TRANSFORMATION CASE STUDY SERIES

Network Centric Operations (NCO) Case Study

U.S. Navy's Fifth Fleet Task Force 50
in Operation ENDURING FREEDOM

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Foreword

The purpose of this case study report is to describe the evolution of network enabled capabilities in the context of naval operations conducted under the command of RADM (now retired) T. Zelibor. The focus is on the background and creation of Task Force 50 (TF-50), and primarily on the evolution of the transformational capabilities that permitted TF-50 to succeed in the manner that it did. The study examines those transformation innovations from their inception up through current day.[1] The evidence is drawn from discussions with key naval and TF-50 personnel, as well as open-source data. This case begins with an overview of the overall case study and introduction. It is followed by a brief review of TF-50. The report then describes the study methodology. The findings section follows, and describes in detail the development and success of TF-50, including information regarding various technological systems, information sharing practices, and the importance of strong leadership. The final section of this report includes the conclusions. This study finds that it is the continuous evolution of a variety of factors that lead to the effectiveness and efficiency of TF-50. It did not require unlimited financial resources to make this change happen. Rather this transformation occurred as a result of intuitive leadership, a culture to allow for change, and personnel willing to trust a new method of operating.

This report is the result of work performed under contract #W74V8H-04-D-0051, for the Office of Force Transformation, performed by Evidence Based Research, Inc.

This report is the result of the effort of many people. The following are the primary contributors:

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[1] Current as of March 2006. The NCO Harvard Business Review-Like Case Study: "Task Force 50 During Operation Enduring Freedom" is based on (1) the 2003 Network Centric Operations Case Study: "Network Centric Warfare in the U.S. Navy's Fifth Fleet: Web-Supported Operational-Level Command and Control in Operation Enduring Freedom," conducted on behalf of the Office of Force Transformation by Dr. Mark Adkins and Dr. John Kruse of the Center for the Management of Information at the University of Arizona and (2) open-source information as noted.

Chapter 1.0 Introduction

The *USS Carl Vinson* (CVN-70) battle group, commanded by Rear Admiral (RADM) Thomas E. Zelibor (now retired), departed its home port in Bremerton, Washington, on July 23, 2001, ready for a scheduled deployment in support of Operation SOUTHERN WATCH in the Arabian Gulf. On September 11, 2001, the same day that the battle group reached the North Arabian Sea, the al-Qaeda terrorist network attacked the Pentagon, the Twin Towers of the World Trade Center in New York City, and crashed a plane into a rural Pennsylvania field. Over the next several months, the battle group would undertake combat activities it had not planned for and would work in a joint and combined environment fighting the war on terror during Operation ENDURING FREEDOM (OEF).

RADM Zelibor, having seen the power of network centric warfare (NCW) firsthand during the Global 2000 wargame, implemented transformational practices that changed the very nature of his command and control. He saw the need for a more efficient and effective way of conducting daily activities. He also sought to change the way his sailors could get information and react to that information by reducing the amount of time needed to prepare briefs (that were outdated as soon as they were created) and by adding time for staff planning. Under RADM Zelibor's guidance, the sailors and staff were able to transform daily operations and work together more efficiently to achieve their mission.

RADM Zelibor's task force grew by an order of magnitude after the September 11 attacks. The sailors and staff were so successful at streamlining the daily operational process that they were able to make changes that allowed them to experience a shared understanding of the battlespace, collaborate, and develop mission objectives more quickly. For example, morning briefs were reduced from 1–2 hours to 30–45 minutes, all relevant personnel were able to access continually updated information, and more time was available to plan tactics and strategy. Ultimately, the plans and processes instituted by RADM Zelibor paid off. Under his direction, Task Force 50 (TF-50) clocked almost 25,000 flight hours, flew almost 8,700 sorties, and dropped over 2 million pounds of ordnance. Additionally, TF-50 conducted maritime intercept operations, air-to-ground strikes, undersea warfare, air warfare, Tomahawk Land Attack Missile (TLAM) strikes, and provided protection for shipping.

Study Context: Network Centric Operations and Transformation

The theoretical lens that underlines this case study report is the theory of NCO. The United States National Defense Strategy and the Capstone Concept for Joint Operations both assert that NCO is a key element of transformation of the U.S. military. It is a new theory of war based on Information Age principles and can be summarized by the NCO tenets.[2] These state that a robustly networked force improves information sharing and collaboration, which enhances the quality of information and shared situational awareness. This enables further collaboration and self-synchronization and improves sustainability and speed of command, which ultimately results in dramatically increased mission effectiveness.

Following the "NCW Report to Congress" in 2001and the publication of *Network Centric Warfare* and *Understanding Information Age Warfare*, it became clear that the hypotheses of NCO needed to be tested and evaluated using empirical data. While anecdotal

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[2] Department of Defense. *Network Centric Warfare Report to Congress*. July 2001.

evidence existed to support the NCO claims,[3] no systematic effort to collect and analyze NCO related data had been undertaken to date. As a consequence, the Office of Force Transformation (OFT) and the Office of the Assistant Secretary of Defense, Networks and Information Integration (OASD/NII) began collaborating on an effort to develop metrics to test hypotheses in the NCO value chain. The primary objective was to develop a rich and comprehensive set of NCO-related metrics that could be used in case studies, experimentation, and other research endeavors to gather evidence. This evidence could then be used to inform investment decisions across the lines of development of doctrine, organization, technology, materiel, leader development, personnel, and facilities (DOTMLPF). The result of this effort is the development of the Network Centric Operations Conceptual Framework (NCO CF). The NCO CF identifies key concepts and linkages to output measures in the NCO value chain in the context of the four domains: physical, information, cognitive, and social. Figure 1 depicts the NCO CF.

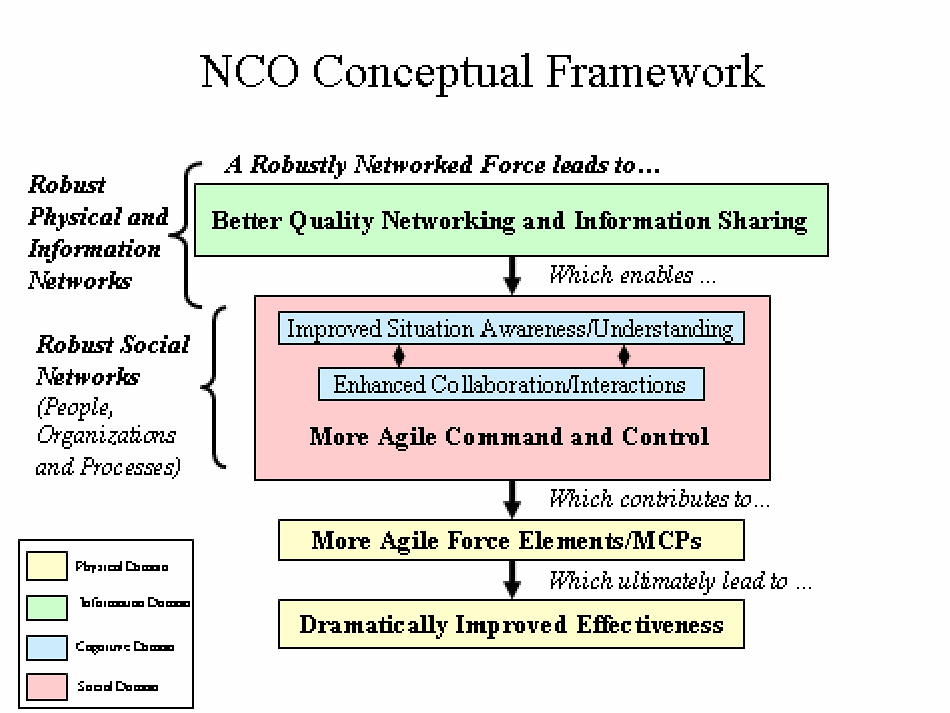

Figure 1. Network Centric Operations Conceptual Framework

To gain a better understanding of the theory of NCO and to validate the utility of the NCO CF, the OFT is conducting a broad research program aimed at gathering empirical evidence related to networking, information sharing, collaboration, and decisionmaking in the context of recent military and non-military operations. As part of this program, the OFT is sponsoring multiple case studies that examine NCO across the spectrum of operations, from high intensity combat to stability and support operations.

This case study research team had the following objectives:

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[3] Alberts, D.S., Garstka, J., Hayes, R.E., & Signori, D.T. (2002). *Understanding Information Age Warfare.* Washington, DC: CCRP Publication Series. (Chapter 10)

OBJ 1: Determine what NCO technologies and practices were developed, implemented and/or modified prior to and during OEF by TF-50.

OBJ 2: Determine what impact these technologies and practices had on operational performance and mission effectiveness, utilizing the NCO CF as a measurement and analysis tool.

OBJ 3: Determine what factors contributed to and enabled the successful implementation and use of NCO technologies and practices by TF-50 using the DOTMLPF lines of development as a framework.

OBJ 4: Explore how the experiences of TF-50 may provide lessons learned that are applicable to other military contexts such as future naval operations as well as joint, multinational or other service operations.

This report documents the method by which this study was conducted and presents its findings. It is organized as follows: Chapter 1.0 provides an introduction to the study. Chapter 2.0 explains how naval task forces are formed and describes TF-50. Chapter 3.0 provides a brief description of the study methodology. Chapter 4.0 presents the findings of the study and is followed by the Conclusion, Chapter 5.0.

Chapter 2.0 Task Force 50

In 2000, RADM Zelibor and key members of his staff participated in a major war game that focused on network centric technologies designed to facilitate information sharing and collaboration. As a result of this experience, prior to his deployment to the Gulf in 2003, he introduced new technologies into his battle group as well as new techniques, tactics, and procedures (TTPs) that were developed and adapted to take advantage of the new technologies. Using simple and inexpensive technologies along with the new TTPs, the commander, sailors, and staff of TF-50 were able to transform daily operations and work together to efficiently and effectively conduct their missions.

The 59-ship task force that constituted TF-50 supported Operation ENDURING FREEDOM (OEF) in Afghanistan. When the CVN-70 battle group departed its home base on 23 July 2001, it was scheduled to support ongoing missions for Operation SOUTHERN WATCH. After the 11 September attacks, RADM Zelibor's forces quadrupled in size, were redesignated as TF-50, and were reassigned to support military operations in Afghanistan. During OEF, TF-50 clocked almost 25,000 flight hours, flew nearly 8,700 sorties, and dropped over 2 million pounds of ordnance. Additionally, TF-50 conducted maritime intercept operations, air-to-ground strikes, anti-submarine warfare, anti-air warfare, Tomahawk Land Attack Missile (TLAM) strikes, and provided protection for shipping. The success of TF-50 was especially impressive given the speed with which the mission and objectives were changed.

Background

Navy operations and command posts are divided into separate geographic regions that are commanded by and specific to numbered fleets. This study examines the Fifth Fleet, which is based in Bahrain and supports naval operations under the command of the United States Central Command (CENTCOM). (See Appendix B for more information regarding the U.S. Navy's five fleets.) Fifth Fleet's area of operations (AOR) (Figure 2) encompasses roughly 7.5 million square miles of Middle Eastern territory, including the Arabian Gulf and Indian Ocean, and 25 countries including: Bahrain, Saudi Arabia, United Arab Emirates, Iran, Iraq, Pakistan, and Somalia. Units and personnel that operate under the Fifth Fleet are not organic; that is, units train elsewhere and then rotate into the Fifth Fleet for duty.

