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14. ABSTRACT
Command and control (C2) has evolved throughout the ages and is turning point for a paradigm shift in this age of the Information Environment. Analysis of the term command and control indicates it is neither properly defined for the complex coalition nor interagency operations that prevail today and the future. This paper reviews the current joint definitions and discusses the proposed replacement lexicons. It then reviews how generational characteristics must be understood and applied in the leveraging of technology in the development of the C2 systems across the operational level. Technology, while a driver of C2, cannot replace the human element. The architecture of tomorrow is more important than the system and there are echelons when removed facilitate a compression of C2 systems across the joint force. Operations centers will provide synergy throughout the operational level of war and serve as hubs that dispersed tactical units can access. Finally, the paper draws conclusions regarding how the Information Environment will allow for the compression of C2 architectures, common structures among operations centers, well crafted and communicated commanders' intent and systems that conform to the generational characteristics.

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COMMAND AND CONTROL – PARDIGM SHIFT AHEAD

by

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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Abstract

Command and control (C2) has evolved throughout the ages and is turning point for a paradigm shift in this age of the Information Environment. Analysis of the term command and control indicates it is neither properly defined for the complex coalition nor interagency operations that prevail today and the future. This paper reviews the current joint definitions and discusses the proposed replacement lexicons. It then reviews how generational characteristics must be understood and applied in the leveraging of technology in the development of the C2 systems across the operational level. Technology, while a driver of C2, cannot replace the human element. The architecture of tomorrow is more important than the system and there are echelons when removed facilitate a compression of C2 systems across the joint force. Operations centers will provide synergy throughout the operational level of war and serve as hubs that dispersed tactical units can access. Finally, the paper draws conclusions regarding how the Information Environment will allow for the compression of C2 architectures, common structures among operations centers, well crafted and communicated commanders' intent and systems that conform to the generational characteristics.

Introduction

Command and Control (C2) structures as described in current joint doctrine are unsuitable for the future military operations. C2 has tenets that continue to evolve while some of its other fundamentals are timeless. At first, C2 seems to be a static and an easily definable function, yet its definitions and the components of C2 have evolved as much as the manner of war they were designed for - ensuring victory in battle. The Joint Force Commander (JFC) of the future is far from exempt in addressing the continual evolution of C2.

There fails to be a single, universally accepted definition for C2. Even when dissected into separate components, subtleties arise showing diversity in concept and basic definition. Further complicating matters are the difficulties inherent in establishing C2, coordination, and intent across the Interagency, International Governmental Organizations (IGOs) and Non-Governmental Organizations (NGOs). The concept of C2 used throughout the Joint Force and specified in the Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, cannot easily be applied to these organizations leading to a need to redefine this age old concept.

The joint C2 architecture will be significantly different in 20 years as the overall architecture flattens due to an adaptation of a variety of known and unknown innovations. C2 will be influenced by the allocation of decision rights, patterns of interaction and the ability to distribute information. The Information Environment will facilitate the movement from classic C2 to edge C2 creating edge organizations through its three interrelated dimensions: physical, informational and cognitive.^{1,2} This will allow for the compressing of

¹ The Information Environment, a term of art, is defined as; the aggregate of individuals, organizations, and systems that collect, process, disseminate, or act on information. The actors include leaders, decision makers,

C2 structures across the joint force. While C2 may not be compressed during all operations it will retain a capability to be compressed in a scalable fashion during operations. Such compression is required to allow the Joint Force Commander to shrink his Observe, Orient, Decide and Act (OODA) loop to prevent the enemy from operating inside it. Future state adversaries are working diligently to exploit the U.S. C2 systems and structures. Non-state hybrid forces also are developing the ability to adapt systems, in particular information systems, structures, and strategies which will allow hybrid forces to outmaneuver conventional forces and the bureaucracies that govern them.³

Overly restrictive or sub-optimized C2 processes have the ability to put elements of the force at greater risk in the future.⁴ As future forces will most likely operate in Joint Distributed Operations (JDO) there are many factors the JFC must consider to optimize C2 of

individuals, and organizations. Resources include the materials and systems employed to collect, analyze, apply, or disseminate information. The information environment is where humans and automated systems observe, orient, decide, and act upon information, and is therefore the principal environment of decision making. ...The information environment is made up of three interrelated dimensions: physical, informational, and cognitive...These dimensions are inextricably linked. The *physical dimension* is composed of the command and control (C2) systems, and supporting infrastructures that enable individuals and organizations to conduct operations across the air, land, sea, and space domains. It is also the dimension where physical platforms and the communications networks that connect them reside. The *informational dimension* is where information is collected, processed, stored, disseminated, displayed, and protected. It is the dimension where the C2 of modern military forces is communicated, and where commander's intent is conveyed. The *cognitive dimension* encompasses the mind of the decision maker and the target audience (TA). This is the dimension in which people think, perceive, visualize, and decide. It is the most important of the three dimensions. This dimension is also affected by a commander's orders, training, and other personal motivations. Battles and campaigns can be lost in the cognitive dimension. Factors such as leadership, morale, unit cohesion, emotion, state of mind, level of training, experience, situational awareness, as well as public opinion, perceptions, media, public information, and rumors influence this dimension. (Joint Publication (JP) 3-13, Washington, DC: CJCS, 9 October 2006, I-1 – 2)

² *Edge C2* is characterized by a robustly networked collection of entities having widespread and easy access to information, sharing information extensively, interacting in a rich and continuous fashion, and having the broadest possible distribution of decision rights. The objective of Edge C2 is to enable the collective to self-synchronize. *Edge organization* is a configuration of participants that have no predefined structure. Participants are not assigned to teams or roles, and every participant has access to all information sources. *NATO NEC C2 Maturity Model*, DoD Command and Control Research Program report (Washington, DC: CCRP Publication Series, February 2010)

³ Richard M. Crowell, *Analyzing Hybrid Warfare*, (Newport, RI: Naval War College, August 2010), 3.

