VIRTUAL TEAM COMMUNICATION AND COLLABORATION IN ARMY AND CORPORATE APPLICATIONS

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This research addresses the following question. Can sharing "lessons learned" between Army and corporate applications foster more effective virtual teams by analyzing the "best practices" of virtual communication and collaboration described by academic research findings?

The results suggest there are "lessons learned" that can be transferred between Army and corporate disciplines. The resulting recommendations are the Army should: (1) develop a standardized training program for virtual teaming, (2) strive to develop a flatter organizational power structure and implement social changes to support technological systems, (3) develop an organization to address virtual teaming issues and, (4) specifically target senior leaders for virtual team leadership training. Corporate organizations can: (1) develop a standardized problem solving methodology (if needed) and (2) utilize a mission focused style of leadership based on the military's commander's intent.

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

VIRTUAL TEAM COMMUNICATION IN ARMY DISCIPLINES: THEORETICAL APPLICATIONS FROM CORPORATE LESSONS LEARNED, by Tony L. Jones, 116 pages.

Successful leadership requires clear communication between team members, yet globalization of our society has introduced the reality of directing teams who are often not co-located. In the military environment, distributed teams are increasingly common. However, the current research is primarily directed at such teams in corporate environments. Additionally, senior Army leaders typically have, at best, a passing knowledge of technology and virtual teaming.

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TABLE OF CONTENTS

Page

ACRONYMS

ARFORGEN	Army Force Generation
ARI	Army Research Institute
AT	Action Team
BCT WFX	Brigade Combat Team War Fighter Exercise
C2	Command and Control
CALL	Center for Army Lessons Learned
COP	Common Operational Picture
CPOF	Command Post of the Future
CTC LTP	Combined-arms Training Center Leader Training Program
ETC	Electronic Training Center
FAC	Forward Air Controller
GIS	Geographical Information System
GWOT	Global War on Terrorism
ILE	Intermediate Level Education
IT	Information Technology
IVIMEDS	International Virtual Medical School
JIIM	Joint, Interagency, Intergovernmental and Multi-agency
JFACC	Joint Forces Air Component Commander
LTG	Lieutenant General
MDC-Iraq	Multinational Division-Center in Iraq
MDMP	Military Decision Making Process
MNF-I	Multi-National Force-Iraq
NATO	North Atlantic Treaty Organization

RWMP	Radioactive Waste Management Project
SA	Situational Awareness
SOP	Standard Operating Procedure
SACEUR	Supreme Allied Commander Europe
SMS	Short Message Service
SU	Shared Understanding
TOC	Tactical Operations Center
UHF	Ultra High Frequency
VoIP	Voice over Internet Protocol

ILLUSTRATIONS

Page

TABLES

Page

CHAPTER 1

INTRODUCTION

Background

The Army's leadership paradigm is in an active process of transition and adaptation to meet the critical demands of globalization and mobilization associated with the current world situation. The previous high-intensity, formal planning strategies associated with the Cold War are changing to reflect a more decentralized, networked, "plan on the move" method of controlling combat operations. Advances in technology coupled with the extraordinary speed of information transfer have created new and unique capabilities for military commanders to exercise leadership and planning through virtual command processes. For example, it is now possible for the Chain of Command to 'virtually' execute combat operations from behind desks and computer monitors geographically distant from the actual battlefield. As a result of such technological advances, traditional staff planning models, where all staff members are physically co-located, are transitioning to virtual staff teams that are distributed across the battlefield.

There are both benefits and risks associated with virtual teams and the associated challenges to traditional leadership models. Despite these challenges, it is clear that such virtual operations and virtual technology represent a component of 21st century military leadership. The Leader Development Research Unit of the Army Research Institute (ARI) predicts a period of unprecedented change in the next 30 years of combat planning in which

> Army leaders will be faced with ambiguous, high-risk situations for which no Standard Operating Procedures (SOPs) have been developed . . . future Army leaders will need to develop teams more rapidly, to resist stress, and to adapt more

> quickly and effectively in complex, volatile, and unstructured environments. They will require not only versatile decision-making and critical thinking skills, but creativity and the interpersonal skills to inform, persuade, and inspire confidence. Dispersed units will challenge them where traditional notions of cohesion and chains of command may be difficult to achieve. (Leader Development Research Unit 2003)

In order to meet the needs of an Army in transition, current Army leaders must develop an integrated approach to learning new methods and processes of combat command facilitate virtual team communication and collaboration. In addition, these leaders must also assist mid-level and senior Army officers in transitioning from analog, co-located teams, to increasingly digital, virtual teams by training them in virtual communication and decentralized execution. Commander Richard C. Gomez, United States Navy, notes the blurred lines between centralized command and decentralized execution, and suggests that in order for a successful transition, military leaders must have a "thorough understanding of command relationships and leadership principles at the strategic, operational, and tactical levels of conflict, coupled with increased education" in order to balance the benefits and risks of transition (Gomez 2003, iv).

This requirement for increased education is required because of rapid increases in communication and collaborative technologies and the emergence of virtual teams. Virtual team requirements in Army applications are a result of combining advances in information technology with the requirements of maximizing command performance to meet the leadership challenges of modern warfare in a global society.

It is no longer economically or strategically feasible to depend solely on the Army's traditional hierarchy of top-down command; instead, access to real-time data through technological resources such as digitalized maps, geographical information system (GIS) reports, and instant communication channels including video-conferencing,

web-based group portals, and text messaging capabilities has made it possible for command decisions to be made in a collaborative context regardless of physical proximity of the command team. More specifically, virtual teams are defined as "teams whose members operate across space, time, and organizational boundaries, and who are linked through information technologies to achieve organizational goals" (McShane and Von Glinow 2008, 561). Given this definition, virtual command teaming models represent clear examples of unprecedented change for Army leaders in combat planning strategies that mirror the Leader Development Research Unit predictions stated previously.

Virtual team command models also offer opportunities for current Army leaders to utilize the experiences of junior officers, many of whom have encountered the complex and ambiguous combat situations of the Iraq War. Douglas C. Lovelace, Jr., Director of the Strategic Studies Institute, notes that these junior leaders are an essential component to the Army's process of leadership transformation because "the lowest officer ranks are filled with leaders who have learned to deal with ambiguity, change, and complexity" (Wong 2004, iii). Lovelace's assertion is expanded and supported by Leonard Wong, a former Professor of Leadership at West Point with over 20 years of Army service. Wong's research findings predict that as a result of Operation Iraqi Freedom, the Army will soon have experienced leaders capable of cutting-edge command strategies and proficient in use of much of the Army's current technological innovations, yet Wong cautions that current Army leadership must recognize these officers' lessons learned through relevant, challenging intermediate training courses designed to facilitate

successful leadership strategies as mid level officers. Wong describes the potential of these leaders quite succinctly:

> [T]he Army will soon have a cohort of company grade officers who are accustomed to operating independently, taking the initiative, and adapting to changes….the Army must now acknowledge and encourage this newly developed adaptability in our junior officers or risk stifling the innovation critically needed in the Army's future leaders. (Wong 2004, v)

In order to establish effective training programs for the Army's future leaders, it is important to understand the nature of future command environments including virtual command contexts. One approach to understanding involves examining research studies of virtual teaming in other contexts, such as academic and educational research findings in Leadership theories. Collaborative processes in dynamic, global situations are current areas of emphasis in Leadership literature in both military and civilian sectors. Much of what is known about establishing, sustaining, and leading effective virtual teams originates from studies involving corporate and executive-level business applications. Researchers from the disciplines of Organizational Leadership, Organizational Behavior, and Technical Communication have tested, assessed, and evaluated characteristics associated with effective virtual teams since 1991 (McShane 2008, 1). In comparison, a review of existing military literature indicates a relatively limited body of knowledge regarding potential areas of transferability of previous findings in corporate contexts to military applications.

Frequently, virtual teams are comprised of members representing multiple disciplines, and the primary literature sources referenced in this study reflect this reality by examining three different fields of research and application related to virtual teaming: (1) theoretical academic and educational research literature and studies from the fields of

Organizational Leadership, Management, and Business, (2) practical Army applications drawn from both doctrine and examples, and (3) contextually-relevant case studies involving corporate teams from multiple professional fields. Each of these disciplines offers unique, and sometimes divergent, perspectives and ideas based on both the discipline and the context or constraints of the study. Comparisons of these aggregated findings present opportunities for a broader and more balanced examination of the best practices in each discipline.

Primary Research Question

Through examination of multi-disciplinary research findings, this study is guided by the following primary research question. Can sharing "lessons learned" between Army and corporate applications foster more effective virtual teams by analyzing the "best practices" of virtual communication and collaboration described by academic research findings?

Subordinate Research Questions

The following subordinate research questions support the primary research question by establishing a framework of characteristics used by effective multi-disciplinary virtual teams: (1) What characteristics of communication and collaboration are identified by academic research findings as "best practices" for promoting effective virtual teams? (2) What "best practices" of communication and collaboration are found in Army and corporate applications? (3) What communication and collaboration practices can Army organizations apply from corporate "lessons learned"? and (4) What

communication and collaboration practices can corporate organizations apply from Army "lessons learned"?

Significance

This study aims to identify the best practices of effective virtual teams as suggested by findings from academic and educational research. Such analysis may then identify certain characteristics common to these best practices specific to Army and corporate discipline that could be relevant and transferable to other disciplines and additional applications. This data may subsequently establish the groundwork for sharing such knowledge between the disciplines. Such practices could offer future benefits and advantages for maximization of best practices between educational, military, and corporate applications. More specifically, this pool of shared knowledge could aid in supporting the Army's transitional approach to future needs in virtual communication, in addition to providing lessons in leadership of virtual teams to corporate organizations.

Assumptions

While the Army may have specific criteria or end-states for virtual teams that differ from those in both academic and corporate disciplines, this study assumes that each type of team shares a goal of increasing communication and promoting effective forms of collaboration within virtual teams. General Henry Shelton, Chairman of the Joint Chiefs of Staff, who espouses the future doctrine of the joint military, expresses this concept.

> The overarching focus of [Joint Vision 2020] is full spectrum dominance – achieved through the interdependent application of dominant maneuver, precision engagement, focused logistics, and full dimensional protection. Attaining that goal requires the steady infusion of new technology and modernization and replacement of equipment. However, material superiority alone is not sufficient. Of greater importance is the development of doctrine, organizations, training and

> education, leaders, and people that effectively take advantage of the technology. (Chairman, Joint Chiefs of Staff 2000, 3)

Note the phrase interdependent application, which would denote the requirement for a form of collaboration. Additionally, greater importance is placed on the training of members to be able to take advantage of technology, a component of which would be communications technology.

The corporate world has already seen the beginning of this trend as well. In a Business Week article, Conlin states,

> distributed workers are those who have no permanent office at their companies, preferring to work in home offices, cafes, airport lounges . . . <they> are what author Richard Florida calls the 'no-collar workplace.' They are people who do team projects over the Web and report to bosses who may be thousands of miles away . . . Currently, about 12% of the U.S. workforce qualifies as distributed. (Conlin 2005, 78-79)

These two quotes indicate both organizations have a vested interest in improving the ability of distributed teams to communicate and collaborate.

Limitations

This research examines current technology and is limited to communications technologies and techniques that are commonly in use and do not require additional technological advancements. In other words, this study is limited to readily available forms of technology that Army organizations can readily implement using “off the shelf” technologies. Additionally, this is a qualitative study and, as such, all analyses are specific to the case studies and therefore, generalization cannot be expected. Specifically, this research is focused on Army applications, and any attempt to expand the research to other branches of the armed forces would necessitate an examination of other services’

doctrines and applications. A study of this magnitude is beyond the scope of this research.

Summary

For Army leaders at all levels, these transitional processes of effective communication and collaboration present challenges of balancing issues of modern technology, tactical and strategic problem solving, and directing increasingly diverse staffs. Successful leadership hinges on clear communication between team members. Yet globalization of our society and, by extension, our military has introduced the necessity of directing teams who are not physically co-located, and often may be operating in different time zones.

Effective communication and collaboration within combat planning teams in the future will involve the utilization of virtual teams. Essentially, this will require planning and command operations with commanders and staffs distributed at numerous locations on the battlefield. Junior Army leaders are comfortable with these concepts as the technological advancements and changes in modern warfare have occurred during their formative years.

At the same time, senior and mid level Army officers typically have limited knowledge of how to lead virtual teams. These skills have been studied and practiced by academics and corporate leaders for many years. Any skills that are readily transferable should be identified and applied to facilitate the transition of the Army to a virtual team oriented organization. Conversely, the current pace of operations that the Army has sustained and the utilization of Army units in nontraditional roles has generated significant lessons learned that corporate organizations could utilize.

This chapter briefly described the requirements for improving virtual teaming in Army and corporate contexts, and the need to utilize a comparison to determine possible lessons learned to improve the functioning of these teams. The following chapters will further detail a structure to facilitate this comparison as well as provide examples of case studies to illustrate the lessons learned. The study will conclude with suggestions for ways to implement the results of the comparison.

CHAPTER 2

LITERATURE REVIEW

Introduction

Chapter 2 presents a systematic review of research related to the communication and collaboration processes of virtual teams from academic, military, and corporate contexts. The research literature and data included in this study represent three distinct disciplines with varied forms of communication and collaboration processes linked to the respective norms of each group. The common characteristic of this examination and analysis, however, is based on each discipline's use of virtual teams to conduct business and complete professional projects. More specifically, this study addresses virtual teaming processes as represented by the following resources:

1. Academic and scholarly publications such as textbooks, journal publications, and conference proceedings designed as educational references and instructional materials;

2. Army field research findings conducted by organizations such as the Army Research Institute (ARI), designed and disseminated as training and doctrinal materials, and

3. Corporate project team research findings structured as case studies and disseminated as executive models and training aids.

While teamwork is common in nearly all disciplines and professions, the concept of virtual teaming is a relatively new development. By most accounts, virtual teams emerged in response to the increasing demands of globalization and the economic realities of a dynamically changing workforce. Accordingly, the body of research data is

relatively new, with a noted spike in publications and presentations in the period between 2003-2008 (McShane 2008, 3).

Components of Virtual Teams

For the purposes of this study, virtual teams are "cross functional groups that operate across space, time, and organizational boundaries with members who communicate mainly through information technology" (Lipnack 2001, 291). Basically, teams are considered "virtual" when one or more of the team members are physically located in separate places, and team members communicate primarily through use of technology in contrast to traditional face-to-face meetings (McShane and Von Glinow 2008, 292). Examples of types of technology used in virtual communication include use of the Internet, intranets, e-mail exchanges, real-time videoconferences or meetings, instant messaging, and phone conferences. In addition, virtual teams vary with respect to coordinating the timing of technology as tools of communication and collaboration: depending on the requirements of the team and the types of technology, individual team members' work may be synchronous or asynchronous (Lumsden and Lumsden 2004, 11-12).

The commonality is the virtual team's overall objective, and most often, technology and scheduling are selected accordingly. While individual team members most often have multidisciplinary subject matter expertise, success for virtual teams depends largely on the interdependence shared between group members. Kazenbach and Smith describe this element of virtual teams succinctly with the following definition: "A team is a small number of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves

mutually accountable" (Kazenbach and Smith 1993, 68-71). Note the use of the term complementary. This indicates that teams in general, and virtual teams in particular, are most often non-homogeneous. Teams are comprised of members with specific subject matter expertise, yet individual team member must work collaboratively in order to complete all components of the overall project.

One of the early researchers in virtual teams was Dr. David Gould. His research in the organization of virtual teams emerged as the result of three critical factors: (1) rapid changes in the marketplace; (2) broad advances new types of enabling technology, and the (3) increasing emphasis of economic accountability (Gould 1999, 1). Much of Gould's research in virtual teams took place in the late 1990s, and in the interval, these factors appear to have increased in significance, thus supporting Gould's on-point description of the future workplace as "a virtual workplace where productivity, flexibility, and collaboration will reach unprecedented new levels" (Townsend, DeMarie, and Hendrickson 1993, 18).

Gould's findings were consistently supported by other researchers in the following years; however, the scope of study expanded to consider not only new forms of technology, but to examine potential applications in a social sense. In other words, researchers supplemented new knowledge of technological tools within a more communication-centered, global context. McShane and Von Glinow describe the relationships between the tools and the teams as mutually sustainable with the statement that while "information technologies and knowledge-based work make virtual teams possible, two other factors--globalization and knowledge management make them increasingly necessary" (McShane and Von Glinow 2008, 292). These factors present a

solid rationale for the presence of virtual teams in multiple disciplines and varied environments in our 21st century workplace. Understanding of how effective virtual teams are formed, maintained, and sustained is essential knowledge both for team members and team leaders.

Research findings are categorized into three types of characteristics consistently discussed throughout the literature:

Environmental characteristics: These characteristics represent the physical requirements of the virtual team environment such as technology, space, or geographic location;

Social characteristics: These characteristics represent team level perspectives--both individual and collaborative team social characteristics; and

Leadership characteristics: what traits and actions are required of virtual team leaders.

This structured framework makes it possible to examine multidisciplinary research case study findings while maintaining organization across the disciplines.

Educational Applications from Academic Research Findings

Much of the existing research related to communication and collaboration practices in virtual teams has been published in the academic field of Organizational Leadership. In some ways, Organizational Leadership studies represent a type of "umbrella" through the combination of research literature and studies from the fields of Business, Psychology, Technology, Information Science, and Educational Research. In general, topics in Organizational Leadership research are limited to the application of theories from each of these fields on social and political challenges faced by an

organization. Methods of communication are an integral extension of these challenges at all levels in an organization.

It was not until the early 1990s that the techniques of communication technology advanced in conjunction with widespread reliance on workplace teams in contrast to the more traditional forms of individual projects (Bell and Kozlowski 2002, 14-49). Research findings indicate that in the early 1980's, 5 percent of U.S. workers reported regular use of some form of technology as part of a workgroup compared with over 50 percent of workers surveyed in 1998 (Savoie 1998, 231). Support for these findings is mirrored by an investigation that examined the number of academic and scholarly publications between 1991-2004. Specifically, researchers searched for the keywords "virtual teams" or "virtual communication," and the findings are presented in Figure 1. The data presented in Figure 1 documents significant and rapid growth of research related to communication through virtual teaming (McShane 2008, 3). A closer examination of these studies shows a broader knowledge base. In addition, as the number of studies increase, a greater consensus on what are effective techniques and relative characteristics emerges.

Environmental Characteristics From Academic Research

Multiple Modes of Communication

Academic research studies of virtual teams consistently emphasize the importance of multiple modes of communication between members of the virtual team. This contrasts with the prevalent misconception that virtual teams are completely technologically driven; in fact, virtual teams often involve a combination of technologically based communication and face-to-face meetings (Sasso 2008). Types of

technology used in virtual communication include use of the Internet, intranets, e-mail exchanges, real-time videoconferences and/or meetings, instant messaging, phone conferences, all of which may be synchronous or asynchronous (Lumsden and Lumsden 2004, 11-12).