Figure 2. United States Naval 5th Fleet Home Location and AOR[4]

The task force included a Carrier Strike Group (CSG)—formerly called a carrier battle group (CVBG)—combat aircraft, and other support elements including units and ships. The CVBG typically consisted of an aircraft carrier, a Destroyer Squadron (DESRON), and a carrier air wing. Carrier Group Three (CARGRU3) was dual-hatted, operating under the command of the Fifth Fleet as Commander, Task Force 50 (CTF-50). CARGRU3 consisted of the nuclear aircraft carrier USS Carl Vinson (CVN 70), Destroyer Squadron Nine (DESRON 9), and Carrier Air Wing 11 (CVW 11), along with their component ships and aircraft squadrons.

A captain (O6), serving as the Chief of Staff (COS), led the TF-50 staff. The staff was composed of officers and sailors who planned, researched, and coordinated for the admiral

[4] US. Naval Forces Central Command, U.S. 5th Fleet, Combined Maritime Forces. Welcome page of commander. From: <http://www.cusnc.navy.mil/Pages/AOR%20page.htm>, accessed 15 September 2005.

(O7–O8) in command. CARGRU3 was organized along typical military staff organization codes with an officer in charge of each:

- N1 – Administration and personnel
- N2 – Intelligence
- N3 – Current operations
- N4 – Logistics
- N5 – Plans, and
- N6 – Command, Control, Communications and Computers

Deployment

USS Carl Vinson battle group departed its Bremerton, Washington homeport on 23 July 2001. By 10 September 2001, it was rounding the tip of India, poised to enter the Arabian Gulf in support of Operation SOUTHERN WATCH. The ongoing mission was to enforce the southern Iraqi no-fly zone and monitor Iraq below the 32nd parallel. (See Appendix E for more information regarding Operation SOUTHERN WATCH.)

However on 11 September 2001, terrorist attacks on American soil altered the commander's operational courses of action (COA). Vice Admiral (VADM) Charles Moore, Commander, U.S. Naval Forces Central Command, and Commander, Fifth Fleet, ordered the formation of a multicarrier battle force under the command of RADM Zelibor. CARGRU3 became the core command of what would be designated TF-50. Figure 3 displays a picture of CVN-70, the USS Carl Vinson. When Moore passed the order, the battle group changed course and by 12 September had arrived in the North Arabian Sea to spend the next 3 months supporting OEF. By 7 October 2001, the battle group had launched the first strikes in support of OEF.

Figure 3. Image of CVN-70, the USS Carl Vinson[5]

In the weeks after September 11, TF-50 grew to include 59 ships from Australia, Britain, Canada, France, Italy, and Japan. The Task Force also included six aircraft carriers: USS Carl Vinson, USS Enterprise, USS Theodore Roosevelt, French Ship (FS) Courbet, Her Majesty's Ship (HMS) Illustrious, and the Italian Ship (ITS) Garibaldi. Though having such a large force was beneficial, it was also challenging because many of the ships' personnel had never trained or operated together, nor did they have an integrated command and control structure in place. Added to this was the challenge of forming a multinational coalition on short notice. As Moore explained:

> *…an incredible number of nations wanted to contribute naval forces to support the war on terrorism. Gearing up to integrate those naval forces and support them under one commander in a coherent operation was an unusual and challenging aspect of [Operation] ENDURING FREEDOM.*[6]

With the change in mission, the large and dispersed geographic AOR, and the diversity of the task force, TF-50 faced daunting challenges. However, they were able to successfully execute their mission. A key objective of this study was to gain a better understanding of what factors made this possible. The next chapter describes the methodology that the research team utilized to examine the operations of TF-50.

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[5] USS Carl Vinson. (2005). CVN 70 History. From: <http://www.cvn70.navy.mil/history.html>, accessed 22 April 22, 2005.

[6] Peterson, G.I. (2002). *"Committed to victory": Interview with Vice Admiral Charles W. Moore, Jr., former commander, U.S. Naval Forces Central Command/Commander, U.S. Fifth Fleet*. Sea Power. From: <http://www.findarticles.com/p/articles/mi_qa3738/is_200203/ai_n904728>, accessed 22 April 2005.

Chapter 3.0 Study Methodology

The research design developed for this study is based on the best practices of case study research and is founded upon the principles described in the NATO Code of Best Practices for C2 Assessment.[7] The study team was comprised of OFT-sponsored researchers from the University of Arizona's Center for the Management of Technologies (CMI) and Evidence Based Research, Inc. This chapter describes the scope of the research questions that guided the effort. It then discusses the data collection and analysis approach. For a further elaboration of the details of the study methodology, see Appendix C.

Research Questions

This study focused on command and control (C2) of TF-50 during OEF. While there are many factors that contributed to the ability of TF-50 to execute its mission, this research effort was primarily concerned with the impact of NCO technologies and practices on how C2 was formulated and executed, and how this impacted performance and mission effectiveness.

The research questions that guided this study were derived explicitly from (1) the study objectives and (2) the theory of NCO. The major research questions of the study are:

RQ 1: What NCO technologies and practices were developed, implemented and/or modified prior to and during OEF by TF-50

RQ 2: What impact did these technologies and practices have on operational performance and mission effectiveness?

RQ 3: What factors contributed to and enabled the successful implementation and use of NCO technologies and practices by TF-50? Specifically, how did changes in DOTMLPF affect TF-50's ability to conduct NCO?

RQ 4: To what extent can lessons learned from TF-50's experiences be applied in other military contexts, such as joint, multinational and other service operations?

Data Collection Plan

The methodology utilized for this study was based on a qualitative research design. The initial research effort focused on gathering information relevant to NCO technologies and practices as defined by the original NCW tenets. [8] Evidence was obtained from interviews with key TF-50 participants and Naval Commanders, as well as from publicly available primary and secondary sources. After the initial data collection effort, the research design was adapted to utilize the NCO CF. A second, more limited, round of interviews was conducted to clarify findings and to gain insights into areas of inquiry not fully explored during the first round.

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[7] *NATO Code of Best Practice for C2 Assessment*, Washington, DC: CCRP Publication Series, October 2002.
[8] Department of Defense. (2001, July). *Network Centric Warfare Report to Congress*.

Interviews

Interviews were conducted with the Commanding Officer (CO) and staff members of TF-50, and COs of ships with naval deployment experience. Interviewees were chosen by location, access, and functional experience. Some interviewees were requested specifically because of the manner in which they used NCO capabilities to fight the war. Most interviewees were recommended by TF-50 staff members. In addition to senior staff members and operational users, users with limited bandwidth were sought out for interviews. Other interviewees were naval officers with operational experience prior to and following the TF-50 deployment.

The interviews were open-ended with exploratory questions aimed at gathering new information and corroborating previously gathered data. Limited videotaping of key decisionmakers was conducted during the initial data collection. However, tape recorders were not used during most interviews due to classification level of some of the conversations.

The first phase of interviews was conducted between 14 April and 06 May 2003, and the second phase was performed between 20 September and 12 October 2005. All interviews lasted between 60 and 75 minutes, and were conducted with at least two interviewers. Interviews were conducted with officers in the following positions:

- CTF-50 (Rear Admiral)
- Commanding Officer, USS Abraham Lincoln Battle Group (RADM, now VADM)
- Commander, CARGRU3 (Captain)
- COS, CARGRU3 (Captain)
- N3 Deputy, CARGRU3 (Captain)
- N2, CARGRU3 (Captain)
- NETWARCOM Knowledge Manager (Captain)
- Commanding Officer – Guided Aegis Cruiser/ Anti-Air Warfare Commander (Captain)
- Commanding Officer – Guided Missile Frigate (Captain)
- Battle Watch Captain, CARGRU3 (Commander)
- Assistant Battle Watch Captain and TLAM Officer, CARGRU3 (Lieutenant)

Documents

Documents were used to help gather background information necessary to develop an effective set of questions for interviews and to corroborate evidence gathered from other sources. Documents were obtained from open-source media, most from the Internet. For a full list of documents obtained, please see Appendix D.

Physical Artifacts

Physical artifacts were used to provide visual or other displays of elements critical to this case study. Physical artifacts included photos of the Task Force C2 operation center, meteorological reports, classified and unclassified videos, and maps.

Data Analysis

Because the data collected for this study was from a small set of participants in TF-50, the study team did not assume that the perceptions and experiences of those interviewed were representative of all sailors participating in OEF or even TF-50. However, because the interviewees were in very senior positions within TF-50, their perspectives and experiences were considered to be very valuable in terms of understanding the role of NCO technologies and practices on mission performance and effectiveness. These senior officers also had extensive experience developing, implementing, and using these same technologies and practices. Therefore, the study team determined that the evidence gathered from these individuals is both valid and credible.

The research team developed a data analysis plan based on the best practices of qualitative research and case study research design. The study team reviewed the existing evidence and worked with the study sponsor to analyze the data. The results of this effort were briefed several times during the Network Centric Operations Conceptual Framework Workshop series in 2004 and presented to several of the Network Centric Operations Short Courses conducted in 2004 and 2005. As a result, the findings presented in this document have been subject to multiple reviews and revisions based on feedback from these venues. In addition, the findings have been reviewed by several senior naval officers, including RADM Zelibor.

Limitations

Although this case study had its strengths, it also had its limitations. These included the fact that it was not an experimental study, so it was impossible to establish controls that would allow the study team to isolate the effect of NCO technologies and practices on mission performance and effectiveness. Second, there was a potential for bias in that only individuals who had used network centric capabilities with success were interviewed. Those individuals who either did not use network centric capabilities, or individuals who used network centric capabilities and experienced failure, were not interviewed. It should be noted that the personnel interviewed for this study constitute a high percentage of the senior members of RADM Zelibor's staff and does, therefore, represent the views of that sub-group. Finally, as noted, because of the limited number of participants interviewed, the specific results of this study cannot be generalized to other operations. The study team posits, however, that there are lessons learned that may be applicable in other contexts. These are discussed in the final section of Chapter 4.

Despite these limitations the research, and this culminating report, provide insight into how NCO technologies and practices were developed and employed, and what difference they made within TF-50 during OEF. The next chapter describes the experiences of TF-50, based on the evidence gathered during this study.

Chapter 4.0 Findings

Because of the qualitative nature of this study and the interconnectedness of the research questions, many of the findings cut across two or more questions. Therefore, the presentation of the findings, while organized according to the study research questions, is in narrative form with considerable overlap.

Network Centric Technologies and Practices

This section describes the findings as they relate to research question one: What NCO technologies and practices were developed, implemented, and/or modified prior to and during OEF by TF-50?

The task of commanding a multinational coalition was quite daunting. However, based on the evidence gathered for this study, it was made possible by the relatively simple information sharing technologies and new processes RADM Zelibor implemented within the Vinson battle group prior to deployment. He created new processes that allowed all sailors, Marines, and other personnel to collaborate and coordinate on mission planning and operations, as long as they were on the "network." He called this "the art of the impossible."[9] RADM Zelibor recognized the need for a streamlined method of information sharing and aligned TF-50's manner of business and operations in accordance with the concepts of network centric operations. He sought to utilize several simple, inexpensive non-Program of Record applications that facilitated increased information sharing and collaboration, including a Knowledge Web (KWeb), multiple chat rooms, and Command Net. These applications were accessible to anyone with Secure Internet Protocol Router Network (SIPRNET) access. For coalition and allied partners without SIPRNET access, collaboration was achieved via the Coalition Wide Area Network (COWAN) that had some access to KWeb and Command Net by means of U.S. liaison officers placed on coalition ships. These liaison officers had access to the SIPRNET and would release information approved for distribution to non-U.S. forces. (Appendix F lists the TF-50 ships.)