⁴ U.S. Joint Forces Command Joint Warfighting Center, *Commander's Handbook for Joint Distributed Operations*, (Suffolk, VA: USJFCOMJWC, 1 September 2010), 23.

the joint force.⁵ It is imperative that Operational commanders, as well as Service doctrine, leverage a rapidly evolving Information Environment allowing for the optimization of future joint C2 by harnessing the generational traits of Digital Natives, technology, and Component Operation Centers.⁶

What Is Command And Control?

While the question seems simple enough, the complexity of the subject becomes readily apparent in trying to define it. C2 is one of the traditional functional concepts of doctrine, and further explained by Milan Vego as “a process that uses command organization in accomplishing assigned military objectives.”⁷ This process of command organization is not readily apparent in the Joint Pub 1-02 definition of C2:

The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission.⁸

Further dissecting the components, command is defined as:

1. The authority that a commander in the armed forces lawfully exercises over subordinates by virtue of rank or assignment. Command includes the authority and responsibility for effectively using available resources and for planning the employment of, organizing, directing, coordinating, and controlling military forces for the accomplishment of assigned missions. It also includes

⁵ Joint Distributed Operations are joint operations characterized by forces widely dispersed in multiple domains throughout an operational area, often beyond mutually supporting range and operating independently of one another because of distance or differing missions or capabilities, but supported by a variety of non-organic capabilities. The size of these distributed units will vary with the situation, but the idea is that these are formations traditionally not expected to be operationally self-sufficient for extended durations. These distributed elements will require support from other assets under the control of the JFCs. Therefore, the defining attributes of joint operations are the dispersal of joint force elements throughout the operational area and the extensive use of non-organic capabilities to support them. (*—The Concept of Joint Distributed Operations*”, Norfolk, VA: JFCOM, November 2009)

⁶ Digital Natives will be explained and further discussed later in the paper on pg 11.

⁷ Milan Vego, *Joint Operational Warfare*, (Newport, RI: U.S. Naval War College, 2007), XII-28.

⁸ U.S. Office of the Chairman of the Joint Chiefs of Staff, *Department of Defense Dictionary of Military and Associated Terms*, Joint Publication (JP) 1-02 (Washington, DC: CJCS, 12 April 2001 as amended through 31 July 2010), 84.

responsibility for health, welfare, morale, and discipline of assigned personnel. 2. An order given by a commander; that is, the will of the commander expressed for the purpose of bringing about a particular action. 3. A unit or units, an organization, or an area under the command of one individual.⁹

Control is defined as:

1. Authority that may be less than full command exercised by a commander over part of the activities of subordinate or other organizations. (JP 1)... 3. Physical or psychological pressures exerted with the intent to assure that an agent or group will respond as directed.¹⁰

Additionally commanders will often add their touch by trying to reduce the definitions for their subordinates as seen by Commander, United States Fleet Forces (USFF) Serial 002.

Command is the authoritative act of making decisions and ordering action. Command is a function of responsibility, authority and accountability. Control is the act of monitoring and influencing action.¹¹

While encompassing some attributes of the joint definitions, the USFF definition fails to capture the scope of the process.

With this in mind, it is easy to recognize issues arising as the military interlaces with the Interagency, IGOs and NGOs. While these definitions sit well with those in the military, the mere concept of C2 being used to describe the relationship with non-military organizations can be the impetus for these non-military organizations to walk out of a coordination center.

There is much discussion around the term “command and control” and how it has become a significant impediment to progress and unity of effort.¹² Military members (especially those of the senior ranks) are extremely comfortable with the notion of C2 and the

⁹ Ibid

¹⁰ Ibid., 101.

¹¹ U.S. Office of the Commander of U.S. Fleet Forces Command, *Command and Control*, Serial 002 (Norfolk, VA: USFF, January 2010), 1.

¹² David S. Alberts, “Agility, Focus, and Convergence: The Future of Command and Control,” *The International C2 Journal* 1, no. 1 (2007): 1.

wire diagrams resulting from it. The fact remains that C2 is a solution to a continually changing problem set. This has never been more evident than in today's Information Age. The assumptions on which our C2 structures are based on have fallen by the wayside, and prove to be less than effective in coalition operations and complex multi agency endeavors.¹³ Martha Maurer in her 1994 book, *Coalition Command and Control*, explored the concept of C2 warfare during coalition operations. Maurer based her investigation around the context that C2 must provide for unity of effort, centralized direction, decentralized execution, common doctrine and interoperability.¹⁴ As Maurer tackled issues such as exercise of authority, who defines the limits of authority and who is the authority, it became clear the traditional constructs of C2 must be rethought.¹⁵

One may ask, “If not C2, then what?” and “Why change?” These are the classic questions expected from military personnel. The Information Environment allows the military to surpass the days when the commander stood on the hill to observe the battle space. The commander in the past was able to use his direct observations, observe and orient himself to make decisions via his own cognitive processes vice relying on Google Earth™ and Power Point™ presentations that attempt to “kluge” terabytes of information into actionable intelligence.¹⁶ Even as one leverages technologies to connect the cognitive element to the battlefield, it is clear that the military networking of systems complicates the issue.¹⁷

¹³ Ibid., 3-4.

