THE IMPACTS OF DIGITIZATION ON THE ARMY'S MILITARY DECISION-MAKING PROCESS: MODIFICATIONS TO THE ESTIMATE OF THE SITUATION

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

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CHAPTER 1

INTRODUCTION

The United States Army is approaching one of the most significant training events to occur in decades. This event, the brigade Advanced Warfighting Experiment (AWE), is scheduled to occur at the National Training Center (NTC) at Fort Irwin, California, in March 1997. This AWE is one in a series of AWEs to occur since 1994. This AWE allows the Experimental Force (EXFOR, a heavy brigade from the 4th Infantry Division) to test some of the force design, information technologies (digitization), and evolving tactics, techniques, procedures, and doctrine for Force XXI operations.[1] The results of this experiment are supposed to produce decisions on the path the Army will take to field Force XXI equipment, doctrine, and organizational design. Quite simply, the results may produce *evolutionary* and *revolutionary* methods the U.S. Army may use to train, equip, and fight its forces into the twenty-first century.

TRADOC Pamphlet 525-5, Force XXI Operations, refers to the creation of Force XXI operations as a Revolution in Military Affairs (RMA). How and why did the Army reach such a revolution? There are a variety of reasons. However, all of these reasons result from changes that have occurred due to the transformation of the global environment.

TRADOC PAM 525-5 describes numerous reasons why the Army is in the midst of a RMA. Among these reasons are the changes in global threats and the development of information technologies. Advances in information technology and the military's procurement of commercial information technologies are significant reasons why the Army finds itself in a

RMA. These advances have been fueled by the growth of the world's microprocessing technology. The growth of this technology is a great enabling force. As a result of inheriting and employing this technology across the Army's battlefield operating systems (BOS), the manner in which the Army can now *collect,* communicate, and use information is forever changed.

The transition of global threats is another reason why the Army is enduring a RMA. The end of the Cold War, coupled with the rapid and recent changes in global threats (throughout Europe and Southwest Asia, for example) has led to increased nationalism. The quest for nationalism is now the leading cause of interstate and intrastate conflict. Because of changes in threats as these, America's leadership is evaluating the future roles and missions of the Army.[2]

As a result of evaluating the Army's roles and missions, the Army has determined it must "lead through change."[3] What are the effects of leading through change? The Army's position is that future conduct of operations is currently clear enough to set in motion dramatic changes in the way it will conduct future land warfare. These dramatic changes are encompassed within what the Army calls Force XXI operations. It is these operations which are propelling the Army's vision into the twenty-first century.[4]

Force XXI operations are the proposed reconceptualization and redesign of the U.S. Army. A part of this reconceptualization and redesign is the Army's effort to organize and equip itself around information and information technologies. One of the reasons for doing this is to capitalize on the capabilities of information technologies. In order to accomplish this, the Army is digitizing and restructuring its command and control (C2) system. The purpose of digitizing the C2 system is to link C2 systems throughout the battlefield. Theoretically, this linkage produces increased speed of decision making, increased operations tempo, and better overall situational awareness.[5] Therefore, digitization potentially produces a more effective and efficient decision-making environment. If digitization accomplishes this, the value of the Army's decision making process becomes more important than ever before. The Army, therefore, cannot neglect the effects digitization may have upon executing the traditional MDMP.

Definition of the Problem

This thesis analyzes the current doctrine governing the development of the U.S. Army's MDMP with particular emphasis upon assessing the estimate of the situation process--the core of the MDMP. The thesis then evaluates the estimate of the situation against the demands of the future battlefield.

Problems exist if the Army's MDMP is analyzed against the demands of the future battlefield. These problems center around the effects improving the Army's command and control have upon the MDMP. Force XXI encompasses vast improvements in the ability to obtain information dominance through the use of information technologies. Some of these technologies include improvements in soldier systems, weapons, and equipment upgrades (in some cases with digitization). Other information technologies include drastic improvements in command and control systems. All of these improvements might effect the manner the Army will fight on the future battlefield.

At the core of these improvements, however, is the digitization of specific C2 systems and functions. Improving the C2 BOS enables commanders to utilize the enormous amounts of information the entire spectrum Force XXI operations provides them. Properly utilizing this information allows commanders to have increased situational awareness, increased decision-making capabilities, and an ability to execute more precise operations than the enemy (increased optempo).

The Army is improving and digitizing its C2 systems by developing the Army Battle Command System (ABCS). The ABCS is the integration of C2 systems found at all echelons, particularly from battalion through corps. The ABCS includes three major components:

1. Army Global Command and Control System (AGCCS),
2. Army Tactical Command and Control System (ATCCS), and
3. Force XXI Battle Command, Brigade and Below (FBCB2) System.[6]

An analysis of the complete Force XXI doctrine is beyond the scope of this thesis. However, the ATCCS shapes the way the Army conducts its estimate process. Therefore, this thesis focuses on the impacts the ATCCS has on the estimate process. This thesis analyzes two new digital systems and their impact upon the estimate process: the Maneuver Control System Phoenix (MCS/P) and the All-Source Analysis System Remote Workstation (ASAS-RWS).

The MCS/P and the ASAS-RWS are designed to digitize the maneuver and intelligence portions of the battlefield functional areas (BFAs, more commonly known as BOS). According to the Force XXI division's organizational model, conceptually, these systems are fielded from battalion through corps command posts. These systems digitally link the two BFAs and provide the commander a relevant common picture (RCP) of his battle space. A RCP, discussed in detail in this chapter and others, is a graphic description of a given unit's disposition in relation to the current enemy situation and terrain. It is a picture, displayed via various ATCCS systems, of where a unit is in relation to where its enemy is. Theoretically, the RCP provides enhanced enemy and friendly situational awareness. Situational awareness enables commanders to take less time to make decisions because they will know more about themselves in relation to the enemy.

The current estimate process is a manual and time-consuming process to complete. Implementing a digitized C2 system appears (at the outset) to require a decision-making process that can develop recommended courses of action (the product of the estimate process) in a much quicker manner. Is it feasible to assume the traditional estimate process (currently used without any digital C2 systems) is capable of being used properly with digital C2 systems?

The primary research question this thesis attempts to answer is: Within the military decision making process will the estimate of the situation require modifications as a result of implementing the MCS/P and ASAS-RWS? It is important to note that this thesis does not attempt to create a new estimate process or model. The scope of this thesis limits research to the armored and/or mechanized battalion task force. The scope is further defined by parameters reviewed later in this chapter.

In order to answer the primary question the following five secondary questions help shape the focus of the research throughout this thesis:

1. What is the estimate of the situation?

2. Why does the Army use the MDMP to solve its tactical problems?

3. Is the estimate of the situation an effective process to develop courses of action?

4. What are the doctrinal and theoretical requirements for developing necessary modifications to the current estimate process when employing MCS/P and the ASAS-RWS?

5. What does doctrine and related literature suggest about the use of the MCS/P and the ASAS-RWS with the current estimate of the situation?

This chapter explains the nature of this research and provides perspective for the approach to answering the primary question. To accomplish this, this chapter covers the background of the problem, explains the research design, and provides the assumptions, definitions, limitations, and delimitations of the research.

In order to set the stage for the remainder of this research, chapter one reviews the MDMP and explains how the estimate of the situation fits into this process. Chapter one concludes by reviewing why Force XXI operations may require the estimate process to be modified as a result of digitizing the Army's command and control process.

Decision-making

Decision-making is knowing what, when, and if to decide. For the Army, decision making is the process the commander uses to transform his intent into operation plans or orders. Decision-making involves both art and science. The scientific aspects of decision making deal with the quantifiable pieces of military operations--movement rates, fuel consumption, and weapon effects. The decision-making art, however, is harder to define, analyze, and grasp. The art of decision making deals mainly with the application of leadership towards the MDMP.

The Army uses decision-making to plan, prepare, and execute its operations in peace and in war. However, the Army tailors the basic decision-making process to fit its needs. The Army labels this decision-making process the MDMP.

The Military Decision-Making Process

"The MDMP is a doctrinal approach to decision-making that helps the commander and his staff examine a battlefield situation and reach logical decisions."[7] (See fig. 1.) The MDMP, it is known today, has been in use for over eighty years. Captain Roger S. Fitch helped structure the MDMP during his tenure at Fort Leavenworth, Kansas, in 1909. Captain Fitch structured the MDMP from the Prussian Army's use of tactical decision-making during Frederick the Great. Although Captain Fitch did not know it at the time, the U.S. Army would formally recognize and adopt the same process he helped restructure.

The decision making process Fitch highlighted would be developed, over a period of time, into the decision making process the Army uses today. Over eighty years, the decision making process has evolved into Army doctrine. During this evolution, the decision making process recognized by Captain Fitch has been revised numerous times. This decision making process remains as the foundation of the Army's MDMP and remains as the tool to develop Army operation plan and orders.[8]

The Linkage Between the MDMP and the Estimate

The MDMP involves following a systematic approach to analyze and solve tactical problems. The MDMP assists staffs to analyze and solve tactical problems by conducting a methodical and analytical process. The essence of this process is a review of the situation and a comparison of this situation against the given conditions of the tactical problem and the enemy's situation. Essentially, the process allows a staff to begin the process under uncertain conditions (absent a recommended course of action (COA) and complete the process having attained a higher degree of certainty (having a recommended COA). This systematic approach, as outlined in the U.S. Army's Command and Staff Decision Process (ST 101-5) and updated in FM 101-5, Staff Organization and Operations (Final Draft, August 1996), begins with the *receipt of the mission*. The process culminates with the staffs' development of recommended COA. Concurrently, the commander (who participates in the estimate process and conducts his own analysis in the form of the commander's estimate) then chooses the most appropriate COA. (See fig. 2)

This systematic approach follows the seven steps of decision making the Army identifies in FM 101-5 (Final Draft, August 1996). (See fig. 3). These seven steps are the foundation for each of the two decision-making methods (deliberate and abbreviated) the Army currently uses. These steps are identical to the ones staff officers use to develop staff estimates. ST 101-5 considers these steps "the foundation of tactical decision making and . . . as applied to the

Army's warfighting mission, they . . . evolved into what is now called the estimate of the situation."[9]

FM 101-5 (Final Draft, August 1996) describes the purpose of the estimate as "to collect, analyze, and update relevant information to provide viable options and recommendations to the commander. The commander and his staff make estimates that are applicable to any operations situations and at all levels of command."[10] This definition of the estimate process is important to note. Upon approval of FM 101-5 (Final Draft, August 1996), the Army plans to use two methods within the MDMP to help commanders solve problems. These methods are the *deliberate* and *abbreviated* decision-making processes. These two methods replace the *deliberate*, *combat,* and *quick* processes formerly used by the Army.[11] Regardless of a commanders decision to use either the deliberate or abbreviated method, the estimate process remains the same.

It was stated earlier that the estimate of the situation has been around since the turn of the century. A possible reason for the estimates' longevity may be the result of its ability to produce enough certainty to develop courses of action. When staffs and commanders commence planning, they are uncertain of the enemy's disposition, strength, and possible course of action. Once they complete the estimate process, however, the enemy's disposition, composition, and strength is better understood. This occurs because of the analytical nature of the estimate process. The results of this process produce recommended friendly courses of action to defeat the most likely or dangerous enemy course of action. Another reason for the estimate's longevity could be the flexibility it offers. There are numerous staff estimates available to assist staffs to develop recommended COAs during the MDMP. The purpose of these estimates is alike: they help commanders decide on the best COA.[12]

Over the years, the estimate has endured changes in Army doctrine, equipment, and technology. Additionally, with modifications, the estimate has been used throughout the range of military operations. However, the estimate is now faced with possibly its most significant challenge: Information. If digitization is able to produce the degree of situational awareness it is theoretically capable of, then staffs may not have to endure commencing the estimate process under such uncertain conditions.

Force XXI operations, as outlined in TRADOC Pamphlet 525-5, will be characterized by flexible, strategically mobile, and versatile forces. The ability of these forces to accomplish their missions will be enhanced by their possession of information dominance. The Army defines information dominance as the degree of information superiority that allows the possessor to use information systems and capabilities to achieve an operational advantage in a conflict or to control the situation in operations short of war, while denying these capabilities to the adversary.[13] Helping commanders achieve this operational advantage are digital information systems including the MCS/P and ASAS-RWS. These systems, if properly designed, integrated, and employed correctly, may be able to streamline the commander's decision-making cycle. Streamlining his decision-making cycle would enable him to make decisions faster than the enemy and thus create an operational tempo no foe could match. Therefore, U.S. forces would dominate operations through quicker and more decisive tactical decision making. Although TRADOC Pamphlet 525-5 specifies that these conditions may exist, there are some significant shortcomings that prevent these conditions from immediately becoming reality.

This thesis addresses these shortcomings which include: software incompatibilities between the MCS/P and ASAS-RWS, a lack of proper techniques and procedures within the decision-making doctrine to capitalize on the digital capabilities of both systems, and a lack of understanding of and guidance over how commanders should deal with information overload.

A significant portion of the literature review addresses the doctrinal Force XXI publications. This thesis attempts to discern whether these publications address the impacts Force XXI operations will have on the MDMP. Most of the publications do not. This thesis makes a fundamental assumption that the characteristics of Force XXI operations will have an impact upon the MDMP.

The literature review concludes that trends exist among the historical, doctrinal, and related pieces of literature reviewed that establish broad Force XXI decision making guidelines. These guidelines are discussed in detail within chapter two's summary.

In order to demonstrate that digital information systems, such as the MCS/P and ASAS-RWS, create modifications on the MDMP, this thesis uses a methodology that analyzes where and how these modifications occur within the estimate. This thesis analyzes the products of each step of the estimate process against the significant capabilities of the MCS/P and ASAS-RWS. The results of this analysis show that modifications occur throughout the estimate process.

The Birth of Force XXI

The conceptual beginning of Force XXI can be traced back to the late 1970s and early 1980s. Since then, Force XXI has produced some significant improvements in weapons and equipment. During the late 1970s the senior leadership of the Army began to explore the challenges of leading the Army into the twenty-first century. As a result, revolutionary concepts such as "Army 21" and "Airland Battle 2000" began to develop. What was happening? The senior leadership of the Army was visualizing the requirements and challenges they believed the future battlefield would consist of: extremely lethal, chaotic, and fast-paced operations. These senior leaders also based these requirements on the premise that Soviets would remain their biggest military threat.[14]

The results of visualizing the future requirements of the Army produced many new major weapons, equipment, and doctrinal publications which were fielded to the armed forces during the 1980s. Today, the Army continues to benefit from this vision. It has begun the testing and fielding of Force XXI, the Army of the twenty-first century. Although the Army is in the midst of experimenting with Force XXI operations, it is doing so as part of a larger plan which began at the end of the Cold War.

After the fall of the Berlin Wall in 1989, America's leadership began to alter its national security and military strategy. This strategic shift set in motion Force XXI operations, as known today. Reflecting the lack of a single military threat, improvements in information technologies and other technological advances the Army opted to adopt a methodology that consisted of a *force projection and capabilities based* Army.[15] As a result of this shift in philosophy, the Army's doctrine also changed. These changes provided the necessary framework to create Force XXI doctrine. These changes also created the vision for the Army of the twenty-first century and placed significant demands on improving the Army's C2 systems.

Armed with a new philosophy and the framework for new doctrine, the Army began to experiment with redesigning itself around digitization. The focus of this redesign around digitization was to improve the Army's aging C2 systems. In order to digitize the C2 system and meet budget constraints, one of the simplest things to do was leverage off-the-shelf commercial technology. The purpose of leveraging this technology was to reduce cost of the redesign, speed the employment of new systems, and improve the Army's ability to command and control its forces in war. A part of this C2 redesign involved the creation of systems like the MCS/P and ASAS-RWS, components of the ATCCS.

Although vast improvements have been made over the years in weapons, equipment, and communications (the "control" portion), little has been done to help the commander influence the battlefield (the "command" portion). Digitizing the C2 system potentially gives commanders an unparalleled ability to battle command (thus *influence*) their forces by digitally linking various types of new sensors to commanders. By creating this link and implementing digital information systems to help the commander improve his decision-making ability, commanders can provide ground combat forces better information on when, where, and how to engage the enemy.

Figure 4 provides an explanation of how digitally linking sensors to commanders to ground combat forces improves a commanders' situational awareness. The Army's definition of situational awareness is the ability to have accurate and real-time information of friendly, enemy, neutral and non-combatant locations: a common, relevant picture of the battlefield scaled to a specific level of interest and special needs.[16] Situational awareness produces the need to share more information, increases the battlefield's operational optempo, and sets the conditions to shorten a commander's decision cycle, enabling him to decide earlier within the MDMP. Situation awareness may also require him to deliver speedy decisions. The link between the sensors, information technologies, and the by products of situational awareness is information dominance.

Achieving information dominance is the successful application of linking ground-based, airborne, or a combination of ground and airborne sensors, to commanders to collect information on friendly and enemy dispositions. Through the aide of information technologies (information systems), these sensors provide more and accurate information to the commander. By gaining this type of information in a near, real-time fashion while simultaneously denying this information to the enemy, information dominance is achieved. The family of ground and airborne-based sensors combined with the ATCCS comprise the majority of the information technologies that are used to achieve information dominance. The Army feels that gaining and maintaining information dominance enables commanders to improve their decision-making skills, thus improving the MDMP. The ABCS, especially the ATCCS, is supposed to facilitate these improvements by providing a relevant common picture of the battlefield. This concept is important because it completely changes the conditions under which commanders and staffs conduct the MDMP. Armed with information dominance, commanders possess enormous amounts of certainty (or situational awareness about their own situation and the enemy's) never before available. Although there are many benefits of digitizing the C2 process, digitization poses some conflicts for the estimate of the situation. These conflicts are based around the premise that the current estimate is capable of handling the amount and accuracy of information that digitization produces.

Simply using digital equipment like the MCS/P and the ASAS-RWS will not guarantee success on the battlefield. Commanders must use the information correctly to win. This thesis argues that the current estimate process, absent additional techniques or procedures to compensate for digital technologies, may not be compatible with the future demands of the Force XXI battlefield. The production of situational awareness to the degree the new ABCS produces seems to warrant three conclusions that support this argument.

