived due to unmanageable coordination and synchronization problems.

Communications increases have alleviated these concern thus permitting large tactical, operational and strategic leaps to occur during this era. As we departed the Classic European centuries with Moltke's introduction of a decentralized approach to Command and Control with his envelopment tactic; not unlike the naval Commanders at sea, communication technological improvements have caused a similar occurrence and shift towards a more centralized approach in modern day armies as well. Although tactics continued to improve along the lines Moltke had initiated, the decentralized portion of the Command and Control aspect, as observed both here and in the previous section, has been mitigated by technology.

As we conclude our historical look at the evolution of Command and Control, it is quite obvious to see that Command evolved from a very centralized approach in 500B.C. with Sun Tzu, to an attempt to decentralize it in the late nineteenth century with Moltke. Technological advances, starting with the advent of railroads and the telegraph to more modern advances such as email and internet, have caused mankind to migrate back to a centralized full control type of approach to warfare. We also saw that the naval environment, by the very nature of its operations, necessitated a very decentralized approach to Command and Control and it too, with the technological advances of the past two hundred years, developed the capability of exercising a very centralized approach to Command and Control. Human tendency appears to gravitate towards a state of complete

control when dealing with Command and Control in areas of warfare – taking us full circle, right back to the ages of Sun Tzu.

2.3 Re-Defining Command and Control

As seen in the previous section, no real attempts had been made in the past two thousand years to re-define Command and Control since Sun Tzu in 500 B.C., however this is a topic that in the 20th century generated much discussion, and in the past fifty or sixty years, about as many definitions. The concept of Command and Control, also known as C², has grown considerably in recent years to a whole array of varied acronyms, from C²I, to C³I², to C⁴ISR; to name but a few.⁶² With international organizations such as the North Atlantic Treaty Organization (NATO) and the United Nations (UN) which have come into existence since the end of the World War II, it is not surprising that there has been such an effort to put forward, in a succinct fashion, an all encompassing definition for Command and Control. NATO in particular defined Command and Control as:

“The exercise of authority and direction by a designated commander over assigned forces in the accomplishment of the force’s mission. The functions of command and control are performed through an arrangement of personnel, equipment, communications, facilities and procedures which are employed by a commander in planning, directing, coordinating and controlling forces in the accomplishment of his mission.”⁶³

It is the latter part of the century; much effort has been put into achieving a succinct definition for Command and Control. More specifically the research conducted by Dr. Ross Pigeau and Carol McCann from DRDC-Toronto will be treated in this section. This

⁶²Ross Pigeau and Carol McCann, “Re-Conceptualizing Command and Control,” *Canadian Military Journal*, (Spring 2002), 53.

⁶³Ross Pigeau and Carol McCann, *Clarifying the Concepts of Control and Command*, (Toronto: Defence and Civil Institute of Environmental Medicine, 1999), 1-2.

section will attempt to synthesize the work of Pigeau/McCann with an attempt to determine why re-defining Command and Control as a concept was deemed necessary, as well as draw comparisons with their proposed definitions with those proposed by Sun Tzu in 500 B.C.

2.3.1 The Need for a New Definition

According to Pigeau/McCann, a definition "...should concisely embody the essence of a concept, giving it significance and precise meaning, encapsulating its nature and key qualities."⁶⁴ The text goes on to state that a definition provides an available and authoritative anchor for deriving new ideas and interpretation and that it should be neither ambiguous, redundant nor simply descriptive. If we examine the NATO definition above as well as the Maritime Command (MARCOM) definition presented in a sub-subsequent section, we can easily see that each of these definitions are focused on the concept of control measures as they apply to Command. This very concept was highlighted as we progressed through our historic review of Command and Control in that it was control measures that have evolved over time vice Command proper; that technology was providing greater and greater means of exercising control, which served as a tool for Command. This sums up quite succinctly the argument brought forward in the first chapter when it was shown that NEOps essentially is an enabler to Command, hence another tool in the toolbox of control measures. Although these definitions have addressed means by which Command should be exercised, they fail to address the heart of the issue – what is the purpose of Command and Control.

⁶⁴Ross Pigeau and Carol McCann, *Re-defining Command and Control*, (Toronto: Defence and Civil Institute of Environmental Medicine, 1998), 2.

After a great deal of research, both nationally and internationally, the team developed the following definitions for both Command and Control.

“Control: those structures and processes devised by command to enable it and to manage risk.