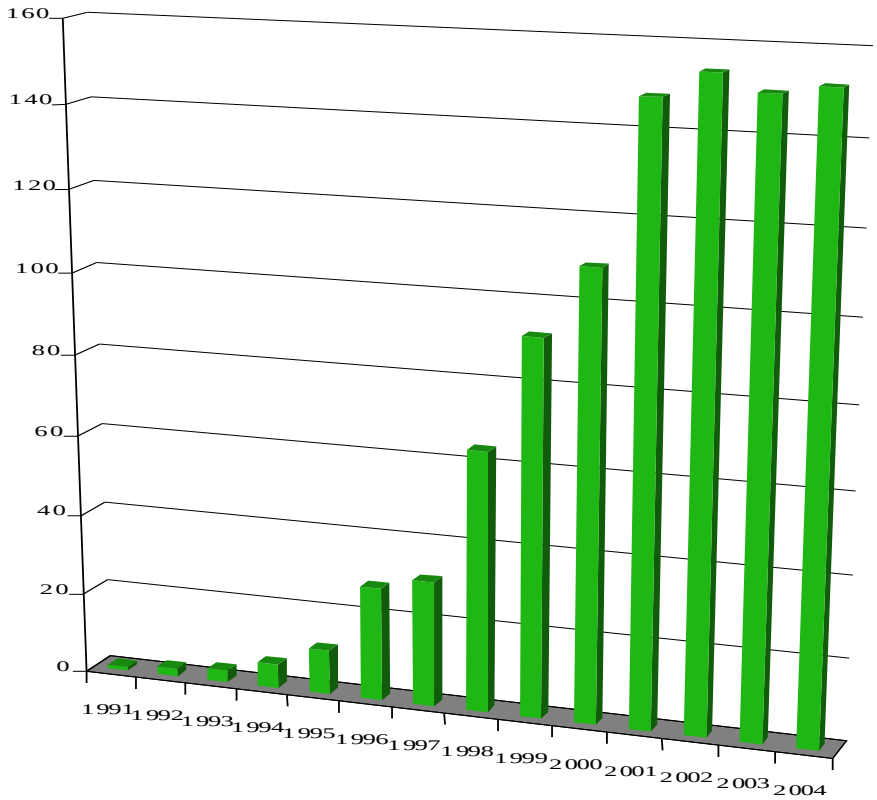

Figure 1. Scholarly Articles of Virtual Teams, 1991-2004
Source: Steven L. McShane, "Watching Virtual Teams Grow in the Academic Vernacular," *Currents: Organizational Behavior Developments in Research and Practice* (October 2008): 3, http://highered.mcgrawhill.com/sites/dl/free/0072931477/133841/oct_mcshane.pdf (accessed 15 February 2009).

Face-to-face interactions are a consistent topic emphasized throughout the academic literature. They provide a method for problem resolution when teams meet periodically during a project (Gould 1997, 157). Face-to-face meetings also help to

overcome the loss of nonverbal cues that "represent 80 to 93 percent of the meaning people receive in face-to-face communication" (Barrett 2006, 255). When a face-to-face meeting cannot be conducted, the lack of non-visual input can be offset through video teleconferencing. Even this method requires multi-modal communication as experts recommend keeping a written record of the video meeting to include updating notes and mind-mapping during the meeting (Sampson 2008, 5).

Video teleconferencing and other multiple modes of communication are also important in overcoming the absence of non-verbal cues. Text-based communication such as e-mail and document sharing are good for basic communication within virtual teams, but researchers caution that they cannot substitute for graphics, diagrams, or replace the importance of face-to-face communication (Gould 1997, 157). Another good reason for multiple modes of communication is to allow for geographic issues. The axiom "a picture is worth a thousand words" is a good description of the relationships between verbal and non-verbal communication processes. As the need for virtual teamwork increases globally, it is important to note that levels of connectivity vary from country to country, thus, flexibility through multiple modes of technology is integral to team success (McShane and Von Glinow 2008, 292).

Clearly, collaboration between members of virtual teams often depends on accessible technology, and the reasons cited in the previous paragraphs support the necessity of multiple modes of communication. Figure 2 presents an example of a multi-mode system of communication for virtual team collaboration.

The examples of communication modes such as those presented in Figure 2 also call attention to the importance of matching the type of communication with the purpose

of a virtual team meeting. Furthermore, each mode of communication necessitates consideration of subsequent factors such as geographic factors, physical space requirements, and relevant time zone differences in planning and executing an effective virtual team meeting. For example, a video teleconference requires synchronization, meaning that while team members may be geographically distributed, time factors must be considered to allow all members of the virtual team to access the teleconference at the same time.

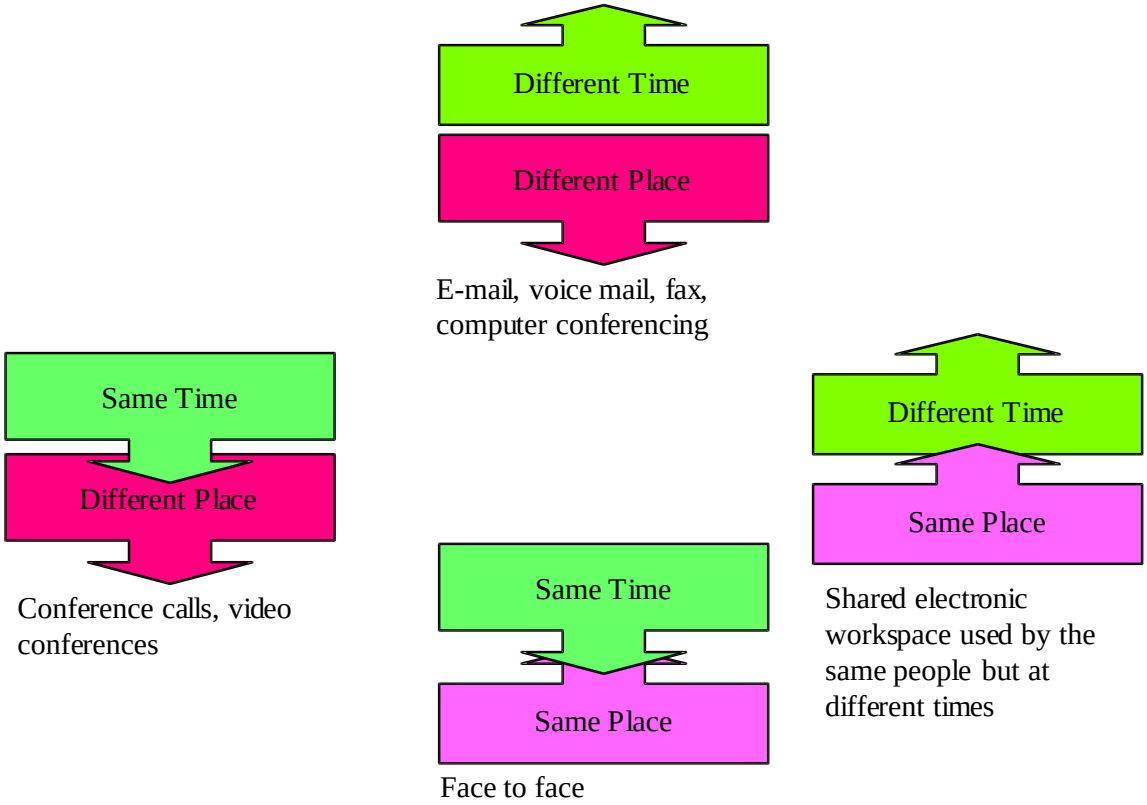

Figure 2. Virtual Team Meeting Options

Source: Deborah J. Barrett, *Leadership Communication* (Boston, MA: McGraw Hill, 2006), 256.

Technological Support

Effective virtual teams must move beyond selection of multiple modes of communication technology by ensuring that all team members are proficient in the multiple modes of technology the team will use to communicate. Researchers report that far too often, virtual team members do not receive an adequate level of technological training:

> Specific training in the actual use of communication and information technology is also critical. Many organizations seem to underestimate the training necessary to allow members to effectively use specific new software applications and upgrades to existing applications. This often leads to a situation where team members underestimate the value of their technology tools because they have not learned the range of possibilities offered by the new tools. Basic training in the benefits afforded by new applications and upgrades can provide a surprising return in increased productivity. (DeMarie 2000, 17)

In addition to training virtual team members for technological proficiency, research studies also note that team members must possess advanced levels of competence in their own communication skills (Katzenbach and Smith 2001, 191). As DeMarie notes, all members of a virtual team must be aware of the importance of integrating technological methods with appropriate participation in active and flexible forms of team dynamics (DeMarie 2000, 17). One factor that seems to facilitate effective forms of team dynamics and collaborative processes is the integration of a shared technological operating space or a virtual team room (Barrett 2006, 256).

Shared Work Space

The establishment of a common work area assists members of the virtual teams in developing both inter-personal connections while simultaneously promoting strategies of sharing information that is critical to team success. Benson-Armer and Hsieh suggest that

having a designated work area (such as a web page) allows all team members to use the available technology to their benefit. As mentioned before, all team members are not required to share the space simultaneously, but the availability of shared work areas offer opportunities for advancing development of ideas and design of documents in a common space (Benson-Armer and Hsieh 1997, 26).

Structured Problem or Task

Generally, virtual teams can accomplish any task a traditional team can. However, research studies have suggested that structured problems or tasks as opposed to ambiguous "brainstorming" tasks tend to be effective in virtual team environments (Lureya and Raisinghani 2001, 533). Riggio further elaborates between product and knowledge-based team work through an emphasis on collaboration. “Rather than each worker independently contributing a piece to the final product, as in traditional work teams, virtual team members share skills and resources, working collaboratively to get the job done” (Riggio 2008, 413). The preceding quote again shows the need for a shared workspace coupled with a requirement to work together on a common problem. These are just two examples of situations where virtual teams require more structure.

In summary, effective virtual teams require specific types of consideration and support in contrast to traditional teams. These factors necessitate different types of technological training in conjunction with specialized training in multiple and varied communication techniques. Just as traditional teams need a physical work area, virtual teams need a common electronic “work area” where ideas and contributions can be exchanged and discussed. Finally, virtual teams work best when assigned structured problems with well-defined inputs and outputs.

Social Characteristics From Academic Research

Cross Functional Teams

Most often, virtual teams are multidisciplinary. Each team member is viewed as a knowledgeable and skilled professional with a specific skill set. One of the strengths of a virtual team is the lack of geographical restrictions. Teams can "go any distance to bring in just the right expert for the job" (Lumsden and Lumsden 2004, 101). As a result, some researchers note higher levels of professionalism within virtual teams, and this factor becomes relevant due to the fact that members of virtual teams often have higher requirements for trust than traditional teams. All professions possess a system of ethics and standards that contributes to "shared beliefs," and these commonalities generate a "storehouse of credibility and trust" within teams (Barrett 2006, 256). This storehouse is filled as team members learn that they can rely on each other by seeing that team members meet deadlines and accomplish assigned tasks with little supervision (Benson-Armer and Hsieh 1997, 25).

Self Managed Teams

Another characteristic often associated with virtual teams is the decrease in levels of supervision in contrast to traditional teams. Again, the issue of trust is at the forefront, as team members have to trust the direction they receive from supervisors. At the same time supervisors have to trust that team members' work will be performed without direct supervision. As such, virtual team members are expected to be self-directed (Connaughton and Daly 2004, 65). They should also be able to function in a less structured environment as effective virtual team members have somewhat of an "informal" structure to getting the job done, but they do not possess the "ultimate

authority" that team leaders do (Riggio 2008, 413). In some cases, virtual team members are expected to "manage their own projects and evaluate their own performance" (Schultz and Schultz 2010, 214). Self-starting and trustworthy team members, who are both adaptable and flexible, are vital to the success of virtual teams.

Communication Skills

Another key aspect of generating trust in a virtual team is that all team members must possess good communication skills. Members of the team have to overcome the lack of non-verbal communication and thus skills in writing and other visual mediums (graphs, pictures, etc.) become paramount (Lumsden and Lumsden 2004, 101). Virtual teams were found to exhibit a rapid initial trust referred to as "swift trust". A study by Jarvenpaa and Leidner in 1999 found that this was highly susceptible to communication behaviors of group members (Bradley and Vozikis 2004, 102). With limited face-to-face communication a team member's ability to communicate clearly is vital to preventing misunderstanding and confusion.

One of the key reasons that the potential for misunderstanding is high is that virtual teams are less likely to be homogenous with team members being drawn from different parts of the nation and even different countries. Most team members need to be trained in cross-cultural issues as these can become amplified due to the previously mentioned difficulties in communication (Barrett 2006, 255). As a result, customized training is required in order to prepare members of virtual teams to meet the expectations associated with global communications. Connaughton and Daly give specific examples of this when they state that "different cultures have different holidays; members work at different times; and they have different beliefs about what is, and what is not, ethical. We

found that it is critical for leaders to stay attuned to these matters" (Connaughton and Daly 2004, 65). Training members of virtual teams addresses these cultural issues and assists the virtual team in choosing appropriate communication styles based on global factors.

Verbal and Non-Verbal Communication Skills

According to Gould, one of the most important factors in the success of teams is the trust and relationships that are developed between team members in face-to-face meetings (Gould 1997, 157). Again, it is a common misconception that virtual teams are completely virtual, yet DeMarie's research findings suggest another possibility:

> Perhaps the strongest message that came from the interviewees was that high-tech tools, including videoconferencing, could not totally replace the advantages of in-person face-to-face communications. Virtual team members reported that some initial face-to-face meeting was necessary to establish the high levels of interpersonal trust required for effective teamwork. This issue of trust is one that frequently seemed to be discounted, but should not be overlooked. Team members on teams that did not have at least one in-person meeting believed that their productivity and the overall quality of the team's work suffered. (DeMarie 2000, 15)

Even when the face-to-face meetings have successfully started a team, the lack of non-verbal cues in virtual communication can lead to misunderstandings and lost productivity. Team members have to understand that different rules and expectations apply to digital communications. For example, people tend to be perceived as more brusque in online communication (Lumsden and Lumsden 2004, 105). Even when teleconferencing or video conferencing was utilized to simulate a face-to-face environment, virtual team members reported reluctance to contribute due to an inability to interrupt the ongoing conversation without feeling rude. Team members were unsure of the proper methods, or strategies, needed to get their peers attention (DeMarie 2000,

16). A solution to these problems was to develop a program to train individual team members on the procedures the team would use and how to develop non-verbal communication skills. A particularly interesting suggestion was to have a team determine its "netiquette" at the initial meeting to avoid insults and misperceptions (Lumsden and Lumsden 2004, 228). Non-verbal communication is like learning a foreign language and, just like foreign language training, learning non-verbal communication has to be structured.

Leader Characteristics From Academic Research

Mentorship and Guidance

While leaders of virtual teams must, in general, meet the same basic requirements that exist for leadership of a traditional team, virtual team leaders must also expand and customize certain management practices to meet the needs of virtual teams. According to Connaughton and Daly, "Virtual teams also exacerbate challenges that traditional teams face and create new ones. One challenge relates to leadership. In a recent study of 500 virtual managers, 90 percent of them perceived managing from afar to be more challenging than managing people on-site" (Connaughton and Daly 2004, 49-50). Essentially, virtual team leadership requires mentorship and guidance beyond that of a traditional team. Virtual teams require more structure and the establishment of team goals is more important due to the difficulty in developing trust. According to Barrett, "With a virtual team, a high level of commitment is even more critical than with a traditional team" (Barrett 2006, 256). Connaughton and Daly describe the responsibilities and increased commitment in leading virtual teams as follows:

> In an empirical study of virtual teams in an international educational setting, Kayworth and Leidner (1998) found that the leaders rated as "effective" by their members demonstrated a "mentoring" quality characterized by understanding, empathy, and concern for team members. In other words, effective distanced leaders are adept at building and maintaining relationships with those they lead from afar. (Connaughton and Daly 2004, 52)

Essentially, while leaders of traditional teams focus on results or output, leaders of virtual teams are required to increase levels of mentorship through coaching and facilitation, thus making them more involved with the process (Van Bree, Vlietman, and Wierda 2001, 15).

To develop a high performing team, virtual team leaders must assist virtual team members in establishing a shared vision while guiding individual members in understanding the importance of their respective contributions to the overall team objectives (Hellriegel, Slocum, and Woodman 1995, 691) (Katzenbach and Smith 1993, 119-126). Goals are important for any team, but they are more critical to virtual teams due to varied norms within virtual teams and a decreased ability to adjust the direction the team is progressing (Van Bree, Vlietman, and Wierda 2001, 13).

Monitored Collaborative Workload

By their nature, virtual teams are collaborative. One of the key advantages of virtual teams is the ability to utilize team members with the best qualifications from disparate fields (Lumsden and Lumsden 2004, 101). However, this comes with a downside as well. One of the pitfalls of virtual teams is that team members can become overwhelmed. The ability to reduce travel time, by conducting work from a distance, allows organizations to assign more work to team members (DeMarie 2000, 13). Some research studies report that members of virtual teams who tele-commute feel that they are

never away from the job and feel pressure to answer e-mails and other correspondence at any time (Schultz and Schultz 2010, 253).

Another aspect of the collaborative work is the assignment of tasks. Since a given task may require various team members to complete, leaders have to be deliberate in assigning tasks to specific team members to ensure that no confusion results. The requirements for giving information back to the team along with deadlines must be clearly understood by everyone as well (Lumsden and Lumsden 2004, 125). However, not all team leaders are clearly delineated. Huxham and Vangen identifed three key activities of collaboration displayed in Table 1 (Paparone 2004, 8-9). Developing a virtual team requires the ability to focus on collaboration and balance the team.

Table 1: Key Activities of Collaboration

Activity	Definition	Example
Controlling	managing power and controlling the agenda	manipulation and bargaining, empowerment, or reflexivity the latter meaning challenges to taken-for-granted assumptions
Organizing	representing and mobilizing member organizations	balancing the dilemma of representing the member organizationÕs needs while playing a partnership role, acting as conduits to the resources of member organizations, and coordinating commitments
Motivating	enthusing and empowering those who can deliver collaboration aims	building commitment, overcoming geographical barriers, and being assertive

Source: Christopher R. Paparone, Deconstructing Army Leadership, *Military Review* (January-February 2004): 8-9.

Defined Team SOPs

Another area where structure is required is the early establishment of team ground rules or norms. These tend to prevent conflict and misunderstanding (Gould 1997, 159). As an example, there should be a process in place where face-to-face interactions can occur if the virtual team encounters communication or proficiency issues (McShane and Von Glinow 2008, 292). The primary focus of these norms should center on the communication practices of the virtual team, which is central to the key issues of trust and collaboration. Successful leaders of virtual teams have learned to set the rules at the establishment of the team (Connaughton and Daly 2004, 58).

Another place where ground rules are required is team structure. Many virtual teams are formed on an ad hoc basic in order to rapidly deal with emerging situations (Gaspar 2001, 3). As a result, many times team members are not clear who they are working for and what the reporting requirements should be. DeMarie found that one of the difficulties with virtual teams is that many times individual team members were working for an organization that was part of a separate government office. Direct supervisors had no visibility of the virtual workload and team members were placed in the position of working for two different individuals who may not be aligned (DeMarie 2000, 13). Clear reporting requirements helped to mitigate these factors.

Decision Policy

One of the most critical procedures to an organization is the development of a decision policy. In his research on decision-making in virtual environments, Pleban states, “one of the critical components to unit success is the leader’s ability to recognize environmental cues and relevant situational factors, maintain situational awareness (SA),

apply appropriate strategies, and make effective real-time decisions" (Pleban 2001, 11). This demonstrates one of the key capabilities a team leader must have. It is one area where virtual teams and traditional teams differ. One of the most startling differences between traditional and virtual teams has been described as a "flat organizational structure" (Townsend, DeMarie, and Hendrickson 1993, 17). At the same time, advances in technology have created an "information explosion" which requires new ways of thinking to "adapt to a changing environment's complexity, uncertainty, ambiguity, and information overload" (Riedel 2001, 7). Because of these factors, leaders must establish clearly what decisions require leader input and what the individual members and subordinate leaders of this self managed team, as described in the previous characteristic, can decide for themselves.