First, TRADOC Pamphlet 525-5's underlying theme is that the synergy of the ABCS creates a faster friendly operations tempo. Theoretically, forces would be able to conduct more operations, quicker because of the information dominance they would possess. Therefore, if the OPTEMPO increases, so would the requirement to execute more decisions in a shorter period of time. Reducing the decision cycle may require a shift in the manner the estimate is performed. The current analytical, methodical process may not be completely compatible in the fluid, agile environment that digitization creates.

Next, the amount of raw information which is available to the commander via the MCS/P and ASAS-RWS is going to be enormous. How does the commander prevent becoming overloaded with too much information? This raises the question of how commanders and staffs process and filter information. Filtering information, either through manual techniques or software packages, may become necessary if the current estimate is to meet the future needs of FXXI decision making.

Finally, commanders, staffs, and doctrine writers must adapt to the capabilities digitizing the C2 process provides. Adapting to the capabilities of digitization entails training and trust in the systems.

Assumptions

Research on this topic requires the following assumptions:

1. The estimate process is the same for each method (deliberate or abbreviated) of decision making. The difference between the two is the amount if time available to conduct each. As stated in FM 101-5 (Final Draft, dated August 1996), the commander decides which part of the estimate he and/or the staff conduct and the degree of detail it is conducted in (written or verbal).

2. Conceptual abilities outlined in the Operational Requirements Document (ORD) for the MCS/P and ASAS-RWS will be attained.

3. This research focuses on the capabilities of the most current software and hardware of the MCS/P and ASAS-RWS. The current software for the MCS/P is Block III, version 12.01. The current software for the ASAS-RWS is Block I, extended.

4. ATCCS systems provide more, accurate, and timely information than the TF commander and his staff currently receives under the Army's current C2 systems.

5. The probability of making accurate decisions increases when key elements of required information are available and accurate.

6. The Army adopts the proposed Division XXI organization.

Operational Definitions

The following definitions apply to terms that are an important part of this thesis:

Commander's Estimate. FM 101-5 (Final Draft dated August, 1996) describes both a Commander's and Operations estimate. The Commander's estimate is an analysis of all the factors that could effect a mission. It follows the same format as the Operations estimate but includes visualizing feasible COA and how each COA would affect friendly forces. The commander's estimate concerns itself with assessing the intangibles of warfare.[17]

Estimate of the Situation: A problem solving process used by a military organization to collect and analyze relevant information for developing, within the time limits and available information, the most effective solution to a tactical problem. It is applicable to any situation and to any level or type of command. It is composed of the commander's, operations, and staff estimates.[18]

Military Decision Making Process: An analytical process and approach to solving tactical problems within the U.S. Army. It is the tool that assists the commander and his staff in developing a plan. The MDMP is a doctrinal approach to decision making that helps the commander examine a battlefield situation and reach logical conclusions. The deliberate MDMP is detailed, deliberate, and time consuming process used when adequate planning time and staff are available to examine numerous friendly and enemy courses of action. The MDMP is the foundation for planning in a time constrained (abbreviated) environment. The MDMP begins upon the receipt of a mission and concludes with the issue of a plan or order.[19]

Operations Estimate. FM 101-5 (dated May 1989) describes this estimate as one which analyzes factors affecting the accomplishment of the mission to determine all reasonable courses of action and the effect of these courses of action on friendly forces. The operation estimate and the commander's estimate follow the same format and usually have similar content. The operation estimate differs in its product, however. The operation estimate culminates with a recommendation and the commander's estimate culminates with a decision.[20] FM 101-5 (Final Draft, August 1996) adds the following:

The operations officer, who prepares this estimate must also understand:

1. The commander's intent (one and two echelons above).

2. The unit's risk assessment.

3. The current task organization.

4. The unit's status such as locations, combat capabilities (level of training, effectiveness, degree of mobility, type of equipment, radiation exposure, and limitations), and current missions.

5. The availability and capabilities of joint assets, such as air support, naval gunfire, or amphibious assets.

- Other information, such as location, status, and mission of flank and supporting units.[21]

Staff Estimates: The staff uses the estimate process to assist the commander in reaching a decision. The staff estimates analyze factors within the staff's particular area of interest. During this process, the staff officer consults with other staff officers and other agencies to ensure that he considers all factors in developing the estimate. The endstate of a staff estimate are conclusions and recommendations.[22] For a detailed review of *current* staff estimates see FM 101-5 (Final Draft dated August, 1996).

Deliberate Decision-making Process: The DDMP is simply the Military Decision Making Process *without any* modifications due to time constraints. The commander is able to use his staff's full strength *and* maximize his involvement in the process. Additionally, the staff has time to explore the full range of *probable* and *likely* enemy COA's as well as time to develop, analyze and compare friendly courses of action.[23]

Abbreviated Decision-making Process: This process follows the MDMP model. It is slightly modified, however, using different techniques in order to be effective when time is limited. The abbreviated process is commonly used when one or more of the following occur:

1. Less time is available to conduct the MDMP.
2. The staff is new or inexperienced.
3. The commander's access to the staff is limited.

FM 101-5 (Final Draft dated August, 1996) states that "It is up to the commander is decide what adjustments to make to the MDMP. . . "[24] This allows the commander to use his knowledge and intuition in order to determine the best method for modifying and executing the abbreviated process.

Maneuver Control System/Phoenix (MCS/P): The MCS/P is a ground based, mobile automated processing system designed to distribute tactical information on the battlefield allowing commanders to readily access and display current situation reports, intelligence and contact reports that assess enemy strength. MCS/P databases maintain and display critical situation awareness information on friendly and enemy forces in both *text* and *graphic* formats. MCS/P is capable of assisting the commander in his decision process due to its inherent capabilities. These specific capabilities are discussed in following chapters.[25]

All Source Analysis System (ASAS): ASAS is a ground-based, mobile, automated intelligence processing and dissemination system assigned to provide timely and accurate intelligence and targeting support to commanders. ASAS will provide communications and intelligence processing capabilities that allow intelligence data to automatically enter into the all source database and be simultaneously available at multiple workstations. ASAS provides these capabilities from theater to battalion levels.[26] The Remote Workstations (RWS) are a part of the ASAS. The RWS is commonly found at the battalion and brigade level due to its ruggedized, compact design versus the full ASAS systems.

Relevant Common Picture (RCP): A graphically displayed picture of a given near real time combined enemy and friendly situation of a specific battlespace.

Battlefield Functional Areas (BFAs): The major functional areas the Army labels it "fights" as part of the combined arms team; commonly referred to as the Battlefield Operating System (BOS). According to the ATCCS structure there are five BFAs: Maneuver, Air Defense, Fire Support, IEW, and CSS.[27]

Digitization: Application of information technologies to acquire, exchange and employ timely digital information tailored to meet the needs of the decider (commander), shooter and supporter allowing each to maintain a clear, accurate vision of the surrounding battle space necessary to support planning and execution.[28]

Battle Space: Components of this space are determined by the maximum capabilities of friendly and enemy forces to acquire and dominate each other by fires and maneuver.[29]

Limitations

The following limitations represent weaknesses imposed by constraints beyond the intent, scope, and resources of this research:

Effect of Timing: Conducting this research during one of the most important AWE's held to date poses some specific limitations. First, due to the sensitive nature of the AWE, no empirical data was able to be gathered. Access to the AWE preparation and execution was extremely controlled. Therefore, doctrine, historical references, known and projected capabilities of digital systems, operational requirement documents, and other second hand sources pertaining to Force XXI and decision making were relied upon to construct the majority of this research. The effect of timing also impacts the Army's current decision making doctrine. Although the current doctrinal manual which defines the MDMP process (FM 101-5) has been re-written, it was re-written before the AWE was completed. Therefore, this study cannot control changes in MDMP doctrine that may occur as a result of lessons from the AWE in March 1997 at the NTC.

Software and Hardware Improvement. This research is based upon the *current* and *projected* software and hardware capabilities for the MCS/P and ASAS-RWS. Although changes in software are predicted to occur for both systems, this study cannot control the impact these changes may have upon each systems ability to digitally impact the estimate process.

Current Research Effort. This study acknowledges there is a current lack of research done on the impacts the MCS/P and ASAS-RWS will have on the estimate process. This may be due, in part, to the Army's focus to conduct experiments with these new systems while *simultaneously* writing doctrine for the employment of the C2 systems. Therefore, this study relies upon the conceptual and theoretical capabilities of the MCS/P and ASAS-RWS to answer the research question.

Changes in Azimuth. During a speech to the Command and General Staff College students at Fort Leavenworth, Kansas on 24 October 1996 a senior army staff officer implied that the Army plans on adhering to its Force XXI objectives it established for itself. The focus of the upcoming AWE is to determine how effective the armored and mechanized battalions and brigades can fight while command and controlling the battlefield using the newer digital tools such as MCS/P and ASAS-RWS. The Army acknowledges that there are many unknowns as the EXFOR proceeds with the testing and fielding of Force XXI equipment. This study recognizes the existence of these unknowns and additional unknowns that may arise as a result of the March AWE. These unknowns may encompass new developments in doctrine, training and tactics, techniques, and procedures which may affect how units employ MCS/P and ASAS-RWS during the estimate process.

Delimitations

This research focuses on the estimate of the situation as it relates to the following constraints:

1. Level of war: Tactical.

2. Spectrum of conflict: Mid to high intensity, as opposed to low intensity conflict and military operations other than war.

3. Types of forces: Combat maneuver.

4. Level of organization: Battalion, for the specific purpose of focusing on close operations as opposed to higher level organizations that address deep and rear area operations.

5. Type of organization: Armor/Mechanized Infantry task force. Excluding other type units is done because of the focus of *fielding* of the Army Tactical Command and Control System (ATCCS). The fielding focus of the five tactical command and control systems (which include MCS/P and ASAS) is currently limited to the heavy divisions within the U.S. Army.

6. Types of operations: Offensive scenarios in general where the focus is on delivering decisions in a fluid, chaotic environment.

7. Type of estimate: The estimate of the situation *in general* as it relates to the MDMP. The purpose of this approach enables findings of this research to apply to the various types of estimates found in U.S. doctrine.

Significance of Study

> Victory demands that commanders effectively link decision making to execution through the concept of command and control. . . more than ever before a command and control system is crucial to success and must support shorter decision cycles and instantaneous flexibility across vast distances of time and space.[30]

This study attempts to determine if there is a need to modify the estimate of the situation as a result of digitizing portions of the Army's C2 and decision making process. Although this study occurs amidst great changes in the way the Army plans on fighting its battles, it is a part of the evolving Force XXI operations doctrine. This study attempts to fill the missing gaps of research on the effects digital information systems will have upon the MDMP by analyzing the impacts the MCS/P and ASAS-RWS will have on the estimate process. The aim is to examine the MDMP in light of advances and application of digitization. This thesis does not attempt to create a new estimate process.

Some fundamental conclusions this thesis reaches are that the current estimate of the situation remains a sound and proven decision making tool and that historical and doctrinal literature related to digitization and decision making produce decision making criteria for application within the decision making environment of Force XXI operations. Finally, capabilities of the MCS/P and ASAS-RWS create modifications throughout the estimate process (with some minor exceptions), and digital systems like the MCS/P and ASAS-RWS enable commanders to possess more clarity and certainty to make tactical decisions.

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[3]Ibid., chapter 1.

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[6]U.S. Army, U.S. Army Homepage, Army Digitization Homepage Master Plan 96, (U.S. Army Homepage web, September 1996), Section 5.2.1 Army Battle Command System.

[7]U.S. Army, FM 101-5, Staff Organization and Operations, (Washington, DC: Headquarters, Department of the Army, Final Draft, August 1996), 5-1.

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[10]U.S. Army, FM101-5, "Staff Organization and Operations," Final Draft (Washington, DC: Headquarters, Department of the Army, August 1996), C-2.

[11]Ibid., chapter 1.

[12]Ibid., C-3--C-5.

[13]U.S. Army, FM 100-6, Information Operations (Washington, DC: Headquarters, Department of the Army, 27 August 1996), Chapter 1.

[14]James G. Hunt and John D. Blair, Leadership on the Future Battlefield, (Virginia: Pergamon-Brassey's International Defense Publishes, 1985), Chapter 1.

[15]FM 525-5, 3-16--3-24.

[16]TRADOC PAM 525-5, Glossary, 7.

[17]Ibid., C-3.

[18]FM 101-5, Final Draft (August 1996), C-1.

[19]Ibid., 5-1.

[20]Ibid., C-3.

[21]Ibid., C-3.

[22]Ibid., C-4.

[23]ST 101-5, 1-5, 1-6.

[24]Ibid., 5-45--5-49.

[25]U.S. Army, Army Digitization Homepage, Army Digitization Master Plan 96, (U.S. Army Homepage, September 1996), Section 5.2.1 Army Battle Command System.

[26]Ibid., Section 5.2.3

[27] U.S. Army, FM 24-7, Army Battle Command System (ABCS) Systems Management Techniques, (Washington, DC: Headquarters, Department of the Army, June 1995), 1-4.

[28]Army Digitization Homepage, Army Digitization Master Plan, Executive Summary.

[29]TRADOC PAM 525-5, 3-8.

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CHAPTER 2

LITERATURE REVIEW

Chapter two reviews the significant and relevant literature on the estimate of the situation and provides the doctrinal framework for the estimate process. It also reviews human information processing techniques, MCS/P and ASAS-RWS capabilities, Force XXI doctrine, and other significant research done on the estimate process. Finally, chapter two assesses the need to modify the estimate of the situation.

Research Focus

The following questions are used as a framework to conduct a literature review of the estimate process, digitization, and the concepts of Force XXI operations and their impacts upon the estimate process:

1. Why does the Army use the Military Decision Making Process to solve its tactical problems?

2. Is the estimate of the situation an effective process to develop courses of action?

3. What does doctrine and related research suggest about the use of MCS/P and ASAS-RWS with the current estimate of the situation?

4. What are the doctrinal and theoretical requirements for the development of necessary modifications to the current estimate using the MCS/P and ASAS-RWS?

The History of the Estimate

In order to complete the study of the research on the estimate process started in chapter one, this section focuses on answering the first two *secondary research* questions. The remaining secondary questions are addressed throughout the remainder of the literature review.

In most cases, reviewing history answers the question of why things are the way they are. The case with the Military Decision Making Process is no different. There is a strong, clear historical link of why the Army uses the MDMP. Surprisingly, however, the initial MDMP has not changed much over the years since its inception.

In Rex Michel's Historical Development of the Estimate of the Situation, he attempts to measure the effectiveness of the estimate process. The concentration of Michel's research effort is on studying the process, feasibility, and means to properly assist decisionmakers during the estimate process.[1] Additionally, Michel conducts a thorough study of how and why the Army adapted the estimate process. After reviewing and analyzing the nine changes of FM 101-5 (Michel does not review the latest change), Michel develops conclusions that support using the estimate of the situation as an effective decision making process.

Origin of the Estimate

The origin of the estimate process can be traced to the Prussian Army during the era of Frederick the Great. The Prussian Army is one of the first armies to develop an analytical, systematic, and logical approach to solving military problems. There are two reasons why the Prussians developed the estimate process. First, they felt the need to have a formal approach to solving their tactical problems. The Prussians wanted "a high degree of ability in leadership" because of the emphasis Frederick the Great placed on training officers in the art of war.[2] The other reason the Prussians developed and maintained the estimate process was to compensate for the loss of Frederick the Great. As a result of his death "subsequent Prussian defeats had made them realize how dependent they were upon the rare chance existence of a true tactical genius."[3] The estimate processed adopted by the Prussian Army facilitated tactical problem solving and included "a mental survey of an existing situation leading up and expressed in the Decision."[4] The Prussians implemented and taught the estimate process using what they called the "applicatory system."

After the end of the Prussian era and throughout the 19th century, the formal estimate process developed by the Prussians was not acknowledged by the U.S. Army. It was not until the early twentieth century that Captain Roger S. Fitch, as described in chapter one, formally acknowledged that the Prussians' decision making process was capable of being adjusted to suit the needs of the U.S. Army's tactical decision making needs. As a result of his efforts to structure an American decision making process after the Prussians', the estimate is documented by the U.S. Army in 1909. In 1910, the estimate process became a part of the Army's doctrine.

In 1932, the estimate was published in FM 101-5 (see fig. 5). Since 1932, the estimate process has been revised nine times (see fig. 6). The tenth revision is in its final draft as of August, 1996. There are four reasons why the estimate process has been revised so many times: The emphasis on the requirement to *war game courses of action* was developed, the development of using *multiple options* and *determining significant information* was created, and the general need to *refine estimate procedures* was required. The following paragraphs explain these revisions in greater detail.

Refining Estimate Procedures

The history of the development of procedures to execute the estimate process evolved over a period of time. First, the process began by using a train of thought sequence. This process originated in 1932. Next, the estimate evolved into a formal decision making/problem solving process. After the Army adopted this process, the estimate evolved back into a more subjective methodology. Since then, the estimate has returned to a more objective and formal process. The Army has retained this methodology since the early 1980s.

In 1940, the evolution of refining estimate procedures included explaining how the estimate process developed from a written exercise into a mental exercise. This development recognized that the mental process was the most common type of estimate conducted at division level. A highlight of this evolution was the introduction of the military decision making and problem solving processes. In 1960, the formal decision making process is introduced as a means to develop and execute a course of action. This process identified the need for both commanders and staffs to execute the estimate process, thus making the process an interactive one. In 1968, the problem solving methodology was added to FM 101-5. This methodology consisted of recognizing the problem, gathering data, and developing, analyzing, and selection the best solution. This development is important because it gave the Army a generally accepted means of solving military problems. This methodology remains as the foundation of the MDMP today.

The 1968 estimate model emphasized that the estimate format, in general, was not a rigid, step by step process that could not be adjusted based upon the situation. As a result of this concept, the 1977 draft made its debut. The 1977 draft contained the most different approach to the estimate process. The 1977 draft viewed the estimate process as a dynamic, subjective, and abbreviated one. The 1977 draft supported the concept of having commanders mentally execute the majority of the estimate to increase the speed of the MDMP. The 1977 draft recognized that speedy decisions were crucial in a fast paced and constrained environment. During the development of the 1977 draft, the full blown estimate and decision process were viewed as proper staff training aides when enough time was available to fully explore significant aspects to the whole situation. The 1977 draft, however, was never put into a final version and published. The 1984 FM 101-5 was the next published revision. This revision went back to a more objective and formal process. The 1984 FM 101-5 re-established the importance of the formal decision making and problem solving processes as the best ways to make decisions on the battlefield.[5]

Multiple Options

Multiple options refers to the requirement to develop both enemy and friendly courses of action. The use of multiple options also requires staffs to analyze these COAs against each other. In 1940, the foundation was established within the estimate process to analyze a friendly course of action against the most probable enemy course of action. The 1940 FM 101-5 stated that if a particular course of action (friendly) seemed obvious, commanders and staffs could proceed to the decision phase of the process.