Command: the creative expression of human will necessary to accomplish the mission.”⁶⁵

The definition for control quite deliberately made use of the word command, as their research suggested a noticeable dependency, in that control cannot be exercised without command to initiate it in the first place. Although these definitions offer clear, simple explanations to each term and a suggested link between the two, they also proposed as part of their research a definition for Command and Control as a concept, ie. C² as a whole vice two entities. As such, C² was defined as “... the establishment of common intent and the subsequent transformation of intent into coordinated action.”⁶⁶

We can see that throughout the definitions, there is a recurring theme which links everything back to the Commander, the individual, the human. For C², the Commander is the individual who defines the intent. For Control, the definition proper links the whole of control back to Command, and lastly the definition for Command utilizes the creative expression of ‘human will’. Although the proposed definition for Command is quite broad, and can be expressed by any individual, this creative expression of ‘human will’ is expected of the Commander as he is the individual who has the responsibility, authority and likely has the required competency to effectively influence and achieve the mission.

⁶⁵Ross Pigeau and Carol McCann, “Re-Conceptualizing Command...”, 56.

⁶⁶Ross Pigeau and Carol McCann, *Taking Command of C2*, (Toronto: Defence and Civil Institute of Environmental Medicine, 1996), 3.

As we have seen in this section, the results of the research conducted by Pigeau/McCann have resulted in simplistic definitions of Command, Control and C². Each of these definitions gravitates around a common theme highlighting the importance of the human in the command process. The concept of competency, authority and responsibility associated with command will be discussed in greater detail in the next section.

2.3.2 Competency, Authority, Responsibility (CAR)

The research conducted by the DRDC team in Toronto with reference to Command and Control yielded the definitions identified in the previous section. It became quite obvious based on their research that ‘Command’ would need further development as their definition made it possible for ‘Command’ to be exercised by anyone with no distinguishing factors. For example, what would distinguish the command capability of general officers from that of a raw recruit? It is based on this premise that they established the ‘CAR’ dimensions of Command capability. ‘CAR’ incorporates three factors; those being: Competency, Authority and Responsibility.⁶⁷ In this section we will examine each of these in turn as they apply to the Pigeau/McCann model of Command, and how Commanders at all levels must strive to operate within the Balanced Command Envelope (BCE) developed as a result of the ‘CAR’ model. This section will also illustrate how higher levels of command must ensure that they entrust their subordinates with the appropriate levels of authority and responsibility given a competency level in order to operate effectively within the BCE.

⁶⁷Ross Pigeau and Carol McCann, “Re-Conceptualizing Command...”, 57.

Competency

In order to properly and effectively command, certain skill sets and abilities are required for a variety of missions. Therefore, competencies can be broken down into four separate sub-categories: *physical, intellectual, emotional and interpersonal*.⁶⁸

The first sub-category, *physical competency*, involves more than brute strength. According to their research, it also must factor in sensory motor skills, health, agility and endurance.⁶⁹ Most of these physical items are pre-requisites within most military organizations as part of the selection/recruiting process, but the most important factor to understand here, is that despite technological advances such as improved weapons, night-vision goggles etc..., there is still a tremendous dependence on the individual skills associated with the human potential.⁷⁰ This fact directly links back to chapter one and the importance which must be associated with human limitations in the context of NEOps.

The second sub-category, *intellectual competency*, deals direction with the importance and criticality of mission planning, the ability to monitor complex situations, the capability of sound and comprehensive reasoning, the capacity to make inferences, the ability to visualize the battlespace and making rapid risk assessments using sound judgment.⁷¹ Since no two scenarios can ever be exactly the same, of equal importance to this sub-category, the following attributes greatly complement the intellectual competency

⁶⁸Ross Pigeau and Carol McCann, "What is a Commander?" in *Generalship* ..., 84.

⁶⁹Ross Pigeau and Carol McCann, *Clarifying the Concepts* ..., 7.

⁷⁰Ross Pigeau and Carol McCann, "Re-Conceptualizing Command...", 58.

⁷¹Ross Pigeau and Carol McCann, *Clarifying the Concepts* ..., 7.

of an individual. Those are: creativity, flexibility and a willingness to learn.⁷² Militaries worldwide are renowned to spend extensive time developing the physical and intellectual competencies of their personnel, but they tend to spend significantly less effort in developing the next two, which truly bring the human into the equation.