Best Practices from Academic Research Findings

Based on the increasing interest and academic inquiry related to virtual teaming, it seems likely that most workers will find themselves working within a virtual team at some point in their careers. Therefore, information related to promoting effective teams is especially useful. Academic research findings suggest that general agreement exists in what are categorized as the environmental, social, and leadership characteristics of virtual teams. In fact, a virtual team has the traits and requirements of a traditional co-located team; however, there are additional requirements. Table 2 shows the characteristics of virtual teams as discussed in the preceding sections. Note that each characteristic is supported by distinct factors that represent general agreement on what constitutes the best practices based on an analysis of examined academic and educational research.

This framework will serve as the means of examining and analyzing case study examples from the Army and corporate disciplines. The information also answers the first subordinate research question by identifying the best practices of communication and collaboration, identified by academic research findings, for promoting effective virtual teams. The next sections of Chapter 2 present case study examples from military and corporate contexts.

Table 2: Framework of Virtual Team Characteristics

Environmental Characteristics				Social Characteristics				Leader Characteristics			
Multiple Modes of Communication	Structured Problem or Task	Technological Support	Shared Work Space	Cross Functional Team	Self Managed Team	Communication Skills	Verbal and Non-Verbal Communication Skills	Mentorship and Guidance	Monitored Collaborative Workload	Decision Policy	Defined Team SOPs

Source: Created by author.

Army Case Studies and Army Research Findings

The United States Army is currently undergoing a transformation that was started in the late 1990s. The deployments of that decade had led the senior leadership to conclude that the Army needed to be more deployable. The Army needed to change from a force focused on fighting a massive ground war in Europe to one that was more flexible

with greater capability for decentralized operations. In 1999, then Army chief of staff, General Eric Shinseki, stated:

> Our heavy forces are too heavy and our light forces lack staying power. Heavy forces must be more strategically deployable and more agile with a smaller logistical footprint, and light forces must be more lethal, survivable, and tactically mobile. Achieving this paradigm will require innovative thinking about structure, modernization efforts, and spending. (Lambeth 2002, 83)

Virtual teams represent an example of this innovative thinking and will be increasingly required in the Army of the future as units will be separated by greater distances and will have to have even greater levels of flexibility.

One of the key aspects addressed by the modernization of the Army, was how to apply technological advancements to Army operations in the post Cold War world. The Army began transforming to address projected future conflicts. The transformation strategy states that conflicts would have the following characteristics:

- Operations will shift from linear to nonlinear;
- Forces will operate much more dispersed;
- Operations will be conducted at a much higher tempo, leading to greater reliance on speed in mobilizing, deploying, and conducting combat operations;
- Advanced information technologies will allow ground forces to form networks, enabling them to violate the principle of mass to better protect themselves by dispersion, while losing little of their ability to coordinate or mass combat capability;
- Although close combat will remain a key element in land warfare, advanced information capabilities and munitions will enable ground forces to conduct decisive engagements at far greater ranges than has historically been the case;
- Adversaries who cannot compete effectively in open battle will gravitate toward combat in complex terrain (urban areas in particular);
- Operations will be much more dependent on maritime and air forces for their success than has been the case--in short, land warfare will become even more of a joint endeavor than it is today; and
- The spectrum of land warfare will become blurred, with various forms of warfare merging, requiring unprecedented levels of flexibility from land forces. (Krepinevich 2008, 9-10)

Looking at several of the predicted characteristics, it is easy to see why Mr. Krepinevich stated that, "The Army's vision looked to exploit opportunities made possible by rapidly advancing technologies, with particular emphasis on information-related technologies." The modular force would be able to "See first, understand first, act first, and finish decisively" and would operate using "more dispersed, yet highly networked, forces that fight the decisive battle not at close range but at extended distances" (Krepinevich 2008, 10). Note the reference to a networked force. These teams will be virtual and required to collaborate and communicate across increased distances.

Another component of the Army's transition is the focus on modular brigades. The previous Army organization was centered on the division as the primary war fighting element. Each modular brigade is, as the name implies, completely self-sufficient and capable of all operations. With this advent of modularity, divisions may still deploy, but they can be composed of various types of brigades. A division may have all, some, or none of its habitually assigned units. For example, the 10th Mountain Division constitutes the headquarters for the Multinational Division-Center in Iraq (MDC-Iraq). However, as Figure 3 shows, it has brigades from Fort Campbell, Fort Hood, Fort Stewart, Fort Riley, and Fort Carson (shown in red) assigned to the division, which is stationed at Fort Drum (shown in green) (Task Force Mountain Public Affairs Office 2009, 1). As the figure highlights, units must form virtual teams while preparing to deploy from disparate posts throughout the United States, if not the world. This is another reason that virtual teams will be more important in the future.

The remainder of this section will discuss the case studies that pertain to Army applications. The case studies begin with broad based, general Army applications and

progress to more specific, small unit level applications with the last one being a tactical level engagement.

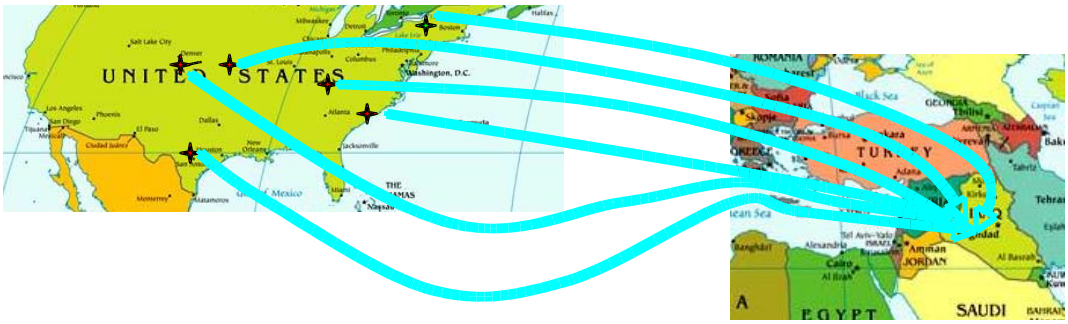

Figure 3. MDC-IRAQ Deployment Challenges
Source: Created by author. Map background from Travelportal.info, *World Images* http://www.traveldir.org/images/world/world_map_political.jpg (accessed 12 February 2009)

Case Study 1: Army Force Generation (ARFOGEN)

Even if units begin in the same location, they conduct a process called Army Force Generation (ARFORGEN), which is depicted in Figure 4 and serves as the first case study of virtual teaming in army applications. ARFORGEN is "a sophisticated, intensive unit deployment preparation and execution, training and learning program for both active and reserve component units" (Brown 2006, Es-4).

Of particular note, the center portion of Figure 4 shows that a part of future pre-deployment training will be what is termed a "virtual right seat ride" where the unit preparing to deploy to a theater of operation can experience the daily operations of the unit they are replacing virtually, prior to leaving the United States. This forms a virtual team of sorts between the leaders of the two units. In addition, the model also shows an Electronic Training Center (ETC) on the left panel that provides a virtual training

mechanism. This is where key leaders are given a chance to hone their skills and develop teams prior to large scale, full force training involving large numbers of soldiers and the associated expenses.

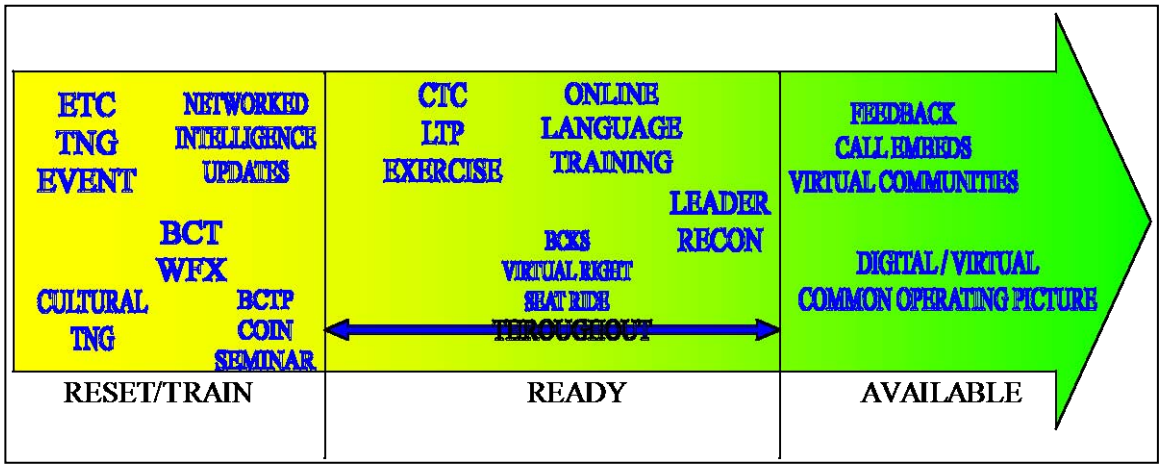

Figure 4. Virtual Components of ARFORGEN
Source: Created by author.

A review of research examining the performance of virtual teams in military combat contexts indicates that the challenges required for effective team communication share many of the same criteria of those associated with general communication. Additionally, there appear to be no definitive procedures or solutions as the modes and methods of communication are directly influenced by the personality and personal preferences of the commander at battalion level and higher (Calhone 2009). It is for these reasons that numerous simulated exercises are required as each command and control structure has to be developed and changed each time a new commander takes over. The Brigade Combat Team War Fighter Exercise (BCT WFX) and Combined-arms Training Center Leader Training Program (CTC LTP) Exercise are two examples of ARFORGEN

training events that are required to build command and control structures and test them prior to full force training events. This lack of standardization in command and control structures is indicative of the Army's lag behind other disciplines in the development of virtual teaming.

Another example of virtual teaming contained in the ARFORGEN model is the various online training programs that the Army has developed. Figure 4 shows several examples of these programs to include networked intelligence updates, online cultural sensitivity training, online language training, and leader reconnaissance. This process can even continue into the theater of operations as the Center for Army Lessons Learned (CALL) website serves as an area where units can research tactics, techniques and procedures that worked well. As the unit gains experience, they begin contributing to the CALL website and documenting new lessons learned. The process starts over with another unit in the United States.

The ARFORGEN model is a systematic way for units to develop a network of teams and prepare to deploy to conduct combat operations. Figure 5 shows a small-scale example of this network at the company level. Note the presence of multiple communication modes between the company fire support officer and the higher commands fire support elements. These communication channels are denoted by the jagged lines with both digital and voice transmissions. This is an example of virtual teams which range in size from small 5-12 person staffs at the company and battalion level to Army wide distributed learning and training teams. Virtual teaming is a key component of each step of the ARFORGEN model.

Case Study 2: Military Decision Making Process (MDMP)

The Army has a structured way of accomplishing missions called the Military Decision Making Process (MDMP). A specific part of ARFORGEN is the training of staff groups to conduct the MDMP. Field Manual 5-0: *Army Planning and Orders Production* defines the MDMP as

> a planning model that establishes procedures for analyzing a mission, developing, analyzing, and comparing courses of action against criteria of success and each other, selecting the optimum course of action, and producing a plan or order. The MDMP applies across the spectrum of conflict and range of military operations. Commanders with an assigned staff use the MDMP to organize their planning activities, share a common understanding of the mission and commander's intent, and develop effective plans and orders. (Department of the Army 2005, 3-1)

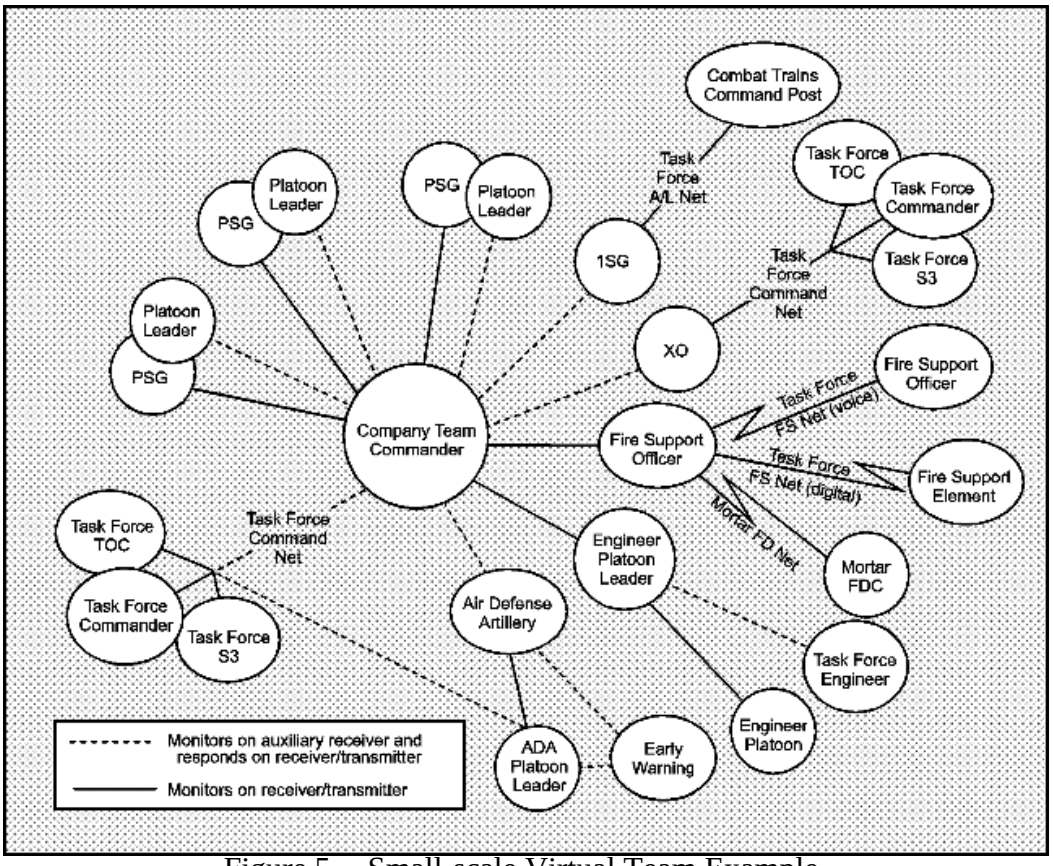

Figure 5. Small-scale Virtual Team Example

Source: Department of the Army, Field Manual 11-50: *Combat Communications Within The Division (Heavy And Light)* (Washington, DC: Government Printing Office, 2004), 8-13.

Figure 6 shows the structure of the MDMP. Note that there are specific inputs and outputs that are required for each step. No mission is the same, but the way the problem is approached is structured such that each staff member knows what is required at each step. This gives a structure to each problem and defines team procedures.

In addition to this institutional standardization, units develop SOPs that further define team procedures and standards (Department of the Army 2003, 4-21). Larger units will have multiple SOPs that cover everything from when reports will be submitted to how to name operational graphics. This combination of structure and defined procedures constitute an environment ideally suited for virtual teams.

The previous quote referred to a commander's assigned staff. Each individual member of a staff is a distinct part of the whole with a very specific body of knowledge. Figure 7 shows the typical organization of a battalion staff. Note the presence of specific skills associated with each position. For example, the intelligence officer is a military intelligence officer with specialized training in the analysis of enemy actions, terrain, and other intelligence functions. It is easy to see that each member of the team has specific skills that are brought into the overall organization.

The Army is composed of interlinked professional teams. These teams are also increasingly self-directed. The Army has developed a mission-based method for planning and executing combat operations that is decentralized (Department of the Army 2003, 1-14). A key component of this style of leadership is the utilization of initiative by subordinate team members (Department of the Army 2003, 1-17). This is also shown by the description of a process called collaborative synchronization in Field Manual-Interim 5-0.1: *The Operations Process*.

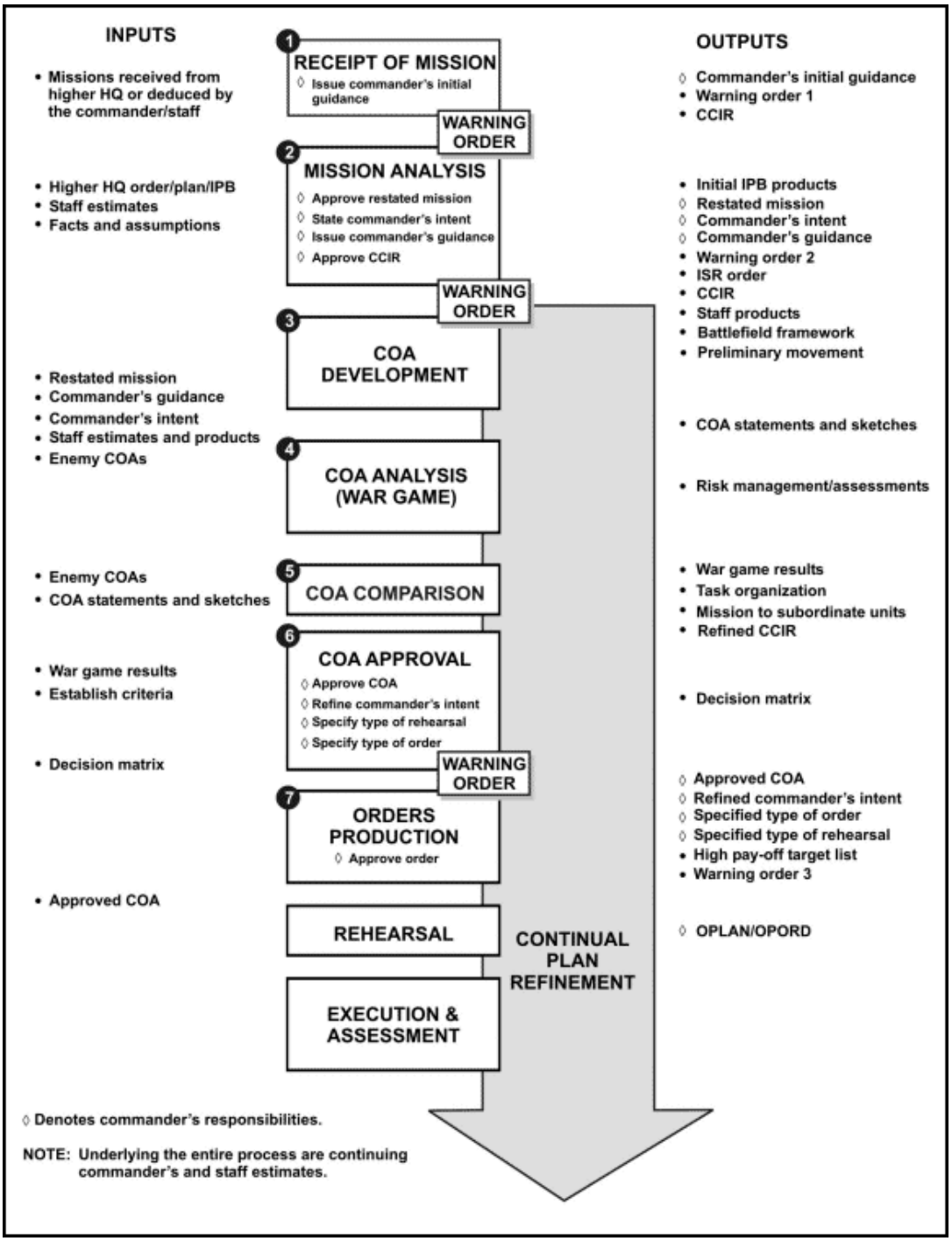

Figure 6. The Military Decision Making Process (MDMP)
Source: Department of the Army, Field Manual 3-21.21: *The Stryker Brigade Combat Team Infantry Battalion* (Washington, DC: Government Printing Office, 2003), 2-14.