Knowledge Wall

Prior to pre-deployment work-ups, RADM Zelibor participated in an experimental wargame for Admirals and Generals that tested the theory of NCW. This wargame, Global 2000, was conducted as a simulated military operation and sought to explore operational and strategic issues associated with network centric warfare. At the wargame, RADM Zelibor learned about various network centric concepts and an application that embodied the key elements of network centric operations known as Knowledge Wall (KWall). Figure 4 is a picture of the KWall.

The KWall featured a cluster of screens that incorporated decision support tools tailored to the Commander Joint Task Force (CJTF), as well as screens with "summary status" information being pushed from the anchor desks used by liaison officers representing the various CJTF departments. Peripheral displays were intended to provide summary information for each of the 14 functional areas of the CJTF command. Though the exercise revealed some

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[9] MacKrell, E.F. CAPT. (2003). *Network-Centric intelligence works*. Proceedings. From <http://www.usni.org/proceedings/articles03/promackrell07.htm>, accessed 18 April 2005.

challenges regarding use of KWall, RADM Zelibor became aware of the type of communication and collaboration that could occur if an information-sharing platform was established for all personnel. Whereas RADM Zelibor knew that flag officers typically have sufficient C2 tools to enable strategic and operational level goals, he also felt that the KWall could have significant impact for the tactical warfighter as well.

Figure 4. Picture of Knowledge Wall [10]

After addressing the problems that KWall exhibited during Global 2000 and modifying the software to suit the battle group's needs, RADM Zelibor implemented KWall software into the Carl Vinson battle group's standard operating procedures (SOPs). It was during OEF that the KWall first had the opportunity to have an impact among watchstanders operating in combat. LT Peter Majeranowski, stationed aboard the USS Princeton and USS Carl Vinson as an air defense commander liaison during OEF, explained that:

> *…the knowledge wall itself had no real power. The power of the system was in harnessing information from multiple sources, fusing it into a consistent, user-friendly format, and instantaneously disseminating that information back to the warfighters and decisionmakers.[11]*

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[10] Adkins, M., & Kruse, J. (2003). *Case Study: Network Centric Warfare in the U.S. Navy's Fifth Fleet, Web-supported operational level command and control in Operation ENDURING FREEDOM.* The University of Arizona Center for Management of Information. (Not yet released).

[11] Majeranowski, P. Lt. (2003). *Knowledge web plays big in transformation*. Proceedings. From: <http://www.usni.org/proceedings/articles03/promajernowski>, accessed 18 April 2005.

Knowledge Web

During his command of TF-50, RADM Zelibor implemented the use of KWeb, a SIPRNET-based information sharing portal. More specifically, KWeb was an operational command system that offered multiple large displays for tactical decisionmakers. Whereas KWall consisted of large visual displays relaying information to the commander, KWeb was used as an information sharing portal—available to personnel in various locations, at the same time. Staff and decisionmakers could access and view information on KWeb screens to discern knowledge regarding air defense, surface warfare, intelligence, weather, and more. During OEF, the KWeb platform was structured to include multiple tiered displays that allowed users to "smart pull"[12] in order to examine and interpret the information visually. (Figure 5 shows the multiple tiered displays.) The CARGRU3 staff no longer had to rely on the old information push. Smart pull became the preferred method because it enabled staff to find the specific information required for their mission, without being required to conduct a large amount of information filtering. Three tactical displays were used to show different areas of theater that could also be displayed on the video wall. Additional displays were used to monitor chat rooms, provide email, keep logs, and track other tasks. KWeb visual displays were also capable of being projected onto screens located in the nearby War Room.

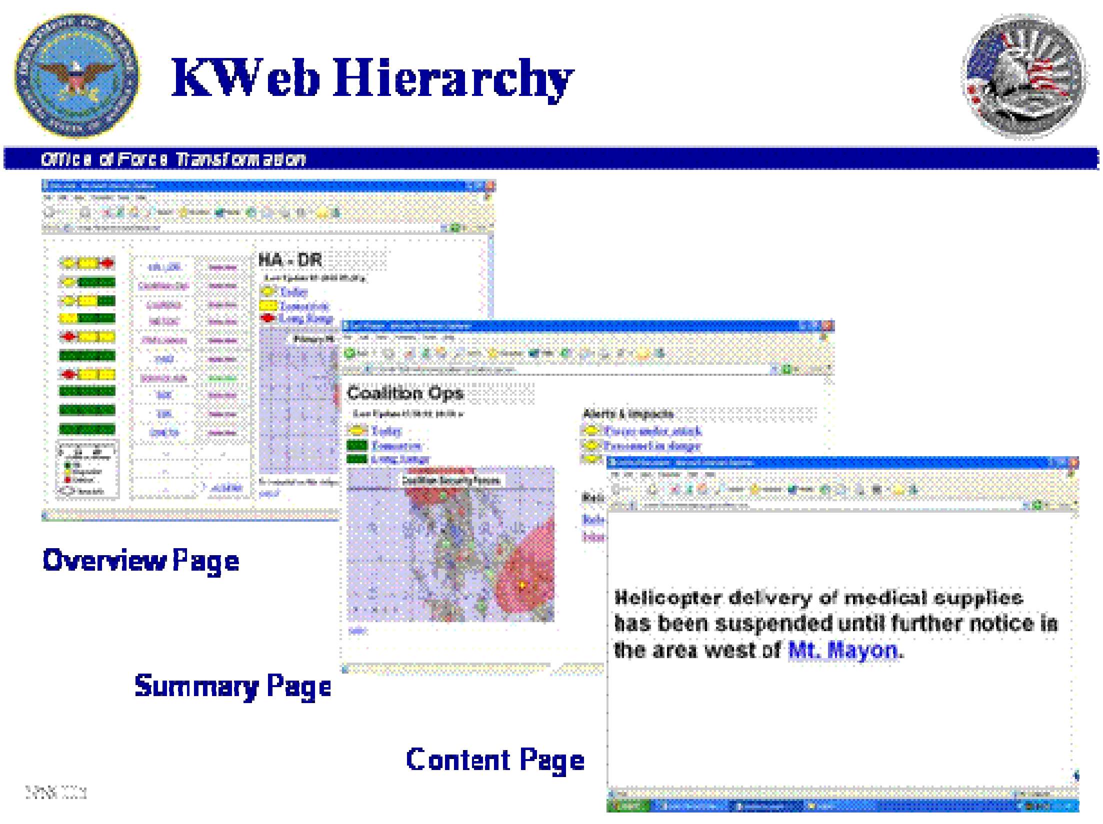

Figure 5. KWeb Hierarchy of Multiple Tiered Display

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[12] "Smart Pull" was what CARGRU3 staff tagged the concept of locating specific pieces of information without wading through large briefs and filtering out unnecessary information.

KWeb was not used for creating information, but rather for displaying and sharing that information in easy to understand formats. KWeb allowed users to drill down through three Web page levels (overview page, summary page, and content page) to access the information they needed. The overview page provided top-level information. The summary page was linked to lower-level content authored by a representative from each functional area. Finally, the content pages contained specific information about individual items located on the summary page. Dr. Jeffrey Morrison, a Space and Naval Warfare Systems Command (SPAWAR) representative who helped design the Navy KWeb application, referred to the technology as the difference between books kept in library stacks to opened books and information spread over a "large oak library table, easily accessible and constantly changing."[13]

Before KWeb, information was not circulated as widely because the formats, media, and transportation of information were unwieldy and inefficient. KWeb significantly lowered the barriers to sharing information widely. Staff officers and enlisted personnel simply put the effort they would have spent on the creation of PowerPoint briefs into maintaining their Web pages. Because these were automatically shared, the staff as a whole became better informed and more responsive as information, previously limited in distribution, was made available to everyone. The COS even found that watchstanders were studying the KWeb out of curiosity and a desire to understand the operation.

KWeb allowed daily battle group operations to function faster and more accurately, outperforming message traffic and voice communications. For example prior to KWeb, operations were created via operational summaries and intention messages. As such, each night the appropriate personnel would send out their daily intentions that others would sort through to gain knowledge of the operational task structure. However, KWeb allowed officers and staff more time to plan tactics and strategy without the need to read everyone else's intention messages. One cruiser commander explained:

> *Every night they would send out their daily intentions. You went through all of those and the operational task structure. People carried big tabbed notebooks of their information, operation officer's notebook, three to four guys would just spend their time updating notebooks. With NCO Tools, like KWeb you don't have to read thru everything to get information. I didn't read a single intentions message during the entire deployment.*[14]

Commodore Joe Natale (COMDESRON 9) further explained how KWeb provided an invaluable service by allowing many individuals to have the same information at the same time:

> *Having multiple people, who are not on watch and not at the same place, all having access to the same information is invaluable. It [KWeb] is a fantastic tool that didn't become clear until Operation ENDURING FREEDOM broke out…This was an operator's dream.*[15]

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[13] Majeranowski, P. Lt. (2003). *Knowledge web plays big in transformation*.
[14] Adkins, M., & Kruse, J. (2003). *Case Study: Network Centric Warfare in the U.S. Navy's Fifth Fleet, Web-supported operational level command and control in Operation ENDURING FREED*OM.
[15] Ibid.

The use of KWeb reinforced RADM Zelibor's assertion that "if you allow collaboration, and the more eyes that see it, [you are] 100 percent guaranteed that it'll be self correcting."[16] The expert synthesis of data brought a higher quality of information to users than they would be able to generate on their own. Essentially, all information consumers using KWeb acted as editors and veracity checkers. When posted information conflicted with another source, conversations took place over the net, and often a more accurate information picture was posted after the discussion.

Chat Rooms

Chat rooms were the second method for communication and collaboration that RADM Zelibor implemented. Chat rooms had been used in civilian settings and were first deployed with the Abraham Lincoln battle group in 2000, which was commanded by VADM (now retired) P.M. Balisle. Building on work initiated by the Stennis battle group, the Lincoln battle group incorporated chat—utilizing a new process—into operations including logistics, intelligence, surface operations, and anti-submarine warfare (ASW). Based on their utility and ease of use in these settings, RADM Zelibor and his intelligence staff decided that chat could be an effective and efficient means of communication for TF-50 personnel. Indeed, VADM Balisle explained that although his battle group was the first to utilize a significant chat network, RADM Zelibor took "the chat rooms to a new level of fidelity."[17]

Chat rooms were Internet locations where people on land and within embarked squadrons could meet and communicate virtually by typing messages on their computers. Chat room messages that users typed appeared instantly to everyone participating in that particular chat room, providing continued sharing and learning. As one individual who deployed with TF-50 noted, "the chat is better because it gives history, and you can watch things unfold in near real time."[18] These virtual chat locations were set up on a server and were typically arranged to support a specific community of interest (COI). Examples of COI chat rooms included meteorological and oceanographic (METOC) chats, Tomahawk targeting, and logistics chat rooms. Initially when chat rooms were used, some were moderated by a designated individual, but most chat rooms remained unregulated, such that messages were posted without any human intervention. However as time passed, and as newly instituted Navy Knowledge Managers spent many efforts on creating rule sets, rules regarding chat rooms use became well-defined. Chat rooms became regulated, and most were posted under human intervention.

Again and again, the researchers found that chat emerged as the primary mode of communication among TF-50 personnel. These running dialogs helped to build the common situational awareness required for NCO operations. The users learned to expand the chat channel by communicating more explicitly and frequently about issues. Additionally, the "lurkers," those who just monitored chat rooms, were able to stay abreast of happenings throughout the task force.