The most significant developments concerning use of multiple options occurred in the 1960 and 1968 versions of FM 101-5. For the first time, the 1960 version addressed the commander's planning guidance, the level of detail required in course of action development, and the comparison of course of action process. The 1968 version made an effort to distinguish duties for the staff during COA development and established criteria to determine a good COA. This criteria; feasibility, accomplishability, and distinguishability, evolve into what is know today as feasibility, acceptability, and suitability. These criteria continue to guide commanders and staffs to develop COAs today.

War Gaming

It was not until 1954 that the process of wargaming developed into a standardized procedure of the estimate process. The 1960 version of FM 101-5 expanded upon this development and noted that "analysis results in a determination of the probable interaction of friendly and enemy forces"[6] In the analysis, the friendly course of action is fought through the predicted enemy actions. The analysis concluded with a summary of advantages and disadvantages of a particular COA.[7] The 1968 FM 101-5 made the first use of the term "wargaming". It provided a description of how wargaming might be accomplished and provided a list of eight products as a result of this detailed wargaming. This list included requirements for supporting fires, use of a deception plan, enemy reactions to friendly COAs, critical areas/incidents, reserve planning, actions on the objective, and the advantages and disadvantages of the course of action.[8] The wargaming process remained the same until modified in 1984. The 1984 FM 101-5 added two more products to the wargaming process, attrition of friendly and enemy forces and the probable location of the enemy second echelon. Additionally, the example of the commander's estimate was dropped from this version of FM 101-5.

Situation Information

Traditionally, paragraph two of the estimate process, ("Situation and COA") has been the longest portion because of the amount of information it requires to be analyzed. The situation and COA, however, have not always been such a challenge to conduct. Actually, these portions of the estimate have evolved into one of the more thorough components of the estimate process. The 1932 version of the estimate contained situational information as a component. However, it did not correctly address how to analyze such information. Therefore, since 1932, significant improvements were added to *analyze combat power* and to analyze characteristics of the *area of operations*. As a result of analyzing the area of operations, the acronym OCOKA was developed. OCOKA (observation, cover and concealment, obstacles, key terrain, and avenues of approach) is a means of analyzing the effects terrain has upon on the enemy and friendly situation. Additionally, another acronym is introduced. In 1977, the concept of analyzing the factors of METT-T (Mission, Enemy, Troops, Terrain, and Time) is introduced. These factors were implemented to assist commanders and staffs to conduct a more thorough analysis of their situation towards the enemy's situation.

The remaining significant development of situation information occurred in 1982. By 1982, the Army's communication and automation capability had improved. Therefore, too much raw information was becoming available for commanders to analyze. The 1982 version of FM 101-5 addressed this concern by stating that commanders had to "avoid the pitfall of requesting and attempting to analyze too much information personally. There is a great risk of being overwhelmed by endless details. The staff should serve the commander by analyzing details and communicating. . . conclusions and recommendations as often as necessary to keep up with the developing situation."[9] This statement was the only warning used to alert commanders of the increased amount of information they would receive. There was no attempt to modify the estimate process to compensate for the increase in raw information.

Summary

Rex Michel's research on the history of the estimate process provides background for the primary research question. His research establishes the historical framework of the estimate process. Michel's research then explains how the Army, over a period of time, develops the estimate process into its primary decision making tool. The four major revisions of the estimate process demonstrate how the Army accomplished this. Michel's research demonstrates that the estimate is a valid process to develop courses of action. Michel's research confirms that the estimate process was, and still is, an accepted and valid means of developing decisions. That the Army would keep the process over such a long period of time and continually revise the process to meet the changing needs of the Army simply adds to the estimate's validity. However, Michel's research does leave some gaps in answering the research question. Additionally, Michel's research argues against using a strictly rigid and formal estimate.

These gaps are found by reviewing the 1982 revision of the estimate process. The 1982 revision states that communication and automation improvements gave commanders access to more information. Michel's research does not specify what these communication and automation improvements were. However, at best they were simply hardware improvements in communications and in data processing. Due to these improvements, commanders were able to communicate over greater distances increasing their realm of command and control. Although the 1982 revision recognized commanders would be overwhelmed with information, minimal changes were made to the estimate process. The 1982 revision is highlighted by only *text* additions to the estimate process versus implementing or recommending specific procedural alterations to compensate for the technological improvements within the Army.

The 1982 revision is significant in two ways. First, the revision identified the need to *modify* the estimate in order to compensate for advances in technology, specifically in the C2 realm. This is the first time a revision of FM 101-5 is recommended due to technological advancements. The other significance of the 1982 draft was in its vision of the requirements of the future battlefield. Although terms like battle space and battlefield visualization were not in use, the Army was beginning to understand that technology would increase or extend a commander's realm of responsibility on the battlefield. The Army, acknowledging some of its earlier technological improvements, was beginning to understand that the commander's battle space was increasing.

Although Michel's research does tend to support the use of the estimate process it highlights arguments against using such a rigid and formal estimate. This argument is supported in the manner the estimate is perceived to be executed since 1932. Between 1932 and 1976, the estimate is perceived as a rigid process. However, the 1977 draft breaks that perception. The 1977 draft mentioned the need to conduct a rapid, mental evaluation of the estimate process. The 1977 draft stated that the commander should mentally develop a concept to employ his unit. The 1977 draft then expected the commander to refine this concept in his mind over a period of time using his knowledge and intuition of the current situation. The 1977 draft referred to a contemporary decision making process called naturalistic decision making. Naturalistic decision making implies that people make natural and logical decisions to current situations based upon how they made decisions in similar situations in the past. Naturalistic decision making also implies that people match situations and decisions in order to render quicker decisions in a variety of conditions. Although the 1977 draft possessed a different methodology towards the estimate process, it was not approved for distribution.

Filtering and Digitization

Much of the information within this literature review recognizes that digitization produces enormous amounts of raw information for the commander and his staff. Historically, the Army has been concerned with overloading the commander with too much information. Therefore, before the literature review progresses, an attempt will be made to explain how humans process information. Describing this process may alert the Army on how it can manage or mitigate information overload, especially in the age of digitization.

Since the 1982 revision of FM 101-5, the Army has recognized that commanders could become overloaded with too much raw information. However, there have been no specific modifications to the C2 or estimate process to control information overload. If the assumption is made that ATCCS systems will provide more information than the TF commander and his staff receives under traditional C2 means, the argument can be made that the commander will be overloaded when using digital systems like MCS/P and ASAS-RWS. Information overload can be dysfunctional to the digitization effort. Therefore, information overload must be reduced. In order to mitigate information overload, the process must begin with filtering information during the estimate process. Filtering information prevents the commander and his staff from receiving and attempting to analyze every piece of information. Filtering information helps prioritize information and focuses the commander and his staff on which information is critical. In Leadership and Information Processing, Linking Perceptions and Performances, by Robert G. Lord and Karen J. Maher, human cognitive abilities and information processing are analyzed. Lord and Maher's research effort was to determine how and why we humans process information. This research helps answer the additional theoretical requirements which are necessary to modify the current estimate when using digital information systems. It does so by first explaining the process humans execute to process information. Then the research offers four alternate means to process information. If we can understand how humans process information, this may lead to help clarify what type of filtering requirements are necessary within the estimate process.[10]

How We Process Information

What type of an environment are chaotic, fast-paced, and demanding combat operations conducive to? Chaotic, fast-paced combat operations requip soldiers, especially leaders, to process multiple stimuli simultaneously. How is this accomplished? Lord and Maher explain it as process of encoding, storing, and retrieving short and long-term memory information.

How the Human Information Processing Function Works

After receiving stimuli (information), it is "encoded" into one's memory. Encoding involves transferring this information from short- to long-term memory where it is stored for an indefinite period of time. How do humans "store" this information? Storing information is done by placing it in very short-term *sensory* memory, very short-term *conceptual* memory, *general* short-term memory, or in *long-term* memory. Each method has different storing capabilities based upon the length of time information is kept in memory. For example, very short term sensory memory stores information for only three hundred milliseconds while information is kept in long-term memory until it is retrieved.[11]

If information is going to be of any value, it must be retrieved. Therefore, retrieval is a critical part of the information processing function. What is retrieval? Essentially it is when "information is recalled from long-term memory in order to make a judgment or a decision."[12] But not all information in long-term memory can be stored and retrieved. This is due to the short- term memory processes. The short-term memory processes actually limit the ability to encode information. If information cannot be *transferred* from short- to long-term memory it cannot be encoded. It is this process which limits the human ability to process information.[13]

Human Cognitive Abilities

Lord and Maher's research investigates how retrieving information can be performed more effectively. In order to learn how to optimize retrieval abilities, Lord and Maher research *human cognitive abilities*. Through this process they describe how cognitive abilities can improve the manner in which information is encoded, stored, and retrieved.

Key to understanding cognitive abilities and the ability to retrieve information is understanding how information *is* retrieved. Often, retrieval requires a cue that is consistent with the way information is encoded. Lord and Maher propose that the retrieval process is subconsciously simplified by using a process called cognitive simplifying mechanisms. "Cognitive simplifying mechanisms. . . help organize incoming methods into more easily stored formats."[14] This process attempts to match incoming information to preexisting "structures" already present in long term memory. These structures are referred to as knowledge structures. Knowledge structures are held in long term memory and are created over a period of time based upon experience in particular areas (or structures). For example, a battalion commander has various tactical "structures" for different tactical scenarios. In the offense he learns, over a period of time, how to correctly maneuver forces. When it comes time to store additional information within this area, he subconsciously stores this information within his tactical/maneuver "structure."

Knowledge structures and cognitive simplifying mechanisms provide a faster means of encoding and storing information. This affords information a better opportunity to be transferred and stored in long term memory for retrieval at a later time

Alternate Models of Processing Information

Lord and Mahcr propose four models on how to process information. These models are based upon the short-term and long-term memory limitations already described. However, each model compensates for these limitations in a different way. The four models are *rational, limited capacity, expert,* and *cybernetic*. For the purpose of this research the expert model is reviewed for applications within the digital environment.[15]

The Expert Model

The word expert implies having a high degree of knowledge in a specific area. The expert model implies much of the same thing. The expert model acknowledges that memory capabilities are limited. As explained earlier, to compensate for these limitations, knowledge structures are used to help process information. An assumption of the expert model is that people, or experts, depend upon *extremely well organized* or highly developed knowledge structures within a specific "content domain." As Lord and Maher further explain: "In other words, an expert is someone with a large knowledge base in a particular context or a particular task."[16]

The opposite of the "expert" within the expert model is the novice. Lord and Maher suggest that there are significant differences in the way novices process, encode, and retrieve information than the way experts do. Obviously, experts perform these tasks much more efficiently. Additionally, novices' knowledge structures are also inferior to those of the experts. The results of expert information processing is that experts can process information "or perform tasks in a qualitatively different manner from the way novices do. In more typical situations, experts can often immediately recognize correct solutions to problems that novices must analyze very carefully to solve."[17] Why do experts have such ability? One of the reasons is due to their experience and knowledge levels within a specific content domain. Additionally, experts are able to naturally store and retrieve more information from long term memory. Also, due to their highly developed knowledge structures, experts can evoke appropriate responses that are stored in long term memory. Lord and Maher label this ability to evoke responses stored in long term memory as intuitive, automatic processing.

However, there are limitations to the expert model. The experts ability, as described above, can only be applied to an expert's domain of expertise. Additionally, even though an expert is an expert in his specific domain, there is no guarantee he will evoke an appropriate, *correct* response in all situations. The highly developed, long term memory and knowledge structure cannot necessarily compensate for changing conditions from one situation to the next.[18]

How Cognitive Strategies are Linked to the Estimate Process

Lord and Maher's research into how humans process information led them to research various concepts of how information processing is done. Using knowledge structures to code and simplify information is one of these concepts. Another concept closely related to knowledge structures is the *schema* concept. In James D. McMullin's master's thesis "Determinants of the Effectiveness of Situation Estimation" he also reviews cognitive strategies and their impact upon situation estimation and the decision-making process.

A portion of McMullin's thesis is dedicated to analyzing how individuals and groups make decisions. McMullin proposes that decision makers use a variety of cognitive strategies when they mentally execute the decision making process. McMullin defines a cognitive strategy as "the mental process to develop a response in a situation."[19] He cites three strategies in his research, *recognitional decision making,* and *schema theory* (schema theory being a variant of recognitional decision making), *analysis of problem-specific information,* and *mental simulation.*[20]

Recognitional decision making is closely related to the concept of knowledge structures. "Recognitional decision making involves retrieving information from experience about past situations which are similar."[21] Through the use of mental cues from long-term memory storage an expert decision maker reacts the way he knows will work to a given situation. However, the decision maker considers the situation and its problems before making a decision. Schema theory, a variant of recognitional decision making, is closely related to how the concept of knowledge structures function. It assumes information processing occurs as a result of *comparing* an observed situation and then *matching* the situation to existing knowledge structures.[22] The recognitional decision making and schema concepts help clarify how the information processing function works. Although they do not necessarily help propel the concept of filtering they do help explain how humans execute the decision making process.

How Information Overload Occurs

Now that human information processing has been described, the process of information overload can be explained. Explaining how the process of information overload occurs leads to understanding how information overload can be mitigated. If information overload is mitigated, then we might understand how to implement measures within the estimate process to more effectively employ digital systems such as MCS/P and ASAS-RWS.

Information overload can result from three conditions: Too much information is *given,* too much information is requested (and received), and the large amounts of information either given or requested are improperly analyzed. The first two conditions exist with the current capabilities of digital systems. The last condition, however, may exist because of three reasons. First, information received is not given any priority. In other words, all information is accepted without first prioritizing which information is actually required. Second, there may be a lack of guidance on exactly what specific information is needed. Third, although the correct information is available, there is a failure to recognize that the right information is already available. Therefore, the process of requesting and receiving information continues.

There area two ways to help mitigate information overload. First, commanders can use software packages to filter raw information. A possible way to this would be to filter the Commander's Critical Information Requirements by using software applications. Unfortunately, the MCS/P is not currently capable of filtering the commanders CCIR by using software applications. However, the use of CCIR as filtering devices leads to the next way to mitigate information overload. CCIR can act as the manual method to filter information. If the commander establishes CCIR *and* uses the MCS/P capabilities, he might effectively filter unnecessary information. If the CCIR is maintained, the commander can theoretically track a unit's status thus help answer necessary portions of his CCIR. For example, if the commander uses a current software capability of the MCS/P (called a Friendly Forces Status Report) he can effectively track *all* of his friendly forces in a near real time manner with a few keystrokes. This application, combined with designing proper CCIR, can keep the commander abreast of his tactical situation.

Summary

Lord and Maher's research on the functions of information processing help clarify how information is encoded, stored, and retrieved. Additionally, their research explains how the short and long term memory processes work in relation to the encoding, storing, and retrieval process. Lord and Maher also explain how the functions of information processing work through their research on human cognitive abilities. These abilities improve the manner information is processed through the use of knowledge structures and cognitive simplifying mechanisms. Lord and Maher's research helps clarify how information is processed, therefore, we can better understand how information overload occurs. Understanding how information overload occurs allows us to understand how to prevent it and possibly establish criteria for the use of filters within the estimate process while using digital information systems.

MCS/P and ASAS-RWS Capabilities

The purpose of this section is to identify some of the general capabilities of the MCS/P and ASAS-RWS. The intent is to describe each systems general capabilities and then categorize these capabilities. The purpose of categorizing these capabilities is to set the conditions for the execution of the methodology and analysis portions of this thesis.

MCS/P and ASAS-RWS Integration Into ATCCS

The MCS/P and ASAS-RWS are two of the five components of the Army's Tactical Command and Control System. The Advanced Field Artillery Tactical Data System (AFATDS), Forward Area Air Defense Command, Control and Intelligence System (FAADC2I), and the Combat Service Support Control System (CSSCS) are the remaining components. Each system represents a Battlefield Functional Area (BFA) within the overall ATCCS. The MCS/P acts as the core for all of these systems. It is *the* digitized maneuver system available to commanders from battalion through corps level which integrates the other systems. In other words, the MCS/P acts as the collector of each systems capabilities. As the collector, the MCS/P is capable of providing a graphic, near real time display of each systems current status. The product of this display is called is the Relevant Common Picture (RCP).

Each of the BFAs are located in the tactical operation centers of battalion through division size units. This organization theoretically enables BFAs to be both *horizontally* and *vertically* linked. This linkage ensures the commander's RCP remains as accurate as possible.

The MCS/P and ASAS-RWS are composed of commercial hardware and software packages designed to fit the needs of the Army's C2 requirements. For example, each system is ruggedized and transportable according to Army specifications. The hardware package generally consists of a transportable computer unit or a lightweight computer unit (laptop), large screen display, a tactical scanner, printers, and accompanying software package.[23]

All-Source Analysis System - Remote Workstation

The operational concept behind developing ASAS was to support the commander's battle management and information warfare process. The ASAS accomplishes this by rapidly processing and correlating large amounts of raw information from all available sensors and sources. The processing and correlation of this data is supposed to produce a fused picture of the battlefield. Additionally, this data provides timely and accurate targeting information, intelligence products, and threat alerts.[24]

The ASAS concept design has been evolving since the Army's modernization during the 1980s. The majority of the 1980s intelligence modernization focused on automating intelligence sensors and collection assets. ASAS is supposed to be the answer to the "inability of the intelligence system to develop, disseminate, and present to combat commanders timely and accurate . . . situation intelligence"[25]

ASAS enables the development, dissemination, and presentation of intelligence to occur by fusing a seamless intelligence architecture. This architecture is composed of sensors (scouts, UAVs, SIGINT systems) processors (ground control stations for UAVs, the Analysis Control Team/Analysis Control Element), and communications (the link between sensors to processors.)[26] The actual ASAS-RWS hardware and software components act as the users receiver via digitization. The ASAS-RWS is the means of providing analyzed intelligence to the commander. Therefore, the commander is able to have a near real time picture of the enemy situation.