The third sub-category, *emotional competency*, deals with the Commander's resilience, hardiness and his ability to cope in stressful circumstances. Military operations impose a variety of stresses on all individuals, in particular during long deployments, difficult operational circumstances, or perhaps resource starved missions. Equally, if not more so, is the added stress of being separated from family life and the worries associated with the 'homefront'.⁷³ The emotional balance of the Commander can be critical in making appropriate decisions, as well as the ability to maintain a sense of humour. Command's ability to cope in these types of circumstances will likely have a large impact on troop moral – thus having a direct impact on mission effectiveness.

The final sub-category, *interpersonal competency*, deals with Command's ability to interact with subordinates, peers, superiors, the media as well as other government departments. The researchers postulated that social skills developed throughout childhood form the basis for this particular competency. This basis further develops with time into attributes of trust, respect and empathy – all of which contribute to promoting effective teamwork.⁷⁴ Also included here and equally important is Command's ability to clearly articulate themselves both verbally and in writing.

⁷²Ross Pigeau and Carol McCann, "What is a Commander?" in *Generalship* ..., 84.

⁷³Ross Pigeau and Carol McCann, *Clarifying the Concepts* ..., 7.

⁷⁴*Ibid.*, 7.

As we have seen in this section, overall Command competency is made up of four different characteristics, physical, intellectual, emotional and interpersonal. The first two comprise attributes which can be taught, nurtured and refined. The final two are made up of attributes defining who we are as individuals, our upbringing and to some extent our social development as human beings. These last two factors are the ones which contribute the most in distinguishing the competency dimension from one individual to another. The next dimension which will be examined is Authority.

Authority

Authority is the second dimension of the ‘CAR’ model. Specifically, authority refers to Command’s ‘domain of influence’, and the degree to which a Commander is empowered to act.⁷⁵ The researchers further sub-divided authority into two sub-categories; those being: legal authority and personal authority. Each of these will be further developed below.

The first sub-category of authority, *legal authority*, is the power to act as assigned by a formal agency outside the military – typically the government. It is explicit in nature, in that it is specifically designated or assigned. This authority provides commanders resources and personnel to accomplish assigned missions. Militaries also have the authority to enforce obedience and instill discipline among their members; a circumstance which is far different from other private or government organizations. Also, militaries, commanders in particular, can place their members in harm’s way if the demands of the

⁷⁵Ross Pigeau and Carol McCann, “Re-Conceptualizing Command...”, 58.

mission so dictate. These legal authorities are the crux of what separates command positions from managerial ones.⁷⁶

The second subset of authority, *personal authority*, is informally given to an individual by his/her peers and subordinates. This type of authority is earned with time based primarily on reputation, experience and character. It is earned typically thru the age old adage ‘lead by example.’ The researchers postulated that there is a direct correlation between *personal authority* and competency. Ethics, values, courage (physical and moral) and integrity are the attributes which form the basis of the adage ‘lead by example’ and thus contribute most to establishing *personal authority*.⁷⁷

In concluding this section, it is obvious that the key when dealing with the dimension of command authority is striking an effective balance between the two. Legal authority would be provided to formalize power, and personal authority would be established to motivate the will and the desire in subordinates, thereby create an effective balance of authority within one’s command.⁷⁸ The next dimension which will be examined is Responsibility.

Responsibility

The final dimension of Command in the ‘CAR’ model which will be examined is *responsibility*. *Responsibility* deals with the degree which an individual accepts moral

⁷⁶Ross Pigeau and Carol McCann, “What is a Commander?” in *Generalship ...*, 85.

⁷⁷Ross Pigeau and Carol McCann, “Re-Conceptualizing Command...”, 59.

⁷⁸*Ibid.*, 59.

liability and obligation which are commensurate with Command.⁷⁹ There are two types of responsibility which will be developed, those being: *extrinsic and intrinsic*.

The first sub-category of responsibility is *extrinsic responsibility*. *Extrinsic responsibility* is the degree to which an individual feels accountable both up to superiors and down to followers.⁸⁰ It therefore is correlated to both legal authority (assigned by superiors) and personal authority (earned by subordinates), and as such should ensure that Command dispenses power responsibly.⁸¹

The second sub-category of responsibility is *intrinsic responsibility*. *Intrinsic responsibility* is the amount of self-generated obligation that one feels towards a military mission – it is the level of ownership and commitment taken by Command to execute the task given. There is a close association between *intrinsic responsibility* and the concepts of honour, loyalty and duty – in essence the military ethos.⁸² The researchers have argued that out of all the dimensions associated with Command, that *intrinsic responsibility* is the most fundamental. They assess that this is the driving force behind the creativity which is deemed essential in their definition of Command. In fact, they argue that *intrinsic responsibility* is the most difficult dimension to achieve in Command as it is unique to the human and as such varies from individual to individual.⁸³

⁷⁹Ross Pigeau and Carol McCann, *Clarifying the Concepts ...*, 8-9.