Chat rooms were used extensively within TF-50 because not all of the ships within the command had the bandwidth necessary to access KWeb and other Internet portals. Because of

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[16] Zelibor, T., RADM. (personal communications, 4 October 2005).
[17] Balisle, P.M. VADM. (personal communications, 20 September 2005).
[18] Adkins, M., & Kruse, J. (2003). *Case Study: Network Centric Warfare in the U.S. Navy's Fifth Fleet, Web-supported operational level command and control in Operation ENDURING FREEDOM.*

this dilemma, the TF-50 intelligence team established secure chat rooms to share time-sensitive intelligence with tactical action officers (TAOs), Web pages to make analytical details available to everyone on all ships, and voice networks to share information regarding immediate and severe threats.

Chatter on key voice circuits dramatically decreased compared to normal voice traffic during deployments. In the past, nearly all information was passed via voice communications. However this change began with the Lincoln battle group. On the Lincoln, orders were issued over voice networks, but discussion took place on chat rooms.[19] Similarly during OEF, TF-50 personnel used chat rooms to pass general and tactical information so that voice communications were reserved for time-sensitive information, such as air defense. As noted by the Lincoln battle group commander, "air defense moves too fast to be going back and forth on chat."[20]

Furthermore, because most information was passed via chat and not by voice communication, background noise in the command centers diminished considerably. Consequently, when voice communications were used to pass information, people took notice. One person deployed with TF-50 described the effect of chat rooms as follows: "Chat was awesome. Chat [was] like getting 20 new radios, and being able to work all at once."[21]

Because Force Intelligence Watch Officers (FIWO) shared and retrieved information via chat, another favorable feature was information could be quickly shared by every member of the TF-50 watch team who participated in that particular chat room. This process saved an immense amount of time, as explained by Captain (CAPT) Eileen MacKrell: "…the FIWO's ability to chat in real time with every unit in the battle group meant we could move analysis to tactical users very rapidly."[22] This capability was extremely valuable because, following the attacks on 11 September 2001, "the exponential growth of terrorist-related threat reporting made rapid coordination and deconfliction essential."

CommandNet

A third component easing information flow and collaboration was the inclusion of CommandNet. CommandNet was originally developed to fulfill a need for group situational awareness (SA) within the Third Fleet's intelligence community. It was a low-cost program designed to disseminate critical messages and incidents throughout the distributed force. Its implementation in TF-50 permitted cost-effective communication and collaboration across the force.

CommandNet was designed to be "drop-dead simple"[23] based on the fact that RADM Zelibor had requested that any technologies they adopted would be simple and would not require the "fighters to be Web page designers."[24] CommandNet's simple design allowed warfighters to use the tool with little effort. Users could collaborate and share information in an almost real time setting. Using CommandNet, personnel could enter data and view the

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[19] Balisle, P.M. VADM. (personal communications, 20 September 2005).
[20] Ibid.
[21] Adkins, M., & Kruse, J. (2003). *Case Study: Network Centric Warfare in the U.S. Navy's Fifth Fleet, Web-supported operational level command and control in Operation ENDURING FREEDOM*.
[22] MacKrell, E.F. CAPT. (2003). *Network-Centric intelligence works.*
[23] Adkins, M., Kruse, J, & Younger, R.E. *CommandNet Point Paper*. Center for the Management of Information; University of Arizona, Tucson, AZ.
[24] Majeranowski, P. Lt. (2003). *Knowledge web plays big in transformation.*

browser from any Web platform. Personnel could use CommandNet on limited or temporary non-existent bandwidth, and when messages were entered, others could see the entry within seconds. Because CommandNet entries were created by trained watchstanders, there was a minimum of extraneous information. Entries were focused solely on the information needed by the command.

CommandNet was so widely used that while aboard the USS Vinson, about 14,000 log entries were made. As such it provided the commander SA anytime or anyplace a SIPRNET computer terminal was located, either on land or sea. CAPT Scot Miller, from the CommandNet design team, stated that CommandNet is "simplistic, yet has actually allowed a much greater understanding of how and what others are thinking."[25] That knowledge led to greater understanding, as explained by one TF-50 watch officer: "The difference was night and day…What I saw was the level of knowledge of the watchstanders increase."[26]

Information Sharing Processes

These capabilities impacted the manner in which information was shared among the battle group ships. RADM Zelibor's staff was able to utilize both relay and direct information exchange.[27] As in previous deployments, such as with the Stennis and Lincoln battle groups, during the TF-50 deployment, information was sent to and from ships in formation via the shore, in traditional naval deployment fashion. Ships sent information to a server located ashore, where it was held until receiving ships came online. The amount of hold time varied, as ships could be offline for many reasons: refueling, turning, blind zones, and aircraft in close proximity. Once ships came online, they would then get the information being held ashore. This process was estimated to require between 30 and 45 minutes, depending upon the situation.[28] Communications with allies and time-sensitive messages were typically sent via electronic mail (e-mail).

Though it took an extra link to transfer information to and from ships, commanders and staffs were generally quite pleased with the information sharing process. An added benefit, as noted by VADM Balisle, was that information could be held and did not get lost. Another benefit, as noted by RADM Zelibor, was that SA rose continually during the course of the operation.

Impact on Performance and Mission Effectiveness

This section describes the findings in terms of research question two: What impact did these technologies and practices have on operational performance and mission effectiveness?

Operational Performance

As a result of introducing network centric technologies and practices, TF-50 experienced a variety of benefits in terms of operational performance. For example, although there were concerns that introducing new information sharing technologies would increase

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[25] Swedlund, E. (11 February 2002). *UA software aids military in cataloging information*. Arizona Daily Star.
[26] Adkins, M., & Kruse, J. (2003). *Case Study: Network Centric Warfare in the U.S. Navy's Fifth Fleet, Web-supported operational level command and control in Operation ENDURING FREEDOM*.
[27] Balisle, P.M. VADM. (personal communications, 20 September 2005).
[28] Hearne, J. CDR. (personal communications, 13 October 2005).

security vulnerabilities and open the task force to scrutiny and criticism, the evidence gathered confirms that instead trust increased and the culture changed in a positive way. These benefits occurred during training before deployment, as well as during OEF.

Effects of the changes across technology, people, and processes were felt even prior to OEF. In the work-ups prior to OEF, RADM Zelibor and his staff executed the same innovations they would implement just months later in support of the War on Terror. For instance during work-ups, RADM Zelibor and his staff had an improved information position in terms of the quantity and quality of information, "…we were acting on pictures and nuggets rather than 100-page documents." This translated to an increase in the warfighting capability of CARGRU3. At one point during the Joint Task Force Exercise (JTFX) training, the Third Fleet Vice Admiral stated that Third Fleet was not able to move the training scenario fast enough to challenge the carrier group because NCO technologies and practices had enabled CARGRU3 unprecedented information availability and sharing capability. RADM Zelibor explained how NCO capabilities benefited his unit's training:

> *It really showed value. During our work-ups during the JTFX where 3rd Fleet [was] putting us through the paces during our work-up cycle, I found that my staff and my warfare commanders were actually about three or four steps ahead of the 3rd Fleet staff because we were able to get information out quicker, which caused us to focus more on tactical discussions rather than information briefs. And the whole process caused us to get inside the OODA loop of…our enemy.*[29]

Once OEF began, the transformation of technology, process, and leadership had an impact on TF-50 and other commands in several ways. First, information was not only accessible to TF-50 command, information was also accessible to other commands within the fleet, and even those outside the fleet with access to the SIPRNET. For example Commander, Fifth Fleet's staff continually sifted through TF-50's battle damage assessment matrix for details of air strikes. This additional information allowed Commander, Fifth Fleet, to pass along information that preempted questions from superiors. Also, following the deployment, TF-50 staff learned the U.S. Federal Bureau of Investigations (FBI) had been accessing their intelligence pages. RADM Zelibor stated:

> *Where we knew it was powerful [was] that if we didn't update, we got calls from around the globe… [However] we were in the middle of a war, and we weren't getting any calls (from Washington or higher headquarters).*[30]

A second benefit of these innovations was the dramatic increase in battle group situational awareness (SA). Information was available on the SIPRNET and because individuals had the ability to continually receive information, that information was accessible to personnel in every group and at every level. For example, one Operation SOUTHERN WATCH department head stated that as a department head of a particular squadron, they only had access to the Air Tasking Order (ATO) because that squadron was only looking at what

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[29] Adkins, M., & Kruse, J. (2003). *Case Study: Network Centric Warfare in the U.S. Navy's Fifth Fleet, Web-supported operational level command and control in Operation ENDURING FREEDOM.*
[30] Adkins, M., & Kruse, J. (2003). *Case Study: Network Centric Warfare in the U.S. Navy's Fifth Fleet, Web-supported operational level command and control in Operation ENDURING FREEDOM.*

they needed. The department head believed that they did not have a need for the big picture. However, during TF-50, when NCO capabilities were implemented, that same individual explained that he:

> *…knew the flight schedule, logistics flight, vertical replenishments, where…forces would be. I had a picture in my mind what was happening.*[31]

One individual explained that prior to implementation of the new technologies and processes, the Combined Air Operations Center (CAOC) typically produced the ATO 72 hours before each mission commenced. This meant that weather was not considered a planning factor and that weapons payloads could not quickly be adjusted to account for weather changes.

> *… initially many aircraft were unable to execute their assigned missions and had to dump these bombs into the sea prior to landing. It was a waste.*

Additionally, technological and process changes occurred in relation to METOC data that eased Web page use for all personnel, including CAOC users. Written METOC data was transformed into an image that was visually understandable. Usually weather information was distributed in a standard text format, which required time and skill for an aviator or squadron to understand. However TF-50's METOC group brought the cryptic data together and published it in a form that was more accessible and understandable to people. Figure 6 shows a transformed METOC page. The net effect was that squadrons became more effective and efficient by being able to select munitions and tactics that were more appropriate to each particular operations environment. The METOC Web page:

> *… [E]volved into a predictive tool accessible to the CAOC. Because we were dealing with command and current information, together we were able to match aircraft and ordnance for specific weather and areas, working near real time. If dust storms were predicted…, we recommended all Navy F/A-18s carry … since they most likely would be able to expend them and not waste a valuable asset and ordnance.*[32]

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[31] Ibid.
[32] Ibid.