ASAS Characteristics

The ASAS-RWS acts as the receiver of fused intelligence (HUMINT, SIGNINT, IMINT, and CI) operations. The process of fusing all of these sources begins at the national level and ends at the brigade level. Each level has the capability to process and analyze the data it fuses. Therefore, each subordinate element commander, theoretically, should spend less time *analyzing* the intelligence and more time *acting* upon it. An example of the processing and analyzing capabilities can be seen within the current Force XXI Division design. The Analysis and Collection Management Element (ACE), organic to the divisional MI battalion, is the Force XXI Division's focal point for intelligence collection, management, and synchronization. The Analysis Collection Management Team (ACT), organic to the direct support MI company, provides the brigade commander automated intelligence processing, analyses, and dissemination.[27] Once intelligence data is analyzed (at either level), it is sent to subordinate units. In some cases, this data is sent via the "broadcast" method. Sending information in this manner automatically allows the sensor to send intelligence information to every unit capable of receiving it. This method further enables the dissemination and presentation of intelligence to the combat commander.

ASAS Composition

The ASAS is composed of three different workstations which are configured based upon the tactical situation. These workstations are the *Remote Workstation* (which is the focus of this thesis), the *All Source Workstation* (located on the ACE) and the *Single-Source Workstation* (also on the ACE). The ASAS-RWS is the primary system the battalion task force uses to receive fused intelligence from its brigade and division headquarters. The ASAS-RWS is primarily focused on maintaining the situational awareness of the enemy and developing estimates of future enemy operations.

ASAS-RWS Capabilities

As a result of fusing all of the types of intelligence, the ASAS-RWS provides the commander with some unique capabilities. These capabilities are:

1. Providing an enemy Relevant Common Picture (RCP). This RCP, conceptually, is integrated into the MCS/P via digitization and the systems' software compatibility. This synergy results in a fused RCP for the commander - he will know where his forces are (or are not) in relation to the enemy. The capability to provide an enemy RCP provides a greater degree of certainty to the commander. Having an enemy RCP reduces the amount of uncertainty encountered during the current estimate process with traditional C2 means. The reduction in uncertainty is one of the reasons why modifications to the current estimate process may be necessary.

2. Processes raw intelligence into useable, graphically and displayable intelligence for use by the commander.

3. Helps perform intelligence analysis through software capabilities to store, correlate, and query data. RWS can also maintain an enemy order of battle databases and graphically display these databases along with reports and IPB products.

4. Due to the processing speed digitization offers, the RWS is able to rapidly receive and send data horizontally and vertically among staffs and commanders. This capability allows commanders to share information thus enhancing the parallel planning process.

5. RWS can assist the commander to identify targets thus enabling him to attack them earlier than before.

6. RWS can also ease many of the pre-existing information choke points by its ability to automate information management.[28]

The largest benefit ASAS-RWS provides, however, is the ability to *enhance the IPB process*. The most significant products of the IPB process are enemy templates, the Modified Combined Obstacle Overlay (MCOO), enemy OB, threat evaluation, and development of the collection plan. Each of these products are enhanced because of the integration and automation capabilities provided from ASAS-RWS. For example, digitized terrain data facilitates developing a MCOO which is normally a time consuming process. The synergy created from digitizing terrain, automating the enemy OB, creating templates, and matching these templates with an enemy RCP is enormous. These capabilities impact most during the planning process when S2s attempt to develop their collection plan. Armed with a significant amount of clarity (certainty) provided by the RCP, the collection plan (and the estimate process) should be easier and faster to complete.

ASAS-RWS Summary

The ASAS-RWS provides numerous enhancements to the commander and his staff while they plan and execute operations. The combination of these enhancements may impact the manner in which the current estimate process is executed. The impact these capabilities provide the commander are important. They will serve as the basis for the analysis conducted in chapter four to describe the impacts the ASAS-RWS and MCS/P have on the estimate process.

Maneuver Control System/Phoenix

The MCS/P is the maneuver information system designed to provide automated C2 support to the tactical commander. The focus of the MCS/P is to act as a decision aide. To accomplish this, the MCS/P is designed to reduce the amount of time and effort it normally takes to retrieve critical tactical information, to analyze this information, and then to disseminate this information. These capabilities will "enhance the quality and shorten the duration of the decision making cycle."[29] It is important to note the MCS/P's capability to shorten or compress the decision making cycle. Additional literature within this chapter highlights this capability as possible decision making criteria/guidelines within the Force XXI environment.

MCS/P Integration into the ATCCS

Previous sections have already described the general means of how the MCS/P and ASAS-RWS are integrated into the ATCCS systems. It is important, however, to highlight one point. The MCS/P is the *primary* system commanders use to view the friendly and enemy RCP of their battle space. Conceptually, each of the other ATCCS systems at a given echelon *fuse* their information and feed it to the MCS/P. In this manner, the MCS/P becomes the integrator of each systems capabilities. The MCS/P, being linked to each of the other ATCCS systems, is also capable of pushing critical information to these systems.

MCS/P Characteristics

The current Force XXI Division organization is composed of MCS/P systems located from the battalion through division level. This organization allows the whole division to be horizontally and vertically linked. For example, the horizontal linkage (linkage among a given staff) allows the MCS/P to integrate the functions of the other ATCCS at that level of staff. These *same* MCS/P systems, however, are also vertically linked (above and below) to other MCS/P systems throughout the division. This linkage enables commanders to prepare, analyze, and disseminate large amounts of tactical information throughout the division. Although this linkage provides numerous advantage to the planning process, there are limitations to the linkage among the ATCCS systems.

Conceptually, the MCS/P is linked to each of the other ATCCS systems and provides friendly and enemy RCP simultaneously. However, due to the incompatibility of some of the software, this linkage is not currently possible between the MCS/P and each of the other ATCCS. In other words, the MCS/P and the ASAS-RWS, AFATDS, CSSCS, and FAADC2I are currently not completely integrated. The lack of integration prevents the commander from currently possessing the full RCP the ATCCS is designed to produce. The current MCS/P, however, is capable of providing the *friendly* RCP. The MCS/P is capable of providing a friendly RCP because it is linked, via digitization, to the Enhanced Position Locating Reporting System (EPLRS) which are outfitted on friendly vehicles within the Force XXI design. EPLRS and its link to ATCCS is discussed in detail later in this chapter.

MCS/P Composition

The MCS/P is composed of commercial hardware and software packages. Currently, the software packages are fielded in "blocks." Fielding the software in this manner allows the design, redesign, and installation of software to occur in a fluid manner. Although the current software lacks interoperability with the other ATCCS software, a newer block of software is expected to be fielded to eliminate this deficiency.

The MCS/P communicates with the other ATCCS systems and MCS/Ps through standard Army communications means. Locally (horizontally), MCS/P communicates via the Local Area Network (LAN). Vertically, the MCS/P communicates via FM tactical communications and Multiple Subscriber Equipment (MSE). There are limitations, however, in the ability of the MCS/P to communicate over standard Army means. These limitations focus on the amount of bandwidth available to the ATCCS systems and in the ability of these systems to send digital information over FM communications nets. Current FM communications capabilities prohibit digital information from simultaneously being sent and received. Additionally, voice and data communications cannot be sent simultaneously. Currently, voice communications over-ride digital communications. Therefore, strict radio procedures and SOPs are required to maintain effective FM communication.

MCS/P Capabilities

The MCS/P possesses hundreds of common core functions. It is beyond the scope of this research to attempt to list or categorize these functions. For the purpose of this research, the common core functions which impact the MDMP are categorized and presented for analysis.

One of the most significant capabilities MCS/P software provides commanders and staffs is its ability to automate portions of the MDMP. Although current software is able to automate portions of the MDMP, the software does not *analyze* data. The following are some unique software applications which apply to the MDMP.

1. Develop, disseminate, and receive all types of operations orders or operation plans.

2. Build, modify, disseminate, and receive friendly and enemy maps and operation overlays.

3. Develop, modify, disseminate, and receive situational maps. This capability allows the MCS/P to integrate all of the other ATCCS systems situation maps once the software becomes compatible.

4. Develop, modify, disseminate, and receive synchronization matrices.

5. Monitor the status of friendly units' combat readiness. This function simply automates the manual commander's situation report which is normally consolidated at each headquarters. This functions enables commanders to get a near, real time snapshot of their units combat readiness from the personnel, equipment, and supply perspective.

6. Digitizes and presents terrain in the commander's area of operation in a 3-D format. This function allows commanders to receive an accurate picture of the terrain which facilitates

terrain analysis and the development of a Modified Combined Obstacle Overlay. This terrain function is so detailed that it allows a commander to view the deadspace and fields of fire for specific crew served weapons or tanks.

7. Develop, modify, disseminate, and receive all types of messages and message traffic from the unclassified through top secret security levels.[30]

These specific functions, taken together, enable the commander to share a greater amount of near, real time information. This is evident in the manner the MCS/P can prepare, modify, disseminate, and receive friendly and enemy information. These core functions also enable the commander to deliver his decisions faster and with more certainty and clarity. Operations orders can be prepared and delivered via FM tactical communications (in the broadcast mode) with confidence that each operations overlay is exactly the same. Additionally, the age of these orders and overlays is significantly reduced--possibly from hours to minutes old.

The most significant capability of the MCS/P is its ability to present and maintain the Relevant Common Picture. The RCP is significant because it has taken some of the uncertainty out of determining the friendly and enemy situational awareness. Armed with a RCP, the conditions are set for commanders to improve their battle command skills, thus improving their ability to deliver effective decisions. Maintaining a RCP sets the conditions for two things to occur in relation to the decision making process. First, the RCP may *help compress the decision cycle.* If the commander is able to graphically view the enemy and friendly situations and integrate the other ATCCS systems capabilities within the RCP, he may be able to abbreviate the amount of steps he would normally take to render a decision. Second, the benefits of a compressed decision cycle could allow the commander *to decide earlier* on a given course of action. Therefore, he could possibly deliver quicker decisions to his subordinates who could execute friendly courses of action before the enemy has the opportunity to execute their own courses of action.

Force XXI Doctrine and the Estimate Process

Doctrine, as well as history, provides a means to answer questions pertaining to any research. This section explores the current Force XXI doctrine which is related to decision making and the estimate process. Four doctrinal sources are used: TRADOC Pamphlet 525-5, Force XXI Operations, FM 24-7, Army Battle Command System Systems Management Techniques, FKSM 71-2-1, The Digitized Battalion Task Force, and FM 101-5, Staff Organizations and Operations, Final Draft, August 1996.

TRADOC Pamphlet 525-5 Force XXI Operations

TRADOC Pamphlet 525-5 is analogous to the current FM 100-5, Operations. TRADOC Pamphlet 525-5 describes how the Army's digitization effort is integrated around the force projection, capabilities based Army of the twenty-first century. This integration entails many new concepts and theories related to warfighting. To bridge the gap between the requirements of the modern Army and the anticipated requirements of the Army of the Twenty-First century, (Force XXI), TRADOC Pamphlet 525-5 was published. Its purpose, besides bridging this gap, is to address ". . . the conceptual foundations for the conduct of future operations in war and OOTW involving Force XXI - the US Army of the 21st century."[31] It addresses how the Army plans to "grow" through the era between the modern army and the Army of the twenty-first century. It describes how the Army is to function as the country's primary land force within *joint* Force XXI operations. Although somewhat conceptual in nature, TRADOC Pamphlet 525-5 sets the conditions for the Army to operate within the Force XXI environment and provides guidance to those Army Battle Labs and institutions who are leading the development of the Force XXI effort.

TRADOC Pamphlet 525 and the Digitization Effort

TRADOC Pamphlet 525-5 claims that Force XXI is defined by five characteristics: Doctrinal flexibility, strategic mobility, tailorability, joint and multinational connectivity, and the versatility to function in war and OOTW. In order to develop these characteristics, TRADOC Pamphlet 525-5 states that the Army must maintain its quality soldiers and exploit the ability to gain information. By gaining information and mastering it (through providing accurate, near real time shared perceptions of the battle space) TRADOC Pamphlet 525-5 proclaims the Army is then able to "command operations at an operational tempo no potential enemy can match."[32] This command and exploitation of information produces force capabilities which then allow soldiers to dominate the battle through quicker, decisive decision making. This type of decision making theoretically leads to decisive operations that become short in duration using the minimum force necessary to accomplish the mission.[33]

The Army plans on controlling and exploiting this information by developing the Army Battle Command System (ABCS). This new command and control system consists of a host of subordinate systems which MCS/P and ASAS-RWS are a part of. Conceptually, ABCS and its associated systems and software "will use broadcast battlefield information, including real time friendly and enemy situations and mold these situations into a digitized image that can be displayed graphically. . . these images depict a units actual *battle space*"[34] Developing and implementing newer systems such as the Unmanned Aerial Vehicle (UAV) and Global Positioning Systems (GPS) are some of the critical sub-components which essentially make displaying a near real time digital image of a given battle space (and the overall ABCS) work.

Additionally, to meet the objectives of digitization, ABCS allows commanders at every level (from battalion through corps, generally) to share a *relevant common picture* of a certain battle space.

Summary

TRADOC Pamphlet 525-5 provides the conceptual foundation for the Force XXI Army. Although it accomplishes this goal, it also accomplishes some other goals which help sharpen the focus of this research. First, TRADOC Pamphlet 525-5 acknowledges that the Army can currently utilize existing commercial information technologies to help them prepare for Force XXI operations. Next, although the Army has access to commercial information technologies which provide them the means to execute Force XXI operations, they do not possess the required techniques to apply these technologies There are two reasons for this.

First, the Army acknowledges it is not fully prepared to tactically adapt to the requirements of the Force XXI environment because it lacks the techniques and procedures to employ the available technologies. Next, TRADOC Pamphlet 525-5 acknowledges the Army is becoming an information based force. Although TRADOC Pamphlet 525-5 addresses that "Doctrine will continue to provide a holistic basis technologies, and organizational designs" it does not address how the Army might manage this information correctly.[35] Previous literature stated that information overload and effective decision making are not complementary. In order to be an information-based army capable of commanding and exploiting such a wide variety and amount of information, parameters must be set to harness and filter such enormous amounts of information. These parameters, or filters, are important because they deal with how humans process information. The ability to process information is critical, especially during the estimate process within the digital decision making environment of Force XXI operations.

TRADOC Pamphlet 525-5 also helps to outline some possible Force XXI decision making requirements. TRADOC Pamphlet 525-5 implies that the following concepts emerge as a result of the Army's effort to redesign and reconceptualize itself around information technologies: Increased operations tempo, better situational awareness, and an extended battle space. As a result of these concepts, some Force XXI decision making criteria/requirements can be identified.

First, extending a unit's battle space extends its ability to cover a larger area of operations. Therefore, a larger area of operations creates the potential for requiring more tactical decisions to be made. Next, increasing a unit's ability to know where they are in relation to the enemy creates the requirement for better decisions to be made. Last, increasing the operations tempo creates the potential for not only making more decisions but for having shorter decision cycles. In other words, there will be less time to conduct formal, lengthy estimates.

All of these potential Force XXI decision making requirements begin to shape the execution of the estimate process. TRADOC Pamphlet 525-5, however, does not specifically state these possible requirements, they are simply implied. Since TRADOC Pamphlet 525-5 is the capstone doctrine for Force XXI Operations, these Force XXI decision making requirements are not captured in other Force XXI doctrine or in current doctrine updated as a result of Force XXI Operations.

FM 24-7 Army Battle Command System (ABCS) Systems Management Techniques

FM 24-7, Army Battle Command System (ABCS), expands upon TRADOC Pamphlet 525-5 by focusing on the development of the Army's new C2 system, the Army Battle Command System (ABCS). FM 24-7 explains the ABCS structure, its components, and then outlines the responsibilities and procedures for establishing and maintaining that structures (network). FM

24-7 helps sharpen the focus of this research because it explains how the MCS/P and ASAS-RWS fit into the ABCS structure. This section explains the ABCS structure, the ABCS components, and then analyzes how the ABCS helps answer the primary research question.

ABCS Structure and Capabilities

> ABCS is the keystone of a digitized battlefield, providing the commander an integrated digital information network that supports warfighting systems and ensures C2 decision-cycle superiority.[36]

ABCS, being the keystone of the digital battlefield, accomplishes the above objective by enabling the commander and his staff to accomplish these objectives:

1. Collect and organize large amounts of information.

2. Combine information from multiple sources to create more complete and useful information.

3. Process information to analyze trends, detect unusual activities, or predict future situations.

4. Develop courses of action based on situational factors.

5. Exchange information efficiently among and within command posts on the battlefield.

6. Present information as a graphic display and textual summaries.[37]

Before describing the ABCS structure, it is important to highlight some issues that deal with the manner ABCS influences information dominance. First, humans will remain responsible for creating database. Therefore, humans will remain responsible for making the appropriate decisions from this information once it is analyzed and becomes available. For example, even though the ABCS possesses the potential to assist commanders and staffs in developing courses of action based on situational factors, commanders and staffs remain responsible for developing, analyzing, and executing COAs. Next, ABCS uses a completely different process (besides the obvious software and hardware improvements) to manage information. Command posts using ABCS possess the capability to *exchange* and *share* information in a revolutionary manner. The manner in which information is shared and exchanged is revolutionary because of the conceptual design the ABCS's *integrated database* offers.

Presently, the Army uses what is referred to as the "stovepipe" method of information management. The stovepipe method refers to the manner in which a given staff is capable of sharing and exchanging information (see fig. 7). The stovepipe method can be a dysfunctional means of managing information because it may not facilitate information sharing and exchange. In order to share or exchange information under the stovepipe method, staffs must physically show or brief that information to one another. The stovepipe methodology would not be effective within Force XXI Operations. In order to gain and maintain information dominance, information exchange and sharing must occur naturally, in a near real time manner. Information dominance enables all of the essential pieces of Force XXI Operations (RCP, situational awareness and extended battle space) to occur. The ABCS, because of its integrated databases, is a more effective method to gain information dominance and manage information (see fig. 8).