⁸⁰Ross Pigeau and Carol McCann, “What is a Commander?” in *Generalship ...*, 86.

⁸¹Ross Pigeau and Carol McCann, “Re-Conceptualizing Command...”, 59-60.

⁸²*Ibid.*, 60.

⁸³Ross Pigeau and Carol McCann, *Clarifying the Concepts ...*, 9.

In conclusion to this section on responsibility, it is clear to see that responsibility both extrinsic and intrinsic have a very human aspect associated with them as each demands of the Commander (the human) to take on/assume responsibility in whatever the context provided. The reactions to the assumption of responsibility will never be the same in two individuals faced with the similar factors as each will draw from their respective experiences and associate with the problem differently – bringing in a very human dimension to Command.

As a general conclusion to this section, we have examined in greater detail the three dimensions associated with the ‘CAR’ model as described by Pigeau/McCann. In doing so, we have been able to establish and further qualify their proposed definition for Command. The three dimensions undoubtedly bring forward a great deal of perspective on the intricacies of human behaviour, up bringing and socialization on Command. Figure 1-7 shown below graphically illustrates the ‘CAR’ model, with the three dimensions of command represented. In order to properly apply the graph, you must first assume a fixed level of competency, whether that is at a low point, depicting a fairly junior individual, or a high point, representing a fairly senior one. Once you have selected your competency level, you can then look more cohesively at the dimensions of responsibility and authority. As shown, for a mid-level of competency, the following four resulting commands can be extracted based on low or high levels of responsibility and authority. Those are; Dangerous Command, Maximal (balanced) Command, Minimal (balanced) Command and Ineffectual Command. Therefore, a Commander placed in a situation of high responsibility and given low to no authority is placed in a situation of Ineffectual

Command. A recent example of such a situation would be General Roméo Dallaire and his command of UNAMIR in Rwanda. Another example of the model would be a Commander placed in a position of high authority (whether assigned or earned) but assumes no responsibility (extrinsic or intrinsic), and as such is in a position to abuse his or her Command. The other two quadrants will be discussed further in the next section on the Balance Command Envelope.

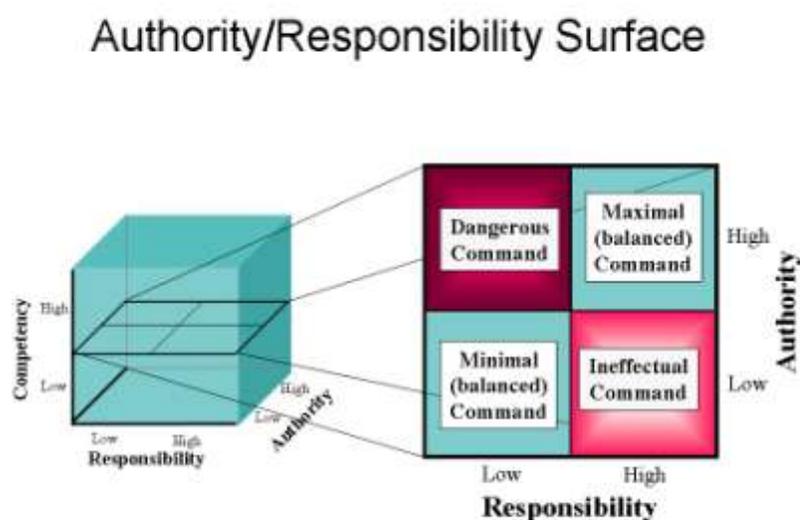


Figure 1-7: Authority/Responsibility Relationship in CAR Structure with Competency at Fixed Level
 Source: Carol McCann and Ross Pigeau, DRDC – Toronto. Presentation at Canadian Forces College, 30 August, 2006.