> The commander's intent, planning guidance, and [commander's critical information requirements] guide subordinates—staff and subordinate commanders--in synchronizing operations. They are also essential to achieving collaborative synchronization. Collaborative synchronization occurs without direction from higher headquarters or commanders. It requires subordinates to inform other affected staff sections or commanders of their decisions and actions. It also requires monitoring their counterparts' decisions for implications that affect their areas of expertise. Doing this allows subordinates to resynchronize their activities with their counterparts'. This exercise of subordinates' initiative results in collaborative synchronization of the force. (Department of the Army 2006, 4-10)

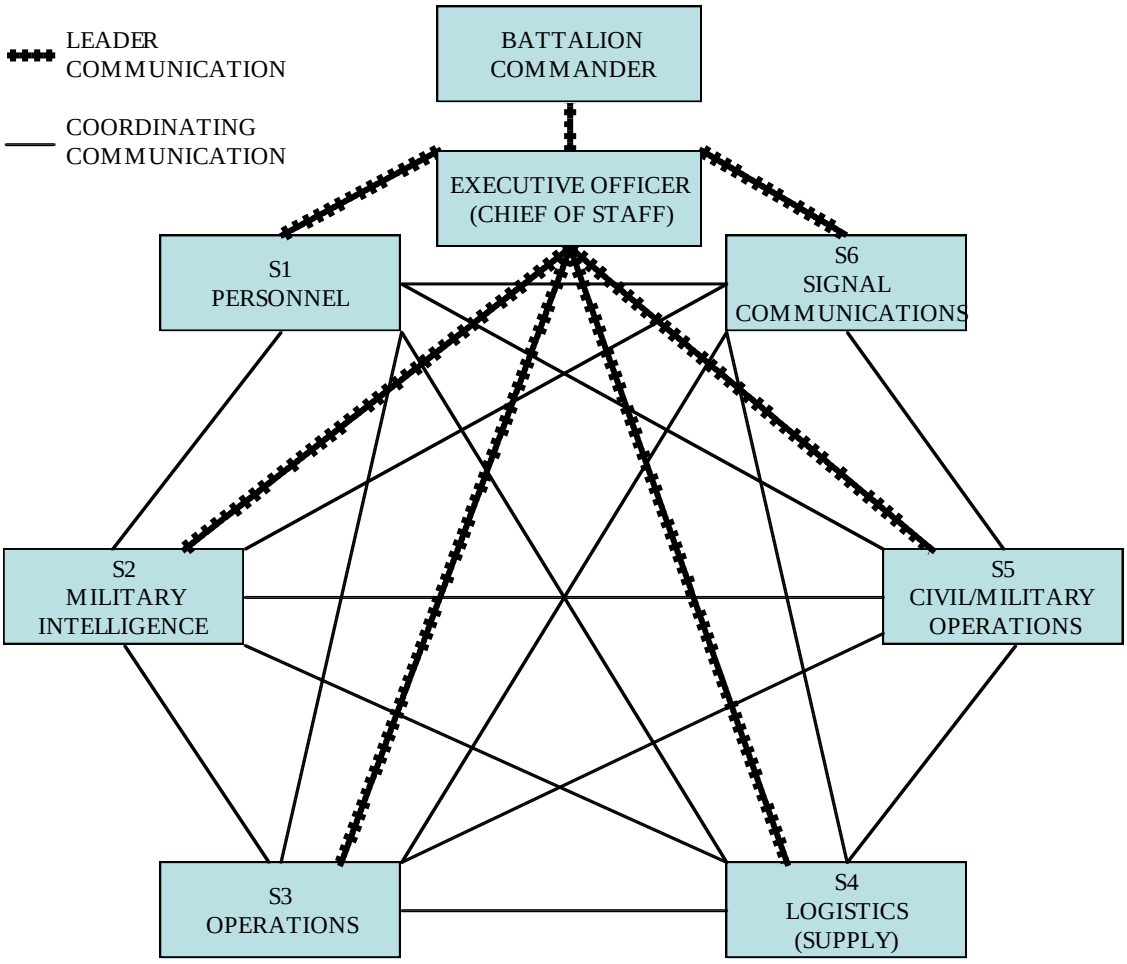

Figure 7. Battalion Staff Organization

Source: Created by author.

The key point of this quote is the alignment with the academic findings that virtual team members must be self-directed and do not require detailed guidance. Note also the interrelationships between staff officers that are intimated which will be discussed in the next section.

Due to this interrelation and decentralized execution, military virtual teams must be able to trust one another to accomplish their duties within their specialized field. The Army specifically requires this trust in its mission command method. The very definition of the term states that it "requires an environment of trust and mutual understanding" (Department of the Army 2003, 1-17). Staff members also gain greater trust, as they understand each other's skills. A research study by the Army Research Institute found that "collaborative tasks benefit when collaborating participants are cross trained to have a broader, system-wide view of the entire situation. Participants trained on both their role and their partner's role . . . were more successful" (Schaab, Dressel, Sabol, and Rittman 2007, 13). Another way that this is facilitated is through the use of specific doctrinal terms and standardized graphics (Department of the Army 2005, 1-11). These principles directly contribute to trust within Army team.

Figure 7 shows that coordinating communication exists between related staff sections, but as mentioned before staff members are expected to use their initiative to determine how their "actions in their area of expertise affect other areas and what is required to synchronize them" (Department of the Army 2006, 4-10). They then must inform others, who are affected, of their decisions. Finally, team members must also monitor "their counterparts' decisions for implications that affect their areas of expertise" (Department of the Army 2006, 4-10).

These collaborative actions are not restricted to a single staff but also exist between higher and lower echelons. New technology allows higher and lower staffs to plan in parallel without being co-located (Department of the Army 2005, 1-22). When this occurs, the effect is one of a team of teams with two way data exchange and refinement of the plan from lower echelons who may have more detailed information. Figure 8 shows a wire diagram illustration of this. For example, the team leaders or commanders communicate with their staffs as well as their superiors and peers. Within the staffs, the S2s similarly communicate with their respective representatives on the higher and adjacent staffs as well.

Additionally, these collaborative and co-located teams are not relegated to staffs only. Frequently staff groups are forced to assemble working groups or ad hoc teams and virtual collaboration facilitates this. The definition of an Action Team (AT) has essential elements of virtual teams as an integral part. An AT is an example of a working group or ad hoc team.

> Action Teams (AT): Quick-response temporary teams formed globally across Joint, Interagency, Intergovernmental and Multi-agency (JIIM) organizations if necessary, to assemble the best expertise available to support accomplishing specific tasks. ATs include Army ATs, Joint ATs, Intergovernmental ATs, and Multi-national ATs. ATs build things and advise or make recommendations to those who run things; they come into being when there is a need to innovate to solve a problem, make a decision, or build new knowledge or expertise. (Brown 2006, 2)

Note that these action teams also require members with specific skill sets and are distributed globally. This capability is also denoted in Army doctrine as Field Manual 6-0 *Mission Command: Command and Control of Army Forces* states that "as technical capabilities improve, different echelons can combine [Information Management] with

new procedures to obtain . . . physical and information resources from organizations that have them, regardless of their location" (Department of the Army 2003, 5-16).

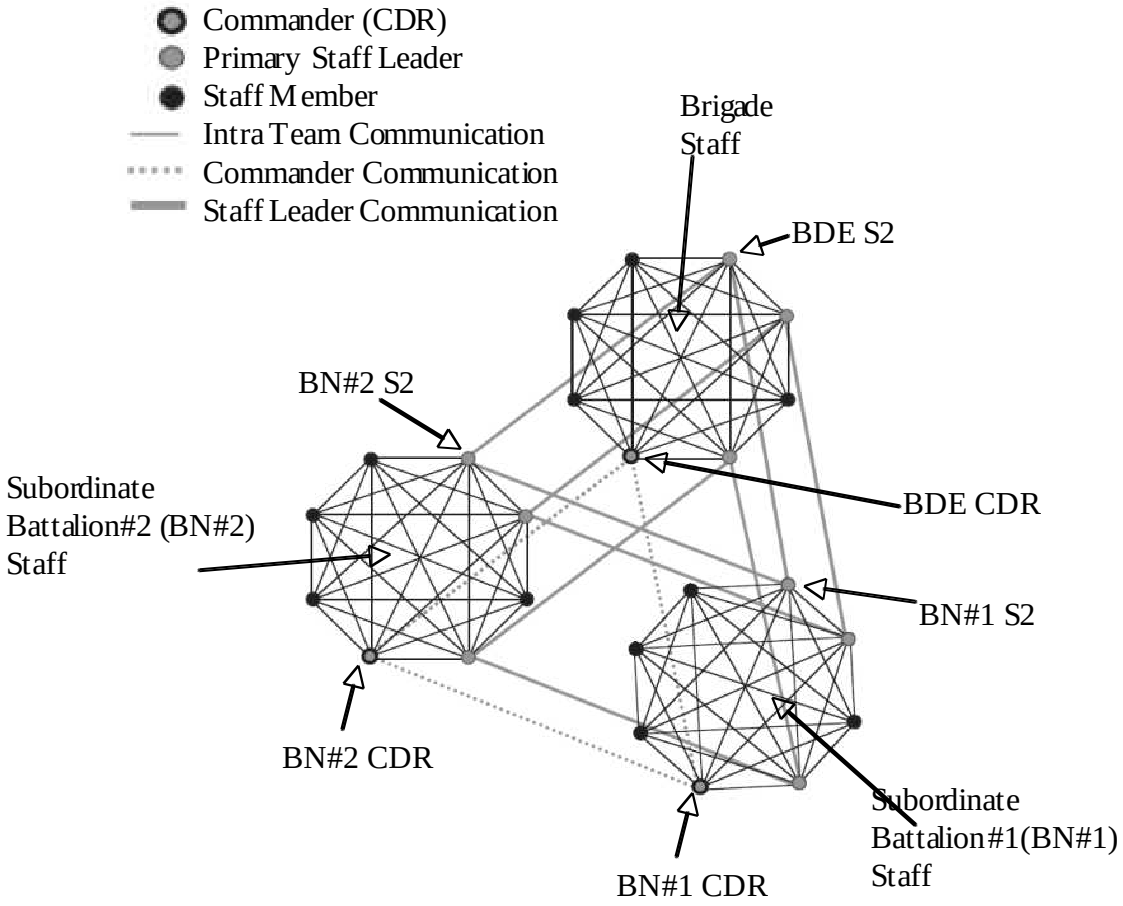

Figure 8. Inter-Staff Communication

Source: Created by author.

Whether the team is an established staff or an ad hoc working group, the MDMP gives a structure to problem solving that facilitates working in virtual teams. The teams are comprised of professionals who each possess a unique skill set. Additionally, each team member is required to rely on the work of the others in order to complete assigned tasks; the work is interrelated. Military staff officers are expected to use initiative and

judgment working within the commander's intent. These teams are becoming increasingly distributed and self-directed with the pace of current operations.

Case Study 3: SamePage

One example of virtual staff training comes from the Army's SamePage program. SamePage was originally designed as a supplementary educational tool to help individual Soldiers maintain or update their technological skill sets, yet over a period of six years, the SamePage program has expanded to address situationally-specific environmental and social interactional skills. The technical report for the project states that

> the overall objective of Phase II was to develop a validated, functional version of SamePage that promotes shared understanding among members of a five-person battalion command staff. Upon completing the scenario-based training, users of SamePage should have a better appreciation of SU, learned basic principles underlying SU, and received hands-on experience with SU tools that can be used in a variety of Command and Control (C2) team settings beyond the original battalion staff exercises. (Spiker, Holder, Walls, Campsey, and Bruce 2007, 3-4)

The SamePage program of 2009 is described as a "scenario-based, interactive multimedia training in which multiple methods of instructional delivery are used" (Spiker, Holder, Walls, Campsey, and Bruce 2007, iii). Examples of mixed technological approaches include small-group or individual on-line instruction, computer-delivered scenario-based team training, and face-to-face interactions with a training instructor as each section of the program is completed.

Figure 9 presents the model of team performance that the SamePage program is based on. Due to the complexity of mental model measurements the designers choose to focus the SamePage training on the items in the middle box where the components of teamwork, task work and coordination form the basis of shared understanding (SU). These items are behavioral in nature and are easier to train and develop.

The principle of SU aligns roughly with the Army doctrine of a Common Operational Picture (COP), which is discussed in the next case study. Figure 10 shows the model of SU as taught in the SamePage program of instruction. It is very inclusive and focuses on synchronization and communication. Also note that SamePage addresses both technological variables and situational variables similar to those that could be anticipated in the field.

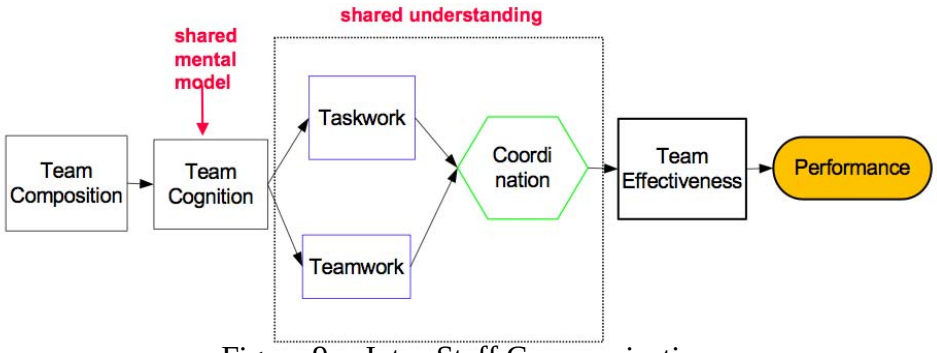

Figure 9. Inter-Staff Communication
Source: Spiker, V. Alan, Eric W. Holder, Wayne F. Walls, William M. Campsey, and Philip D. Bruce, *SamePage: Development of a Team Training Tool to Promote Shared Understanding* (Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, July 2007), 10.

In addition, as Soldiers complete these virtual scenarios, they also experience multiple modes of virtual teaming. One such transition involves progression from an individualized online Soldier-centric scenario to a 5-person team working collaboratively in a shared database platform. One of the key components of the database is a document sharing feature, an example of which is shown in Figure 11. With this tool, the staff could share knowledge regarding friendly forces status with the entire team.

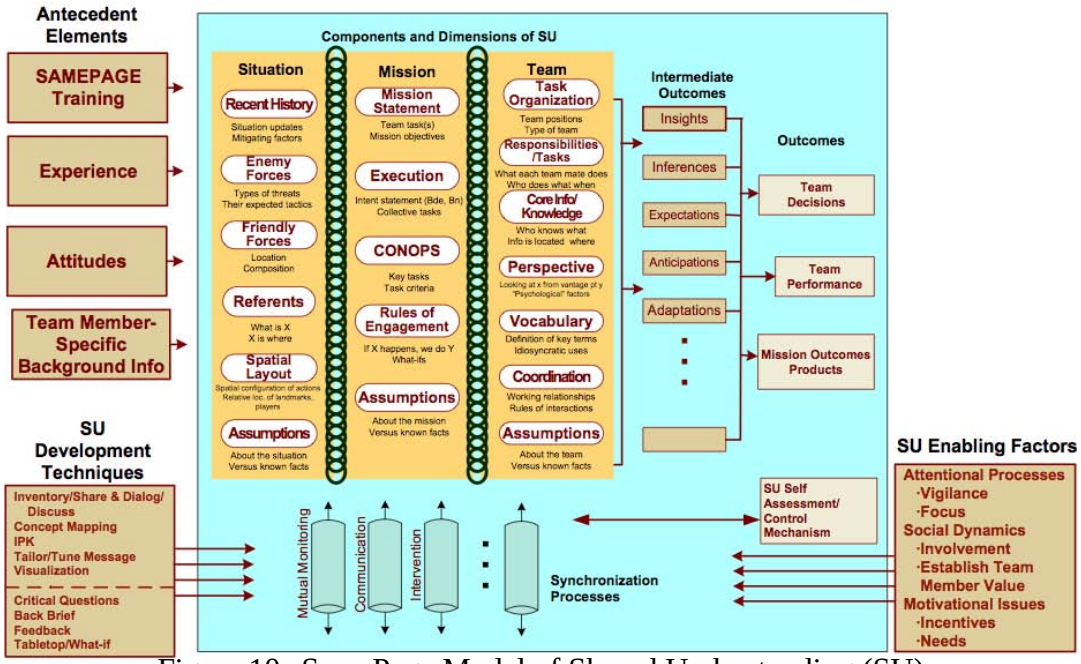

Figure 10. SamePage Model of Shared Understanding (SU)
Source: Spiker, V. Alan, Eric W. Holder, Wayne F. Walls, William M. Campsey, and Philip D. Bruce, *SamePage: Development of a Team Training Tool to Promote Shared Understanding* (Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, July 2007), 12.

At any time, the SamePage team facilitator may halt the scenarios in order to redirect team members, assist with technological support, or provide overall guidance to the team. It is interesting to note that Soldiers' comments, responses, and suggestions have resulted in a dynamic process of customizing SamePage training scenarios to reflect the changing needs of an Army at war. Such environmental modifications are based on interviews of Soldiers who had been deployed to Iraq, as the training scenario occurred in the fictional Iraqi town of Belen. A more extensive formative evaluation of the program was provided by members of the 63rd Regional Readiness Command, Los Alamitos California (Spiker, Holder, Walls, Campsey, and Bruce 2007, iii).

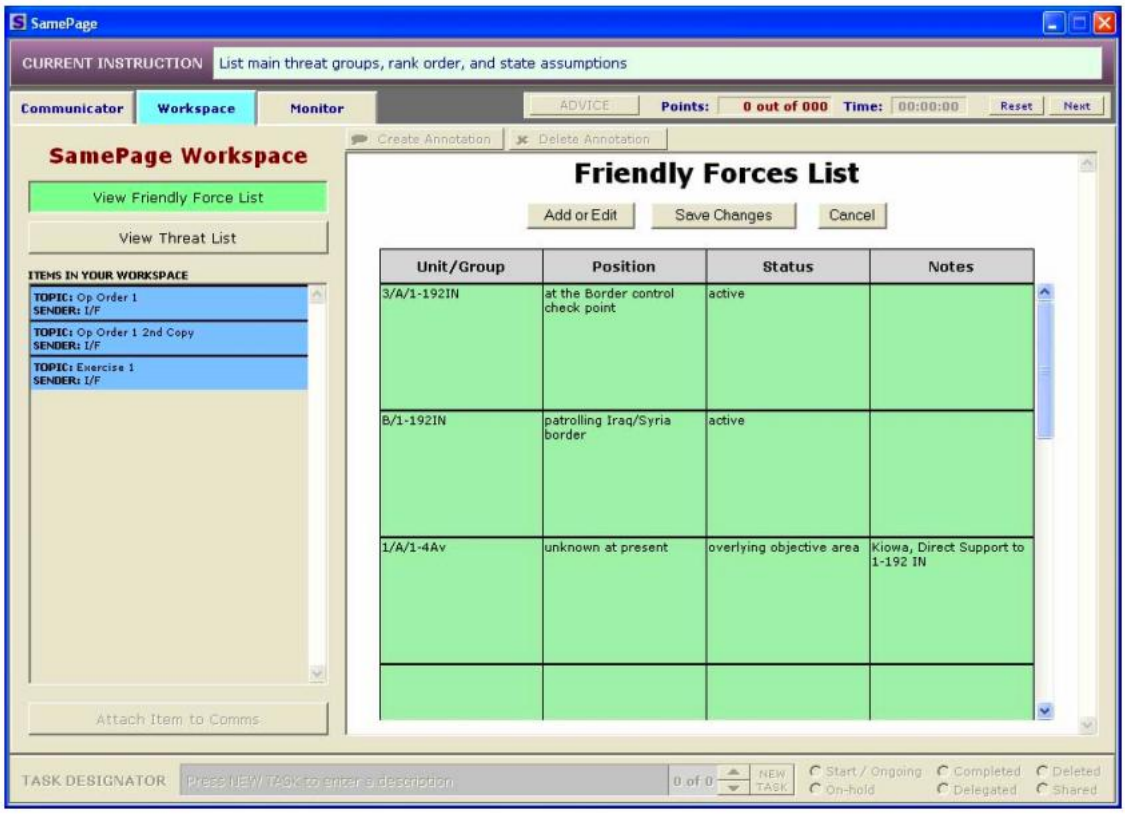

Figure 11. SamePage Document Sharing Example
Source: Spiker, V. Alan, Eric W. Holder, Wayne F. Walls, William M. Campsey, and Philip D. Bruce, *SamePage: Development of a Team Training Tool to Promote Shared Understanding* (Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, July 2007), 40.