¹⁴ Martha E. Maurer, *Coalition Command and Control* (Washington, DC: National Defense University Press Book, 1994), 18-19.

¹⁵ David S. Alberts, “Agility, Focus, and Convergence: The Future of Command and Control,” *The International C2 Journal* 1, no. 1 (2007): 6.

¹⁶ U.S. Air Force, *Information Operations*, Air Force Doctrine Document (AFDD) 2-5 (Washington, DC: Department of the Air Force, 11 January 2005), 2.

¹⁷ Ibid., 1-2.

In today's complex operations, often encompassing scores of non-military organizations, there is no "unified commander"; thus, all-encompassing "unity of command" becomes an irrelevant concept. This is due in part to civilian organizations refusing to fall, or wishing to avoid the perception that they fall under military or governmental control. So the U.S. military attempts to gain consensus through unity of effort through the commander's intent which no longer targets just a military audience. Alberts and Hayes in their book, *Understanding Command and Control*, showed there were numerous instances when there is no supreme or higher authority that can, in practice, determine intent. What is important is that the behaviors of the entities involved act as if they are working toward some common purpose."¹⁸ Pigeau and McCann's work in 2000 on, *Re-defining Command and Control*, presented that intent conveyed using words only covers a small fraction of the overall communicated intent. A much greater part is "unvocalized or implicit, consisting of expectations that commanders group into personal expectations, military expectations and cultural expectations."¹⁹ Furthermore, many have concluded the word *control* fails to properly describe the realities and "sends the wrong message," only adding to the aforementioned confusion.^{20,21} As stated in 1996 in MCDP 6, *Command and Control*:

Given the nature of war, the remarkable thing is not that commanders cannot be thoroughly in control but rather that they can achieve much influence at all. We should accept that the proper object of command and control is not to be thoroughly and precisely in control.²²

¹⁸ David S. Alberts and Richard E. Hayes, *Understanding Command and Control*, (Washington, DC: DoD Command and Control Research Program Publication Series, January 2006), 37.

¹⁹ Ross Pigeau and Carol McCann, *Re-defining Command and Control. In the Human in Command: Exploring the Modern Military Experience* (New York: Kluwer Academic/Plenum Publishers, 2000), quoted in David S. Alberts, "Agility, Focus, and Convergence: The Future of Command and Control," *The International C2 Journal* 1, no. 1 (2007): 15.

²⁰ Ibid.

²¹ N2N6, *C2 of the Futures Conference* (Washington, DC: May 2010).

²² U.S. Marine Corps, *Command and Control*, Marine Corps Doctrine Publication (MCDP) 6 (Washington, DC: Headquarters U.S. Marine Corps, 4 October 1996), 43.

While not making the leap in 1996 to change the lexicon, it identifies the traditional construct no longer fits the environment.

Alberts in his 2007 article, *Agility, Focus, and Convergence: The Future of Command and Control*, introduces the terms of *focus*, to replace command, and *convergence* to replace control. He uses *focus* to define intent, awareness, shared awareness, understanding, and shared understanding representing a synthesis of how situations are perceived and understood.²³ He presents the idea that convergence by itself does not imply moving in the right direction, only movement toward something, whether or not it is desirable. But combined with focus it is about moving in the right direction, both as individual entities, coalitions or the greater collective.²⁴

While it may seem at first to be only a massaging of terms in order to palliate interagency partners, the idea truly reflects a change due to the information environment.

Figure 1, Hayes visualization of the C2 realm and factors inherent in C2.

²³ David S. Alberts, —Agility, Focus, and Convergence: The Future of Command and Control,” *The International C2 Journal* 1, no. 1 (2007): 19.

²⁴ *Ibid.*, 20.