2.3.3 Balanced Command Envelope (BCE)

As explained in the previous section, command capability is measured over three separate and distinct dimensions. When put together, these three dimensions form a three dimensional space known as the command space, and that all commanders operate within that space depending on their varying levels of competency. This is illustrated in figure 1-7

above. Taking this one step further, Figure 1-8 below, illustrates the Balanced Command Envelope (BCE). The BCE deals with the Minimal (balanced) Command and the Maximal (balanced) Command quadrants. In essence, and optimally, the BCE depicts an individual's military career as they progress through the ranks, starting at a low 'CAR' in the command space and progressively over time stepping towards the high area in 'CAR'. Individuals finding their command capabilities outside of the BCE essentially run the risk of a compromised command capability. The researchers argued that it is in the military's best interest to ensure that most of their personnel fall within the BCE.⁸⁴ The BCE essentially brings the entire concept of 'CAR' together as it applies to Command, and serves as a visual tool to illustrate and bring the whole together.

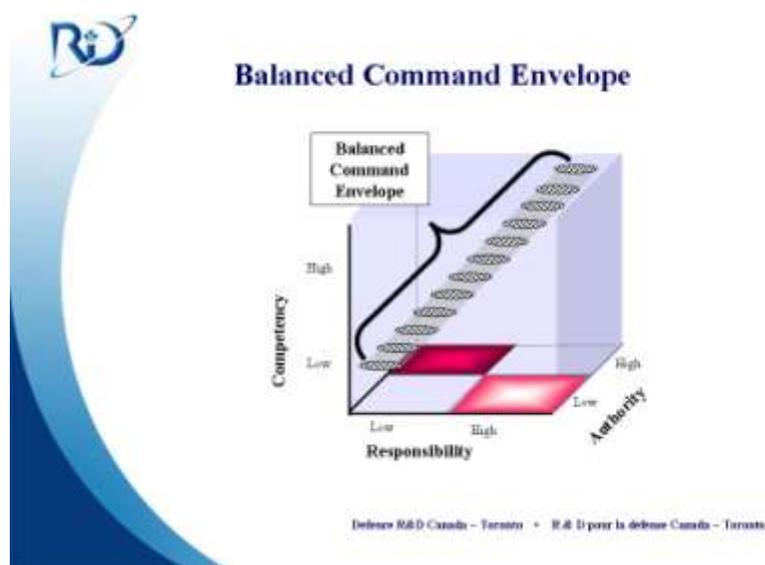


Figure 1-8: Balanced Command Envelope

Source: Carol McCann and Ross Pigeau, DRDC – Toronto. Presentation at Canadian Forces College, 30 August, 2006

⁸⁴Ross Pigeau and Carol McCann, *Clarifying the Concepts ...*, 9-10.

In conclusion to this section, we have examined the essence of the research conducted by Dr. Pigeau and Ms McCann on the topic of Command and Control. In doing so, we were able to establish that in fact there was a need to succinctly re-define Command and Control, and that based on their proposed definitions, as well as the accompanying dimensions associated with Command through the ‘CAR’ model that in fact Command is the creative expression of human will necessary to accomplish the mission. Control, being those structures and processes devised by command to enable it and to manage risk, thus becomes supported by technology in order to properly enable command to manage the risk associated with the mission and the tools required to do so. Pigeau/McCann have also cleverly illustrated their ‘CAR’ model graphically, and taken it one step further with the Balanced Command Envelope (BCE) to illustrate how an individual should mature from a command perspective with successive increases in competency. An added benefit of their modeling is that it helps identify potential trouble areas as they relate to command capabilities – areas which, if identified early enough can potentially be re-organized to ensure success. General Dallaire’s command of UNAMIR is a perfect example of potentially such an instance.

In conclusion to the chapter, we have effectively defined what is meant and associated with the term Commander. We have also established that the concept of Command and Control dates back as early as the writings of Sun Tzu in 500 B.C. and through a historical lens, have established that until the twentieth century, few attempts had been made in defining Command, but that rather as technological advances commenced in the eighteenth and nineteenth centuries, control was directly affected, resulting in greater

flexibility of command. We reviewed in extensive detail the latest research conducted by DRDC-Toronto by Dr Ross Pigeau and Carol McCann and concluded that their research efforts have succinctly re-defined Command and Control. Through the use of the 'CAR' model (Competency, Authority and Responsibility), all dimensions they have associated with Command, they have graphically captured and depicted what they called the Balanced Command Envelope (BCE). This envelope serves as a tool to illustrate based on varying levels of competency, where command capabilities may lie based on associated levels of responsibility and authority.