The SamePage training program is an example of many ways that the Army has developed to train teams to collaborate and communicate to gain SA. It is a simple program that does not require a large amount of support for a unit to run. This is however, only a training program and the Army has developed programs which assist units with SA in actual operations.

Case Study 4: Common Operating Picture (COP) and Command Post of the Future (CPOF)

It should come as no surprise that the Army has environmental requirements that are unique when compared to other organizations. The ability to operate in austere conditions with mobile work areas and little fixed infrastructure are requirements that exist for an Army at war. Table 3 shows a comparison between the former requirements of the Army and the requirements of the Army's future force. Of significant note are the dimensions of unit context, command posts, planning process, and rehearsals. They are a direct reflection of the requirements that will necessitate the use of virtual teams.

Table 3. Objective Versus Current Force Characteristics

	Characteristics	
Dimension	Current	Objective Force
Unit Context	Proximate, centralized	Isolated, decentralized
Command Posts	Stationary	Mobile
Planning Process	Echeloned, sequential	Collaborative, parallel
Decision-Making	Plan-centric, fast paced	Intent-centric, accelerated
Rehearsals	Physical	Virtual
Weapons	Crewed, smart	Crewed, intelligent, robotic
Team Membership	Joint, coalition, stable	Joint, coalition, flexible
Leader Skills	Competent, specialized	Multi-functional, adaptive, self-aware
Soldier Skills	Competent, specialized	Multi-skilled, adaptable learners, self-aware

Source: John C. Johnston, Bruce C. Leibrecht, Leonard D. Holder, Robert S. Coffey, and Kathleen A. Quinkert, *Training for Future Operations: Digital Leader's Transformation Insights* (Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, November, 2002), 1.

For example, one of the key requirements for a command post is to establish and maintain a common operational picture (COP). In a stationary command post, this is accomplished by having the entire team gather around a common map table. However, when the command post is mobile, this is impossible and the common operating picture

must be accomplished through a networked common database that every element has input into and draws relevant information from (Department of the Army 2003, 3-8).

A key requirement to establish this COP is the use of multiple modes of communication. The Army has recognized this and has described it explicitly in Field Manual 6-0: *Mission Command: Command and Control of Army Forces*.

> Digitization will increase the capacity of commanders and staffs to share information. All commanders will have access to a single COP, based on an integrated database, scalable to their echelons and [information requirements], and available on the move. This COP will provide commanders a horizontal and virtual picture of the AO, including voice, data, graphics, imagery, and video information. (Department of the Army 2003, 5-29)

According to Field Manual 5-0, *Army Planning and Orders Production*, "collaborative planning is enabled by information systems that allow real-time exchange of information by voice, and video" (Department of the Army 2005: 1-23). Note the reference to collaborative planning, which will be discussed in a following section. Primarily, both of these statements show that multiple forms of communication will be required on future battlefields.

One of the primary systems the Army has developed to facilitate this is the Command Post of the Future (CPOF). Open source literature describes CPOF as follows:

> CPOF is a software capability hosted on a computer system that currently provides collaboration and visualization for Army division and brigade commanders and staff. The CPOF software provides a collaborative operating environment, Voice over Internet Protocol (VoIP), a highly intuitive, graphical user interface (GUI) and enhanced briefing capabilities. CPOF allows commanders from battalion level and higher to feed real-time situational awareness into the system and have that information available in text and graphic representation immediately by fellow commanders and operations officers at all levels. Inside the CPOF system network, operators can visualize the Commander's intent and COP as well as manipulate tactical data in a collaborative manner alone or with other operators. The system is a valuable planning and management tool. The system allows commanders to access real-time situational intelligence. It eliminates the need for a physical TOC by

> providing a rich enough virtual TOC through collaboration in a distributed operational environment. (globalsecurity.org 2005, 1)

The first use of CPOF in a combat environment occurred during the deployment of the 1st Calvary Division to Baghdad Iraq in 2004. During this deployment, the division staff was able to collaboratively plan, conduct briefings, and battle track with the staffs of five subordinate brigades distributed throughout the city using fourteen CPOF systems (globalsecurity.org 2005). This level of collaboration is possible through the utilization of the three primary CPOF capabilities: (1) visualization through 2D and 3D map information and data plotting systems, (2) composability with drag and drop information analysis across visualization products, and (3) collaboration by providing visibility of evolving understanding among distributed subordinates and team members (General Dynamics C4 Systems 2009).

For CPOF to work, all users must have access to the shared database and the ability to utilize all of the systems. In a study by the Army Research Institute, it was determined that successful "digital operations" would require teams that were repetitively trained in "digital skills" (Johnston, Leibrecht, Holder, Coffey, and Quinkert 2002, 37). This requirement is also expressed in Army doctrine. Field Manual 6-0: *Mission Command: Command and Control of Army Forces* states, "Training tactically and technically competent leaders and teams is essential to effective [command and control] systems. The best technology cannot support [command and control] without trained personnel" (Department of the Army 2003, 5-10). The development of virtual teams who are able to utilize the full spectrum of tools available to them is essential to the functioning of a modern Army.

Even with a highly trained team, the Army Research Institute found that it was critical for leaders to maintain a COP in order to make effective real-time decisions (Pleban 2001, 11). Historically, one of the key ways for Army leaders to do this is through the commander's presence on the battlefield. A key academic finding was that virtual teams still have a requirement for face-to-face meetings. Army doctrine supports this as Field Manual 3-0: *Operations* describes.

> In many instances, a leader's physical presence is necessary to lead effectively. Advanced information systems provide detailed information that facilitates situational understanding and command and control; however, much of the art of command stems from intuition. Commanders carefully consider where they need to be, balancing the need to inspire Soldiers with that of maintaining an overall perspective of the entire operation. The commander's forward presence demonstrates a willingness to share danger. It also allows them to appraise for themselves the subordinate unit's condition, including leader and Soldier morale. Forward presence allows commanders to sense the human dimension of conflict, particularly when fear and fatigue reduce effectiveness. Then commanders need to lead by example, face-to-face with Soldiers. Commanders cannot let the perceived advantages of improved information technology compromise their obligation to lead by example. (Department of the Army 2008, 5-12)

It is interesting to note that the doctrine specifically warns against eliminating face-to-face contact due to technological advancements. The value of non-verbal communication is also discussed and leaders and team members are encouraged to communicate in person as much as possible to prevent misunderstandings (Department of the Army 2003, 3-18). These statements indicate that face-to-face communication is vitally important in Army communication. In many ways, the Army environmental requirements align with those identified in the academic research.

The CPOF system is a dynamic example of the ability of virtual teams to create and utilize a COP. The requirements to sustain this system are extensive: a network capable of deploying to austere environments and maintaining contact with dispersed and

possibly moving units as commanders will still have a need for face-to-face interaction with subordinates. Another key requirement will be the training and system support to allow operators to fully realize the potential of the system.

Case Study 5: Predator Feeds

Higher-level commanders micro-managing operations at an inappropriate level is an inherent danger that comes with this level of situational awareness. In *Centralized Command – Decentralized Execution: Implications of Operating in a Network Centric Warfare Environment*, Richard M. Gomez relates the example of a tactical level engagement that received "help" from two general officers. Air operations in support of Operation Allied Force were conducted from 24 March 1999 to 20 June 1999 (Operation Allied Force Webpage 1999, 1). According to then Defense Secretary William Cohen, the purpose of the operation was to "degrade and damage the military and security structure" of Yugoslav President Milosevic (Operation Allied Force Webpage 1999, 1). The North Atlantic Treaty Organization (NATO) conducted an air attack to destroy ground elements of the Yugoslav Army. The primary commander was General Wesley Clark, Supreme Allied Commander Europe (SACEUR) and the primary commander of all Air Forces, the Joint Forces Air Component Commander (JFACC) was Lieutenant General (LTG) Michael Short.

At a 2000 Air Force Association meeting, LTG Short described one combat engagement as follows:

> About 45 days into the war . . . we had live Predator video of three tanks moving down the road in Serbia and Kosovo. . . . We had a FAC [Forward Air Controller] overhead and General Clark [SACEUR] had the same live Predator video that I had. 'Mike, I want you to kill those tanks.' I quickly responded. . . . 'Boss, I'll go after that for you.' We had a weapon school graduate on the phone talking

> direction to the FAC on the radio. Call went something like this: 'A lot of interest in killing those tanks, 421. I'd like you to work on it.' 'Roger.' Two or three minutes went by, and 421 clearly had not found those tanks. The young major's voice went up a bit and said, 'ComAirSouth, and SACEUR are real interested in killing those tanks. Have you got them yet?' 'Negative.' About two more minutes went by and the weapons school graduate played his last card. 'General Short really wants those tanks killed.' And a voice came back that I've heard in my house for the better part of 30 years and he said, '[expletive deleted], Dad, I can't see the [expletive deleted] tanks!' (Gomez 2002, 24)

Of note, the fact that the pilot, 421, could not locate the tanks would indicate that there was no visual reference available to him, i.e. the controllers on the ground and the pilot did not have a shared workspace. Their only form of communication and collaboration was through voice via an ultra high frequency (UHF) radio. Also, Gomez comments that the Weapon School graduate on the phone put an inordinate amount of pressure on the pilot due to the presence and interest of two very senior officers. These types of senior leader actions can also have an overall detrimental effect as the leaders place interest and effort into tactical engagements and they lose situational awareness at the operational and strategic levels.

Gomez completes this example by speaking about the potential benefits of what he terms network centric warfare. Gomez concluded that, had there been a common workspace, the ground platform could have detected the target with the predator feed, digitally given precise location and target description to the pilot and sent the same information directly to the pilot's weapon system. Once the pilot was in range to engage, the tanks could have been attacked, evaluated, and re-engaged; all "this occurring in less time than it took to read this paragraph" (Gomez 2002, 27). He also remarked on the concept that the tactical leader on the ground would have a better appreciation for the

tactical situation and could have given recommendations and clarity to the higher level situational understanding.

Corporate Case Studies and Corporate Research Findings

Earlier, the point was made that the research on virtual teams has increased dramatically since the mid 1990's, and to date, much of the existing research comes from corporate and executive training data (McShane 2008, 3). Given the combination of globalization, lean management practices, and recent economic realities, some researchers predict that virtual teams will represent the workplace of the future (Barrett 2006, 254). Michelle Conlin offers a particularly interesting description of the workplace of the future:

> More and more, the creative class is becoming post-geographic. Location-dependent. Office-agnostic. Demographers and futurists call this trend the rise of the 'distributed workforce.' Distributed workers are those who have no permanent office at their companies, preferring to work in home offices, cafes, airport lounges . . . <they> are what author Richard Florida calls the 'no-collar workplace.' They are people who do team projects over the Web and report to bosses who may be thousands of miles away . . . currently, about 12% of the U.S. workforce qualifies as distributed . . . with one expert's prediction that 40% of the workforce will be distributed by 2012. 'We're at a tipping point'. (Conlin 2005, 78)

Whether Conlin's predictions are accurate remains to be seen, but current research data provides both documentation and rationalization of these trends. Research findings cite several consistent factors underlying the rapid emergence of virtual teams within corporate environments. Barrett, for example, links virtual teams to globalization by using 9-11 as an example. Considering the Global War on Terrorism (GWOT), or the perceived threat of it, many companies have restricted travel while increasing use of remote technology and virtual teams (Barrett 2006, 254).

Researchers have also noted economic advantages of virtual teaming for corporations including decreased travel costs and opportunities to compete globally without additional overhead expenses (Tjosvold 1997, 42). One example is IBM: a global company operating in 170 countries. It simply is not feasible for team members to have face-to-face meetings for all projects (Schulz-Hardt, Jochims, and Freya 2002, 23-24).

Beyond financial considerations, corporations look to virtual teams to increase productivity. Project completion time is shorter due to the "leveraging of expertise and vertical integration" within the same company (Barrett 2006, 254). "It is clear that communication technology such as e-mail, cellular phones, and Web-based communications, have had an important impact on increasing team productivity" (Riggio 2008, 302). For these reasons, virtual teaming is frequently used in highly technical fields such as engineering and medicine. That said, a wide variety of corporations have embraced the concept of virtual teams to the point that today most teamwork is virtual and rarely are all team members co-located (Barrett 2006, 254).

Before the corporate case studies are presented, it is important to note several key points. First, it is useful to explain that the terms "virtual teaming" and "distributed workforce" are used interchangeably in corporate studies. In addition, research studies in the corporate field describe several different types of virtual teams. Similar to the military examples of command staffs, corporate virtual organizations can develop as teams of teams (Sampson 2007, 1). For example, many corporations form virtual administrative teams that meet and operate to conduct the overhead business of organizations. They coordinate budgets, personnel assignments, and inter project scheduling and status

reports. Typically, they are composed of senior executives and project managers (DeMarie 2000, 8-9).

Another type of virtual team common to the corporate discipline is a cross-disciplinary project team. These teams accomplish the technical work of a project and focus on a final output. They may consist of members of different departments and even different corporations linked by a common project (Schultz and Schultz 2010, 214). Other virtual teams are capable of responding quickly in a crisis (Gaspar 2001, 3). This is the reason many virtual teams are formed as task force or ad hoc teams. They are developed to rapidly apply expertise to a given problem under time constraints with the expectation that the team will not be continued once the issue has been addressed (DeMarie 2000, 10-11). These are the general types of virtual teams in corporate settings. The following sections present case study applications of virtual teams in corporate environments.

Case Study 6: Volvo

In 2000, Volvo wanted to become a more effective organization recognizing there were numerous sites around the world with language and geographic barriers. The first step was to establish the Collaborative Work Solution Center (CWSC) in Lyons, France. The purpose of the center was to seek "a comprehensive solution for real time collaboration that would encompass presence awareness, instant messaging, online meetings, and external and internal document and idea sharing to secure a competitive advantage" (Microsoft Office 2005, 2). The CWSC was staffed with a cross-disciplinary project team consisting of communication and collaborative experts who developed a comprehensive program within five years.

Prior to fielding the program, Volvo trained upper management and leaders with a focus on behavior, communication, training, and change management (Sampson 2007, 1). Riggio emphasizes that virtual teams must receive expert coaching and support from organizational policies and systems structured purely for getting virtual team members what they need (Riggio 2008, 338). Volvo senior leader training is a cycle that emphasizes management over individual annual evaluations, but according to Volvo's corporate leaders, the training cycle is important to a virtual team's overall effectiveness (Lipnack and Seamon 2008). Volvo addressed these needs by having a seminar for 150 senior executives in Spring 2005 as a technology package was being readied for employees. The technology package was then released with the full support of management. A key part of this was the development of the Volvo Virtual Teams Guide. Additionally, senior leaders were aware of what the teams required: an extensive suite of technologies including e-mail, instant messaging, net meetings, audio conferences, and a virtual team work space (Lipnack and Stamps 2007, 1).

This case study from Volvo once again emphasizes the importance of multiple modes of communication for effective virtual teams. Further verification is provided by Majchrzak, Malhotra, Stamps, and Lipnack involving a study of 54 teams from 26 companies where the companies "combine teleconferencing (86%) with [a] virtual workspace (83%)" (Majchrzak, Malhotra, Stamps, and Lipnack 2004, 45). One of the companies included in the study results was Boeing-Rocketdyne, and the case study was based on a project to build new rocket engines. According to study results, Boeing-Rocketdyne project team was able to design the engine using a fraction of the resources formerly required with a reduction in parts by two orders of magnitude and a reduction of

design time to 10 percent of that required previously. They were able to do this by having "weekly face-to-face meetings [and] working at a distance" (Lipnack and Seamon 2008, Webcast). This is one of numerous examples supporting the inclusion of face-to-face communication components as part of effective virtual teams in the corporate sector.

Volvo recognized the importance of team members having cultural skills, as their virtual teams were "supported using virtual training by a world-wide network of culture ambassadors and collaboration consultants" (Lipnack and Stamps 2007, 1). Virtual teams have both individual and collaborative characteristics that exceed those of co-located teams. Frequently, forming teams comprised of individual members from diverse fields can lead to conflict and disagreements. Successful teams determine how to avoid this early.

These examples from Volvo and Boeing-Rocketdyne confirm Barrett's assertion that virtual teams need to do all that co-located teams do, and more, to succeed (Barrett 2006, 257). One method of doing so, according to Barrett is an initial meeting where team processes and roles can be clarified (Barrett 2006, 255). Successful virtual teams develop rules for interaction. In a presentation entitled *Enterprise 2.0 Case Studies from the Frontier*, the manager of the Volvo IT Collaborative Work Solution Center, Carole Boudiney, gives the list in Table 4 as "keys to virtual work" (Boudiney 2007).

At first glance, Boudiney's list of general rules appears to be simplistic in nature. However, the characteristics mirror Barrett's contention that effective leaders must realize that people skills and good management techniques are required for leading individual members of virtual team to collective team success (Barrett 2006, 255-256).

Table 4: Volvo IT Keys to Virtual Work			
1	be organized	6	dare to ask
2	plan ahead	7	give response
3	show respect	8	seek understanding
4	be clear	9	address problems
5	seek confirmation	10	resolve conflicts ź

Source: Carole Boudiney, “Notes on Enterprise 2.0 Case Studies from the Frontier" An Interview with Eran Barak *http://www.michaelsampson.net/2007/06/notes _on_enterp.html* (accessed 15 February 2009).

Volvo’s new station wagon is an example of flexibility based on time and geographic distance. It is a global collaboration with design engineers working simultaneously in Sweden, Spain, and the United States:

> Using software called Alias, designers in Sweden and Detroit can change the curve of a finder or the shape of a headlight in real time. And if they want the big picture, they don 3-D goggles in special theaters than can project a full-size image of the car in two places at once. When Volvo’s European designers put down their laser pens for the day, their counterparts in Irvine, California pick up their pens and keep going. “We have almost 24-hour design,” says Chief Designer Peter Horbury. (Kinicki and Kreitner 2008, 239)

Horbury’s description emphasizes the collaborative virtual teamwork involved in designing a car, but it also demonstrates the advantages of multiple modes of communication through technological support (Lipnack and Seamon 2008, 35).

Figure 12 shows a typical product team in the automotive industry with designers in Europe, the United States, Japan, and Australia working collaboratively. Note the similarities with Figure 3 in the Army applications. This level of collaboration and communication is the culmination of five years of work specifically targeting ways to be more competitive in the automotive industry.

Case Study 7: Crisis Interventions

Organizations dealing with a crisis have unique requirements that are especially suited to virtual teaming. Team members at the scene of the crisis have extensive knowledge of the situation, but may require special expertise. Virtual teams can offer the advantage of expertise in a timely manner without the expense, especially loss of time, or trouble of bringing the experts to the location. Again, this example supports the advantages of multidisciplinary members of virtual teams through technologically supported forms of collaboration.

Figure 12. Automotive Product Team Locations
Source: Volvo Public Affairs, "Volvo Design Collaboration," *Virtual Highlights Volume 46,* April 2006: 1, http://www.volvo.com/corp/docs/csr/graphics/compov_ww-locations.gif (Accessed 16 October 2008).