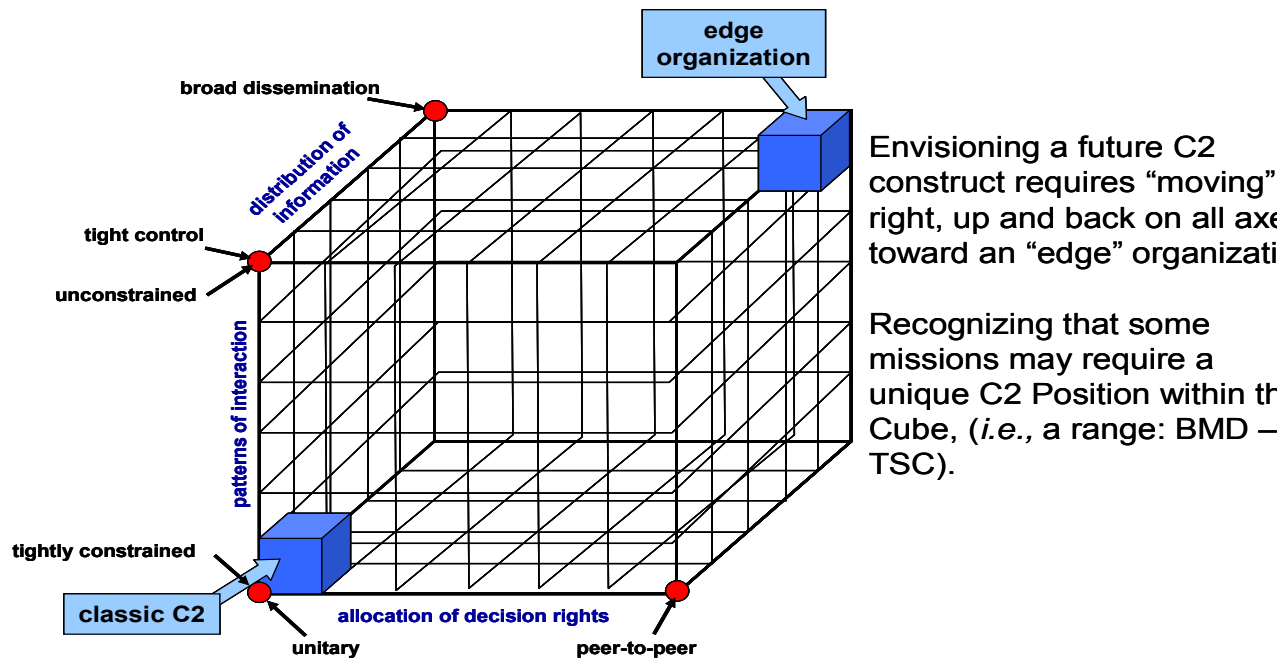


Figure 1 C2 Approach Space. (David S. Alberts, “Agility, Focus, and Convergence: The Future of Command and Control,” *The International C2 Journal* 1, no. 1 (2007): 9)

This figure aptly shows the evolutionary path ahead, as traditional C2 occupies a relatively small set of possibilities in the lower left front corner of this space. The Information Environment and our understanding for the need to evolve will move our practice of C2 in the back and to the right which is occupied by edge organizations. SAS-065, a NATO research group tasked to explore C2, expands Alberts’s research by postulating that the nature and frequency of the interactions that take place between and among the entities increase these interactions shift from the Information Dimension (from sparse to rich exchange of information) to the Cognitive Dimension (from low to high degrees of shared awareness and understanding) and then to the Social [Cognitive] dimension (from low to high sharing of resources).^{25,26} NATO further revised the C2 approach space figure, Figure 2, to graphically represent NATO’s path ahead to an edge organization.

²⁵ SAS-065 is a NATO research task group operating under the auspices of the SAS Panel. It was formed in 2006 for the purpose of developing a C2 Maturity Model for network-enabled operations. SAS-065’s principal products include a detailed description of a NATO NEC Command and Control Maturity Model (N2C2M2)

NATO sees Edge C2 as the information environment, specifically a distributed network facilitating rich and continuous interactions due to the ease of sharing information and the broad distribution of decision rights. With the ultimate objective of Edge C2 to collectively self synchronize.²⁷ NATO describes their goal as:

An Edge approach to C2 distinguishes itself from the other C2 approaches by replacing deliberate and formal coordination collaboration mechanisms with the dynamics of emergence and self-synchronization. In Edge C2 the entities, enabled by a high degree of shared awareness, widespread access to information, and unconstrained interactions, self-synchronize. In terms of the C2 approach space, an Edge C2 approach allows the collection of entities to operate in a region where collective decision rights can be dynamically allocated by rich and continuous interactions and wide-spread sharing of information (the corner furthest from the origin, see figure 2), a space previously associated with Edge organizations.²⁸

with a User Guide (see section entitled *Applying the NATO NEC C2 Maturity Model*) and a revised C2 Conceptual Reference Model (originally developed by SAS-050). SAS-065 builds on the work of a series of research task groups dating back to 1995 that have explored issues in command and control.

²⁶ Alberts, David S., Reiner K. Huber, and James Moffat, *NATO NEC C2 Maturity Model*, DoD Command and Control Research Program report (Washington, DC: CCRP Publication Series, February 2010), 39.

²⁷ Self-synchronization, as a mode of interaction between two or more entities based on highly decentralized C2, refers to the phenomenon of “units linking up with other units, which are either local in a physical sense or local through an information grid or intranet” (Atkinson and Moffat, 2005, p. 41). According to Alberts and Hayes (2003, p. 36), the notion of self-synchronization is consistent with that of self-coordination used elsewhere in place of self-synchronization, defined as the effort to “increase freedom of low level forces to operate near autonomously and re-task themselves through exploitation of shared awareness and commander’s intent” (Rumsfeld, 2003). Among the requirements of self-synchronization are clear and consistent understandings of command intent, high quality information and shared situational awareness, competence at all levels of the force, increased allocation of decision rights, and understanding of the situation, as well as the capabilities and behaviors of appropriate levels of the group; which is based on factors such as training, competence, willingness to be interdependent and trust in the information, subordinates, superiors, peers, and equipment. Key elements of self synchronization are “two or more robustly networked entities, shared awareness, a rule set, and a value-adding interaction. The combination of a rule set and shared awareness enables the entities to operate in the absence of traditional hierarchical mechanisms for command and control. The rule set describes the desired outcome in various operational situations. Shared awareness provides a mechanism for communicating the ongoing dynamics of the operational situation and triggering the desired value-adding interaction” (Alberts et al., 1999, pp. 175- 176).

²⁸ Alberts, David S., Reiner K. Huber, and James Moffat, *NATO NEC C2 Maturity Model*, DoD Command and Control Research Program report (Washington, DC: CCRP Publication Series, February 2010), 61.