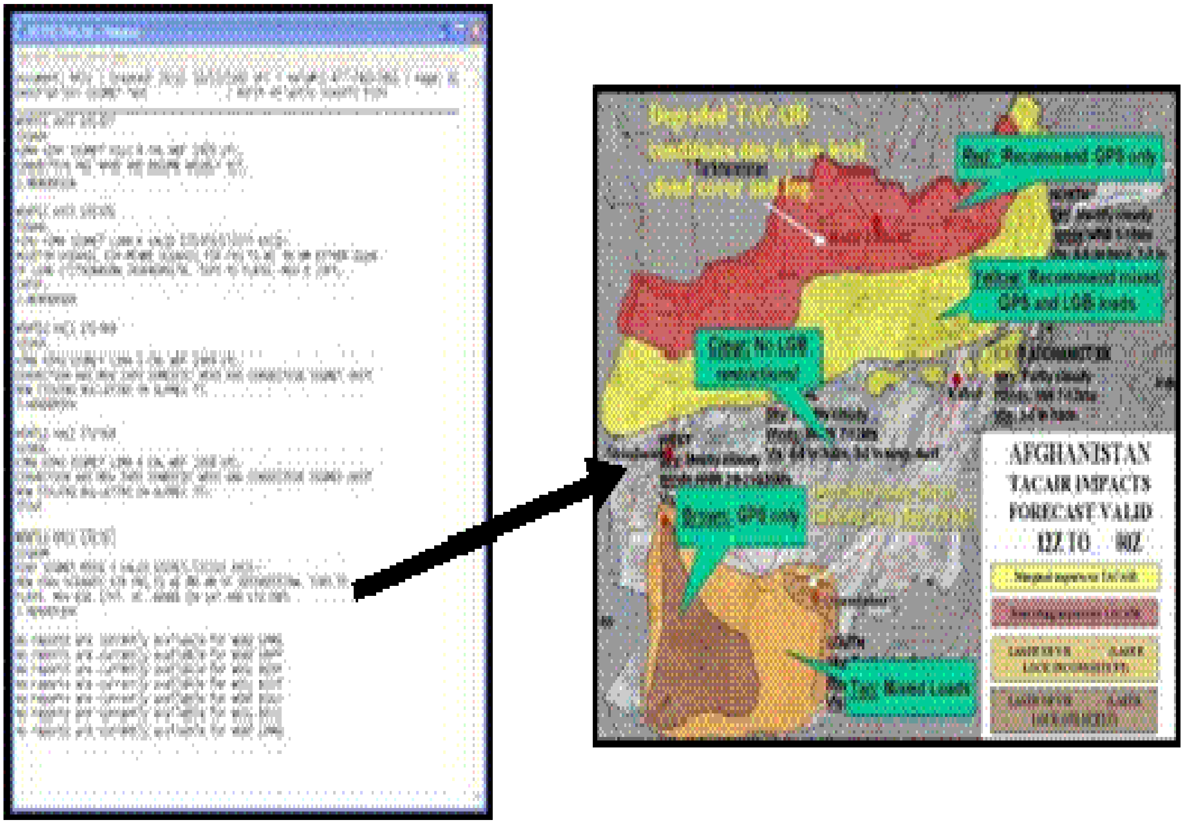

Figure 6. Transformed METOC Data [33]

Additionally, technological capabilities allowed for a much larger awareness and understanding of tasking and operations.

> *I probably had 10 times more information than if we [had not] had this technology. It took me some time, but I read every Web page. I'd get up in the morning and read Web pages. I was cued by yellow and reds, then would go into those issues. By the end, I had the Web pages memorized.*

Tied to increase in SA was the elimination of duplication of effort. During TF-50 the Judge Advocate General (JAG) maintained SA for others in the battlespace, while also eliminating additional work for others. In most commands the JAG officer would work with the commander to develop rules of engagement (ROE), which governed the use of force in the battlespace. On the carrier, each squadron would then send a junior officer to obtain this guidance, who would then record it onto a simplified ROE card that could be carried into the cockpit and easily referenced. One of the problems of such a system was that each squadron would have different short versions of the ROE distributed to their pilots, depending upon the officer who obtained the notes. Therefore, each of the ROE cards could have subtle differences that could cause serious problems. However in TF-50, the JAG officer made up both long and short versions that could be downloaded. This eliminated extra work for other officers and

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[33] Ibid.

reduced the potential for error. All personnel received the same standardized KWeb product. There was also much less radio chatter such as "say again your last, over."

A third benefit of the reorganization was that more time was spent conducting contingency planning and executing and planning missions, rather than passing along the information in order to plan and execute the missions. For example, because of the continual intelligence support, daily morning report times were reduced by up to 75 percent, and briefings were spent discussing what to do with the information and what the COA would be, rather than relaying information to others. As RADM Zelibor explained:

> *… [O]ur meetings would be issue focused for about the first 15 minutes and then there would be 30 minutes or so beyond that where we would talk about what-ifs [and] tactical discussions, so the whole tenure of the morning meeting just changed. And because of that, we had already gone through the courses of action and we'd already thought of all the what-ifs of playing the game, what can they do to us next, and so when it happened, or when something would happen, we'd already thought through it and it was executed immediately.* [34]

One individual explained that the information required for these informal, yet indepth discussions was always available at any SIPRNET terminal. The staff no longer had to find a stateroom—ready room of operations center—to get information that was critical to the discussion. CAPT Fitzpatrick (Deputy COS, Operations and Plans) further elaborated how the impact of shared awareness decreased the time needed for decisionmaking to occur.

> *Because everybody had the same information available to them and the Web became an authoritative source, they were very rarely surprised, and so when a new issue came up all the warfare commanders across the board were working from the same baseline, you wouldn't have to take that bring-up time to get to a decision point .*[35]

The ability to do indepth contingency planning was of great value as OEF progressed. Rather than improvising and reacting to changes in the war as battle groups previously had, the CARGRU3 staff was able to enact well-thought-out plans. Of the 35 war plans developed by the staff during the deployment, 33 were executed. Executing this number of war plans was an impressive accomplishment.

One example of time saved for planning and executing missions included a search and rescue operation over the Indian Ocean. A watchstander supporting the mission stated that he was able to pass along information to a ship approaching the wreckage, thus shortening mission time.

> *I look[ed] at one log that [had] the coordinates of the bailout. [The] surface ship heading north towards the bailout area didn't have the same communication ability. I pulled the lat/log and gave it to the surface ship and*

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[34] Ibid.
[35] Ibid.

he said thank you. It was [a] fast and efficient rescue. The network centric capabilities saved time and allowed the search and rescue team to act faster. [36]

Another important benefit of the transformation was that of culture change and trust. Although the staff did not recognize it immediately, they found that the development of trust within the task force had changed. Prior to NCO capabilities the staff had developed working relationships through their personal networks. Now people were creating close working ties through chat and monitoring KWeb pages. The constant updating of available information allowed widely distributed users to feel that they had the best information available. Thus, the users were able to trust one another, and were able to focus on doing their job effectively.

Mission Effectiveness

Transforming technologies, processes, and leadership allowed the commander to change the course of action (COA) from operations supporting the annual Operation SOUTHERN WATCH to operations supporting OEF. The mission objectives for each were very different. However, the transition was seamless. The technological and process changes embraced by CTF-50 not only enabled the sailors and staff to experience enhanced awareness and communication, but it also allowed the group to more quickly plan and more effectively conduct their mission in support of OEF. This was in part because the information flow had two directions. As CAPT Fitzpatrick explained, the commanders not only sent information to subordinates, but also received information from them as well.

> *…It wasn't just us sending information one way down to them. Because of the tools available, the information was coming back up to us also. So we were very confident that we were aware of what they were doing, what they were thinking, and what the tempo of ops was that we could sit back and let them continue to operate independently, and if they misunderstood something or we had another piece of information that they didn't have that became obvious very early on, and we could get it to them and get them a …correction.*[37]

RADM Zelibor further elaborated that allowing the sailors and staff to have access to more information also decreased the amount of supervision he had to provide.

> *… [I]f you have enough information that gets to the important decisionmakers, then they know that I trust the information that they have that they are going to actually execute things without playing 'mother may I' with me.*[38]

During OEF, TF-50 logged 24,905 flight hours, flew 8,688 sorties, dropped 2,009 bombs, and transported 2,020,000 pounds of ordnance.[39] RADM Zelibor later reported that during OEF his task group flew fewer numbers of sorties than they had originally thought they would need. This has been attributed, in part, to the collaboration and accuracy found in OEF

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[36] Ibid.
[37] Ibid.
[38] Ibid.
[39] Ibid.

close air support operations that was missing in operations conducted during Operation DESERT STORM. RADM Zelibor stated that the OEF mission:

> *…had us flying fewer, albeit significantly longer sorties than previous deployments. Our parts requirements in support of this schedule were as high as twice that routinely experienced on an Operation SOUTHERN WATCH deployment.* [40]

RADM Zelibor has reported that, "In my heart, I know we improved speed of command."[41] TF-50's success was due to a multitude of factors, not limited to technology changes, process changes, and leadership style. The culmination of these aspects provided a fortitude of power that CTF-50 was able to unleash during OEF. As Admiral Dennis Blair stated:

> *Rear Admiral Zelibor…and his staff set up a network to command and control battle group functions in preparation for SOUTHERN WATCH, and used it with great effect when diverted to support [Operation] ENDURING FREEDOM.*[42]

Enablers of NCO Technologies and Practices

This section describes the findings as they relate to research question three: What factors contributed to and enabled the successful implementation and use of NCO technologies and practices by TF-50? Specifically, how did changes in DOTMLPF affect TF-50's ability to conduct NCO? Of all of the factors that contributed to the successful use of NCO technologies and practices, this study concludes that the most important one was leadership. While changes in organizations, material and other elements of the DOTMLPF were important, one of the most critical was leadership. The following section describes the role of leadership in promoting the use of NCO technologies and practices. Discussion of the changes across the other elements of DOTMLPF is embedded in the findings described in the previous section.

Leadership

The U.S. Navy developed over hundreds of years in relative isolation from other services. Prior to the advent of radio communication, ships commonly operated autonomously for months at a time. To this day, naval corporate culture reflects this relative independence. The most telling manifestation of this is that the Navy places a great deal of power and discretion with commanders. This approach has served the Navy well for over 225 years, as the officers trained to take command and use judgment in the absence of detailed instruction while they were away on deployments lasting months or years at a time. Where the Army or Marine Corps have had to stress standardization to ensure close coordination on a crowded battlefield, the U.S. Navy has always been able to give commanders more autonomy. One

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[40] Navy Supply Corps Newsletter. (2002). *Newsletter talks to RADM Zelibor, USN Commander, carrier group 3 – Thomas E. Zelibor interview*. From: <http://www.findarticles.com/p/articles/mi_m0NQS/is_3_65/ai_90624348>, accessed 21 April 2005.
[41] Adkins, M., & Kruse, J. (2003). *Case Study: Network Centric Warfare in the U.S. Navy's Fifth Fleet, Web-supported operational level command and control in Operation ENDURING FREEDOM.*
[42] Blair, D.C. ADM. *We can fix acquisition*.

consequence of this autonomy is that naval commanders have the ability to introduce innovative technologies and to adapt processes without going through a complex acquisition process. Most commanders, however, fail to fully embrace transformation. RADM Zelibor was an exception.

CAPT MacKrell succinctly described the pivotal role that leadership plays in promoting transformation:

> *…if the boss still insists on PowerPoint status briefs every morning, you will still be in the PowerPoint business…If your senior decisionmakers are not receptive to innovative use of technology and tools, you have a challenging sales job ahead of you.*[43]

CAPT MacKrell's boss, RADM Zelibor, had a similar mantra: "A smarter, more informed boss makes life a whole lot easier."[44] RADM Zelibor was not an unreceptive senior decisionmaker. He had worked with several of the network centric applications during Global 2000, and sought to have these information-sharing tools implemented throughout every level of the battle group from intelligence to operations. He explained the reasoning behind changing the method of sharing information:

> *We wanted a better method for distributing information across the battle group. We didn't want it to make the warfighter's job harder. Rather, we wanted to prevent duplication of effort. We needed a dynamic warehouse of continuously updated information. Above it, it had to filter and format information, eliminating the spam, adding value to the information and ultimately improving speed of command.*[45]

Some individuals suggested that RADM Zelibor's leadership had an impact on the battle group's culture. LT Majeranowski explained that, because of the culture that the TF-50 leadership helped to create, individuals were more willing to accept the new network-enabled capabilities, and to learn about and implement the newly revised processes.