ABCS can effectively manage information because of its software and microprocessing capabilities. For example, within the ATCCS, information management is accomplished for the commander through the MCS/P. The MCS/P acts as the focal point for all of the ATCCS systems. Each of these systems operates independently but remains integrated with one another and the MCS/P. Therefore, when either of the ATCCS systems input or update a specific database, this information is shared with all of the other ATCCS systems. The MCS/P also receives this information and is able to consolidate it into a RCP. FM 24-7 describes this process as "the single point of entry concept whereby once a piece of data has been captured in digital form, it can be provided across echelons and geographic boundaries without being retyped or otherwise reentered."[38]

Summary

FM 24-7 implies there are some general criteria of what the doctrinal or theoretical requirements are for developing modifications to the current estimate process when using digital systems like MCS/P and ASAS-RWS. These criteria are the need for *speed in the decision* making cycle, the ability to *share information*, and enabling the commander *to decide earlier on the* MDMP.

The MCS/P and ASAS-RWS systems capitalize on *speed.* The microprocessing capabilities of these digital systems have the ability to collect, analyze, and distribute enormous amounts of information extremely fast. These capabilities enable the commander to access more information about himself and the enemy. Essentially, these capabilities enable the commander to potentially know what tactical actions he needs to conduct before the enemy does. Therefore, the decision cycle is compressed. (In other words, the amount of time to provide a commander decision making information is shortened.) If the decision cycle is compressed, then the commander and staff are able to execute other key decisions within the estimate process because more time is available for the commander and staff. For example, because the MCS/P has the potential to gather information then produce and distribute operations orders at a quicker pace, the commander and staff are afforded more time to refine their current plan. This refinement could include building branches or sequels to the base plan. If the commander and staff are able to conduct this type of refinement, they are given a greater degree of tactical flexibility, especially within a time constrained environment.

The next criteria FM 24-7 identifies, *information sharing*, not only improves information management but it also improves synchronization. When the MCS/P and ASAS-RWS become truly integrated, the synchronization benefits created by this integration will have more value in a digital decision making environment than under the current manual environment. For example, during the IPB process, the G2/S2 produces NAIs (Names Areas of Interest) for the Recon and Surveillance plan. The G3/S3 then tasks his reconnaissance assets to cover and collect information within these NAIs. With the integrated capability of the MCS/P and ASAS-RWS (along with the situational awareness and RCP available to these staff officers), recon assets can be identified to cover these NAIs quicker. Additionally, with a RCP, both staff officers can test the validity of a particular NAI. If no enemy forces are present, they can shift their recon focus and cover other NAIs within the collection plan.

The last criteria FM 24-7 identifies is the *ability of the commander to decide earlier* during the MDMP. If MCS/P and ASAS-RWS enable commanders to decide earlier in the MDMP, then decisions can be given to forces earlier as well. Therefore, if a commander's decision is correct, he sets the conditions for his forces to act quicker than the enemy can allowing him to build combat power more effectively. The MCS/P and the ASAS-RWS, however, simply create the existence of these conditions. They are not a guarantee that the right decision will be made.

All of these criteria begin to demonstrate that trends exist throughout some of the doctrine reviewed in this chapter. The criteria of *speed* and *information sharing* are common themes among TRADOC Pamphlet 525-5, FM 24-7, and Mayfield's work on parallel planning (which is reviewed later in this literature review.) The criteria of *deciding earlier* is a common theme among FM 24-7 and FM 101-5, (Final Draft, August 1996), which is also reviewed later in this chapter.

FKSM 71-2-1

FKSM 71-2-1 is the field manual at the task force level that attempts to integrate and execute the broad concepts TRADOC Pamphlet 525-5 outlines. FKSM 71-21-1 is the digitized task force's field manual describing the enhanced C2 structure of the digital battalion (mechanized or armored). FKSM 71-2-1 describes how the improved C2 systems at the TF level (known as FBCB2) are employed. FKSM 71-2-1 helps answer the research question because it explains the link between the FBCB2 and the ATCCS. Additionally, it suggests alternate estimate process procedures to use in order to capitalize on FBCB2's enhanced C2 capabilities. FKSM 71-2-1 also identifies and reinforces doctrinal and theoretical requirements to modify the estimate process as a result of digitizing the C2 process.

FBCB2 Structure

Chapter one and FM 24-7, The Army Battle Command System, explain the components of the ABCS (the AGCCS, the ATCCS, and the FBCB2) in general terms. FKSM 71-2-1 explains the FBCB2 portion of the ABCS in greater detail. FBCB2 is comprised of enhanced C2 systems at the brigade and below. These enhanced C2 systems are:

1. M1A2 Abrams tank with IVIS (Intervehicular Information System).
2. Bradley Fighting Vehicle (BFV) equipped with the DBCS (Digital Battle Command System) and the DSSV (Dismounted Soldier Systems Unit).
3. A gateway that connects the IVIS and DBCS.
4. A Lightweight Computer Unit (LCU) and is complementary DBCS software.
5. The DSSV and its DBCS software.[39]

The FBCB2 is the foundation enabling the ATCCS to create the friendly forces situational awareness. The ASAS creates the enemy portion. The FBCB2 creates friendly situational awareness by using the Enhanced Position Locating Reporting System (EPLRS). EPLRS works off of the POSNAV concept - each vehicle within a given digital TF is outfitted with a device that transmits its precise location to the MCS/P. The EPLRS provides the commander with near real time information of these locations. He then is able to digitally display, distribute, and share this picture. FKSM 71-2-1- states: "With this information, the commander and his staff are able to make informed decisions and respond more quickly and decisively to changes in the tactical situation.[40] It should be noted that the IVIS, also outfitted in each Abrams tank (and also referred to as appliqué'), *also* displays the friendly picture (of a *given* friendly unit) created by EPLRS. It does so on a smaller scale, however, due to the size of the screen inside of the tank. This capability enables both ground commanders and their headquarters outfitted with MCS/P to see the same near real time friendly picture of the battlefield. Besides enhancing the commander's situational awareness capabilities, the FBCB2 also enhances the planning and reporting capabilities within the mech/armor Task Force.

Reporting Capabilities

The reporting capabilities of the IVIS and DBCS systems enable the digital TF to digitally send and receive tactical reports and orders to one another.[41] This capability provides an enormous advantage for a digital force. The digital TF can, on the move if necessary, transmit orders and graphics. This capability saves time and ensures accuracy and clarity of these orders throughout the task force. This ability to share such near real time information clearly enhances the C2 process.

Planning Capabilities

The largest benefit the IVIS and DBCS systems provide are found in their ability to enhance the planning process. With the ability to digitally send warning/operations orders along with operations overlays, subordinate commanders can begin their troop leading procedures sooner than previously possible. On the other end, the staff, upon completing its planning process, can digitally send the subordinate commanders updated orders and overlays. This process actually creates more available planning because less time is consumed physically retrieving orders or updates. Creating more available planning time creates the ability to conduct and execute the parallel planning process. Parallel planning is simply the process of sharing information during the planning process. This process enhances the accuracy and synchronization of plans. Therefore, the digitized battalion task force, is given the ability to increase its parallel planning, especially between the staff and the company/team commanders. For example, with IVIS and DBCS, the TF can publish warning orders *and* direct the reconnaissance plan simultaneously. As this occurs, the company/team commanders can receive these warning orders and clarify them with the task force staff. The parallel planning process is a continuous one that culminates during rehearsals. Imagine the benefits a digitized battalion TF attains once they assemble for a rehearsal. Company/team commanders have simultaneously seen the ground, conducted their reconnaissance, and received orders prior to the rehearsal. Therefore, the rehearsal can accomplish its purpose - rehearsing critical actions versus backbriefing/confirming the order.

The Digitized Task Force and the Estimate Process

Although FKSM 71-2-1 describes the IVIS and DBCS in detail, these aspects of digitization do not help answer the primary research question. However, FKSM 71-2-1 does help answer the research question because it provides three factors commanders and staff should consider when applying any digital information system towards the MDMP. These factors are assessing the task forces' ability to employ automated C2 techniques, course of action development, and capitalizing on digitization capabilities.

During mission analysis (the first step of the estimate process), FKSM 71-2-1 states that the commander must consider his capability to fully employ the automated techniques described earlier. The commander and his staff should review the composition of the subordinate maneuver elements. It is critical to determine if all units are operating on similar software and hardware. If units cannot digitally exchange information across the task force, alternate methods must be developed to do so.

During COA development FKSM 71-2-1 recommends that staffs plan on working with similar staffs outfitted with digital information systems. Planning in this manner allows the task force to exploit their enhanced C2 and information sharing capabilities. FKSM 71-2-1 also notes friendly-enemy planning ratios and the relative combat power analysis do not change as a result of fielding digitization and automation equipment.

FKSM 71-2-1 is unique because it recognizes Force XXI operations will likely create a compressed decision making cycle. FKSM 71-2-1 states that "Time constraints may require the commander to use the abbreviated decision making process."[42] (see fig. 9) Therefore, it recommends commanders and staffs utilize an abbreviated decision making process rather than a deliberate, lengthy process. With the capabilities of the FBCB2, units are able to integrate the use of digital messages, orders, and overlays to speed the decision making process. It is important to highlight this capability because the MCS/P also has some of the same capabilities. (The significance between the two systems are the echelons they operate in). Therefore, if the FBCB2 can use its functions to help speed the decision making process, it is logical to assume that the MCS/P can do the same. FKSM 71-2-1 is the only doctrinal manual that recognizes these similarities between the FBCB2 and the MCS/P. Additionally, it is the only doctrinal manual that states the decision making process may need to be modified in order to compensate for digital C2 capabilities.

FBCB2 Limitations

Although the FBCB2 provides numerous enhancements for the digital TF it also possesses some limitations. These limitations focus around a lack of interoperability, the physical limitations of the digital hardware and software, and problems with using FM communications.

Not every unit is currently outfitted with the FBCB2 capabilities. Therefore, it will be a significant challenge for digital and non-digital forces to exchange information and achieve total inter-operability. Units will have to establish special techniques and procedures to ensure proper coordination and operability is maintained.

The hardware and software within the FBCB2 structure have unique peculiarities. For example, users have little flexibility in terms of the types of messages sent and the types of graphic control measures available to use. Units may have to develop digital SOPs to overcome these limitations.

The most significant limitation within the FBCB2 are its communication capabilities. Currently, the technology is not perfected for a single communications net (SINCGARS) to handle both digital and voice transmissions simultaneously. Voice transmissions override digital ones. Therefore, strict net discipline and SOPs are necessary to overcome these limitations.

Summary

FKSM 71-2-1 helps sharpen the research focus because it identifies three important guidelines for successful Force XXI decision making. First, and most important, FKSM 71-2-1 identifies Force XXI Operations will likely create a *compressed decision making cycle*.

Therefore, it recommends an abbreviated decision making process to capitalize on the FBCB2 capabilities. Next, FKSM 71-2-1 recognizes the importance of *parallel planning* during the decision making process. The capabilities of the FBCB2 enhance the use of this planning technique. Finally, FKSM 71-2-1 recognizes the importance of *information sharing* during the planning process. Information sharing, especially during the near real time availability of accurate information, allows for speed, clarity, and certainty within the decision making process.

FKSM 71-2-1 establishes the importance of being able to execute parallel planning within the digitized battalion. In Parallel Planning: How Digital Information Systems Can Improve the Combat Decision Making Process by Major Thomas D. Mayfield III, this concept is reinforced. The central question of Mayfield's monograph is: "How can the digital information systems available on the Force XXI brigade facilitate parallel planning in the CDMP?" (Combat Decision Making Process). Mayfield claims that digital systems can make parallel planning more effective by employing specific techniques and procedures during the estimate process. Mayfield also contends that to make parallel planning more effective, technique and procedural changes ought to occur at the brigade level and below. Mayfield's monograph helps answer the research question by providing additional theoretical requirements to modify the current estimate while using the MCS/P and ASAS-RWS.

New TTP and the Estimate Process

> Digitization does not replace the requirement for the command and staff to apply a logical, coherent thought process to solve problems.[43]

Mayfield assumes, like some of the digitization doctrine implies, that the employment alone of digital systems will not guarantee success. Digital systems must be applied correctly and with the right techniques and procedures to be successful. Mayfield believes these procedures are a combination of using parallel planning during the CDMP. The techniques he proposes to make this procedural combination effective are collaborative planning and the commander's vision.

Why Use the CDMP and Parallel Planning With Digital Systems?

The best reason to use a combination of an abbreviated decision making process (the CDMP) and the parallel planning technique with digital systems is to capitalize on digital C2 capabilities. Digital systems, especially ones like the MCS/P and ASAS-RWS, are able to *produce* and *share* enormous amounts of information. Doctrinal manuals and other publications like TRADOC Pamphlet 525-5 are beginning to demonstrate that Force XXI operations may require the need to maintain an increased optempo. Additionally, these manuals assume that decision making cycles will become shorter and that systems capable of processing information faster will be more efficient. Therefore, if the capabilities of the MCS/P and ASAS-RWS are combined with what these doctrinal sources are saying, there is a need to search for a method to deal with this dilemma. Mayfield proposes units aggressively emply the parallel planning technique. This technique is not a new one. However, with the employment of digital capabilities, parallel planning becomes a necessary method to conduct the estimate process in order to meet the new demands of the Force XXI decision making environment.

Parallel planning is also an effective planning tool to utilize when time management is critical. Parallel planning effects the estimate process because it impacts upon time management. Parallel planning allows units to begin the mission analysis and staff estimate processes before they receive an order from a higher headquarters[44] There are risks involved when using this process, however. For example, the commander's intent could be misunderstood. To mitigate this, more detailed communications between echelons are required.

Additionally, communications and updates between staffs are required to keep parallel planning an effective technique. Mayfield recommends using collaborative updates to accomplish this.

Collaborative Updates/Planning

Collaborative planning is the process of exchanging and updating information between staff and subordinate units. It keeps staffs and units effectively coordinated throughout the planning process. This prevents units from executing old or incorrect orders and facilitates the parallel planning process. Mayfield cites there are three types of collaborative planning; inter-echelon command collaboration (between brigade and battalion commanders), stovepipe collaboration (between staffs members and their counterparts at higher, subordinate or adjacent units), and inter-staff collaboration (between members of the same staff.).[45]

Conducting the collaborative planning process is extremely easy to accomplish using systems such as the IVIS, MCS/P or ASAS-RWS. Staff members, for example, could use collaborative updates during mission analysis to provide freindly forces updates of the enemy situation. If the staff is given guidance to plan a certain COA but receives updated enemy intelligence that may change this COA, conducting collaborative updates can re-focus the staff to develop a more suitable COA. The major benefits of the collaborative process are savings on time and improving the tactical synchronization of a given TF.

Commander's Vision

Although technology can facilitate the planning process because commanders and staffs now possess accurate, near real time information and situational awareness, the human dimensions of decision making cannot be overlooked. Mayfield reinforces the concept of personal leadership by noting when units conduct parallel planning and use collaborative updates, it is best to ensure commanders provide personal guidance (for the mission analysis and the COA development phases) with the staff. For example, he states, "during AWE Focused Dispatch (the commander of Task Force 2-33 Armor) stated that it is very important to have this initial interchange with the staff face-to-face."[46] Once this is done, the passing of digital information is more effective.

Summary

Mayfield's research helps answer what some of the theoretical and doctrinal requirements to modify the current estimate process using MCS/P and ASAS might be. These requirements could be implementing a combination of the *CDMP* (now abbreviated decision making), collaborative planning, and parallel planning techniques. Mayfield's research also reinforces previous literary conclusions regarding the use of time during the planning process. One of the major benefits parallel planning provides commanders and staffs is effective time management. Effectively managing time produces more time to decicate to mission planning. This time can be spent planning branches and sequels to the plan and to conduct thorough reconnaissance. Mayfield's research also provides some insight into the ability of digital systems to overload staffs/commanders with information. He points out that providing more information is not necessarily better. In fact Mayfield states that, "Large amounts of raw data may quickly overload the commander's ability to synthesize the data into something useful."[47] Earlier literature has already addressed the concerns of information overload and chapter four will touch upon this subject once again.

FM 101-5 Staff Organization and Operations

FM 101-5 is the Army's doctrine on how it conducts the Military Decision Making Process. The last update of FM 101-5 occurred in 1984. Since then, however, there have been significant changes in the Army's doctrine and equipment. Therefore, the Army is currently distributing its tenth revision of FM 101-5 which is in final draft as of August, 1996. This revision highlights new techniques and procedures to conduct the MDMP. It offers improvements to conduct the estimate process, especially when time is constrained. Although FM 101-5 offers improvements, it is deficient in providing guidance on how to conduct the estimate process within the Force XXI decision making environment. The current draft of FM 101-5 simply fails to address how to properly conduct the MDMP and estimate process given the new capabilities of the ATCCS systems and the demands of the Force XXI battlefield.

FM 101-5 is a significant improvement over the 1984 version. The most significant improvements focus on new decision making processes, the use of parallel planning and information sharing, and on COA development. The following is a summary of those improvements.

New Decision Making Processes

The 1984 version of FM 101-5 outlined three decision making processes available to commanders: The DDMP (Deliberate), the QDMP (Quick), and the CDMP (Combat). The current draft of FM 101-5 offers only two: The DDMP (Deliberate) and the ADMP (Abbreviated). The abbreviated method follows the same steps as the deliberate method. However, the draft FM 101-5 offers commanders guidance on when the abbreviated method should be used. Besides providing this guidance, the draft FM 101-5 offers additional techniques to optimize the use of the abbreviated method. These techniques are:

1. Having the Commander become more involved in the estimate process.
2. Having the Commander become more direct during the estimate process.
3. Having the Commander limit the number of COAs developed during the estimate process.[48]

Besides these improvements, draft FM 101-5 also emphasizes the importance of allowing the commander to decide earlier within the decision making process. FM 101-5 also recognizes the use of parallel planning and information sharing as techniques to improve the MDMP.[49] Both of these improvements have already been identified in other literature reviewed throughout this chapter.

All of these improvements focus around finding techniques or procedures to save time during the conduct of the MDMP. The final draft of FM 101-5 fails to recognize that the ATCCS, especially the MCS/P and ASAS-RWS, are designed to save planning time through digitization and information dominance. The final draft of FM 101-5 does not analyze where and how the ATCCS may impact the MDMP, therefore, it cannot provide guidance on how to adjust the estimate process within the Force XXI decision making environment.

FM 101-5 (Final Draft, August 1996) Deficiencies

One of the more significant capabilities the ATCCS provides to the MDMP process is the ability for commanders to possess a more certain environment to make decisions. Prior to possessing the degree of certainty available with the new digital information systems, the traditional estimate process met the decsion making demands of the commander. The current estimate was designed to help a commander gain certainty by executing the methodical, analytical process initially developed by the Prussian Army.