Hurricane Katrina was an example of where the use of virtual teams broke down. Lack of decision making and confusion regarding who was in charge were prevalent everywhere. One of the most basic requirements in crisis interventions is "the need for a single voice" (Barton 2008, 130-131). The chain of command was notoriously uninformed as then President George Bush and Department of Homeland Security chief Michael Chertoff appeared to have no concept of the scope of the disaster for days after the event. Barton states "CNN seemingly knew more about the disaster" (Barton 2008, 126). The Mayor of New Orleans waited until too late to begin an evacuation due to concerns about damaging tourism resulting in a significant loss of life and greater damage (Barton 2008, 124-125). All of these facts show a complete misalignment with the factors necessary for leadership of virtual teams in a crisis.

Another issue with the Katrina situation was a complete lack of multiple modes of communication. The New Orleans emergency management team assembled in the Hyatt Hotel only to find a generator with little fuel and communications equipment running out of power. The only connection to external resources was as intermittent Internet connection though Vonage, a personal account one of the team members owned (Barton 2008, 128). The main means of communication "consisted of police authorities passing scraps of paper t one another on the street and in the office" (Barton 2008, 129). One method of communication that is historically reliable is the Short Message Service (SMS). This technology is satellite based and works over 96 percent of the time (Barton 2008, 130).

Beyond physical crisis events, corporations look to virtual teams to increase productivity under time constraints. Project completion time is shorter due to more

efficient use of employee time (DeMarie 2000, 11). Virtual teams are capable of responding quickly. Communication technology such as e-mail, cellular phones, and Web-based communications, have served to increase team productivity and shorten reaction times (Langan-Fox 2001, 197). Time is critical as virtual team members must choose between actions; most often, the context of the problem does not allow the luxury of brainstorming sessions or research-based analysis. This type of decision making process differs for leaders of virtual teams and leaders of traditional teams. As Riggo notes, virtual teams have limitations according to tasks. While leaders of virtual teams cannot expect brainstorming, they can (and do) expect complex decision-making tasks or solutions that require innovative strategies (Riggio 2008, 337). Alexander, speaking about problem tasks stated, "You don't have time for open-ended conversation [in a virtual team]…you can't informally brainstorm with someone (Alexander 2000, 55-56).

Today, most teamwork, especially crisis-management teamwork, takes place in a virtual environment with geographically distributed team members (Barrett 2006, 254). Virtual teams are rapidly able to share techniques and make decisions without face-to-face interaction. A good example of this type of decision-making is found in the Price Waterhouse-Coopers reaction to the Code Red virus in 2001. They were able to quickly assemble an international team of experts who were able to halt the virus before it was able to spread (Gaspar 2001, 3). All of these reasons have contributed to corporations embracing the concept of virtual teams, especially in time constrained, crisis situations.

Case Study 8: Radioactive Waste Management Project (RWMP)

As seen in the Volvo case study, virtual teams are prevalent in technical fields. Another example of technically oriented virtual teamwork is from the Radioactive Waste Management Project (RWMP) (DeMarie 2000, 5). The Department of Energy employed a variety of specialists from locations across the United States, from California to Washington D.C. to develop a waste storage facility at Yucca Mountain, NV. The fields of specialty were diverse: nuclear physics, geology, plant and animal biology, various environmental sciences, media and public relations professionals, and information technology (IT) specialists as well as nuclear, mechanical, structural, civil, and electrical engineers (DeMarie 2000, 6). It is important to note that virtual teams operate most effectively in environments or with tasks that require "moderate levels of interdependence"--essentially, each team member brings a different skill set to the task--the team itself then becomes multi-disciplinary (McShane and Von Glinow 2008, 295). Adding to the complexity of this project; the 2,500 employees on the project represent seven government contracts involving two primary contractors and over 40 subcontractors (DeMarie 2000, 6).

This disparate group was connected through robust technology and communication platforms. Each member had a personal computer with access to a common network. There were dedicated videoconferencing facilities used weekly, though many team members lamented the lack of desktop videoconferencing abilities. This was somewhat offset by the use of teleconferencing. The primary software utilized was Lotus notes but the IT staff was commended for being “highly competent and have designed both security and ease of use (as much as possible) into the network system”

(DeMarie 2000, 7). This was especially difficult as each subject-matter expert favored "a set of applications that [were] customized to their particular needs" (DeMarie 2000, 7).

Clearly, the leadership of such a diverse group required flexibility. This was facilitated through the establishment of three general types of virtual teams. Administrative Teams were composed of project leaders and decision makers and were primarily concerned with allocating resources and tracking overall organizational progress. Cross-functional Project Teams were composed of various scientific specialties and were formed for long-term projects that dealt with "highly complex scientific issues" (DeMarie 2000, 10). Finally, Task Force Teams were formed for short duration projects that required an answer that generally supported the work or a decision in a Cross-functional Project Team. These teams typically operated under time constraints and were formed on an ad hoc basis to deal with discrete, specific issues. Table 5 displays the details of each type of team. Of particular note is the lack of continuity or standardization; the various teams required very different structures and operational characteristics.

The establishment of these various virtual teams was based both on necessity, due to the geographic distribution of team members, and the required multidisciplinary subject matter. Grenier and Metes extracted the following list of six advantages associated with virtual teams:

Table 5. Radioactive Waste Management Project (RWMP) Team Comparison

	Administrative Teams	Cross-functional Project Teams	Task Force Teams
Scope of work	Monitoring and assessing progress towards overall RWMP goals	Complex projects requiring multiple areas of expertise	Special projects contained within one department or discipline
Approximate team size	5-8	6-12	3-7
Membership	Across multiple units	Across multiple units	Within a single department/unit
Members' home locations	Geographically dispersed across 2-4 sites	Geographically dispersed across 3-6 sites	Colocated, or spread across 2-3 sites
Meeting frequency	Regular intervals: monthly/quarterly	Regular intervals and as needed: weekly/ bi-monthly	Primarily as needed: daily to weekly
Primary communication media	• Face-to-face • Videoconferencing • E-mail • Phone conferencing	• E-mail • Phone conferencing • Videoconferencing	• E-mail • Face-to-face • Phone conferencing
Primary goals	• Cross-unit coordination • Resource allocation • Inter-organizational communications and relations	• Cross-functional assessment of complex choices concerning materials or design of facilities and their long-term impact	• Assessments that usually become input into later, more complex cross-functional projects
Planned duration of teamwork	Ongoing	Six months to two years	Three to nine months
Biggest challenges	• Managing multiple constituencies and conflicting interests • Establishing a hierarchy among resource allocations	• Determining which data are most critical • Facilitating communication across disciplinary specialists	• Meeting aggressive deadlines

Source: Samual M. DeMarie, *Using Virtual Teams to Manage Complex Projects: A Case Study of the Radioactive Waste Management Project* (The PricewaterhouseCoopers Endowment for the Business of Government, August 2000), 9.

1. Increased productivity by enabling simultaneous in addition to sequential work;

2. Improved work quality by providing members continuous access to the latest and best information;

3. Increased pool of potential virtual team members by allowing members to participate from their home office (or even their homes in the case of teleworkers);

4. Decreased organizational costs by avoiding travel costs and downtime;

5. Efficient training and mentoring of new team members by using an online record of ongoing work; and

6. Increased impact of teamwork by capturing the work electronically so it could be accessed by other segments/members of the organization as needed. (Grenier and Metes 1995, 46)

The RWMP achieved varying degrees of success in all of these areas except for item number five. According to DeMarie, many virtual team members felt that socialization and integration of new members was harder. DeMarie theorized that infrequent videoconferencing and the lack of desktop video capability contributed to this, but many participants believed that these technologies could not solve the problem (DeMarie 2000, 12).

Despite five of six successes, the RWMP experienced other problems as well. Interpersonal communication was a problem as many members "found it frustrating that messages often were misunderstood or not received by important constituents" (DeMarie 2000, 12). These misunderstandings were attributed to a heavy use of e-mail, a lack of face-to-face communication, excessive use of technical jargon, a lack of conferencing protocols, and ambiguity regarding team membership. This ambiguity also led to confusion over reporting requirements, in many cases leading to confusion over who was in charge and who was subordinate to whom (DeMarie 2000, 12-13).

When communication and organization did work, team members believed that they were overloaded with an unrealistic expectation of productivity due to the time savings of not traveling. Members were assigned to too many groups at once. Finally, though the IT support structure was praised, there were times when the entire system was not available and no backup or alternative was provided. Additionally, hardware and software incompatibility resulted in a significant amount of time lost (DeMarie 2000, 13-14). Despite these difficulties, the project has been successful and has identified numerous lessons learned which will be discussed in the following chapters (DeMarie 2000, 15-18).

Case Study 9: Virtual Medicine

Home Telehealth Limited

Another technical field that has experienced the growth and utilization of virtual teams is medicine. For numerous reasons, there is a chronic and increasing shortage of medical practitioners and caregivers (Graetz, Boyle, Kimball, Thompson, and Garloch 1998, 718). One way to alleviate this issue is through the use of virtual teams represented by the practice of telemedicine (Painter, 2009). One company who has excelled at this practice is based in England. Home Telehealth Limited was recently awarded the United Kingdom's National Health Service (NHS) award for innovation and partnership. The company had accomplished the following results:

1. An 11.77 percent decrease in hospital admissions
2. A 40 percent reduction in hospital bed days used
3. Length of hospital stays was reduced from 4.8 days to 2.26 days
4. A 25 percent Improvement in "Quality of Life" questionnaire scores

5. A 24.53 percent reduction in face-to-face visits of Community Respiratory Team

6. General practitioner visits during monitoring period were reduced by 22.45 percent

7. and 36 unplanned hospital admissions were prevented (Home Telehealth Limited 2009, 1).

These remarkable results were the product of a fusion of communication technology and dedicated medical experts. The company specializes in home health care for patients with long term health care needs such as stroke recovery and diabetes. There are a variety of systems and equipment that are available so the customer can tailor equipment to their needs and budget. The basic requirements are voice, video, and data modes of communication that are readily available in both low and high bandwidth options (Home Telehealth Limited 2006, 2-4). An example is shown in Figure 13. Note the presence of voice (telephone), video (computer and videophone), and data (wireless blood pressure cuff and digital heart rate monitor) capabilities.

Figure 13 shows the portion of the system the patient requires in their home. Figure 14 shows the entire system architecture. Note the presence of three primary participants. The patient interacts everyday with a nurse who is able to see the patient, ask how they are doing, check vital signs, and observe them taking their medications. All of this is accomplished with the benefit of having the patient remain at home with family and friends rather than in a hospital.

Additionally, the nurse is able to log off and log on with the next patient rather than drive across town as in a traditional home care program. If the nurse detects an

anomaly or sees an indication of a problem such as slurred speech, discoloration, trouble breathing, etc., he/she can notify the call center control where a doctor can also log in and evaluate the situation to determine the immediate needs (hospitalization or additional treatment) and the long term requirements (Home Telehealth Limited 2006, 20-26). This collaboration between patients, nurses, doctors, and families is possible through modern communication technologies and adjusting expectations for home health care.

Figure 13. Home Telehealth Limited Patient Home Station Equipment
Source: Home Telehealth Limited, *Care Companion Sales Brochure* http://www.hometelehealthltd.co.uk/images /CareCompanion%20System.pdf (accessed 29 May 2009).

Telemedicine Consultation

The same level of collaboration can also assist remote health facilities in a similar manner. Many procedures require the evaluation of specialists who are centrally located. Rural health care facilities typically do not have the services of neurologists, cardiologists and other specialists. When a patient requires these types of specialties, they are generally flown to large medical centers that require time that some patients do not have.

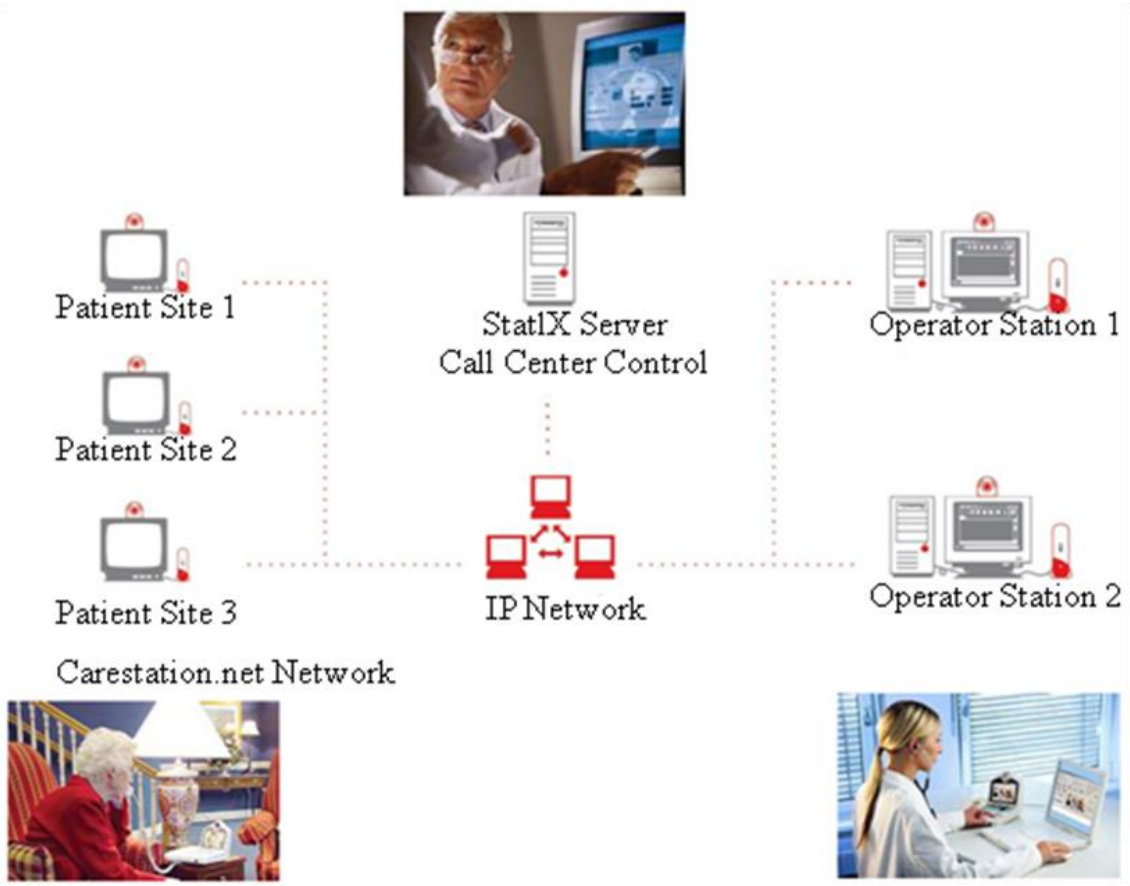

Figure 14. Home Telehealth Limited System Structure
Source: Home Telehealth Limited. *Video Enabled Telehealth* (Cardiff, England: Home Telehealth Limited, 2006), 7. http://www.hometelehealthltd.co.uk/Presentations /Video%20enabled%20Telehealth%20-%20October%202006.pdf (accessed 29 May 2009).

In Kingman, Arizona, a stroke patient recently demonstrated that telemedicine could overcome these obstacles to timely medical care. The patient experienced slurred speech and drooping facial muscles and went to the local emergency room. She was initially diagnosed with stroke. However, she had to be evaluated by a neurologist before a necessary drug could be administered. A neurologist 200 miles away in Phoenix was able to conduct a visual examination while reviewing brain scans and asking the patient questions. This "telestroke" consultation was facilitated through the use of a videoconference and a shared digital database. Her treating physician decided to administer the drug based on the neurologist's recommendation and she experienced a full recovery within a day (Painter 2009, 5D). This virtual team, is an example of a specialized, cross-functional team formed on an ad hoc basis that still, due to the tenants of the medical profession, had a clear decision policy and SOPs.

Digital Medical Records

The previous example also highlighted another benefit of technology currently being explored by the medical community, digital medical records. These records are utilized in ways that traditional paper and film records cannot be. With digital records, doctors in various locations can look at the same MRI or x-ray result simultaneously (Haikes 2009, 1). Soldiers at Keller Army Community Hospital at West Point, New York are able to have their physician review x-rays within minutes of the procedure. The only delay is the time it takes for the imaging device to write the x-ray file to the server. The advantage, beyond a decrease in processing time, is that when the Soldier is transferred to their next duty station, a common occurrence, the medical files are available to the gaining hospital and the initial treatment facility at the same time (Jones 2007). These

digital records can also be displayed in ways to facilitate rapid understanding as demonstrated by the following quote:

> An IBM technology innovation for intelligent electronic patient records, using a 3D model of the human body has proved both practical and valuable…Using an "avatar" or map of the human body, medical staff easily navigate an electronic patient file. Doctors can rotate the avatar and zoom in and out to generate the level of detail needed. With the tool, they can also choose between different views, for example enabling inspection of the organs or the circulatory, muscular and nervous systems. Arrows indicate the areas of the body for which medical data is available. By selecting one of these arrows, medical staff have all pertinent information at the click of a mouse. (Herfurth, Loughran, Groenning, Andersen, Nielsen, and Elisseeff 2009, 1)

Figure 15 shows an example of this technology. Note the callouts that show available records. Digital records are clear ways to share highly technical information with many people in different locations. The records serve as a common workspace and use cutting edge technology to facilitate team communication.

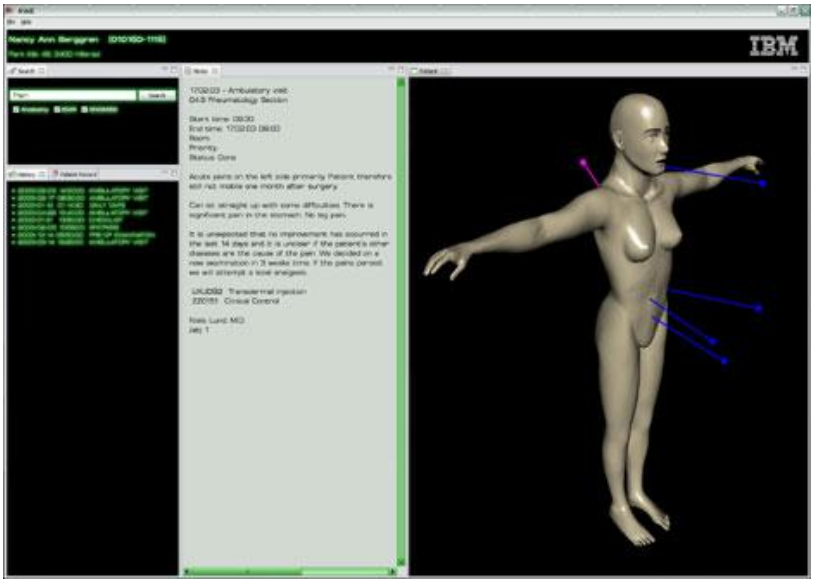

Figure 15. Digital Avatar Filing System Example
Source: Joe Fernandez, *IBM Uses 3D Imaging to Visualise Patient Records* (E Health Media Limited, 2007): 1, http://www.e-health-insider.com/news/3066/ibm_uses_3d_imaging_to_visualise_patient_records (accessed 29 May 2009).