> *…the transformation came from Admiral Zelibor's leadership, resulting in wholesale acceptance of a new and more effective way to collect, manage, display, and use information…Admiral Zelibor created a warfighting culture in the battle group…* [46]

Many argued that had it not been for RADM Zelibor's continual drive for information sharing and collaboration, the sailors and staff would not have conducted business in the manner that they did, and the Task Force would not have been as efficient and effective as they were. RADM Zelibor supported increased shared awareness among commanders, sailors, and staff by discouraging the use of existing legacy systems and encouraging personnel to use network-enabled applications for communication, information sharing, and collaboration. In fact, he went so far as to reward those in his chain of command who exhibited regular use of

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[43] MacKrell, E.F. CAPT. (2003). *Network-Centric intelligence works.*
[44] Adkins, M., & Kruse, J. (2003). *Case Study: Network Centric Warfare in the U.S. Navy's Fifth Fleet, Web-supported operational level command and control in Operation ENDURING FREEDOM*.
[45] Ibid.
[46] Majeranowski, P. Lt. (2003). *Knowledge web plays big in transformation*

the network centric tools in order to pass information, communicate, and collaborate. For example, RADM Zelibor would personally give positive feedback and encouragement to those who used NCO tools. He also gave out CARGRU3 coins, a highly coveted collection item for those in the military.[47]

The staff was instructed to completely abandon traditional viewgraph presentations.[48] Instead, they were expected to maintain current Web pages from which they could brief. RADM Zelibor believed that this would not only cut down on the staff's workload of building disposable briefs, but would also give the fleet an invaluable tool for situation awareness. The N2 stated that she now had a deputy who could perform valuable work other than creating daily PowerPoint briefs for the boss. Staff officers' Web pages were updated incrementally as new information arrived. There was no need to call the Intelligence officer and ask what was happening. Users could simply go to the Web page and see the most recent developments.

In high-level naval commands the presentation software PowerPoint is vital to sharing information. Staff officers succeeded or failed on their ability to put together and brief from electronic viewgraph presentations. They spent much of their day gathering and formatting information for a presentation the next day at the commander's morning brief. The commander of TF-50 fundamentally changed the way that his staff worked by breaking with this convention. He and his Chief of Staff (COS) felt that the staff was expending too much effort in creating these briefs and making the information "pretty." Additionally, he felt that the information was often not the most current and that the effort put into making briefing viewgraphs was often wasted, as they were not used by anyone after the brief.

Originally, many on the staff were fearful that the KWeb would just add work rather than make them more efficient. The exact opposite proved true. The commander made a point that he did not expect perfection on the KWeb. Formats were intentionally kept simple and trivial errors (e.g., spelling) were ignored. The admiral was well aware that a common mistake of staff officers is to be too conservative and play it safe in an effort to avoid getting in trouble. In response, he told everyone that he wanted people to give their best information estimates on KWeb and that no one would get their head cut off for making a mistake.

Because of the way in which the technologies aided in renovating the process of how operations were conducted, RADM Zelibor was able to delegate responsibility for information to lower levels. For example, petty officers were able to post information independently, without the review from officers or other superiors. RADM Zelibor further explained why he and his staff felt comfortable delegating responsibility to relatively junior levels:

> *Because of the way we distributed information and did our command and control, I felt perfectly comfortable. It didn't matter whether somebody [was] off the Horn of Africa or they were in the Northern Arabian Gulf, or they were 500 yards off the stern of the carrier, we were all connected in some way.*[49]

An additional way in which the leadership impacted the culture was through relaxation and stress relief. In the high stress environment of OEF, being well-rested provided opportunity for optimal performance from the staff when the operations required execution.

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[47] Zelibor, T. RADM. (personal communications, 4 October 2005).

[48] MacKrell, E.F. CAPT. (2003). *Network-Centric intelligence works.*

[49] Adkins, M., & Kruse, J. (2003). *Case Study: Network Centric Warfare in the U.S. Navy's Fifth Fleet, Web-supported operational level command and control in Operation ENDURING FREEDOM.*

Additionally, the senior leaders made a point to be seen winding down themselves, often by playing cards. This action by the senior leaders made it acceptable for junior officers and enlisted personnel to do the same, switching from the "sleep when you are dead" culture of the embarked Navy.

RADM Zelibor was recognized by superiors for implementing network centric operations throughout his force. As Admiral Dennis Blair explained, RADM Zelibor used what he learned from Global 2000 to create a C2 KWeb, displays, sensors, and new procedures to run the battle force on the Web. The Task Force had arrived in theater ready to support Operation SOUTHERN WATCH, and even though there was a major change in operations planning to support the new tasking, their self-developed information-sharing processes "worked splendidly in Operation ENDURING FREEDOM."[50]

Challenges Posed by NCO Technologies and Practices

The purpose of this research was to document the extent to which NCO capabilities were developed and deployed during OEF by TF-50, and to assess the impact on performance and effectiveness. The majority of the evidence gathered supports the view that NCO capabilities had a dramatic impact on both performance and effectiveness. Nonetheless, there were some drawbacks associated with the development and employment of NCO technologies and practices. These challenges resulted from the difficulties associated with introducing new tools and communication procedures. Additionally, challenges existed in terms of how to integrate new processes with existing logistic procedures. Finally, and importantly, there were some security concerns associated with information sharing.

First, some interviewees mentioned that KWeb, specifically, had a relatively steep learning curve because KWeb required users to spend a large amount of time learning the tool's topology. However, others suggested that this work was an investment that paid off greatly after each user had mentally mapped the KWeb pages. Once this happened, users stated they could easily find data they regularly needed, and were able to quickly find supplementary data that had been referenced.

A second challenge originated from the form of communication used during the deployment. The communication used in the TF-50 environment had neither the formal structure of standard Navy message traffic nor the free flow and contextual cues of face-to-face oral communication. Also, at that point, few rules regarding its use existed. As such, conversations had to be extremely explicit. In some cases the opportunity for misunderstanding the senders' message in a text chat was quite high.

An additional challenge was that speeding up the command decision cycles did not significantly alter the amount of time and effort it took to fuel, arm, maintain, and fly combat missions. This was due, in part, because even though decision cycles increased, primary weapons systems were already fully tasked. Thus, even though NCO capabilities enhanced collaboration and communication, it did not make a significant positive impact on logistics processes.

A final challenge faced by CTF-50 and his staff was that of security. By lowering the barriers to gaining information, the force also opened up new opportunities for those that

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[50] Blair, D.C. ADM. (2002). *We can fix acquisition*. Proceedings. From: <http://www.navalinstitute.org/proceedings/articles/02/problair05.htm>, accessed 22 April 2005.

might breach the system either on purpose or inadvertently. A wealth of information was available on the KWeb and CommandNet systems to anyone with SIPRNET access. There was a fine line between an officer exercising a need to know and nosing around. NCO dictates that information should be readily available. However, this high degree of freedom does require greater responsibility and discretion on the part of information producers and consumers in the absence of formal checks.

Lessons Learned from TF-50

This section describes the findings in terms of research question four: To what extent can lessons learned from TF-50's experiences be applied in other military contexts?

This case study is of significant value in the investigation of NCO theory and practice in that it is one of the first examinations of a staff at the operational level of war. A key question is: Can lessons learned from the experiences of TF-50 be generalized to other operations? The study team concludes that while the specific experiences were unique to TF-50, there are several lessons that should be widely applicable.

First, TF-50 developed and implemented NCO technologies and developed appropriate processes without expending a great many resources. One of the biggest criticisms of NCO is that it costs too much in terms of hardware, software, and training to be widely implemented. This work, however, demonstrates that even limited improvements in networking and information sharing can lead to dramatic improvements in performance. Those without NCO capabilities are able to participate by leveraging their strengths while profiting from the information generated and shared from a wider high-tech sensor grid. For instance, in the case of TF-50, the Maritime Interdiction Operations (MIO) in the Arabian Gulf, hundreds of miles away, were made possible because the task force was able to make the operations transparent throughout the fleet. The bulk of the task force was able to devote efforts to strike missions in Afghanistan while the MIO force operated with a great deal of autonomy farther north. The collaborative tools allowed the TF-50 commander to stay abreast of the MIO operations while providing occasional guidance. The MIO forces, on the other hand, understood the commander's intent and the disposition of the task force, which allowed them to complete their mission with a greater degree of independence. This was primarily accomplished through constant updates over simple tools, such as chat, Web pages, and an electronic log.

Second, although the TF-50 staff did not realize they were breaking ground when they started the move into NCO systems and practices, their experiences helped pave the way for the formal recognition that information management and networking are critical to successful naval operations. The impact of their experiences and lessons learned has influenced developments within the Navy, which now officially recognizes the role of information professions in command and control. Additionally, a new command has been established to deal with the issues associated with networking naval forces. This lesson is applicable across the services as well other joint, multinational, or interagency contexts.

Information Management

During the second round of interviews, RADM Zelibor was asked how he saw the future of the Navy. He stated that knowledge managers (KMs) should be routinely deployed, and they should understand not only the information technology (IT) side of business, but also the operations side as well.[51] Since RADM Zelibor's tour, the Navy has developed a new community of information professionals (IPs). These personnel now serve on CVBG staffs as the Assistant Chief of Staff (ACOS) for Command & Control, Communications, Computers and Intelligence (C4I), KMs, and Flag Communicators.[52] While it is not important where these officers are located, it is important that the staff employ knowledge management strategies and processes. The fact that IPs are sending O5-level officers, in their milestone job, to serve in this demanding role reiterates the importance of KM afloat.

Initially the role of the Knowledge Management Officer (KMO) was undefined. However as time passed, duties became clearer and KMs were included in deployments to oversee tasks including, but not limited to, information management, information security, creation of IT business rules for personnel in the fleet, IT account administration, and KWeb administration. Each staff has the ability to place the KMO anyplace within the organization. Three specific assignments include special assistant to the Strike Group Commander, the KMO within the Operations Department, and serving concurrently as the Deputy N6 and KMO. Additional tasks often include governance of the Collaboration at Sea and KWeb sites, governance of the Combined Enterprise Regional Information Exchange System (CENTRIXS) enclaves, author and enforcement arm of the Information Management messages, facilitator for battle rhythm process improvement, and change agent for innovation.

Over time, KM requirements and training have improved. A major requirement included sea time. It became very important for KMs to have operational or previous deployment experience. The Navy also instituted personal qualification standards (PQS) to ensure that people were trained before they became KMs. KMs had the ability to train one another, and most KMs stayed in touch with one another, providing the opportunity for them to learn and share resources with one another. They also took part in academic courses, such as the Afloat Knowledge Management Course offered while at sea. KMs also had the opportunity to serve as guest lecturers for a KM course offered at the Naval Postgraduate School (NPS). KMs formed communities of practice in which they came together, built curricula, and shared knowledge in order that they all stay current on the latest information management insights.

Naval Network Warfare Command

As RADM Zelibor and VADM Balisle indicated, the future of naval warfare lies in the information and technology domains. CAPT Robert N. Whitkop (Commander, Naval Network Operations Command, NNOC—stood up in 2001) further explained, "we are already fighting battles on our networks…that is why it is so important to protect information networks and deny access to our adversaries."[53] However, making the modifications needed to fully develop and exploit technological capabilities entails changing peoples' thoughts and organizational culture into an environment that will be accepting of change and transformational goals. In support of this effort, Naval Network Warfare Command (NETWARCOM) stood up in July 2002 with the goal of serving as the Navy's central operational authority for space and IT

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[51] Zelibor, T. RADM. (personal communication, 4 October 2005).
[52] Hearne, J. CDR. (personal communication, 13 October 2005).
[53] CHIPS. (2002). *NETWARCOM stands up*. From: <http://www.chips.navy.mil/archives/02_summer/authors/index2_files/netwarcom_stands_up.htm>, accessed 19 October 2005.

requirements, and to act as the operational forces' advocates in the development and fielding of such systems.