FM 101-5 does not describe the impacts of possessing such certainty has on the MDMP. It does not even mention the availability of the ATCCS systems, their hardware, software, or any of their specific capabilities. The literature review has identified specific Force XXI decision making guidelines as a result of the ATCCS capabilities and other factors. FM 101-5 does not recognize the possible existence of such guidelines except in two cases. First, FM 101-5 acknowledges the importance of parallel planning and information sharing. Next, FM 101-5 recognizes the importance of allowing the commander to decide earlier in the decision making process. Although FM 101-5 recognizes these guidelines in a very vague manner, it does not recognize them as Force XXI decision making guidelines. In other words, FM 101-5 does not establish any new decision making criteria as a result of digitization.[50]

Summary

The new draft of FM 101-5 is a significant improvement to apply the MDMP within the tactical environment. For example, it refines the MDMP when time is constrained. FM 101-5, however, lacks guidance and analysis of how to adjust the MDMP to capitalize on the abilities of the ATCCS systems.

History proves that the estimate process is a sound and proven method to develop decisions. The current FM 101-5 reinforces this belief because it continues to apply and adjust the estimate process to suit the needs of the Army. However, FM 101-5 remains too extreme in its application of estimate procedures during abbreviated planning. FM 101-5 prescribes that omitting steps of the estimate process during abbreviated planning is not permissable. FM 101-5 recommends the best approach to abbreviated planning is to anticipate, task organize the staff, and prepare for those times when the abbreviated planning technique must be applied.[51]

The Army, in its race to create doctrine to fit technological improvements, must somehow and somewhere account for the new C2 capabilities digitization offers. If the Army fails to account for these capabilities, the integration and success of Force XXI operations could be at risk.

For example, FM 101-5 should structure the estimate process to account for how the Relevant Common picture could affect the S2's execution of the estimate during mission analysis. FM 101-5 should consider whether the S2 will have the time to conduct a complete IPB process during offensive operations or if there is even a need to complete an entire IPB and develop numerous enemy COAs when the RCP dictates the enemy's inclination to execute a specific COA (which can be seen developing by viewing the most current enemy RCP). These circumstances drive the need to determine what modifications are necessary within the estimate process and where these modifications ought to occur.

Chapter 2 Summary

This literature review identifies the trends among the historical, doctrinal, and related literature dealing with Force XXI operations and decision making. These trends help establish some broad Force XXI decision making guidelines. The majority of these trends serve as the basis for the analysis to be conducted in chapter four. These trends are:

1. The MCS/P and ASAS-RWS can provide an unparalleled degree of situational awareness for the Force XXI commander and staff. This situational awareness is able to be displayed visually to the commander in a near, real time mode (via a RCP).

2. Force XXI commanders are able to operate at an increased optempo because of a combination of Force XXI battlefield demands and the amount of information they possesses due to digitization.

3. Resulting from an increased optempo is the requirement to render speedy decisions.

4. Access to near real time information in the form of a RCP gives Force XXI commanders and staffs the ability to decide earlier in the decision making process.

5. All of the above conditions create a shortened/compressed decision cycle.

6. Information sharing is easier to accomplish (both horizontally and vertically) among commanders and staffs. Information sharing significantly contributes to accomplishing the estimate process using the MCS/P and ASAS-RWS.

7. Filtering information during the estimate process is necessary to prevent commanders and staffs from becoming overloaded with information.

8. Commanders and staffs can execute the estimate process with a greater degree of certainty using the MCS/P and ASAS-RWS.

The literature review also highlights some doctrinal shortcomings. These shortcomings deal with how the Army's current decision making doctrine fails to compensate for the demands Force XXI operations have on the estimate process. This doctrine also fails to address the impacts the ATCCS system has on the estimate process. The following section summarizes these two points.

The Army has historically recommended changes to the estimate process as a result of technological improvements. These recommendations were highlighted in the 1984 version of FM 101-5. However, the Army has not adequately adjusted the current FM 101-5 draft to meet the demands of current technological improvements. Although the current draft is a significant improvement over the earlier version, it does not compensate for the revolution in C2 advances that characterize Force XXI operations.

The 1984 version of FM 101-5 clearly stated the need for commanders to consider the impacts of improved communications on the estimate process. FM 101-5 (Final Draft, August 1996) does not specify any such considerations. Further, it does not refer to any of the ATCCS systems possible impacts on the estimate or decision making process. There could be numerous reasons for this. First, the draft may serve as a bridge between the old FM 101-5 and what a new FM 101-5 may look like. Also, the Army may choose to keep the current revision of FM 101-5 in draft form until the completion of brigade and division AWEs. Upon completion of these AWEs, there may be enough significant lessons learned to produce a final draft. However, it is important to note the historical link to changing the estimate process as a result of significant technological improvements. It may be time to consider this historical precedence again.

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[1]Rex R. Michel, Historical Development of the Estimate of the Situation, Research Report 1577, (Fort Leavenworth: US Army Research Institute for the Behavioral and Social Sciences, October, 1993), 1.

[2]Ibid., 3.

[3]Ibid., 3.

[4]Ibid., 3

[5]Ibid., 4-6.

[6]Ibid., 9.

[7]Ibid., 10.

[8]Ibid., 10.

[9]Ibid., 14

[10]Robert G. Lord and Karen J. Maher, Leadership and Information Processing, Linking Perceptions and Performance, (London: Routledge, 1993), Chapter 2.

[11]Ibid., 13, 14.

[12]Ibid., 16.

[13]Ibid., 16, 17.

[14]Ibid., 17.

[15]Ibid., 20, 21.

[16]Ibid., 22, 23.

[17]Ibid., 23.

[18]Ibid., 23.

[19]James D. McMullin, "Determinants of the Effectiveness of Situation Estimation" (Master's thesis, Naval Postgraduate School, 1990), 20.

[20]Ibid., 20-28.

[21]Ibid., 20.

[22]Ibid., 22.

[23]U.S. Army, "The Operational Requirements Document (ORD) For Maneuver Control System (MCS)," (Fort Monroe, VA: Headquarters, U.S. Army Training and Doctrine Command Memorandum dated 20 March, 1996), 3, 4.

[24]Ibid.

[25]Ibid., 3-4.

[26]Ibid., 3-4.

[27]Ibid., 2-1 - 2-3.

[28]Ibid., Chapter 1.

[29]Ibid., 1.

[30]Ibid., Complete Memorandum and the Explanation of Core Functions Within the UFD.

[31]U.S. Army, TRADOC Pamphlet 525-5, Force XXI Operations, A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Tweny-First Century (Fort Monroe, VA: Headquarters, U.S. Army Training and Doctrine Command, August 1994), 1-1.

[32]Ibid., iii.

[33]Ibid., 3-3.

[34]Ibid., 3-4.

[35]Ibid., 4-1.

[36]U.S. Army, FM 24-7, Army Battle Command System (ABCS) Systems Management Techniques (Washington, DC: Headquarters, Department of the Army, June 1995), 1-2.

[37]Ibid., 1-1.

[38]Ibid., 1-2.

[39]U.S. Army, FSKM 71-2-1, The Digitized Battalion Task Force, Fort Knox, KY: U.S. Armor School, December 1995), 1-1.

[40]Ibid., 1-3.

[41]Ibid., 1-4.

[42]Ibid., 2-16.

[43]Thomas D. Mayfield III, "Parallel Planning: How Digital Information Systems Can Improve the Combat Decision Making Process," (SAMS Monograph, U.S. Army Command and General Staff College, 1996), 5.

[44]Ibid., 12.

[45]Ibid., 14.

[46]Ibid., 30.

[47]Ibid., 28.

[48]U.S. Army, FM 101-5, "Staff Organizations and Operations," (Final Draft) (Fort Leavenworth, KS., Headquarters, Department of the Army: U.S. Army Command and General Staff College, August 1996), 5-46 - 5-48.

[49]Ibid., 5-50 - 5-53.

[50]Ibid., Chapter 5.

[51]Ibid.

CHAPTER 3

METHODOLOGY

Introduction

This chapter describes a methodology to answer the primary research question: Will the estimate of the situation require modifications as a result of implementing the Maneuver Control System/Phoenix and the All Source Analysis System--Remote Workstation during the estimate process of the Military Decision Making Process? The methodology has two steps. First, it defines the eight decision-making criteria described in the summary of chapter two. These criteria serve as the basis for the methodology. The criteria are placed into the form of questions in order to analyze the major products of the estimate process against the most significant capabilities of the MCS/P and ASAS-RWS. The second step of the methodology, the analysis, uses these questions to analyze where and how impacts on the estimate process occur. This chapter also describes how data was collected for the research and concludes with an explanation of why this particular methodology serves to answer the primary research question.

Data Collection

This thesis gathered the most significant array of primary sources dealing with historical and doctrinal background information on the estimate process. These sources included published and draft U.S. Army doctrine, official army history, and program development related materials. This thesis also evaluated secondary sources which included books on information processing and studies from the Army Research Institute. Both of these sources were used to assess the estimate and explain its applicability in facilitating tactical decision making. Additionally, these sources were used to determine the current and projected use of the estimate process within the Force XXI environment.

This research was exploratory in nature. There has been little, if any, documented research done by the U.S. Army to determine if the Army's estimate process will require modifications as a result of employing digital systems like the MCS/P and ASAS-RWS. There was no empirical data gathered to answer the primary research question. Access to the current Advanced Warfighting Experiment preparation and execution was extremely limited. Although this was a research constraint, enough evidence was gathered to conduct an analysis and answer the research question.

Step 1: Establish and Define the Broad Guidelines

The literature review provided a strong doctrinal and historical perspective on the topic of decision making within Force XXI operations. Additionally, the literature review described the general capabilities of the MCS/P and ASAS-RWS and the functions humans use to process information. As a result of this literature review, significant trends were identified. These trends are used as broad decision making guidelines criteria within the Force XXI decision making environment. The broad guidelines identified were: Information technologies produce enhanced situational awareness, information technologies increase the battlefield operations tempo, a result of this operations tempo is a need for speedy decisions and shorter decision cycles, information technologies enable commanders to decide earlier, information technologies demonstrate the need to share information, and finally, information technologies produce enormous amounts of information. This information needs to be filtered in order for it to be useful in the decision making process. Before proceeding further, it is important to demonstrate how each of these guidelines are linked to each other. Additionally, each of these guidelines are defined. Defining them enhances understanding of the methodology and later, the analysis process.

Linkage

Each of these guidelines interact with one another because they are products of information technologies. Figure 4 (which was explained during chapter one) visually demonstrates this linkage. Essentially, this linkage is based upon information dominance.

As a result of harnessing new information technologies (sensors, information processors) and focusing these technologies to improve the Army's C2 system, the Army believes it is capable of gaining information dominance.[1] The basis for gaining information dominance is achieving situational awareness--the ability to know more about yourself in relation to the enemy and the terrain. Achieving situational awareness requires employing and linking sensors to combat forces and then linking these forces to humans and the digital information systems required to analyze and process the information gathered. Digital information systems enable commanders to graphically display and share this situational awareness through the RCP. Possessing unparalleled situational awareness allows combat forces to expeditiously engage and defeat enemy forces. This agility creates the conditions to operate at a faster pace thus increasing a forces' operational operations tempo. Possessing an increased operations tempo generates the need to deliver more decisions in a quicker fashion. This entire process, from the moment sensors begin to gather data to the delivery of tactical decisions, enables (and possibly requires) commanders to decide earlier within the MDMP. If commanders decide earlier, they may compress the decision cycle because they did not have to conduct every step within the estimate process.

The remaining guidelines, the *need to share information* and *have filter requirements*, are also linked to each other and the overall process just described. However, they influence the overall process versus influencing or being directly linked to one another. For example, the need to share information influences all of the guidelines. It influences all of the guidelines because the capabilities of the MCS/P and ASAS-RWS allow commanders a revolutionary means to share information. The requirement to filter information also influences the overall process. If information is not filtered, commanders will suffer from information overload. Therefore, if a commander has too much information or does not know how to filter unnecessary information, he will not be able to effectively make a decision.

Definition of Guidelines

The following definitions are used to guide the methodology, analysis, and conclusions of this thesis:

1. Increased operations tempo: The ability to conduct more operations in a quicker fashion.

2. Speedy decisions: Quicker decision making abilities to keep pace with a heightened operations tempo.

3. Compressed decision cycles: A decision cycle is defined as the amount of time a decision maker takes to make a decision; using information technologies the amount of time it takes to make a decision is decreased because of the increased operations tempo Force XXI operations produce.

4. Ability to decide earlier: Commanders have the ability to deliver a decision earlier in the estimate process because of the capabilities of information technologies.

5. Sharing information (Information sharing): The act of exchanging information or decisions. This can be done verbally, by messenger, or through digital means (in graphic, text or a combination of the two).

6. Filtering: The ability or process (through manual or software capabilities) of removing unnecessary or irrelevant information during the estimate process.

It is beyond the scope of this thesis to conduct analysis that yields a new estimate process. The focus is to demonstrate that a need exists to modify the current estimate process. The analysis portion of the methodology analyzes where and how the broad guidelines produced from the literature review may effect change on the current estimate. The analysis is conducted in chapter four of this thesis. Upon conclusion of chapter four, chapter five presents the conclusions and recommendations of the thesis. Chapter 5 also offers areas within the decision making process which requires more research as a result of Force XXI's digitization effort.

Step 2: Analysis: Evaluate Broad Guidelines and MCS/P, ASAS-RWS Capabilities Against the Current Estimate Process

Focusing the analysis on where and how the MCS/P and ASAS-RWS capabilities create modifications within the estimate process resolves the primary research question. In order to focus the analysis process, the following steps were taken. First, the eight Force XXI decision making criteria/guidelines identified in the literature review are reduced to four criteria/guidelines because some were redundant. The guidelines of *increased operations tempo*, the *need for speedy decisions*, and *shortened decision cycles* are combined into one guideline, *compressed decision cycle*. The thesis is then left with four criteria/guidelines consisting of: The ability to decide earlier, the need or ability to share information, the need to filter information, and compressed decision cycles. With these criteria/guidelines established, the next step of focusing the analysis can be done--placing these criteria/guidelines into question form.

The approach this methodology takes to determine where and how modifications occur within the estimate are to place the criteria/guidelines into questions in this manner:

1. Where and how will compressed decision cycles modify the current estimate of the situation?

2. Where and how will the ability to decide earlier within the decision making process modify the current estimate of the situation?

3. Where and how will the need or ability to share near, real time information modify the current estimate of the situation?

4. Where and how will the need to filter information modify the current estimate of the situation?

Finally, with the criteria/guidelines in question form, the analysis can be conducted. The analysis follows these general steps: First, the steps of the estimate process (mission analysis, course of action development, course of action analysis, courses of action comparison, and course of action approval) are analyzed. This analysis yields the actual products each step produces. For example, analyzing the mission analysis step yields four significant products: Intelligence Preparation of the Battlefield products (Modified Combined Obstacle Overlays, situation templates, etc.), Commander's Critical Information Requirements (CCIR), High Value Targets (HVT list), and the restated mission. The analysis then commences, focusing on how these products are influenced by the capabilities of the MCS/P and ASAS-RWS. Again, the analysis is conducted in the framework of the four questions already discussed.

Summary

This is an appropriate methodology to answer the research question because it provides guidelines from the literature review which can be evaluated against the current estimate process. Additionally, the analysis serves to focus the impact of these guidelines, along with the capabilities of the MCS/P and ASAS-RWS, against the products of the estimate process. This technique attempts to determine where and how the guidelines could create modifications on the current estimate process.

[1]U.S. Army, FM 100-6, Information Operations (Washington, DC: Headquarters, Department of the Army, August 1996), Chapter 1.

CHAPTER 4

ANALYSIS

Introduction

This chapter analyzes where and how modifications to the current estimate of the situation process occur as a result of the capabilities of the MCS/P and ASAS-RWS. This chapter follows this sequence to conduct a thorough analysis: each step of the estimate process and their products are described. After this description, the questions outlined within the methodology are applied to the particular step of the estimate being analyzed. Next, a description is given which demonstrates how the capabilities of the MCS/P and ASAS-RWS enhance each of the major products of the estimate process. This step describes where the modifications occur. After this step, the results of the enhancement are discussed. These results describe how modifications would occur. The results normally entail technical or procedural shifts throughout the estimate. Any deviations to this analysis process are highlighted during the introductions of each section of this chapter.

Mission Analysis

The mission analysis is the first step of the estimate process. FM 101-5 (Final Draft, August 96) outlines eighteen steps that comprise the mission analysis (see fig. 10). Conducting mission analysis enables the commander and his staff to accomplish these tasks:

1. Digest the order, nest tactical tasks and purposes, and determine the units' significant contribution to the tactical operation.

2. Begin staff estimates.

3. Achieve a degree of certainty as to the current enemy disposition, composition, strength, and most likely course of action.

In order to accomplish these tasks, FM 101-5 outlines four significant products the mission analysis should produce. These are: initial Intelligence Preparation of the Battlefield (IPB), an understanding of the Status of Friendly Forces, the Commander's Critical Information Requirements (CCIR), and the Restated Mission. The following is a detailed description of these products.

Intelligence Preparation of the Battlefield

The focus of the initial IPB is to develop these subordinate products:

1. Develop the doctrine (enemy order of battle) and situation templates.

2. Develop the Modified Combined Obstacle Overlay.

3. Develop an initial threat evaluation to determine enemy disposition, composition, strength, and most likely or dangerous course of action. Threat evaluation continues throughout the whole estimate process and is updated as necessary.

4. Develop the initial intelligence collection plan and launch available reconnaissance to collect this information.

5. Define the friendly and enemy battlespace (area of interest, area of operation).[1]

Status of Friendly Forces (Subordinate Product)

The focus of this product is to:

1. Develop an understanding of friendly strengths and weaknesses.

2. Develop the initial task organization; understand current status of resources, identify additional resources needed to accomplish the given mission.[2]

CCIR

CCIR is comprised of the following three information requirements (subordinate products):

1. Develop Priority Intelligence Requirements (PIRs--information required to gain an appreciation of the enemy disposition, composition, strength, and course of action.)

2. Develop Essential Elements of Friendly Information (EEFI--friendly information which needs *protection* from enemy forces).