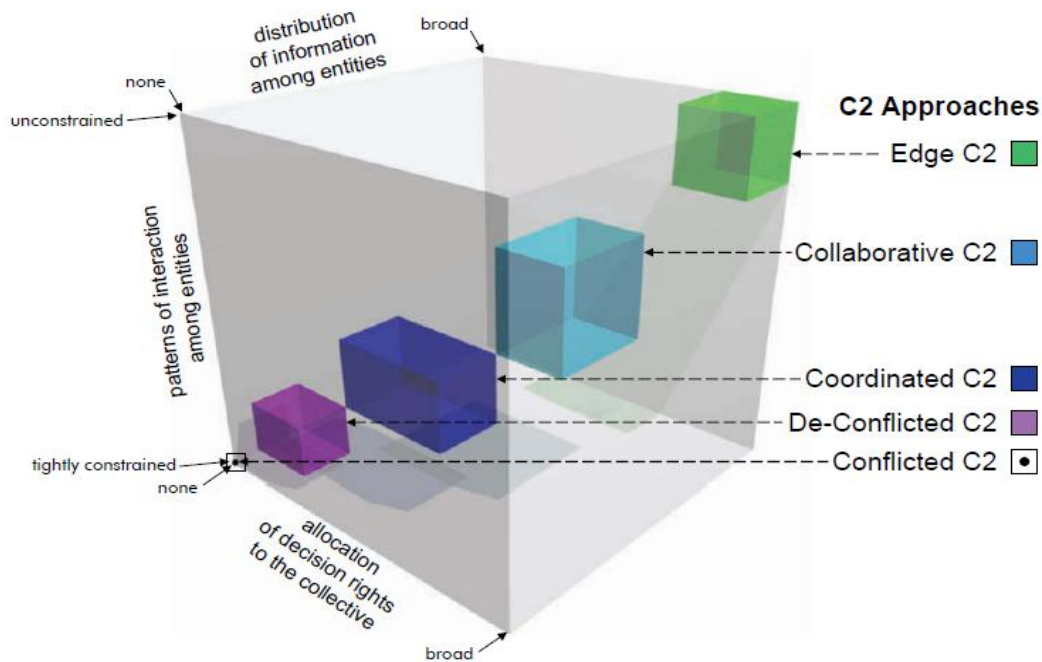


Figure 2 NATO C2 approach. (Alberts, David S., Reiner K. Huber, and James Moffat, *NATO NEC C2 Maturity Model*, DoD Command and Control Research Program report (Washington, DC: CCRP Publication Series, February 2010), 66).

NATO is actively addressing the paradigm shift in the C2 world in order to be organized for complex coalition and civil military operations. It intends to use these rich and continuous interactions to execute essential functions of C2 in their approach.²⁹

Hey Lieutenant! How Do I Make the Words Big and Red Again?

If the section title seems humorous, it is because the scenario may be all too familiar. Generational differences can manifest themselves when it comes to utilizing technology. When coupled to the process of C2, the seams in understanding, application, and comfort can become readily apparent. Milan Vego warns that —~~new~~ operational concepts, while embracing new information technologies, must at their very center be based on the human

²⁹ Essential C2 functions include: establishing intent; determining roles, responsibilities and relationships; establishing rules and constraints; monitoring and assessing the situation and progress; inspiring, motivating, and engendering trust; training and education; provisioning. David S. Alberts and Richard E. Hayes, *Understanding Command and Control*, (Washington, DC: DoD Command and Control Research Program Publication Series, January 2006), 47.

element – that is, leadership rather than management – and war fighting.”³⁰ The human element will remain at the center of the C2 process, yet the differences in generational characteristics will create a paradigm shift. The shift will be due to the lack of human to human interaction and the increase of digital interactions and relationships.

Understanding the successive generations is difficult at best. Most leaders have, at some point, scratched their head wondering how their junior subordinates were “wired.” The JFC of the future will, for the first time, have a force solely manned by only digital natives. Digital natives are characterized as having not known anything but a life connected to one another and to the world through a 24/7 network, blending the human with the technical, thus transforming their human relationships fundamentally.³¹ To fully ensure an optimal C2 construct is in place for the future, understanding some of the digital natives’ characteristics is required. Developing a C2 construct with which the leadership of today is comfortable will not meet the needs of the future, nor will it be optimally employed by digital natives.

Examining the characteristics of digital natives ensures development of a system they can employ and one that guard against their lack of understanding of the analog generation. Privacy is a key digital natives’ characteristic. Their idea of privacy is vastly different from those serving today in the senior ranks. When they post information online that past generations would never share, they do so to share their creativity and aspirations. Care must be taken to prevent accidental sharing of intelligence and classified information. While training seems to be the answer from leadership, this shows a failure to understand that keeping information closely held is contrary to everything this generation experiences daily. The digital native see themselves at the center of a social circle with friends and family in the

³⁰ Milan Vego, *Joint Operational Warfare*, (Newport, RI: U.S. Naval War College, 2007), XII-35.

³¹ John Palfrey and Urs Gasser, *Born Digital: Understanding the First Generation of Digital Natives* (New York, NY: Basic Books, 2008), 4-5.

surrounding layer followed by teachers, coaches and mentors, then by trusted companies and software providers, state and finally law enforcement.³² Today's generation must understand how to implement Palfrey and Gasser's Disclosure Decision Model in framing the C2 architecture of tomorrow. In this model people decide what information they disclose, how they disclose it and to whom the information is disclosed based on an evaluation of rewards and risk.³³ By understanding the goals that individuals will attempt to gain, C2 architectures can leverage this and facilitate robust information sharing while reducing inherent risks.