Web Based Radiology Theater

The previous examples of a shared workspace allow collaboration at a previously unseen level. Haikes states that with IBM's web based "radiology theater"

> A group of doctors can log into a secure website at the same time to review and analyze a patient's recent battery of tests. For instance, a radiologist could use her mouse to circle an area on the CT scan of a lung that needs a closer look. Then using the mouse she could zoom into that scan to enlarge the view for all to see. An expert on lung cancer could use his mouse to show how the spot had changed from the last scan. And then, a pathologist could talk about patient treatments based on spots of that size depending on age and prior health history, paging through clinical data accessible on the site. (Haikes 2009, 1)

Figure 16 shows an example of the scenario where the collaborative work is seen by the multicolored digital pen strokes as doctors explain issues and draw attention to the image. The previous quote also demonstrates another aspect of the profession in that there are relatively structured protocols and established treatments. This lends a structured nature to the medical profession that is conducive to virtual teaming.

Virtual Medical Training

Another example of virtual teaming and mentorship in the medical community occurs during the training of medical professionals. The collaboration that occurs in actual treatment has also been applied to training medical students. Online training sites where students can gain the experience of several physicians have been developed. One example of this is The Virtual Autopsy website. It was created to allow students to develop pathology knowledge in a risk free environment (Verma 2001).

The Virtual Autopsy website is an example of early attempts to mentor future doctors in a virtual environment. Figures 17 shows the home page for the website. Note that it is a collaboration of three main individuals. Figure 18 is an example of one of the

cases. Students are given a case history and can select items from the body to view actual organ photos as shown by the inset.

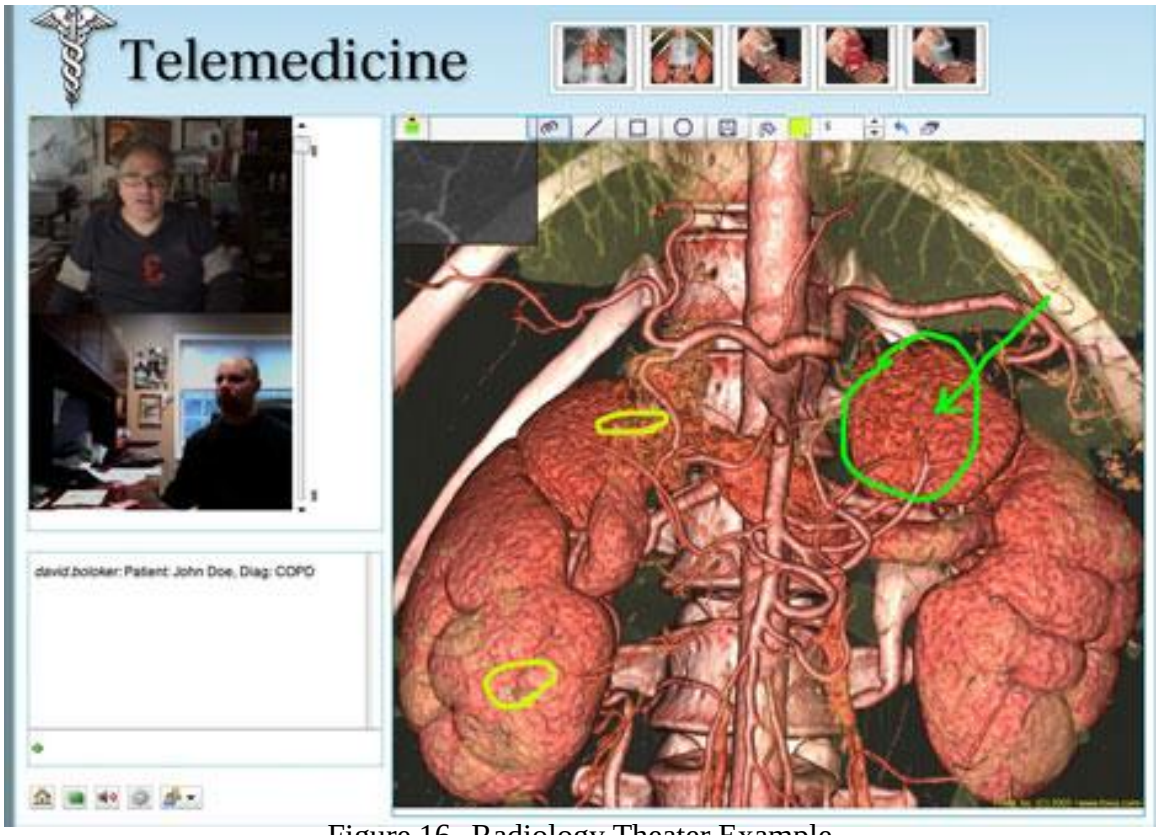

Figure 16. Radiology Theater Example

Source: Medgadget. *IBM Working on Web-based "Radiology Theater"* (Medgadget LLC, 13 March 2009), 1. http://medgadget.com/archives/2009/03/ibm_working_on_webbased_radiology_theater. html (accessed 29 May 2009).

Many scholars and doctors see this as the future of medical training as shown in the following quote.

> The introduction of new learning technologies, the exponential growth of Internet usage and the advent of the World Wide Web have the potential of changing the face of higher education…An international virtual medical school (IVIMEDS) with a high-quality education program embodying a hybrid model of a blended curriculum of innovative e-learning approaches and the best of traditional face-to-face teaching is one response to these challenges. (Harden and Hart 2002, iv)

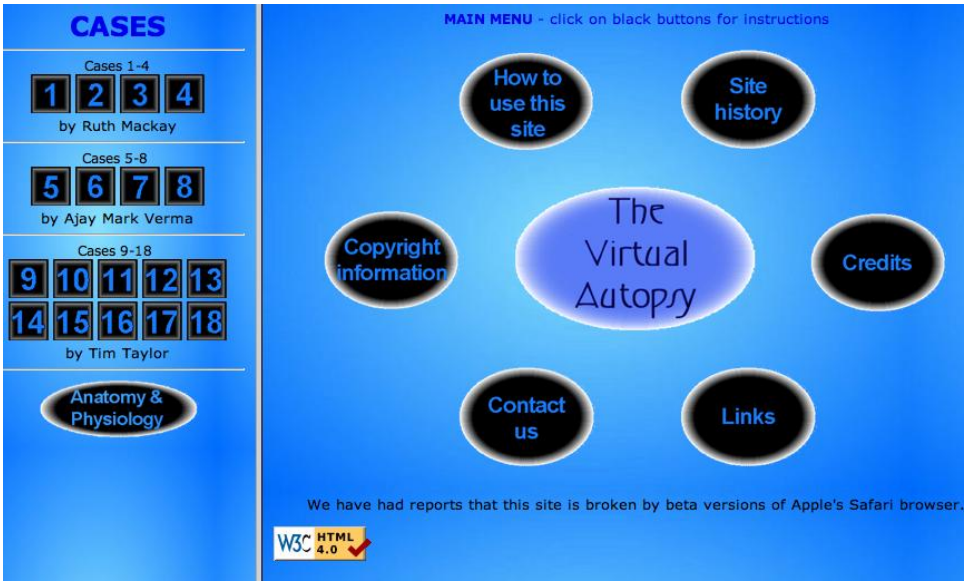

Figure 17. Virtual Autopsy Main Page

Source: Verma, Ajay Mark *The Virtual Autopsy* (Leicester, England: University of Leicester, 2001), 1, http://www.le.ac.uk/pathology/teach/va/titlpag1.html (accessed 29 May 2009).

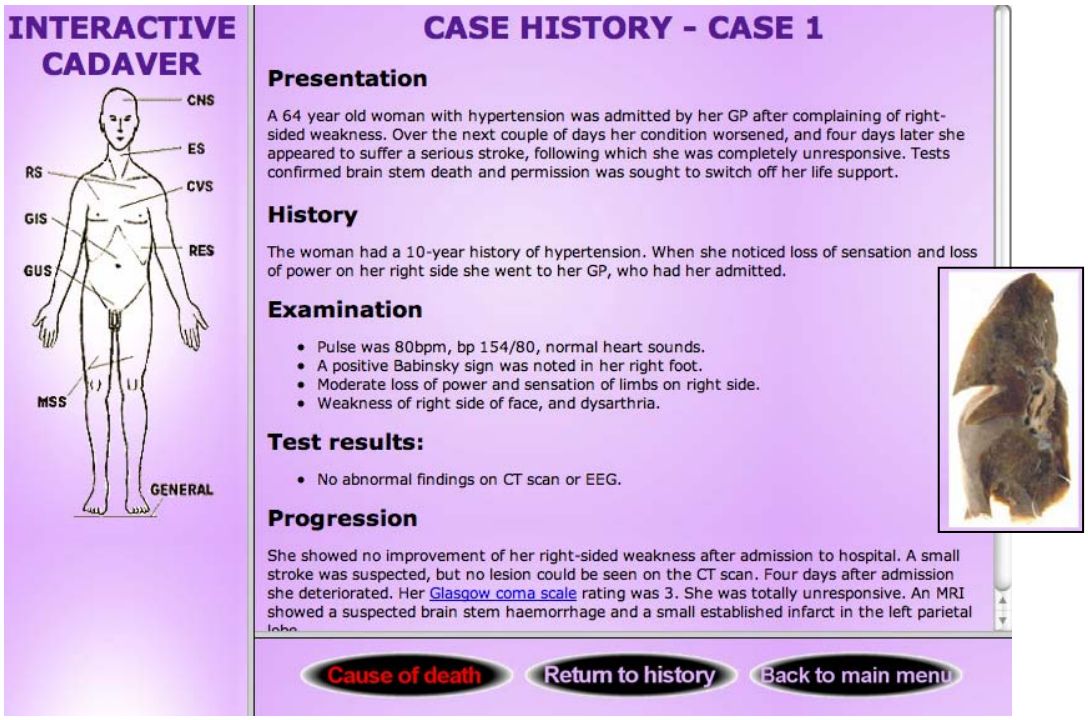

Figure 18. Sample Virtual Autopsy Case

Source: Ajay Mark Verma, *The Virtual Autopsy* (Leicester, England: University of Leicester, 2001), 1. http://www.le.ac.uk/pathology/teach/va/case_1/frmst.html (accessed 29 May 2009).

This is indicative of the impact that virtual learning has had on the training of medical professionals. The medical profession has always had a strong mentorship style of leadership as new doctors progress from interns to residents as they learn their profession while doing it under the guidance of a senior professional. This guidance will increasingly be virtual in nature.

Summary

Chapter 2 has laid the foundation of knowledge needed to understand the current theories related to virtual teams as understood in the fields of Organizational Leadership and Organizational Behavior, a basic understanding of the current Army applications and requirements, and applications from the corporate world. This basis of knowledge will be used in the following chapters to further analyze how practices from the corporate environment can benefit the Army and how Army strategies can benefit the corporate sector.

CHAPTER 3

RESEARCH METHODOLOGY

Introduction

Data for this study was collected by a methodological approach of descriptive data collection and analysis consisting of a meta-analysis of existing research findings and a categorical framework analysis. Meta-analysis provides a means of examining data from existing assessment and evaluation metrics for the purpose of identifying and examining trends (Schultz and Schultz 2010, 45-46). As a result, the aggregate data results in increased levels of knowledge and understanding of transferable strategies for forming, leading, and maintaining effective virtual teams in military and corporate contexts.

A systematic review of virtual team communication and collaboration findings, primarily research from academic and scholarly work, identified consistent factors of successful virtual teams. These factors are classified into three general characteristics: (1) environmental characteristics: for example, what is physically required in regards to technology, space, or location; (2) social characteristics: what's been consistent with respect to team-level perspectives---both individual and collaborative team social characteristics; and (3) leadership characteristics: what traits and actions are required of virtual team leaders. Categorical framework analysis offers a systematic approach of organizing individual case study findings from different disciplines into a framework of characteristics common to effective virtual teams. Collectively, findings from the meta-analysis as categorized into discrete characteristics of the framework make it possible to compare similarities and differences between each of the virtual case study examples.

This methodological approach increases the depth of this study's research base through a systematic examination of what each of the disciplines report as best practices for virtual teams. It is possible that findings in one discipline may be transferable to other disciplines, and such types of shared knowledge hold potential for increases in understanding of processes and practices of virtual teaming for virtual team members and leaders of the future.

Data

Data for this study represents a review of available literature and case studies from three different disciplines: academic teachings and scholarly research, Army doctrine and research, and corporate applications. Examination of each of these disciplines provided a way to look at the same topics from three completely different disciplines and view the characteristics of virtual teams from multiple perspectives.

Academic and Scholarly Data

The first discipline researched is a review of literature from several academic fields, primarily those of Organizational Behavior and Organizational Leadership. This portion of the research is fundamental due to the multi dimensional aspect of the material. Observing commonalities and general agreement on best practices between the different dimensions developed a framework for this study. The data was based on varied inputs: classroom/educational applications, workplace research, simulation-oriented/information technology based studies, and other academic pursuits. The sources for this material consisted of textbooks, scholarly works specifically dealing with virtual teams, journal articles, and a doctoral thesis.

Army Application Data

The next discipline researched is Army applications. Army research studies differ from the academic material due to a narrow focus on planning and leadership. While the academic and Army disciplines share extensive similarities within the content of planning and leadership, the Army literature uses unique terminology not present in the academic or scholarly realm. Sources for this portion of the research are current Army doctrinal manuals as this represents the official statement of what Army organizations require.

Additional material comes from reports generated by the Army Research Institute, Command and General Staff College (CGSC) classroom instruction as well as journal articles from Department of Defense related journals and related publications.

Corporate Application Data

The last portion of research literature relates to virtual teams in the corporate discipline. This material more closely resembles the academic material in the breadth and scope of the material covered as well as the terminology used. The primary difference is in the focus of the material. This portion of the research focuses mostly on corporate case studies and looks at concrete examples of how the best practices identified in the academic/scholarly section are applied in corporate settings.

Sources of corporate oriented research include textbook case studies, conference proceedings, instructional webcasts, academic and professional journals, and websites. This material was also organized using the criteria developed in the academic section.

Data Analysis

Once the data was collected, a meta-analysis was conducted to identify characteristics associated with the "best practices" of virtual teams in academic, Army, and corporate disciplines. The methods of meta-analysis involve qualitative processes of data collection and this multi-perspective approach of data collection and analysis identified common criteria/characteristics of effective virtual teams. Additionally, the analysis also showed areas of individual requirements or practices that were not shared by all disciplines. As a result, a framework of characteristics used by effective virtual team was developed and is shown in Table 6.

The categorical framework provides the structure for comparing characteristics of virtual teams presented in case study research from Army and corporate disciplines. Figure 19 depicts graphically how the framework was used to compare Army and corporate disciplines. The academic research data provided the framework and the Army and corporate case studies provided comparative data points. The two disciplines were analyzed to determine where one discipline could learn from the other. It is one of the basic tenants of this study that each discipline has lessons learned that can be applied to the other.

The final step in the analysis process is to determine the level that each case study meets the definition of each factor defined in Table 6. Ratings of Low, Medium, and High were assigned for each factor, and results were analyzed, compared, and examined to identify shared characteristics within the Army and corporate disciplines.

The ratings applied are based on subjective evaluations of the case studies. A high rating indicates that the case study exhibited successful application of the evaluated factor

and is an example of a “best practice”. A medium rating would indicate that the case study exhibited evidence of applying the evaluated factor but showed room for improvement despite being successful. A low rating indicates that either the factor was not addressed by the case study or there was significant room for improvement. A blank example of the categorical framework is shown in Table 7.

Table 6. Data Analysis Categorical Framework

CRITERIA	DEFINITION
Environmental Characteristics	
Multiple Modes of Communication	Use of multiple modes of media to transmit data. Examples include audio, video videoconference, and e-mail
Structured Problem or Task	Clearly-defined problem/structure with inputs and outputs. Limited brainstorming or other unstructured group activities.
Technological Support	Team members trained in the multiple modes of communication technology; IT support is available
Shared Work Space	Designed location where project data is accessible to all team members; data can be viewed, saved, updated by all team
Social Characteristics	
Cross functional Team	Subject matter expert team members with specific skills that are not common to all members
Self Managed Team	Team members function with minimal supervision to communicate and coordinate with other team members
Communication Skills	Proficiency in clear communication through writing and other visual mediums (graphs, pictures, etc.); awareness of team cross-cultural issues that could affect team communication.
Verbal and Non-Verbal Skills	Proficiency in verbal communication skills; awareness of team dynamics and social interaction techniques.
Leadership Characteristics	
Mentorship and Guidance	Leadership techniques of mentoring, support, and facilitation to establish, maintain, and support team collaboration.
Monitored Collaborative Workload	Interdependence of individual team member tasks coordination and collaboration between team members; team leader monitors team progress and individual workload of team members
Decision Policy	Team leader establishes a clear policy of decision-making for virtual team members.
Defined Team SOPs	Defined team procedures that specify communicating requirements and responsibilities.

Source: Created by author.

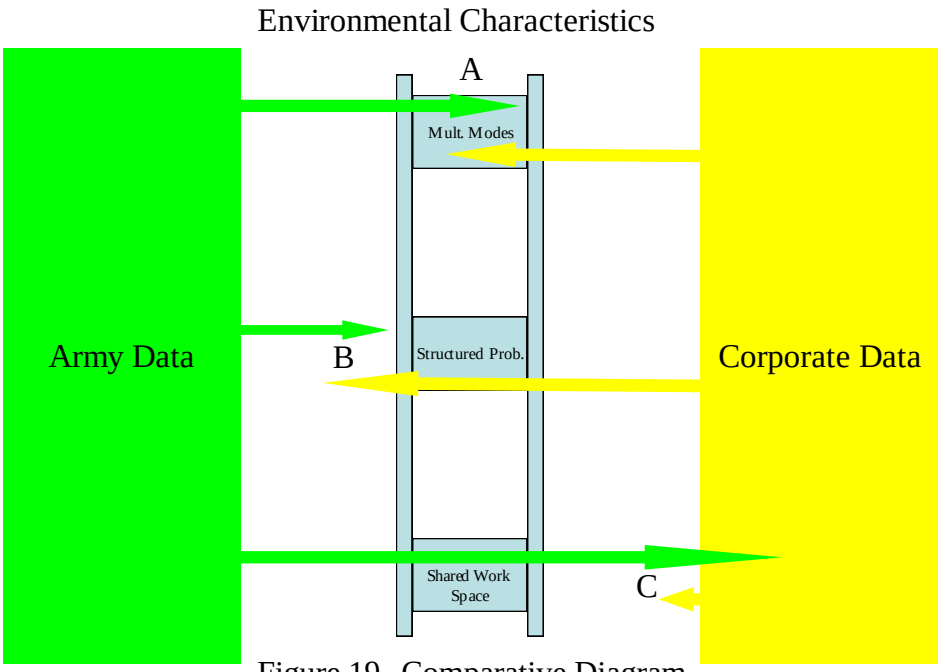

Figure 19. Comparative Diagram

Source: Created by author.

Table 7: Sample Categorical Framework

Case Study	Environmental Characteristics				Social Characteristics				Leader Characteristics			
	Multiple Modes of Communication	Structured Problem or Task	Technological Support	Shared Work Space	Cross Functional Team	Self Managed Team	Communication Skills	Verbal and Non-Verbal Communication Skills	Mentorship and Guidance	Monitored Collaborative	Decision Policy	Defined Team SOPs
ARFORGEN												
MDMP												
Same Page												
COP & CPOF												
Predator Feeds												
Volvo												
Crisis Interventions												
RWDP												
Virtual Medicine												

Source: Created by author.

Summary

Research studies employing meta-analytical approaches include both qualitative and descriptive components. Both are important tools of analysis to help researchers identify characteristics and view trends between disciplines based on research findings from previous literature studies. Informed decisions, however, cannot be reached through re-analysis of the data alone; academic research will always include subjective components human factors of interpolation and interpretation.

CHAPTER 4

ANALYSIS

Introduction

This study's methodological approach employed a meta-analytic examination of the best practices used by virtual teams from three disciplines. Chapter 4 begins with a discussion of findings from the academic discipline. These findings were organized into a framework representing consistent characteristics related to effective virtual teams. Targeting these characteristics through use of this framework made it possible to use a systematic analysis of case study findings from Army research and corporate studies.