3. Develop Friendly Forces Information Requirements (FFIR--critical information the commander desires about his unit or adjacent units which may effect the outcome of the mission).[3]

Restated Mission (Subordinate Product)

1. Essentially, the restated mission is one of the capstone products of the analysis process. It provides the direction required for the commander, staff, and their subordinate units to continue their estimate process.

2. Along with the restated mission, a warning order is produced and sent to subordinate units. This formally initiates subordinate units' planning process.

3. An additional portion of the mission analysis which helps clarify the restated mission is developing initial planning timelines which dictate the amount of time the staff will dedicate to planning. Additionally, friendly and enemy event timelines are normally developed to identify critical events, decision points, and future synchronization matrices, event, and decision support templates.

Now that the major and subordinate products of the entire estimate have been described, the analysis process can begin.

Analysis--Mission Analysis

This section outlines specifically where in the mission analysis process the ability to decide earlier, the need or ability to share near, real time information, and the need to filter information would occur. The literature review does not support the conclusion that the mission analysis would be affected by compressed decision cycles. The criteria of compressed decision cycles affects the whole estimate process. Therefore, outlining specifically where and how compressed decision cycles would affect the estimate process is not discussed within this section. Compressed decision cycles and their impacts on the estimate process using the MCS/P and ASAS-RWS are discussed later in this chapter.

Where and how will the ability to decide earlier within the decision making process modify the mission analysis portion of the estimate?

The commander's ability to decide earlier is first influenced during the mission analysis process because of the capabilities the ASAS-RWS possesses. The ASAS-RWS is capable of digitizing and enhancing IPB products such as the doctrinal and situational templates and the MCOO. The following sections describe these enhancements and the impacts these enhancements have on the mission analysis process.

Product--Enhancement

DOCTRINAL TEMPLATES. ASAS-RWS capabilities enable the analyst to store and create doctrinal templates that can graphically portray enemy composition, disposition, and tactics. The analyst is able to receive changes to this composition via inbound message highlights he or she is sent from other ASAS stations.

Results

These enhancements simply save time for the analyst and S/G-2. As long as the database is kept current, the analyst is able to graphically show the commander specific changes in the enemy's doctrine over a period of time. However, the largest benefit of this enhancement is that it saves time doing busy work and allows analysts and S2s the opportunity to conduct more thorough analysis later into the IPB process.

Product--Enhancement

SITUATION TEMPLATES. The most significant capability the ASAS-RWS affords the analyst and commander could be the situation template it produces. If updated and distributed correctly, the situation template becomes the enemy RCP. Additionally, ASAS-RWS can save these situation templates (enemy RCPs) and automatically update them.

Results

Determining the enemy's most probable course of action is simplified. If analysts can view a near real time snapshot of the enemy RCP, they can assist the commander in developing the best friendly course of action to defeat the most probable enemy COA.. The days of developing two or three friendly COAs may not be necessary. Possessing clarity and certainty of the enemy's situational awareness, commanders could feasibly use an abbreviated COA development process to develop, wargame, and rehearse fewer friendly COAs.

Abbreviating the normal time consuming process of developing situation templates enables more time to be spent synchronizing, rehearsing, and collecting intelligence. Additionally, these ASAS-RWS capabilities give the G/S2 a tool to maintain a living or continuous IPB process and assist the analyst/commander in identifying enemy trends. The situation template database maintaining the historical RCPs could become a key "query" of the

IPB process. It is possible that commanders would want to query such historical information when they develop or synchronize friendly COAs. Although these trends and queries will not tell commanders the enemy's intent, they remove some of the uncertainty in determining the enemy's most likely COA.

Product--Enhancement

MODIFIED COMBINED OBSTACLE OVERLAY (MCOO). The ASAS-RWS allows key elements of the MCOO (unrestricted, restricted terrain, avenues of approach) to be built. Once the ASAS and MCS/P become integrated, it is possible that the MCOO built on the ASAS could be shared with operations graphics available on the MCS/P. The MCS/P also offers a terrain visualization and MCOO building function. Combining these functions would enable the MCOO to become automated for distribution throughout a given staff.[4]

Results

The number of man hours it takes to produce the maps for MCOO, complete the MCOO, and hang the products is reduced. Additionally, all staffs would have access to the same MCOO (via their digital linkage). With the capabilities of the MCS/P and ASAS-RWS there is no need to reproduce the MCOO--one of the most important products of the IPB process. The MCOO and terrain visualization software package of the MCS/P allows maps to be loaded into the MCS/P. This software package allows the MCS/P operator to develop the MCOO directly from the MCS/P. Once MCOOs are completed, they are distributed digitally via a Local Area Network (L.A.N.) or standard Army tactical communications. Besides the savings in time, the automated MCOO helps the commander determine the feasibility of a COA earlier in the decision making process. Since the MCOO is automated, sharing it with subordinate commanders could result in earlier COA wargaming among commanders and staffs (informally), especially during abbreviated decision making when time is constrained.

Product--Enhancement

DEFINING BATTLESPACE. A given enemy RCP (again, the most current situation template) describes the enemy battlespace. It depicts *where* the enemy is or is not and *when* he is there. Coupled with this capability, the ASAS-RWS also provides the analyst access to inbound messages (called Inbound Message Operations) of additional battlefield information. This information includes weather, terrain, and NBC information.[5]

Results

Defining the battlespace impacts the estimate process the most during abbreviated planning. It allows commanders to quickly define the enemy and describes the enemy's current combat power. It is possible that "*Defining the Enemy Battlespace*" could be a useful technique or procedure during the mission analysis process of abbreviated planning. Battlespace definition provides the tools for commanders and staffs to quickly develop COAs to defeat the current enemy posture. Defining battlespace also enables the G/S2 to *task or retask his sensors* and other available R&S assets to cover enemy battlespace if it was not covered beforehand.

The ASAS-RWS possesses an additional capability which enables commanders to decide earlier within the decision making process. This capability deals with developing and executing a High Value Target (HVT) list. Under the traditional IPB process, analysts, G/S-2's and G/S-3's study enemy courses of action and develop HVTs based upon doctrinal and situational templates. Usually, these HVTs are hard to identify, attack, and assess as KIAs so the HVT list can be properly maintained as a decision making tool. The ASAS-RWS enables the analyst to complete these tasks more efficiently. The ASAS-RWS possesses software which allows analysis to query current situational templates. These queries make the identification, attacking, and battle damage assessment of the HVT development process easier and faster.[6]

Results

The query's (the ability to extract existing information within a database) usefulness is applicable during operations when abbreviated planning is normally used. Again, it is possible commanders would want to implement a "*Query HVT*" technique or procedure during the IPB process to identify or update HVTs. Using the query process, HVTs can be identified earlier into the abbreviated planning process. If a current enemy RCP demonstrates significant HVTs and attacking these HVTs lends itself to mission success, a commander is able to decide upon a COA earlier than normal.[7]

Although the ASAS-RWS possesses some capabilities which influence the commander's ability to decide earlier, the MCS/P also offers capabilities which do the same. The MCS/P capabilities have an impact on the *Status of Friendly Forces* product which, when analyzed, influences the ability to decide earlier. The following section on MCS/P reports explains these capabilities in more detail.

Product--Enhancement

MERCEDES, CHICKLET, GUMBALL REPORTS--These resource reports are a part of the MCS/P software package labeled Friendly Forces Status Reports. They are a graphic and text representation of a units status on personnel, critical classes of supply (I, III, IV, V, VII, VIII, IX), and other critical combat information the commander desires to track. These reports are available in near, real time just like a RCP. Again, they are database items. Therefore, they must be maintained and updated to remain valuable. Currently, the MCS/P enables commanders at the battalion through division level to query their own and subordinate forces' status. Again, due to the digital nature of the ATCCS, queries can be done both vertically and horizontally.[8] (See Figures 2-4)

Results

These reports enable commanders to get a near, real time snapshot of their *friendly situational awareness*. The impacts of this, combined with a *friendly RCP* (which the MCS/P also provides) are enormous. The combination of a Friendly Forces Status Report *plus* a friendly RCP equals true situational awareness. There is really no need for a technique or procedure to modify the mission analysis process (as a result of this capability) as long as staffs and commanders understand that these tools are available and the synergy they create is enormous! If a technique or procedure was to be added as a modification, it could be labeled "*Friendly Forces Query/Friendly RCP*." This technique or procedure would provide the most use during abbreviated planning when developing COAs under a constrained environment is necessary. Again, due to the nature of digitization these reports can be shared throughout a TF (horizontal) and can be rolled up to higher headquarters and shared vertically.

Where and how will the need to share, near real time information modify the mission analysis portion of the estimate process?

Information sharing is a critical component of the mission analysis process. It is a critical component because it is during mission analysis when information is needed the most to develop COAs. The capabilities of the MCS/P impact the way information is shared during the mission analysis. These impacts are a result of synergy the software packages produce and the digital linkages inherent within the ATCCS architecture.

Mayfield's research in chapter two reinforces the synergy that software and digital communications produce if used with the parallel planning process. However, identifying the benefits of this synergy during the MDMP at the battalion task force level requires some analysis. In order to achieve parallel planning using the MCS/P what must be done? First, we must determine *where* in the process we can capitalize on the MCS/Ps capabilities. Then, we must determine *how* we can do so. The following section outlines where and how we can capitalize on these capabilities.

Product--Enhancement

THE EIGHTEEN STEP MISSION ANALYSIS PROCESS--The MCS/P has the potential to automate and digitally share the results of the process. For example, a brigade headquarters can begin their mission analysis process and simultaneously begin to share some of their initial products with their subordinate units.

Results

What was just described is known as inter-echelon collaborative planning (sharing information between staffs of different levels within the same organization). Mayfield asserts this is one of three ways collaborative planning can be conducted. Another collaborative planning technique, *intra-staff collaboration* (sharing information between members of the same staff), can occur once inter-echelon collaboration is completed. *Stovepipe collaboration* (sharing information between similar staffs (Battalion S4--Brigade S4) would occur concurrently with both collaborative processes already described. Collaborative planning enables all types of critical combat information (this information includes text and graphics) to be shared. The power of combining collaborative planning with the capabilities of the MCS/P however, is in what information is shared and when.

Some of the most important products of the entire mission analysis process can be shared to achieve collaboration. For example, sharing initial warning orders with a *MCOO* can provide the battalion task force an unusual amount of information to commence planning. As the estimate matures, the task force can also send and receive synchronization matrices and the status of friendly forces reports from (or to) the brigade headquarters. Simultaneously, the battalion can begin to share the same mission analysis information it produces amongst itself and its subordinate units. The results of implementing these collaborative processes as part of the mission analysis enable the battalion task force to commence their planning with more certainty than ever before. Collaboration sets the conditions for commanders to decide earlier because these commanders begin planning with accurate information. Additionally, collaboration provides the most benefits during abbreviated planning processes. When time is constrained, the goal is to quickly produce a COA with as much relevant and accurate information as possible. Combining the collaborative techniques with the MCS/P facilitates this process.

A process of *injecting collaborative updates* could be a possible technique or procedure to capitalize on the MCS/P abilities to digitally share information. For example, during the mission analysis process, a battalion task force planning standard operating procedure (PLANSOP) could include specific "*collaborative uplinks*" with their higher headquarters. Specifically *where* in the estimate process these uplinks would be found and *what* these uplinks would entail would be up to the discretion of the commander.

Using collaborative updates with the MCS/P is not without risk, however. Mayfield notes that although collaborative updates are useful, they can become dysfunctional if they are either *not* understood or *mis* understood. Mayfield implies that if collaborative updates are taken and used as complete factual information to build a COA *without* first verifying the information, those receiving and using the updates could build less than desirable COAs. Techniques and procedures, if developed to implement collaborative updates, should account for these risks.

Digital technologies like the MCS/P and ASAS-RWS assist our abilities to manage information. The previous section of analysis described the impacts sharing information could have on the estimate process. The following section transitions to explaining how *filtering information* can modify the process.

Where and how will the need to filter information modify the mission analysis portion of the estimate process?

The literature review established four parameters concerning filtering information within the digital environment. These parameters were:

1. As a result of understanding how humans process information, it is understood that humans can become overloaded with information.

2. Digitizing and automating the C2 process produces more information. Commanders will have access to this information.

3. In order to mitigate information overload with the ATCCS, filters must be used during the MDMP.

4. CCIR acts as manual filters.

The CCIR are products of the mission analysis process. It is during this process when PIR, FFIR, and EEFI are shaped. All of these information requirements are critical. For example, PIRs normally drive the intelligence collection plan. Maintaining the status of the FFIR enables commanders to husband units he may want to execute specific missions. These information requirements establish the information parameters for the remaining portions of the estimate process and the operations which follow. Therefore, CCIR has the potential to influence the estimate process the most during mission analysis. The following is a description of the CCIR products and the enhancements systems such as the MCS/P and ASAS-RWS create in relation to these products.

Product--Enhancement

CCIR. The act of developing CCIR alone does not influence the mission analysis process. The dynamic impact of CCIR on the mission analysis and the overall estimate process occurs as a result of how the CCIR is developed, maintained, and used. Currently, software capabilities of the MCS/P enable the MCS/P to assist commanders in only *maintaining* FFIR. (The battalion task force commander is able to simultaneously view a near, real time snapshot of the status of his forces in relation to the information provided by the, Gumball, Chicklet, and Eighteen Wheeler reports). As long as this data is maintained by his subordinate units, the FFIR remains valid. There are no existing software systems that help the commander manage all of his CCIR. The ability to monitor the FFIR is not a function of software design. Monitoring the FFIR is a result of manually querying the MCS/P to check the status reports. Therefore, the commander is left to filter and identify answers to his CCIR manually. There is no software database which helps the commander input his CCIR and then receive automatic, automated feedback when the CCIR is answered.

The software capabilities of the ASAS-RWS enable battalion task force commanders only to develop, maintain, and use PIR. This significant enhancement is available because of ASAS' ability to handle large volumes of messages, cross references these messages (it can query many dimensions--location, unit type, time), and provide and enemy RCP. These capabilities demonstrate that the ASAS-RWS capabilities can effect the entire PIR process.

Although these significant enhancements are available, they are limited because of the current lack of inter-operability between the MCS/P and the ASAS as described in chapter two. If the commander desires to track CCIR he must do so from two sources--the MCS/P and ASAS. These "swivel chair" operations will take time to get accustomed to before the software of both systems is integrated. Again, the commander is relegated to manual system to track and develop his PIR.

Results

The MCS/P and ASAS-RWS capabilities require a better application of CCIR. In other words, the technique of requesting the location of an entire enemy unit or formation within a given AO may not be prudent. With today's digitization, this request can be fulfilled. Using such traditional techniques within today's digital environment are dysfunctional and will lead to information overload. Additionally, these techniques can possibly overload the bandwidth capabilities of a particular organization. In today's environment, PIR will have to become focused. The focus of PIR should be on requesting only that information necessary to develop COAs and then adjust these COAs once fighting commences. A technique to accomplish this would be to query specific enemy information or enemy indicators. Examples of indicators are: Determining locations of the Forward Detachment (indicates a possible enemy strike sector), and determining locations of artillery units (indicates possible enemy center of gravity or an attack). Focusing PIR in this manner could enable commanders, staffs, and analysts access to the most critical information they need quicker. This enables them to maintain the demanding optempo Force XXI operations require. There is nothing new about the process of using indicators to collect information on an enemy's intentions. The point here is that commanders must continue to apply the basics of warfighting and understand each digital systems' capabilities. Failing to do so will result in mission failure just as it would without any digital capability.

In order to maintain FFIR with the MCS/P, techniques also have to be developed. The MCS/P does not possess alarms indicating when information (which was requested) has been received. Therefore, commanders are unable to determine the status of their units unless they manually query the Friendly Forces Status Report, Gumball, Chicklet, or Eighteen Wheeler reports within the MCS/P. Adding manual query requests during mission analysis and throughout the remainder of the estimate process to check on the FFIR enables commanders to remain abreast of their friendly situational awareness.

The optimal solution to filter information in order to prevent information overload is using a combination of manual queries, software design, and achieving inter-operability between the MCS/P and ASAS-RWS. Designing software which allows CCIR to be inputted into the MCS/P and then answered through the MCS/P via some type of automated alert system would be an optimal solution. Additionally, and most likely to occur before the design of such software, integrating the ASAS-RWS and MCS/P is necessary. This would enable commanders to track the majority of their CCIR from only one station and share this information across their battlespace.

Now that the impacts of using the CCIR as information filters during the mission analysis process has been discussed and analyzed, the impacts of using CCIR will not be re-analyzed against the other steps of the estimate process during the remaining portions of this chapter. This thesis concludes that the impacts CCIR has as manual information filters occurs primarily during the mission analysis process. Therefore, reanalyzing where and how the need to filter information might modify the remainder of the estimate process would be redundant.

The next step within the estimate process is developing courses of action (COA development). FM 101-5 (Final Draft, August 1996) outlines six steps to properly develop friendly courses of action. These steps are to: Analyze relative combat power, generate options, array initial forces, develop a scheme of maneuver, determine C2 means, and prepare COA statements and sketches. These steps permit the commander to successfully develop feasible, acceptable, and suitable COAs. The products of the COA development are the friendly COAs, sketches and statements that coincide with each COA, and the supporting tactical overlays for the COAs.[9]

COA Development--Analysis

In order to focus the analysis of the COA development process, this thesis slightly deviates from the prescribed method of analysis. The deviations include focusing the analysis of the COA development process during planning under abbreviated conditions (when the commander's and staff's time is constrained). The other deviation entails how the COA development analysis addresses the four questions outlined in chapter three. Again, these questions guide the analysis of each step of the estimate process.

First, question four "Where and how will the need to filter information modify the current estimate of the situation?" is not addressed. There is no need to address this question because filters have no direct and plausible impact during the COA development process.

Next, to focus this analysis and prevent further redundancy, the first three questions are analyzed simultaneously because of the limited amount of major enhancements the MCS/P and ASAS-RWS have on the COA development process. Additionally, more aspects of the traditional COA development process remain the same regardless of the future digital enhancements the MCS/P and ASAS-RWS provide. These conditions further support simultaneously analyzing the first three questions outlined in chapter three. The following section accomplishes this simultaneous analysis by first explaining which conditions remain the same. Then, the significant enhancements MCS/P and ASAS-RWS bring to the COA development process are discussed.