The social interactions that future generations use must be weighed by today's engineers developing future C2 systems. As the digital native does not distinguish between their online identity and their personal identity, this manifests itself in their group memberships within social programs, such as Facebook or MySpace. (The concept of risk is a complex issue that involves not only technology but human aspects as well and is beyond the scope of this paper.) By leveraging the social interactions in tomorrow's C2 systems, information flow between operational commands can be improved, thus facilitating better and timelier information at the tactical and operational levels.

Even the savvy digital natives are faced with the limitations of human processing. A person's short term memory can hold about seven items at once and roughly process 126 bits per second.³⁴ This is easily dwarfed by today's internet information causing even the most talented network users to become overwhelmed in their attempt to find truthful and accurate information. The quality and accuracy issue may not be as significant an issue for classified networks, but will become self evident as the digital natives mine the unclassified networks.

³² John Palfrey and Urs Gasser, *Born Digital: Understanding the First Generation of Digital Natives* (New York, NY: Basic Books, 2008), 11.

³³ *Ibid.*, 24.

³⁴ *Ibid.*, 186.

The JFC of tomorrow will find it much more challenging as information flowing across the unclassified networks is multiplied as it synchronizes with coalition partners and the interagency information. A prime example is the JFC of Joint Task Force - Katrina relying on Microsoft Office Groove residing on the internet.³⁵ The civil authorities are organized under an entirely different C2 construct for emergency response than the joint force. DoD units were initially unaware of the civilian procedures, doctrine and Information Environment tools utilized to be effective.³⁶ Initially, many of the JTF-Katrina staff devoted their efforts to confirming the accuracy and quality of information shared through Groove before forwarding reports to NORTHCOM. In JTF-Katrina, military members were ill prepared to integrate into an interagency environment because their generational characteristics were based heavily on the constructs of traditional C2 and hierarchy among organizations.

Command and Control: More than Just Technology

Ironically, when people think of C2 they usually envision a “widget” or a system of boxes and wires. While technologies play an important part in today’s C2 they are not the sole solution. The Operational Level of War (OLW) effectiveness is sub-optimized by its C2 systems. Joint forces are swimming in an ocean of raw data and the tools do not exist to facilitate turning the data into useful information and eventually knowledge. Bandwidth is also a limiting factor as current architecture fails to adapt as quickly as systems employed. For instance, one Global Hawk UAV uses 500 megabits per second, about five times as much bandwidth as the entire U.S. force in Operation Desert Storm in 1991, while total

³⁵ Microsoft Office Groove is a desktop application designed for document collaboration in teams with members who are regularly off-line or who do not share the same network security clearance.

http://en.wikipedia.org/wiki/Microsoft_SharePoint_Workspace

³⁶ Ivan T. Luke, *Homeland Security – Civil Support: How DoD plugs into the Interagency C2 Structure*, (Newport, RI: Naval War College, August 2008), 6.

available bandwidth remains constant.³⁷ Our Command, Control, Communications, Computers, and Intelligence (C4I) systems must be robust enough to support the total package, from war fighter communications, operational level coordination centers and the centralized control of forward area sensors.

Leadership today must identify a strategy for introducing and using information age technologies that accomplishes two things: first, the identification and avoidance of adverse unintended consequences associated with the introduction and utilization of information technologies; and second, the ability to recognize and capitalize on unexpected opportunities.”³⁸ This will be critical to the JFC of the future as C2 capabilities must enable the commander or decision-maker to dynamically establish or adapt command structures across the force and within staffs tailored to the mission and create the processes that will enable collaboration and information management across the organization.”³⁹

Literature often describes the C2 of the future in capability of systems, networking of these systems and the information they fuse together. While operators of today wait for the future systems, it is worth noting that little research exists on the human element or architectural relationships. It seems DoD is marching forward without heeding Vegos’ warning that C2 must be integrated in both human and technical systems and if forces rely exclusively on information technology there is danger that the C2 process can collapse.⁴⁰

³⁷ Benjamin S. Lambeth, *Air Power against Terror: America’s Conduct of Operation Enduring Freedom* (Arlington, VA: Rand, 2005), 353.

³⁸ David S. Alberts, *The Unintended Consequences of Information Age Technologies*, Director, Directorate of Advanced Concepts, Technologies, and Information Strategies (ACITS) (Washington, DC: National Defense University Press Book, April 2006), 2.

³⁹ The Office of the Assistant Secretary of Defense for Networks and Information Integration / DoD Chief Information Officer, *Department Of Defense Command and Control Strategic Plan*, Version 1.0 (Washington, DC: DoD, 18 December 2008), 6.

⁴⁰ Milan Vego, *Joint Operational Warfare*, (Newport, RI: U.S. Naval War College, 2007), XII-35.