NETWARCOM, headquartered at Naval Amphibious Base Little Creek in Norfolk, Virginia, acts as the central operational component responsible for the coordination of IT, information operations, and space requirements and operations.[54] NETWARCOM is based on the concept of a single naval network and supports that network's end-to-end operational management by more succinctly organizing the various staffs working towards this goal. The organization has five guiding principles:

- Networks are a weapon system.
- Information is a domain of the battle environment.
- FORCEnet delivers naval C2 for Joint Operations in the 21st century.
- The space domain is critical.
- Forces are at risk without complete, secure, assured, and timely information.[55]

These guiding principles led to NETWARCOM's global mission, which focuses on information age business options to support the warfighter:

> *Naval Network Warfare Command creates warfighting and business options for the Fleet to fight and win in the information age. We deliver and operate a reliable, secure, and battle-ready global network. We lead the development and integration of Information Operations capabilities into the Fleet.*[56]

NETWARCOM is headed by a Vice Admiral, and oversees authority of three commands:

- Naval Network and Space Operations Command (NNSOC) in Dahlgren, Virginia
- Navy Component Task Force Computer Network Defense (NCTF CND) in Washington, DC
- Navy Information Operations Command (NIOC) in San Diego, CA (newly redesignated as a merger of Fleet Information Warfare Center and Naval Security Group Activity)

Sensing the benefits of information warfighting, the Navy took its first step toward integrating all of its Informational Operations capabilities following the stand up of NETWARCOM.[57] On 27 July 2005, the Fleet Information Warfare Center (FIWC)

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[54] Navy Newsstand. (2002). *Navy establishes Naval Network Warfare Command*. From: <http://www.news.navy.mil/search/display.asp?story_id=1156>, accessed 19 October 2005.
[55] Naval Network Warfare Command. (2005). *Home: Navy's central operational authority for network, information operations, and FORCEnet*. From: <https://ekm.netwarcom.navy.mil/netwarcom/nnwc-nipr/>, accessed 19 October 2005.
[56] Ibid.
[57] Information operations is the warfare composed of five integrated capabilities: Electronic Warfare, Computer Network Operations, Psychological Operations, Military Deception, and Operational Security that work with supporting and related capabilities to impact, disrupt, and corrupt an adversary's decisionmaking process while protecting one's own. Information from: Navy Newsstand. (2005). *First NIOC stands up as NSGAs align with*

Detachment in San Diego and the Naval Security Group Activity (NSGA) in San Diego were disestablished. The two were merged into one new command: the Navy Information Operations Command (NIOC) in San Diego.

The NIOC provides cryptographic and information operations capabilities previously provided by the two separate FIWC and NSGA commands. As VADM J.D. McArthur (Commander, NETWARCOM) explained,

> *now these functions will be at NETWARCOM, and we will be able to provide an integrated, synchronized team in the area of information and network warfare. And with this merger, we now have our first command that will lead the way to full spectrum information operations in addition to the cryptologic mission.*[58]

Gaining practical and applicable lessons from a case study such as this can be daunting for the reader. In response, the researchers kept this in mind. Throughout the course of the research the team worked to distill simple and pertinent lessons that could be applied by leaders in an NCO environment. The following are some of the observations and associated recommendations that the researchers believe may make NCO transformation and implementation more successful.

Finally, the following insights and recommendations gleaned from the experiences of TF-50 are likely to be useful across a wide range of operations.

Systems that provided value up and down the chain of command were used extensively. KWeb worked at TF-50 in large part because the users at all levels derived real value from the system. It was not just a reporting system for senior leaders. Systems that benefit more than just the senior leadership are likely to be used more extensively. Those that are perceived as only benefiting a few are resisted by the many.

The frequency of use of a new technology is essential to both adoption of tools and establishing communities of trust. Systems that require regular interaction from contributors and consumers force regular interaction that can foster effective virtual teams.

Cheap and simple tools can be very effective if a common structure is enforced. KWeb was, in reality, a fairly simple Web authoring system. Much of its power lay in a predictable and useful organization that provided a common organizational memory.

NCO need not create more work. By relying on incrementally updated Web pages and logs, the TF-50 staff was able to eliminate a great deal of outmoded message traffic, PowerPoint shows, and the associated work. Waiting for perfection has costs. By letting petty officers post their own information, the command took the risk that faster access to available information would become more valuable than delaying information requiring verification by the chain of command.

NETWARCOM. From: <http://www.news.navy.mil/search/display.asp?story_id=19396>, accessed 19 October 2005.

[58] Navy Newsstand. (2005). *First NIOC stands up as NSGAs align with NETWARCOM.*

Chapter 5.0 Conclusion

The results of the study support the hypothesis that NCO technologies and practices played a key role in enabling the success of TF-50. The commander and staff of TF-50 described the impact of the NCO technologies and practices on the ability of the force to share information, collaborate and coordinate actions using superlatives such as “unprecedented” and “dramatic.” The evidence gathered in this case study strongly confirms the importance that information sharing and collaboration play in enabling mission effectiveness. The study also contributes to our understanding of what factors make NCO technologies and practices effective. Specifically, this study finds that relatively inexpensive technologies can add tremendous value if (and likely “only if”) they were coupled with strong leaders who are willing to implement changes in TTPs and who will act as “change agents” promoting transformation. Changing TTPs often requires great effort, as many TTPs are the result of a military culture which does not support information sharing. The changes instituted by RADM Zelibor required that people be flexible, adaptive, and open to changes in TTPs. Finding the right people who can work effectively in such a manner requires changes in military personnel policies, such as those that govern recruitment, retention, and training. In order to succeed, RADM Zelibor introduced changes to organizations via new relations of authority (decentralized decisionmaking for example), as well as changes to processes via the creation of new procedures for exchanging information and decisionmaking. The findings of this study suggest that changes of this magnitude require strong leadership. The study concludes that TF-50 is a “proof of concept,” introducing new technologies in concert with appropriate changes in people, processes, and organizations, leading to dramatic improvements in effectiveness as posited by NCO theory.

The most recent naval transformation advancements have only been made available because of the continuous evolution of transformational capabilities that started in the mid-1990s. From the use of chat aboard the USS Abraham Lincoln, to the development of KWall at Global 2000, to RADM Zelibor’s implementation and support of transformational technologies, ideas, and behaviors, NCO capabilities continue to grow and strengthen. Evidence gathered in this study suggests that it does not take only sophisticated technology and money to allow transformation to unfold. It requires the synergistic development of technology and funding, as well as organization, people, process, belief, and strong leadership, fostered in the appropriate culture and environment that will allow transformational capabilities to unfold. RADM Zelibor, who demonstrated such a successful deployment aboard the USS Carl Vinson, explained the concept very succinctly: “I am not an innovator,” he said. “I just know what works.” [59]

[59] Zelibor, T. RADM. (personal communications, 4 October 2005).

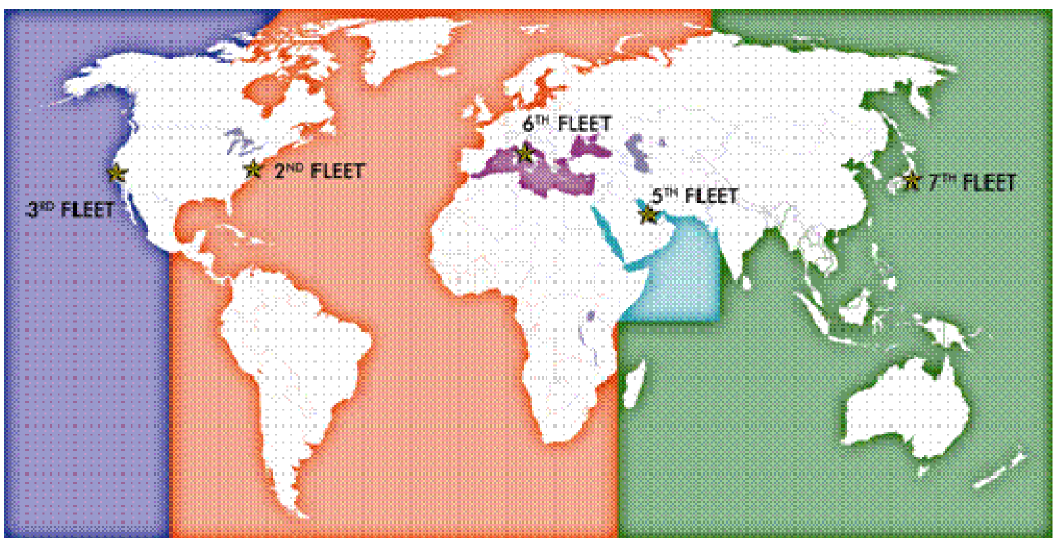
Appendix A. Acronym List

ACOS	Assistant Chief of Staff
ATO	Air Tasking Order
C2	Command and Control
C4I	Command & Control, Communications, Computers and Intelligence
CAOC	Combined Air Operations Center
CARGRU3	Carrier Group Three
CENTCOM	Central Command
CJTF	Commander Joint Task Force
CMI	Center for the Management of Information
COS	Chief of Staff
CSG	Carrier Strike Group
CTF-50	Commander, Task Force 50
CVN 70	USS Carl Vinson
CVW 11	Carrier Air Wing Eleven
DESRON	Destroyer Squadron
JAG	Judge Advocate General
JTFX	Joint Task Force Exercise
KWall	Knowledge Wall
KWeb	Knowledge Web
METOC	Meteorological and Oceanographic
MIO	Maritime Interdiction Operations
NCO	Network Centric Operations

NCO CF	Network Centric Operations Conceptual Framework
NCW	Network Centric Warfare
OEF	Operation Enduring Freedom
ROE	Rules of Engagement
SAR	Search and Rescue
TF-50	Task Force 50
TLAM	Tomahawk Land Attack Missile

Appendix B. The U.S. Navy's Five Fleets and CENTCOM

- Currently there are five naval fleets.
- These include the:
  - Second Fleet, which operates in the Atlantic Ocean
  - Third Fleet, which operates in the eastern Pacific Ocean
  - Fifth Fleet, which is based in Bahrain and supports naval operations under the command of the United States Central Command (CENTCOM)
  - Sixth Fleet, which operates in the Mediterranean Sea
  - Seventh Fleet, which operates in the western Pacific Ocean
- Fleet rotations are typically 6 months in length. However as the world is not stable, neither is the fleet rotation timetable; deployments are often longer than 6 months in duration.
- The figure below represents the fleet home locations and the AOR of each of the five naval fleets.



Appendix C. Study Methodology

Study Environment

An important element of the research design is the identification of the environment within which the study will be conducted. This environment can be considered to have two major areas of interest: internal and external. The internal environment is comprised of the core study team members and their direct government sponsors. The external environment is comprised of the various stakeholders that have an interest in NCO as well as the operational effectiveness of U.S. forces such as TF-50.

Internal Environment: TF-50 Study Team

The following personnel form the core research team for the TF-50 study. They conducted the first round of interviews and conducted the majority of the analysis required for this study. They also were instrumental in writing this final report.