Conclusion and Recommendations

“Warfare is about human behavior in a context of organized violence directed toward political ends. So, network-centric warfare (NCW) is about human behaviors within a networked environment. “The network” is a noun; the information technology can only be the enabler. “To network” is the verb; the human behaviour, the action, and the main focus. So, implementation of NCW must look beyond the acquisition of the technical enablers to individual and organizational behavior, e.g., organizational structure, processes, tactics, and the way choices are made. In other words, all elements of the enterprise are in play.”

*A.K. Cebrowski
Director, Office of Transformation
Office of the Secretary of Defence*

At the outset, this research paper sought to answer whether or not the Commander was being inundated with too much information to effectively perform his duties and whether the systems which were providing him this information were also eroding the traditionally accepted authorities and responsibilities associated with his Command and Control.

After examining the approach of four separate nations (AUSCANUKUS) with reference to their approach in implementing NCW it became clearly evident that all three nations had reached similar conclusions – the human must be placed first and foremost with further implementation of NCW. It was also shown that the initial implementation of NCW by these countries was somewhat rushed as a result of various external factors, which necessitated a rapid exchange of information which NCW provided.

As a result of this rush of technology to the battlefield, comparisons were drawn between the new network-enabled battlespace and what has become known as the common-business practices of the civilian sector. It was shown that the gap between the two has

shrunk to the point of being practically unrecognizable. It was also demonstrated that the more technology is acquired, the more one tends to become very dependant on it, to the point where society cannot function properly without it. The military is no exception to this rule notwithstanding the redundancies built into 'military grade' hardware and software, if the systems go down, the military will find itself somewhat left in the dark. It was also shown that the human being can only process so many inputs and that the newly networked force provides far too many inputs for any one operator to effectively process. Our quest for technical advancement has in effect saturated the human capacity to process, and as a result, better decision-making aids will need to be developed. First and foremost, proper workstation ergonomics must be integrated, allowing the operator to function with ease from one workstation which allows data fusion from the various systems which are being operated. Also, measures must be taken to develop intelligent software assistants and decision support matrices which permit the Commander to be presented with the right information at the right time to allow him to make accurate and timely decisions – a state which is not currently optimally supported. In essence, the Commander requires the appropriate tools to effectively navigate the virtual sea of endless data. The first part of the research paper hence concluded that in fact the advent of NCW was inundating the Commander, which affected his capability of making the appropriate decisions at the critical times.

The second part of the research paper was dedicated to identifying the importance of the Commander in effecting proper Command and Control. This was done by examining Command and Control from a historical perspective, and identified that in fact Command and Control can be found in the earliest of military writings, dating back to Sun Tzu in 500

B.C. It was also shown, that throughout the ages, and up until the twentieth century, there was little effort made in re-defining Command. Control however substantially changed, in particular with the technological advancements of the eighteenth and nineteenth centuries.

A synopsis of the research conducted in the late twentieth century by DRDC-Toronto was presented with the goal of illustrating the latest research conducted on the topic of Command and Control. The Pigeau/McCann 'CAR' (Competency, Authority, Responsibility) model was reviewed as it applied to and amplified their definition of Command. As well, the Balanced Command Envelope (BCE) was presented as a tool for determining command capability given various levels of competency. The ultimate objective of this section was to prove unequivocally that technological advancements serve as a means to provide increased control, and that control is a tool used by command to mitigate risk. Therefore based on the Pigeau/McCann research, NCW/NEOps serves as another tool for Command and therefore must be structure in such a fashion as to provide the requisite support – which is the current problem. Also, the second portion of the thesis statement can be addressed here. NCW/NEOps has provided superior commanders with the tools to centralize command at their leisure and have effectively eroded the traditionally accepted views of Command. In applying the Pigeau/McCann model, NCW has allowed for a reduction of authority but not responsibility which resides with the Commander, precipitating him or her into a situation of potentially ineffectual command.

It was shown that society becomes technology dependant, and that the military is no exception to this rule. As such, a reversal of the advancements made is not a viable solution to the information overload of the Commander. The only alternative is to continue with the developments of better ergonomics, data fusion, intelligent software assistants and decision

support matrices, in order to reduce individual operator overloads. As for the erosion of Command, the only solution to this problem is education at the highest levels of the potential effects associated with our desire to delve into a subordinate commanders affairs, which effectively strip away his authority – in particular his legal authority, but to some extent, his personal authority as well.

As such, in answer to the question: “*Is the Commander, with the advent of NCW, being inundated with too much information to effectively perform his duties and are the very systems providing him this information also eroding the traditionally accepted Command and Control authority and responsibility which lie with him?*”; the answer has been unequivocally shown to be true on both counts.

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