The absence of the human element or architectural relationships is contrary to a principle DoD maxim of C2: that technology enables the human interface and supports command and the decision-maker, rather than forcing the decision-maker to operate within the constraints of the control of technology.⁴¹ The primary focus across numerous DoD C2 documents fails to mention much besides capability required or specific systems. This might be because DOD is focused on budget items. A more likely reason is that developing systems to perform specific tasks is relatively easy. Reorganizing the flow of information in the fight—from primarily hierarchical to primarily lateral—is a daunting task. It is also contrary to senior leaders’ career-long paradigm, and there is the subconscious resistance to change. In some areas, incremental change – modifying C2 tools – is occurring. But this approach is not enough for future JFCs to succeed; while system designers can bypass some problems, the real solutions tend to cluster around PME, training, and doctrine.”⁴²

Operations Centers across the Joint Force

Leveraging operations centers of the future will allow for greater horizontal movement of information across the joint force. The U.S. Air Force has capitalized on the operations center concept through its Air Operations Center (AOC), a networked center supporting the Joint Force Air Component Commander (JFACC) as he accomplishes JFC tasking. The Army utilizes a similar construct in their Theater Operations Center (TOC) by drawing individuals from multiple commands to form the staff. The Navy is currently researching the idea of a somewhat similar Maritime Operations Center (MOC) based on the

⁴¹ The Office of the Assistant Secretary of Defense for Networks and Information Integration / DoD Chief Information Officer, *Department Of Defense Command and Control Strategic Plan*, Version 1.0 (Washington, DC: DoD, 18 December 2008), 3.

⁴² David S. Alberts, *The Unintended Consequences of Information Age Technologies*, Director, Directorate of Advanced Concepts, Technologies, and Information Strategies (ACITS) (Washington, DC: National Defense University Press Book, April 2006), 23.

AOC's success. Operation centers would offer a paradigm shift and break with the traditional C2 constructs found in past joint architectures. These organizations would afford the elimination of echelons in order to produce a compressed C2 architecture. These architecture models have traditionally focused on decentralized C2 of the force as constrained by line of sight communications. With the dispersed forces of the future, the operations centers will become hubs and will optimize the execution of joint forces missions.

Today's leaders continue to emphasize command relationships that possess the enduring ability to be effective, unambiguous, hierarchical, and documented.⁴³ This restrains the true potential that operations centers can provide the JFC. Current arguments exist that as technological systems develop, they will allow command relationships to enable leaders to become more effective decision makers.⁴⁴ Waiting for technology to solve the issue is short sighted. Leveraging evolving generational characteristics to create organizations that share similar social constructs would better serve the JFC. A key example is how the Air Force leveraged the existing structure of the AOC when developing the Space AOC (SAOC). The AOC has five primary divisions: Strategy, Combat Plans, Combat Operations, ISR and Air Mobility. When creating the SAOC the Air Force built in the social structure to facilitate horizontal movement by creating similar divisions: Strategy, Combat Plans, Combat Operations and ISR. By creating a common structure the Air Force was able to create a synergy between the organizations from their inception.^{45,46}

⁴³ Commander U.S. Fleet Forces Command and Commander Pacific Fleet to commanders, *Core C2 Principles*, Message R131600Z JAN 2010.

⁴⁴ U.S. Navy, *Command and Control Aspects of the Future Force*, Final report, Navy Warfare Development Command Study (Norfolk, VA: NWDC, 5 March 2010), 3-3.

⁴⁵ U.S. Air Force, *Space Operations*, Air Force Doctrine Document (AFDD) 2-2 (Washington, DC: Department of the Air Force, 27 November 2006).

⁴⁶ U.S. Air Force, *Information Operations*, Air Force Doctrine Document (AFDD) 2-5 (Washington, DC: Department of the Air Force, 11 January 2005).

By fostering a common structure among the operations centers one can optimize C2 through the provision of resources and environment to enable mission accomplishment. This prevents random peer to peer connections and fosters decision – rights – based patterns of interactions thus facilitating decisions in a decentralized manner – thus allowing organizations to move up, back, and to the right towards the edge organizations described by Alberts and Hayes. The Navy has been researching this for their task force structures in order to better support the Joint Force Maritime Component Commander (JFMCC). While the current structure still falls within legacy hierarchal and mission centric mission operations, the information being shared between the task forces is beginning to leverage the future C2 constructs. Operational commands linked laterally by functional divisions will enable the joint force to seamlessly execute multiple missions through exploitation of the Information Environment.

Operations centers will also create synergy between theaters or with possible future global warfare centers (examples: Ballistic Missile Defense (BMD), Space, Cyber). Creation of such a common structure within the joint force will be a C2 enabler. It will allow the force to better leverage the technologies as envisioned by the DoD C2 Strategic Plan. There remains a great deal of work in the areas of authority/direction, personnel, equipment, doctrine/procedures, facilities and communications systems, the creation of AOCs, MOCs and TOCs represent first steps in applying a new C2 architecture. Additional changes will come with time, requiring clear definition of the relationships and span of control these organizations possess.

The More Things Change, the More Stay the Same

There are those that would argue that a new joint C2 architecture, leveraging the Information Environment while balancing risks and benefits is nothing new and does not require the in-depth examination of the subject. This position also presupposes C2 is primarily a process and technologies and new concepts continuously act upon it. The human element is central and timeless, is the argument de jour, and technology cannot replace it.

While the human element remains, the current C2 approach and legacy paradigms are sub-optimal for the force of tomorrow. The U.S. can ill afford to hamper the future Information Environment with the outdated constraints of yesterday's C2 approach.⁴⁷ The days of commanders being able to collate raw information to develop their own cognitive understandings and orientations have passed. With the speed of information and systems to be employed in the future, the constructs of traditional C2 no longer fit the problem set.

While the human element will always remain at the core of C2 (or focus and convergence) this aspect will also be challenged in the future. Already systems are successfully employed in the stock exchanges to trade stock, all without human interaction. This is done with complex algorithms. This same approach can be leveraged across the future joint forces from sorting through the sea of information to complex directions for unmanned vehicles. The JFC will operate in a concept that Scherrer and Grund, who explored a C2 model in Cyberspace, identify as a hybrid C2 model – a model that moves away from the traditional C2 model by uncoupling command from control.⁴⁸

⁴⁷ U.S. Navy, *Command and Control Aspects of the Future Force*, Final report, Navy Warfare Development Command Study (Norfolk, VA: NWDC, 5 March 2010), 10-4.