Dr. Mark Adkins	University of Arizona, CMI
Dr. John Kruse	University of Arizona, CMI

In addition, the following personnel contributed to this study by conducting the second round of interviews and by writing this final report.

Dr. Kim Holloman	Evidence Based Research, OFT's NCO Program Lead
Christine Balisle	Evidence Based Research, Analyst
Joanna Centola	Evidence Based Research, Analyst
Angela D'Haene	Evidence Based Research, Research Assistant

The U.S. sponsor is the Office of Force Transformation. The following personnel directly contributed to this study and the final report.

Mr. John Garstka	OFT, Assistant Director for Concepts and Operations
Captain Frank Caruso	OFT, Concepts and Operations
Captain Neil Parrot	OFT, Concepts and Operations

The External Environment: Major Stakeholders

The external environment is comprised of individuals and organizations that have a substantial stake in the outcome of this study. Some stakeholders are easily recognized due to their proximity to the study. For instance, current and future naval commanders are considered to be key stakeholders. Other stakeholders are less obvious, but potentially equally important. For instance, the OASD-NII, as a principle developer of the NCO CF, is a stakeholder in this study.

Hypotheses

Hypotheses are statements that relate the values of at least two variables and are typically stated as "if…then" or "the more that…the more likely that" type statements. They are specific statements which describe, in concrete terms, the expected relationship between at least two variables. Hypotheses are derived from the study research questions and allow researchers to narrow the focus of the study to the concepts identified and defined by the study's theory (ies). Hypotheses are typically utilized in a deductive process which links study objectives to observations:

Study objectives→research questions→theory→hypotheses→observation→analysis

Hypotheses are the key mechanism by which the study objectives can be realized because they link the research questions to data collection. Therefore, they must be directly related to the research questions. The next section describes the hypotheses of this study as they relate to the research questions.

Research Question One required that the study team gather evidence regarding the NCO technologies and practices developed and utilized by the TF-50 staff during OEF. While no specific hypotheses were utilized, the NCO CF guided the data collection effort in answering this question.

Research Question Two examined the impact on effectiveness of the NCO technologies and practices put in place prior to OEF and further developed during operations. Based on NCO theory, this study hypothesized that TF-50 experienced improvements in information sharing, which enabled it to rapidly obtain and maintain shared situational awareness of the battlespace, and therefore it was better able to synchronize and coordinate decisionmaking and actions. TF-50 succeeded in synchronizing and coordinating decisions and actions despite operating with a very diverse force (six countries represented) and large number of platforms (59 ships), while operating in an area of operations (AOR) of more than 800 nautical miles. While many other factors contributed to the effectiveness of TF-50 during OEF, such as the disposition of friendly and enemy forces, for instance, this study focused primarily on how NCO technologies and practices impacted operational performance and mission effectiveness, using the NCO CF as an assessment tool.

The NCO CF is in itself a set of interdependent hypotheses. The NCO CF Top-Level view illustrates the possible hypotheses (Figure 7). Each box represents a specific NCO concept, which can also be thought of as a variable. The arrows found between individual variables indicate a potential dependency or relationship. These relationships, when considered holistically, constitute the NCO “value chain”.

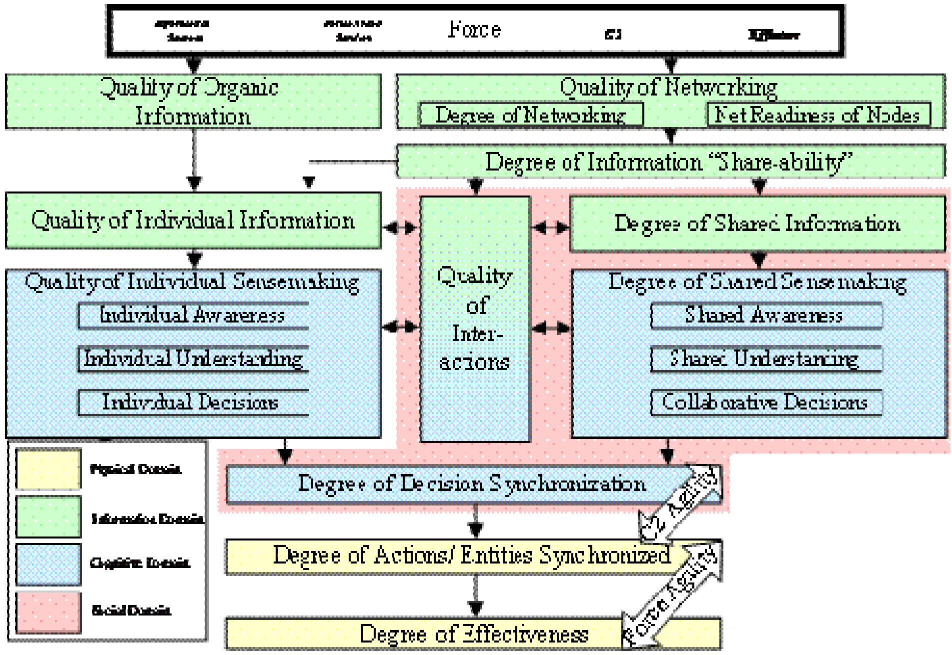


Figure 7. NCO Variables and Relationships

Each of these individual relationships can be explicitly stated as hypotheses. While the NCO CF has many potential hypotheses, the ones of interest to this study are listed below.

Main Hypothesis:

HYP 1.0 The use of network centric technologies and practices by TF-50 positively contributed to mission performance and effectiveness during Operation ENDURING FREEDOM.

Supporting Hypotheses:

HYP 1.1 Improvements in the quality of networking can improve the quality and extent of shared information.

Illustrative example: The use of SIPRNET technologies enabled TF-50 staff to rapidly share information regarding mission status and requirements. Since information was shared with many users, inaccuracies within the information could be quickly identified and corrected.

HYP 1.2 Improvements in the quality and extent of information sharing can improve the ability of people to be aware of the situation and to understand what is happening, this can lead to an improved ability to make appropriate decisions.

Illustrative example: As TF-50 personnel received updated information regarding ongoing missions, they were able to be aware of the mission status, and then decide what measures to take in order to fulfill TF-50's objectives.

HYP 1.3 Improvements in situational awareness, understanding, and decisionmaking can lead to better coordination and synchronization of actions.

Illustrative example: As more personnel and officials gained a better awareness of the situation and made better decisions in terms of what munitions to use in order to complete the mission, staff were better able to coordinate their actions so as to maximize their ability to carry out such missions.

HYP 1.4 Improvements in collaboration (i.e., the quality of interactions within and across organizations) can lead to improvements in information sharing, shared awareness and understanding, and collective decisionmaking.

Illustrative example: As more organizations and individuals interacted, utilizing existing formal networks and emerging informal networks (enabled by chat rooms and email) their ability to exchange information and to gain situational awareness and understanding improved, leading to improvements in their ability to make collective decisions.

HYP 1.5 Improvements in the ability of decisionmakers to coordinate and synchronize their actions can lead to greater agility and improved mission effectiveness.

Illustrative example: The success of TF-50 in achieving mission effectiveness and efficiency is to some extent a function of their ability to synchronize and coordinate actions across a wide range of ships, personnel, and organizations.

Research Question Three required that the study team examine the factors that contributed to the development and successful implementation of NCO technologies and practices. The research team, in collaboration with the government sponsor, determined that the key elements of transformation, also referred to as the DOTMLPF lines of development, is a useful framework for understanding what factors help explain the extent to which a force is able to develop network centric capabilities. The hypothesis derived from this question was more exploratory than evaluative in that insufficient evidence exists to posit specific relationships between DOTMLPF levels of investment and outcomes in terms of network centric capabilities. However, preliminary evaluation of existing case study research indicates that successful transformation requires synergistic investment across the DOTMLPF rather than the focusing of investments in a single line of development, such as materiel (for instance, investments only in communication infrastructure and information technologies without corresponding changes in training, TTPs, etc.).[60]

Based on the TOPP framework, the following hypothesis will be evaluated:

HYP 2.0 The success of TF-50 in implementing and executing NCO during OEF was a function of synergistic changes (investments) in technologies, organizations, people and processes.

Variables

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[60] See (insert reference for Stryker and Coalition Ops study)

Independent and Dependent Variables

An independent variable (IV), also called an "explanatory" variable, is a variable that is theorized to influence or explain the value of another variable. The dependent variable (DV), also called the "outcome" variable, is a central focus of the research design. The independent, or explanatory, variables for this study are those concepts represented in the top level of the NCO CF. The primary dependent variable of this study is mission effectiveness.

However, because the hypotheses in the NCO CF are interdependent (i.e., they represent a value chain), a variable that is denoted as an independent variable in one hypothesis may be a dependent variable in another hypothesis. Generally speaking, any variable, depending on the specific hypothesis and type of analysis being conducted, can be classified as either independent or dependent. The variables between the first and last variables in the value chain can be considered "intervening" variables.

Exogenous Variables

In order to evaluate the possibility of causal relationships between the independent and dependent variables, it is essential that evidence regarding exogenous variables is also gathered. Exogenous variables are those that can influence the value of the dependent variable, but which are not directly tied to the theory being evaluated. For instance, an exogenous variable that may affect the effectiveness of a particular military force is the extent to which a team has worked together in the past. All things being equal, teams that have previously worked together are more likely to perform better than newly-formed teams.

The NCO CF includes a rich set of exogenous factors that are likely to affect the major NCO variables (shared awareness, shared understanding, collaborative decisionmaking, and mission effectiveness). It is hypothesized that these variables will impact the ability of a unit or organization to collaborate effectively and to perform a given mission. This study will include some of these variables in order to collect data on the factors that may impact the performance of TF-50 participants in terms of how well they utilize their network enabled capabilities.

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Appendix E. Operation SOUTHERN WATCH

The goal of Operation SOUTHERN WATCH was to ensure that Iraq complied with United Nations Security Council Resolution (UNSCR) 688.

UNSCR 688 stated that Iraqi leader Saddam Hussein would stop the repression of the Iraqi civilian population.

In support of this goal, the coalition barred Iraqi fixed and rotary wing aircraft from entering the surveillance area.

The figure shows the Iraqi no-fly zones.

Appendix F. TF-50 Coalition Ships

United States of America

USS ENTERPRISE
USS Nicholson
USS Obrien
USS McFaul
USS Arctic
USS Providence
USS John Paul Jones
USS Kitty Hawk
USS Curtis Wilbur
USS Gary
USNS Rappahannock
USNS Saturn
USNS Niagara Falls
USNS John Ericsson

USS CARL VINSON
USS Antietam
USS Ingraham
USS O'Kane
USS Sacramento
USS Key West
USS Olympia
USS Peleliu
USS Comstock
USS Dubuque
USS John Young
USS Russell

USS T. ROOSEVELT
USS Leyte Gulf
USS Peterson
USS Detroit
USS Hartford
USS Bataan
USS Shreveport
USS Whidbey Island

United Kingdom

HMS ILLUSTRIOUS
HMS Southampton
HMS Kent
HMS Bayleaf
HMS Triumph
HMS Trafalgar
RFA Fort Victoria

Australia

HMAS Sydney
HMAS Anzac
HMAS Kanimbla
HMAS Adelaide

Canada

HMCS Iroquois
HMCS Charlottetown
HMCS Halifax
HMCS Preserver

Japan

JDS Hamana
JDS Kirisame
JDS Kurama
JDS Towada

Italy

ITS GARIBALDI
ITS Aviere
ITS Zeffiro
ITS Etna

France

FS COURBET
FS Var