This chapter begins with a meta-analysis of multiple case study examples from military and corporate virtual teams, then presents a comparison/contrast of categorical findings. After presenting the findings from analysis of the individual characteristics, a summary of all the characteristics and interpretation of the findings in relation to this study's original research questions is presented. All case studies were reviewed and categorized into three types of virtual teaming characteristics: (1) environmental characteristics, (2) social characteristics, and (3) leader characteristics. Essentially, each case study presented a snapshot that described the environmental, social, and leader characteristics found in the processes of virtual teams. Gradually, these snapshots formed a larger, more detailed, picture representing common characteristics of the best practices of communication and collaboration within virtual teams.

Environmental Characteristics

Environmental Characteristic Findings

Table 8 presents the results of environmental characteristics revealed through analysis of nine case studies of virtual teams. Ratings of "high-medium-low" represent each case study's level of alignment with the virtual team factors identified in the categorical framework.

Table 8. Environmental Characteristics Results

Case Study #	Case Study	Environmental Characteristics			
		Multiple Modes of Communication	Structured Problem or Task	Technological Support	Shared Work Space
1	ARFORGEN	Med	Low	Med	High
2	MDMP	Low	High	Low	Low
3	Same Page	Med	High	Med	Med
4	COP & CPOF	High	High	Med	High
5	Predator Feeds	Low	High	Low	Low
6	Volvo	High	Med	High	High
7	Crisis Interventions	Med	Low	Med	Low
8	RWMP	Med	Med	Med	High
9	Virtual Medicine	High	High	High	High

Source: Created by author.

Analysis of Findings, Environmental Characteristics

One of the strongest points displayed by Table 8 is the large degree of problem or task structure found in the Army. One key component of this is the MDMP as this

process is an integral part of two (MDMP and COP & CPOF) of five case studies. CPOF is a tool that can facilitate using the MDMP to plan military operations. This lends a high degree of structure to both of these case studies. The task in the Predator Feed case study was simple and straightforward and was rated high as a result. These statements demonstrate a high potential for successful virtual teams in Army applications.

In the other three environmental factors, the corporate case studies showed a greater degree of alignment with the academic findings. This was especially true in the shared workspace factor. Examples of this were extensive: digital medical databases utilized in every medical case study, the web based radiology theater, the Volvo 3D design center, and the intranet at the RWMP. The first three were especially impressive in their ability to facilitate collaboration by leveraging advancements in communication technology.

The corporate discipline has invested in technology with a focus on multiple modes of communication. In comparison, the Army has barely started this process and struggles with basic technology such as video conferencing. For example, while attending the yearlong Intermediate Level Education (ILE) course from August 2008 to April 2009, the author has experienced technical difficulties in every single videoconference. The Predator Feed case study shows the limitations of voice communication only in a combat environment that is still the case for many tactical units. In contrast, the operation of virtual teams in the corporate sector seems to function worldwide with the Volvo and virtual medicine case studies particularly demonstrating successful multi-modal communication abilities.

Thus the Army possesses the structured problem and specificity in tasks that facilitate virtual teaming. That said, the corporate discipline has truly embraced the environmental characteristics by providing the technology coupled with the necessary training and IT support to allow multimodal communication and collaborative, shared workspaces. The key part that enables the last two is a focus on training.

Social Characteristics

Social Characteristic Findings

Table 9 presents the results of social characteristics revealed through analysis of nine case studies of virtual teams. Ratings of "high-medium-low" represent each case study's level of alignment with the virtual team factors identified in the categorical framework.

Analysis of Findings, Social Characteristics

According to Barrett, people problems are the reasons that many virtual teams fail (Barrett 2006, 256). This concept was observed during the analysis of the factors that support the social characteristics. There were no definitive trends and both Army and corporate case studies exhibited a wide variance with barely discernable trends.

Corporate teams exhibited a high degree of self-management. The virtual medicine case study and the crisis intervention case study both had a large number of ad hoc teams that, by nature, tend to be more self managing. The RWMP also had a significant degree of self-management but this is a deceiving rating as the report stated that a significant problem was a lack of clarity on team leaders and team members which

will be discussed in the next section. Despite this, the virtual teams were generally successful due in large part to self-management.

Table 9. Social Characteristics Results

Case Study #	Case Study	Social Characteristics			
		Cross Functional Team	Self Managed Team	Communication Skills	Verbal and Non-Verbal Communication Skills
1	ARFORGEN	Med	Med	Med	Low
2	MDMP	High	High	Med	Low
3	Same Page	High	Med	Med	Low
4	COP & CPOF	High	High	High	Med
5	Predator Feeds	Low	Low	Low	Low
6	Volvo	Med	Med	High	High
7	Crisis Interventions	Med	High	Med	Low
8	RWMP	High	High	Low	Low
9	Virtual Medicine	High	High	High	High

Source: Created by author.

Corporate teams focused on training in the social aspects of communication including cultural and non-verbal mitigation techniques. This was exemplified by the focus that Volvo placed on training virtual teams in communications skills through the use of the Volvo *Virtual Teams Guide* and many workshops. Many hospitals had difficulty with digital patient records, but the digital avatar filing system is an example of

how communication difficulties can be overcome through the use of technology. The avatar system alleviated many of the problems associated with the lack of real world interaction with paper filing systems, a form of face-to-face communication. Lastly, the web based Radiology Theater allowed a distributed team of doctors to utilize a shared whiteboard to draw in order to make detailed and hard to describe medical facts easily understandable. A visual example was shown in Figure 16 of Chapter 2.

The final social characteristic finding was the realization that both Army and corporate applications utilized the factor of cross-functional teams. However, the two disciplines utilized them for different reasons. The corporate applications used cross-functional teams for virtual teaming due to the financial savings and competitive advantages as well as the globalization of many corporations. Additionally, as the RWMP and medical case studies exemplified, the nature of many corporate projects are multidisciplinary due to the technical nature of the projects themselves.

In contrast, the Army has a highly multidisciplinary team due to the grouping of disparate military specialties into staff groups. This is primarily an organizational choice that results in Army teams being aligned with the multidisciplinary factor but it is due more to an organizational decision rather than a focus on virtual teaming

Leader Characteristics

Leader Characteristic Findings

Table 10 presents the results of social characteristics revealed through analysis of nine case studies of virtual teams. Ratings of "high-medium-low" represent each case study's level of alignment with the virtual team factors identified in the categorical framework.

Table 10. Leader Characteristics Results					
		Leader Characteristics			
Case Study #	Case Study	Mentorship and Guidance	Monitored Collaborative Workload	Decision Policy	Defined Team SOPs
1	ARFORGEN	Low	Low	High	Low
2	MDMP	Low	Med	High	Med
3	Same Page	Low	Med	Med	Med
4	COP & CPOF	Low	Med	High	Med
5	Predator Feeds	Low	Med	High	High
6	Volvo	High	Med	High	Med
7	Crisis Interventions	Low	Med	Med	Low
8	RWMP	Med	Low	Low	Low
9	Virtual Medicine	Med	High	Med	Low

Source: Created by author.

Analysis of Findings, Leader Characteristics

Army teams tend to be leader centric and lack the mentorship found in corporate teams. In the typical MDMP, the team will get initial guidance but the entire process is driven by the need to produce information to present to the commander for a decision. The commander is typically not as involved in the communicative and collaborative team interactions. In contrast, the corporate examples were replete with evidence that the team leader was an integral part of the team and was intimately associated with internal team interactions. However, the Army is better with guidance and getting an overall team

understanding through the concept of the commander's intent, a formalized statement of how the commander views the problem from his or her perspective.

Additionally, this commander centric focus provides alignment in a different factor. The hieratical nature of Army leadership generates a natural decision policy that is unambiguous and clear. In general, leadership and decision making in the military is centralized and the limits of lower level leaders are clearly understood. This does cause some issues with the flatter power arrangement that is commonly found in virtual teams.

The corporate case studies do not have similar clarity. One of the issues in the RWMP case study was a lack of understanding regarding who were virtual team leaders and who could make decisions. Likewise, a team of virtual doctors will have no issues if everyone is in agreement. However, when conflicts arise, it can be confusing to determine who is in charge especially on a complex case with numerous specialists involved. A similar issue arises during virtual team leadership in crisis situations. Conflicts between federal, state, and local agencies as well as conflict between different organizations at the same level can create confusion over who has the authority to make decisions and take action.

The Army's focus on SOPs is applied to virtual teaming but not at the organizational level. The MDMP and Army doctrine lend a certain amount of standardization to Army operations. This provides a baseline of SOPs to coordination operations of units that have been assembled as virtual teams from disparate units. However, the Army's commander centric mentality is also reflected here as the detailed SOPs required for successful virtual teaming are left to the determination of individual commanders. The CPOF and COP case study is the best example of this. In 2004, the

First Calvary Division's commander was a strong proponent of CPOF as a planning and collaboration tool. If one of the subordinate brigades were attached to another division that did not use CPOF, the subordinate brigade would have to completely change its battle tracking and reporting systems. In the old analog Army, this was a simple exercise. With the complexity of modern communication systems and distributed command and control networks, this change becomes problematic.

Summary

Table 11 shows the combined findings of the analysis.

Table 11. Results Summary

	Environmental Characteristics				Social Characteristics				Leader Characteristics			
Case Study	Multiple Modes of Communication	Structured Problem or Task	Technological Support	Shared Work Space	Cross Functional Team	Self Managed Team	Communication Skills	Verbal and Non-Verbal Communication Skills	Mentorship and Guidance	Monitored Collaborative Workload	Decision Policy	Defined Team SOPs
ARFORGEN	Med	Low	Med	High	Med	Med	Med	Low	Low	Low	High	Low
MDMP	Low	High	Low	Low	High	Med	Med	Low	Med	Med	High	Med
Same Page	Med	High	Med	Med	High	Med	Med	Low	Med	Med	Med	Med
COP & CPOF	High	High	Med	High	High	High	High	Med	Med	Med	High	Med
Predator Feeds	Low	High	Low	Low	Low	Low	Low	Low	Low	Med	High	High
Volvo	High	Med	High	High	Med	Med	High	High	High	Med	High	Med
Crisis Interventions	Med	Low	Med	Low	Med	High	Med	Low	Low	Med	Med	Low
RWDP	Med	Med	Med	High	High	High	Low	Low	Med	Low	Low	Low
Virtual Medicine	High	High	High	High	High	High	High	High	Med	High	Med	Low

Source: Created by author.

The first two subordinate research questions have been addressed. The framework developed in Chapters 2 and 3 represent the "best practices" as determined by academic research findings. The factors contained in Table 11 under each of the three characteristics are what virtual teams need to do in order to be successful and effective. This addresses the first subordinate research question.

The second research question asks, "What "best practices" of communication and collaboration are found in Army and corporate applications?" The answer to this question has been the focus of Chapter 4. Within the Army case studies, the "best practices" are a high degree of problem or task structure. The issues being addressed are frequently complex but the Army has a structured way of breaking down problems and addressing them. Most Army teams are cross-functional even though this is not a result of nor developed for virtual teaming. Additionally, the Army has a structured command system and practices unity of command so that virtual teams know who is in charge and at what level decisions are to be made. This structure also provides guidance that virtual teams need with the principle of the commander's intent.

Analysis of the corporate case studies revealed that the corporate sector has a greater understanding of the need for training to support virtual teaming. This training was twofold; the need for extensive training in the technology as well as social training in communication skills. Additionally, the corporate case studies showed a greater variety and a focus on multiple modes of communication. One of the key uses of these communicative technologies was various examples of shared work spaces that are essential to successful virtual teams. These were the "best practices" found in the corporate case studies.

Now that the best practices have been developed, and the Army and corporate applications of them have been determined, the next subordinate questions ask what can be transferred between disciplines. The next chapter will answer the remaining questions regarding what can be shared and discuss recommendations for implementing them.

CHAPTER 5

RECOMMENDATIONS AND CONCLUSIONS

The findings of this study support the research hypotheses that sharing "best practices" of virtual teaming processes from academic, military, and corporate disciplines offers opportunities to transfer certain characteristics between disciplines. The key finding of this study is that it is possible to foster more efficient and effective forms of communication and collaboration for virtual team members and virtual team leaders in each discipline by applying "lessons learned" from one discipline to another. Results from a categorical framework analysis allowed for identification and examination of patterns and characteristics found in case studies of virtual teams from Army applications and corporate applications. Subsequent ratings of these case studies based on common framework factors of each virtual team's environmental, social, and leadership characteristics allowed for a systematic examination of similarities and differences used by these multidisciplinary virtual teams.

Chapter 4 presented these results in terms related to the measurement instruments. The aim of this chapter, however, is to apply those results in a way that is useful to those who lead virtual teams, those who manage the technological needs of virtual teams, and virtual team members themselves. To that end, then, it is appropriate to present and discuss the implications of these results to promote alignment between Army applications and corporate applications, where relevant, and to promote greater degrees of communication and collaboration for successful virtual team processes.

Conclusions

Army Applications from Corporate "Lessons Learned"

The Army's biggest lesson to learn from the corporate environment is the necessity for training virtual teams. A virtual team needs a greater amount of training and it is required in both the use of technology as well as operating with limited face-to-face contact. The Army's primary enabling technology for virtual teaming is CPOF. In an interview with Frank Adkin III, he related his recent experience as a CPOF contractor in Iraq from January to April of 2009. He noted that units who utilized the system for collaboration and communication were units that had a greater degree of training. The example he gave was the 1st Cavalry Division who had invested a year of training on the system prior to the deployment. Note the following quote from Major General Peter Chiarelli, 1st Cavalry Division commander.

> There's no doubt that we've saved soldiers' lives with CPOF. And this is just the start. In my 32 years in the army, I've never seen a system that will have a greater impact on our army and our entire joint force. (Gill 2005)

Unfortunately, Major General Chiarelli is the exception rather than the rule. The corporate sector has shown greater success when senior leaders are trained in the requirements for virtual teams. These senior leaders have to be given the training to help them understand the difference between leading decentralized, virtual teams and traditional Army leadership. They also need to understand the capabilities that modern systems can provide. Frank Adkins related the example of a division changing data from CPOF to PowerPoint which was then imported into the corps CPOF for a briefing. Mr. Adkins then asked, "Why would you want to brief dead data when you could have live

data instead" (Adkins 2009)? It is a function of the technology that Army leaders are comfortable with and most are comfortable with older technology and methods.

Finally, Army leaders will have to adapt the Army's leadership and organizational construct to facilitate the rapid and fast paced nature of conflict in a globalized world. The Training and Doctrine Command Commander, General Martin Dempsey stated,

> LTG Stan McChrystal-one of our truly innovative senior leaders-had it right when he said, "to defeat a network, you have to be a network." So our challenge is to adapt our institutions and develop our leaders to confront the complexity and decentralization inherent in the future operational environment. (Dempsey 2009)

This requires a culture shift in the Army where activities become more decentralized and less direct control is required. If the Army is incapable of adapting the middle and senior level leadership, then they will continue to apply technology toward the concept of virtual teaming. This results in the illusion of a virtual team without the reality. This is supported by Dr. Sharon Johnson, associate professor of industrial engineering at Worcester.

> Just installing an IT system alone typically doesn't achieve efficiencies. What has to happen is that an organization and its processes need to adapt to realize the efficiencies and quality improvements that are enabled by IT--and that's tough to do. If processes don't adapt, then just imposing an IT system alone can be counter-productive. (Cohen 2009)

The Army has to adapt in order to truly realize the potential for virtual teaming to support distributed and decentralized operations. The Army has a long way to go and this is best exemplified by the following quote from Lieutenant General William Caldwell IV.

> The new media has enabled and empowered the rise of a new enemy . . . this enemy is not constrained by the borders of a nation or the International Laws of War. This new technology allows them to decentralize their command and control and disperse their elements around the globe. They stay loosely connected by an ideology, send cryptic messages across websites and via e-mail and recruit new members using the same new media technologies. When I was the Spokesman for Multi-National Force-Iraq (MNF-I) we saw not only the power of the new media in the form of the internet and You Tube videos, but we also saw how adeptly the enemy was leveraging that power. I wanted to get in on the action

> by posting gun tape video showing the awesome power our military can bring to bear . . . If you could have seen the bureaucratic red tape I . . . as a MAJOR GENERAL . . . had to go through to get authorization to do that. But when it was finally approved and posted, I hear that MNF-I videos from Iraq became one of the top ten videos viewed on You Tube for weeks after their posting. I hear that it is true because I wasn't actually able to view the videos because we were still restricted bureaucratically from viewing You Tube in theater! (Caldwell 2008)

Corporate Applications from Army "Lessons Learned"

Within corporate applications, the primary lessons learned from Army applications is the benefits of having a well defined leadership model that leaves no room for question as to who is responsible for making decisions. Due to the ad hoc nature of many of the teams in the corporate case studies, this will never be as clear as the chains of command in a military organization. However, a deliberate and clear establishment of reporting requirements and decision making responsibility and authority must be developed as early as possible. According to Barrett,

> virtual team members must be committed to the team and the team's work. They must deliver what they promise, on time, and according to the team's expectations. With a virtual team, a high level of commitment is even more critical than with a traditional team. (Barrett 2008, 234)

This level of commitment and motivation has to be fostered by team leaders. One of the key ways that Army leaders accomplish this is through the dissemination of the commander's intent. This is one technique that corporate leaders can use to generate commitment as well as a clear understanding of what is required. This is another area where corporate organizations can learn from the Army case studies. A clear well described plan of what is to be accomplished is essential to a successful virtual team.

The preceding sections answered the last two subordinate questions which asked what the Army could apply for corporate lessons learned and what the corporate sector

can learn from the army applications. The remaining portion of the chapter will give basic recommendations.

Recommendations

Environmental Characteristics

The Army needs to develop a standardized training program to train key leaders in how to support virtual teams and ensure leaders know how to integrate the systems. This training is a key part of understanding system capabilities and showing what is possible. A key part of this program should be extensive training on CPOF since this system is the primary means of collaboration for tactical units from battalion to corps level.

If it does not exist, corporations need to develop a problem solving methodology that employees can utilize across the organization. In this way disparate members of different divisions who are brought together to work virtually can have a common reference point. This is similar to the MDMP in military applications.

Social Characteristics

Army organizations should strive to adopt a flatter power structure. The implementation of mission based orders focused on the commander's intent has started this process. However, the Army is still hierarchical in nature and has not adapted enough to fully integrate the self management that virtual teams are capable of. Leaders should expand the utilization of mission focused orders and give greater flexibility to subordinate leaders.

The Army can utilize organizational training such as that found in the Volvo case study. Specifically, develop an organization specifically designed to promote virtual teaming rather than relegating the process to "the SIGO's" (Signal Officer's) problem. A key component that this organization could address would be the social aspects required to overcome the lack of face-to-face interaction and other organizational cultural changes that virtual teams require to be effective.

Leader Characteristics

Utilize the model of Volvo where senior leaders were specifically trained on supporting virtual teams. Help Army leaders see that it is not a technology issue but a people issue where virtual teams require more mentorship.

Corporations should utilize the Army's concept of mission focused orders that rely on leader's intent. To do this a leader must clearly be identified as early as possible. Senior executives facilitate this.

Suggestions for Future Research

This study has just scratched the surface and it is not a predictive model. Future research could investigate where modifications to the traditional Army education system could be most easily made in order to integrate virtual teaming. Another study could examine the impacts of developing a CPOF SOP at the brigade and division level. Finally, the effects on operations and organizational leadership of flattening the Army's power structure would be a natural extension of increasing the utilization of virtual teams.

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