⁴⁸ Joseph H. Scherrer and William C. Grund, *A Cyberspace Command and Control Model*, Research Report no. ADA508535 (Maxwell AFB, AL: Air War College, August 2009), 37.

Conclusions and Recommendations

The JFC of tomorrow will have a significantly different C2 construct due to the increased complexity of the Information Environment. As the U.S. continues to move towards an edge organization, they must shed the legacy C2 model and even go so far as to replace the lexicon. The need to think about new approaches will be driven by the nature of operations, the generational characteristics of our forces, capabilities of adversaries and opportunities provided by advantages in information technologies.⁴⁹ While the evident need to continue developing bandwidth-friendly capabilities, such as securing data, compression techniques, and developing systems with new low bandwidth requirements are filling the majority of C2 documents today, numerous other requirements are in need of attention.

The first recommendation is reminiscent of Lord Nelson, who said –when I am without orders and unexpected occurrences arrive I shall always act as I think the honor and glory of my King and Country demand. But in case signals can neither be seen nor perfectly understood, no captain can do very wrong if he places his ship alongside that of the enemy.”⁵⁰ The crafting of commanders intent is something that is not well done in today’s joint environment. It rarely can stand on its own if subjected to the fog and friction that distributed forces will be operating under in the future – “Will this give forces enough guidance if they lose communication for several days?” Nelson understood that while he could not provide orders during battle, he could influence the outcome by ensuring his subordinates understood his overall intent. Commanders must carefully craft their intent, and subordinates must understand it. There has been little time recently spent on the importance

⁴⁹ David S. Alberts, —Agility, Focus, and Convergence: The Future of Command and Control,” *The International C2 Journal* 1, no. 1 (2007): 7.

⁵⁰ Wikiquote, —Horatio Nelson,” http://en.wikiquote.org/wiki/Admiral_Horatio_Nelson (accessed 20 September 2010).

of the art in crafting such intent and there is no specified training available. The U.S. military has conceptualized future applications such as popup windows in helmets visors or platforms heads up displays, alerting the force to a change in intent while overlooking the critical element of how to create meaningful commanders intent. Coherent commanders' intent becomes more important as the human element of C2 experiences a paradigm shift spread across the Information Environment.

Centralized execution is enough to send shivers down many leaders' spines today. The push for decentralized execution is a legacy still embodied from the times of Nelson and as seen recently in USFF Serial 002. The unfortunate reality is as unmanned vehicles become ubiquitous and missions such as BMD become more prevalent, deployed platforms cannot encapsulate the speed and resources required to make decisions. There will be times and mission sets which, due to scope, must be centrally planned and executed; hence, ~~hybrid~~ "hybrid execution." Hybrid execution portrays the complexity of future operations by acknowledging that not all future missions will be executed using decentralized execution. Hybrid execution also encompasses the fact that there will be tactical missions centrally controlled by operation centers through the use of unmanned vehicles. Unmanned vehicles will be in place or able to be launched in such a manner to prevent a threat to manned delivery vehicles. Operational centers will be the key linkages into the successful hybrid execution of those mission sets as they have the operational and theater perspective to ensure success.

Operational centers will be created with a common standardized structure. This will create a social network between services operations centers that the digital natives will exploit in ways not perceived by the C2 architects of today. Example of such standardized

structure ideas can be found in the AOC and SAOC models of the Air Force or in the Navy's standardized task force organizations for their fleets. Additionally, services must apply resources to create an OLV C2 cadre. This OLV C2 cadre will benefit from the time spent to create systems leveraging digital native tendencies and protecting against these same natives' weaknesses, such as their privacy concept and inability to discern the quality and accuracy of information. The services must also create a viable career path for the OLV C2 cadre thus reducing the need to pull from operational units to form staffs, such as in the case of the TOC. A viable career path, similar to the Air Force model in the AOC, will provide the joint force personnel who are completely indoctrinated in the operational level of war and the social networks operating between entities in the complex joint – coalition – interagency operations of the future. The operations centers will be a mix of career individuals and state of the art technical systems, yielding a synergy for tactical entities to access.

The final recommendation is that the DoD C2 Strategic Plan explores ways to compress the C2 architecture by removing echelons that have outlived their purpose. The U.S. continues to leverage technology against an antiquated C2 system; it will not be enough to shrink our bureaucratic application of C2. Even with automated monitoring and synchronization between operational centers, adversaries can still operate within the U.S. OODA loop. The force structure of the Navy under the JFMCC provides an example of echelons that can be removed. Currently Destroyer Squadrons (DESRON) report to Carrier Strike Group Commanders (CCSGs) which are collocated onboard the carrier. By leveraging an OLV C2 cadre at the MOC, the Navy could eliminate DESRONs and reduce the CCSG staff and can continue to execute the commanders' intent if communications are lost or disrupted with JFMCC ashore. Additionally, C2 architectures of the future must build in a

scalable C2 construct. While an option exists to continue operations in the current construct, it is obvious that the joint force must have a significantly more compressed organization for future conflicts. The ability for a commander to be able to streamline his C2 architecture will be necessary for emerging missions that require extremely short decision cycles such as BMD.

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