What Remains the Same

During the COA development process the most significant aspect of this process to remain the same is the *judgment* and *analysis* required to develop a COA. Commanders and staffs must still generate options. They must continue to brainstorm, debate, and hash out the details of a given friendly COA. No digital software system is designed to accomplish this. However, there is one dynamic change the synergy of the ABCS and Force XXI initiatives have on the COA development process which has a significant impact during the abbreviated planning process--the Relevant Common Picture.

Product--Enhancement

AVAILABILITY OF THE RCP DURING ABBREVIATED PLANNING. Again, it must be understood the components and dynamic effects the RCP has on the planning and decision making process during combat operations. The enemy RCP is primarily built from sensors like the JSTARS and UAVs. Because the ASAS-RWS and MCS/P lack inter-operability, the enemy RCP can only be developed from the ASAS-RWS. It cannot be shared digitally. However, the RCP can be shared by manually producing and sharing the printed product which depicts a near, real time enemy situation or event template. Currently, the impacts of possessing an enemy RCP are just beginning to be realized. The EXFOR brigade during the latest AWE rotation was one of the first Army units to experience having an enemy RCP (of a real opposing force) and apply this RCP towards the estimate process. Initial reports are favorable on using the enemy and friendly RCP's during the estimate process.

Current unscientific reports from the EXFORs AWE rotation at the NTC in March 1997 have stated that intelligence collection gathered about 90 percent of the OPFORS close fight battle picture. Intelligence collection of the OPFOR's deep fight picture was about 60 percent.[10]

The friendly RCP available on the MCS/P depicts the friendly situation of forces (down to the individual vehicle level, if necessary), terrain, and obstacles. The rate at which the friendly RCP is regenerated is a function of the desires of a given command and the amount of bandwidth available to that command.

Current unscientific reports from the EXFORs AWE rotation at the NTC have implied that friendly situational awareness has been nearly continuous throughout the rotation. The only times the EXFOR has experienced a *loss* of friendly situational awareness is when the equipment responsible for maintaining or depicting that awareness has been inoperable or when TOCs displace. When TOCs displace, the average amount of time the EXFOR was without situational awareness was estimated at forty-five minutes.[11]

So how does the RCP affect COA development? The RCP dynamically creates the conditions during the abbreviated planning process to develop one feasible, acceptable, and suitable friendly COA instead of numerous COAs. Developing a single friendly COA is possible because of the *clarity* and *certainty* of the enemy and friendly situations awareness available to commanders. (Having a near continuous picture of your own status and a 60-90 percent picture of your enemy's battle pictures is arguably quite good.)

Results

The results of developing a single COA *compresses the decision cycle* for the commander. Once a COA is developed, the commander and staff can begin to wargame this COA against *more* enemy COAs. (The time saved in developing additional friendly COAs could be spent doing this instead.) Simultaneously, the commander is afforded the opportunity to *decide earlier* on his COA and quite possibly, on the enemy COA. If the commander decides earlier, he essentially gains time to synchronize and rehearse his next fight. Additionally, the earlier the commander decides upon a friendly COA, the sooner he is able to task or retask his available reconnaissance assets to begin collecting intelligence to support his COA. With today's sensors, especially possessing the JSTARS and UAV feeds, the earlier intelligence collection begins, the earlier the commander is capable of determining enemy intentions.

None of these actions described, however, are effective unless the RCP's are shared. A possible way to influence this information sharing process is to implement RCP collaborative updates into the estimate process. Until the ASAS-RWS and MCS/P are fully integrated, collaborative RCP updates (using the inter, intra, and stovepipe techniques outlines by Mayfield) could be introduced as a technique or procedure within the COA development process. Units must, however, include how they plan on sending these RCP updates to each other as part of this technique.

Besides these enhancements, the MCS/P offers additional capabilities which influence the COA development process. They focus on the use of *tactical overlays* and conducting a *combat power analysis*.

Product--Enhancement

TACTICAL OVERLAYS AND THE COMBAT POWER ANALYSIS TOOLS. These MCS/P specific tools, although minor enhancements compared to the RCP features, enable commanders to share their tactical overlays with anyone whom they are digitally linked to. Additionally, the combat power analysis tool allows a staff to recommend a certain COA (or rule out a COA) based on the friendly to enemy force ratios. This tool assists the commander in determining the acceptability of a COA.

Results

Sharing tactical overlays as a scheme of maneuver is developed enhances the ability to share near real time information. Additionally, it gives subordinate commanders more guidance in developing their own COA. For example, if a brigade combat team (BCT) shares its tactical overlays with its battalion task forces during the abbreviated planning process, numerous C2 issues are clarified. The battalion task force commander's battle space is probably defined within these overlays. Additionally, based on these battlespace requirements, the enemy RCP, and the current status of friendly forces, task force commanders could propose or modify a recommended task organizations to the brigade commander to complete their assigned missions.

These enhancements enable the planning process to become both a top down and bottom-up process. Some possible techniques which could result from these enhancements include the need to request or share collaborative overlays. If task forces commanders possess this type of planning tool (which is extremely accurate and quickly available) their COA development and wargaming processes have the potential to become extremely focused and less time consuming. This type of COA development, especially under the abbreviated planning process, helps commanders capitalize on some of the fundamental requirements of the Force XXI battlefield--increased optempo's, the need to get into the enemy's decision cycle, and rendering speedier decisions. Now that the foundation of modifications that might occur during the mission analysis and COA development processes have been analyzed, the COA analysis process can be analyzed next.

COA Analysis (War-gaming)

The next step of the estimate process is COA Analysis (War-gaming). The COA analysis "identifies which COA accomplishes the mission with minimum casualties while best positioning the force to retain the initiative for future operations."[12] In order to develop a COA such as this, FM 101-5 (Final Draft, August 1996) identifies the following issues to guide the COA analysis process. The commander and staff must resolve these issues to wargame a COA that is executable. These issues are: How the task force can best maximize its combat power, how the task force can anticipate battlefield events, how the commander and staff can maintain an identical picture of the battle, which resources will the task force require for success, when should the force be applied, what coordinations will the task force require to synchronize the battle, and what is the most flexible COA available to the task force.

COA Analysis Products

The COA analysis process is conducted by using the war gaming technique. This technique applies a set of rules and establishes responsibilities for staff officers. An example of these rules and responsibilities state that the staff is to remain objective during the process and assigns the G/S2 duties to act as the enemy commander. All remaining staff officers assume their COA analysis roles per guidance given in chapter five of FM 101-5. The staff begins the wargaming process attempting to discern the logical sequence of operations. Abiding by this step, the staff is able to develop a detailed plan. The staff begins to create this plan as they continue to follow the eight steps of wargaming listed in FM 101-5, page 5-29. Discerning the logical sequence of events and developing a detailed plan helps the staff complete the wargaming process. The process culminates as the staff records the results of the eight-step wargaming process. These results help synchronize activities, create decision support templates (DSTs), confirm and refine event templates, and identify decision points. Therefore, these results identify the major products of the COA analysis process: Synchronization matrices, and DST's (DSTs include DPs).

COA Analysis--Analysis

Currently, a software program does not exist within the MCS/P to wargame COAs. However, capabilities of the MCS/P can influence the products of the COA analysis process.

Therefore, the focus of this analysis is to determine the impact these capabilities have on the COA analysis products already identified.

The COA analysis process is affected by only two of the four criteria (questions) outlined in chapter three. These criteria, where and how will the need to filter information and share near, real time information modify the current estimate process, are analyzed in this section. The other two criteria, where and how will compressed decision cycles and the ability to decide earlier within the decision making process modify the current estimate, are not analyzed. These criteria are not analyzed because they have no effect on the COA analysis process. Using the MCS/P and ASAS-RWS capabilities to enhance the mission analysis portion of the estimate actually creates more time within the overall estimate process. This time saved can be put to use during the critical portions of the wargaming process--synchronizing events and developing detailed plans. Therefore, it would be dysfunctional to compress the wargaming process. This rationale holds true for the criteria of deciding earlier too. Staffs and commanders, now afforded additional time to properly wargame, do not want to rush (hence decide earlier) the synchronization process. Deciding too early could result in overlooking critical information which needs to be properly wargamed.

Where and how will the need to filter information and share near, real time information modify the COA analysis portion to the current estimate process?

Product--Enhancement

SYNCHRONIZATION MATRIX AND THE DST. The significant enhancement the MCS/P and the ASAS-RWS bring to the COA analysis process is the ability to help the commander filter and re-filter his information requirements. As the estimate process matures, more information on the friendly and enemy situation accrues. As information based systems, the MCS/P and ASAS-RWS continue to produce, update, and gather more information as the estimate process matures. Just as decision support templates must be modified and adjusted to fit current operations, so does this updated information. If the commander fails to update this information he cannot properly adjust his information requirements. In other words, if commanders do not maintain and adjust filters for their PIR, they will conduct faulty collection plans. Faulty collection plans could lead to disjointed maneuver plans.

Although the filtering process relating to CCIR is vital, refiltering these information requirements becomes essential. Filtering information will be a continuous task within the ATCCS architecture. Refiltering information is important during COA analysis because it is during this process when accurate and current PIR is required to conduct wargaming. FFIR accuracy is also an important filtering concern. If the commander is unaware of his current status of friendly forces, then he could possibly wargame unsuitable COAs.

The major enhancements MCS/P and the ASAS-RWS provide the COA analysis process (regarding synchronization matrices and DSTs) is the ability to build and share these products. The MCS/P software allows commanders to build the synchronization matrix as the operations order is being written. Once complete (or during construction), the matrix can be shared. The ASAS-RWS has much of the same software capabilities to build and share the DST.[13]

Results

The synchronization matrix and DST refine and help synchronize operations. Sharing these products with subordinate and higher units, especially during the COA analysis process, helps eliminate uncertainty as to how the plan is to be executed. From the perspective of the division or brigade commander, the faster these products are given to the battalion task force, the faster the task force is able to refine and begin to rehearse its plan. This type of information sharing should allow subordinate units the amount of time they truly need to plan operations, especially during the abbreviated planning process. Brigade and battalion staffs should create techniques and possess the awareness to ensure these products are shared in a timely manner, now that the capability to share these products is available. These information sharing techniques, however, should account for risks involved in sharing information to enhance collaborative planning. Before collaborative DSTs or synchronization matrices are digitally sent, subordinate units must know the degree of planning they can accomplish from the updates.

Although not directly related to the DST and synchronization matrix products, the impacts of the RCP on the COA analysis process needs to be addressed. Besides filtering and refiltering the CCIR during the COA analysis process, the enemy RCP also requires filtering. Filtering the enemy RCP entails setting parameters on those levels of enemy forces (within each BOS) which the commander desires to view as part of his RCP. For example, the MCS/P possesses a filtering function that allows operators to set the level of units they choose to have appear on the MCS/P screen. The level deviates from squad through corps.

Filtering the enemy RCP allows the commander to build the RCP he requires in order to analyze and wargame the friendly enemy COA. Filtering prevents too many enemy units from cluttering the RCP. Filtering the enemy RCP during the COA analysis process allows the enemy situation to have developed over a period of time. Additionally, those intelligence collection tasks that commenced during mission analysis most likely are beginning to confirm or deny a specific enemy COA.[14]

Some examples of filters the commander may choose to place on the RCP are: Down to what level (platoon, company) will the commander view enemy icons? What level does he desire to view friendly icons? What particular patterns of operations is the enemy showing? Another filter could involve the RCP depicting the specific Friendly Forces Status Reports the commander's desires, and how often he desires to see them.[15]

The RCP and its impacts upon the COA analysis are clearly dynamic. However, they are also somewhat obvious. Implementing the RCP and its capabilities requires developing appropriate techniques and procedures (adjustments) to capitalize on the abilities of the ATCCS systems.

COA Comparison and Approval

The last step of the estimate process is to compare COAs against each other (if more than one is developed) and submit them for approval to the commander. The COA comparison and approval steps do not possess any subordinate products. The COA comparison and approval process entails having the staff make a recommendation on the most supportable COA to the commander. The commander then decides upon which COA to select. Therefore, there are no enhancements the MCS/P or ASAS-RWS can provide for this process. However, as a result of the numerous enhancements already discussed, especially the ability to maintain and share a Relevant Common Picture of ones battlespace, the MCS/P and ASAS-RWS capabilities set the conditions for the comparison and approval process to become swift and decisive. Commanders are now armed with a heightened degree of clarity and certainty concerning conditions of their battlespace, the enemy's disposition, and the ability to decide upon the best course of action to execute.

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[1]U.S. Army, FM 101-5, "Staff Organization and Operations" (Final Draft) (Washington, DC: Headquarters, Department of the Army, August 1996), 5-11, 5-12.

[2]Ibid., 5-13.

[3]Ibid., 5-14.

[4]U. S. Army Military Intelligence School, "How All Source Enhances IPB," (Training notes from the All Source Analysis System Training Package, Ft. Huachuca, AZ, January 1996).

[5]Ibid.

[6]Ibid.

[7]Ibid.

[8] U.S. Army Training, Plans, and Integration Office (TPIO), "Common Core Functionality for the Maneuver Control System/Phoenix," (Ft. Leavenworth, KS: TRADOC Plans and Integration Office, October 96).

[9]FM 101-5, (Final Draft, August 1996), 5-18--5-21.

[10]David S. Nichols, "Chapter 5--The Earth Moved For Me," (Ft. Irwin, CA: National Training Center, March 1997), accessed from the Command and General Staff Colleges' student electronic mail account, user i.d. #@leav-emh1.army.mil, 3-4.

[11]David S. Nichols, "Chapter 6--Into the Valley of Death," (Ft. Irwin, CA: National Training Center, March 1997), accessed from the Command and General Staff Colleges' student electronic mail account, user i.d. #@leav-emh1.army.mil, 3-4.

[12]FM 101-5 (Final Draft, August 1996), 5-26, 5-27.

[13]COL Douglas Tystad, "Relevant Common Picture Guidance," Commander's intent briefing presented to the Mobile Strike Force Staff, Ft. Leavenworth, KS, 20 March 1997.

[14]Tystad, 20 March 1997.

[15]Ibid.

CHAPTER 5

CONCLUSIONS

This thesis has screened a significant amount of Force XXI doctrine pertaining to the projected role of the estimate process within Force XXI operations. Additionally, this thesis reviewed the commander's role in conducting the estimate process during offensive operations using the capabilities of the MCS/P and ASAS-RWS. Specifically, this thesis has scrutinized the impact these systems have upon the significant products of the estimate process. This thesis concludes that these systems impact the ability of the commander to make rapid and accurate assessments to develop and deliver tactical decisions.

It is clear that U.S. Army doctrine, including the evolving doctrine for Force XXI operations pertaining to the use of the estimate with the ATCCS, falls short of meeting the requirements for the future battlefield. Additionally, unless current software operability problems are resolved between systems within the ATCCS, the lack of possessing software interoperability will complicate the issue of the Army's doctrinal shortcomings.

Significant Conclusions

Research on whether the MCS/P and ASAS-RWS cause modifications on the estimate process identifies four significant conclusions. These conclusions are:

1. The Estimate of the Situation as outlined in FM 101-5 (Final Draft, 1996), is a sound and proven decision making model.

2. After a thorough review of the historical and doctrinal literature pertaining to the estimate process and Force XXI operations, evidence is available that supports the development of new Force XXI decision making requirements/capabilities.

3. The capabilities of the MCS/P and ASAS-RWS create modifications on the mission analysis, course of action development, and course of action analysis steps of the estimate process. Both systems were found not to modify the course of action comparison or approval step.

4. Digital systems like the MCS/P and ASAS-RWS enable commanders to possess more clarity and certainty to make tactical decisions.

The following sections comment on these conclusions and make recommendations based upon the analysis done in the previous chapter.

The Estimate of the Situation--Sound and Proven

The current estimate of the situation is a sound and proven methodology to develop tactical decisions. Research has shown that the estimate process, in general, has provided the means to develop decisions throughout the range of military operations. The estimate also has withstood decades of doctrinal, equipment, organizational, and technological changes. As this thesis was being completed, the estimate was enduring its most significant challenge-application within the Force XXI environment during the ongoing AWE at the National Training Center. Although the Army is changing its C2 methodology by implementing the ATTCS, the Army has decided to maintain the current estimate process as its decision making model during the AWE. Final After Action Reviews (AARS) are yet to be written on the performance of the estimate process within the ATCCS systems as a result of the March 1997 AWE rotation. Regardless, this thesis concludes the estimate will remain as the Army's decision making model.

Trends and Force XXI Decision Making

This thesis concludes, as a result of conducting a thorough historical and doctrinal review, that evidence is available that supports the development of new Force XXI decision making requirements/capabilities. These requirements, identified in chapter two, are:

1. The MCS/P and ASAS-RWS provide an unparalleled degree of situational awareness for the Force XXI commander and staff. This situational awareness can be displayed visually in a near, real time manner via the Relevant Common Picture (RCP).

2. Force XXI commanders are able to operate at an increased optempo because of a combination of Force XXI battlefield demands and the amount and clarity of information they possess due to digitization.

3. An increased optempo requires Force XXI commanders to execute the decision making process more often and possibly quicker than contemporary commanders.

4. Access to near, real time information in the form of a RCP gives Force XXI commanders and staffs the ability to decide earlier in the MDMP.

5. Requirements one through four create the conditions to compress the decision making process.

6. Information sharing is easier to accomplish (horizontally and vertically among like and higher and/or subordinate commands and staffs). Information sharing significantly contributes to accomplishing the estimate process using the MCS/P and ASAS-RWS.

7. Filtering information during the estimate process is more important within the ATCCS than it was under the traditional C2 process. Filtering is now necessary to prevent commanders and staffs from becoming overloaded with information.

8. Commanders and staffs can execute the estimate process with a greater degree of clarity and certainty.

These new decision making requirements/capabilities form the basis of determining exactly where and how modifications to the estimate process would occur as a result of the capabilities of the MCS/P and ASAS-RWS. These requirements/capabilities, however, are a result of current Force XXI doctrine. They demonstrate the different battlefield conditions which exist because of the conditions systems like the MCS/P and ASAS-RWS create: Enhanced clarity of the receipt and transmission of information and more certainty that tactical decisions made are accurate because of the possession of increased situational awareness. The essence of change between the Army's traditional C2 system and its new C2 system (ABCS) is the possession of both clarity and certainty.

Modifications Occur Throughout the Estimate

As a result of analyzing the Force XXI decision making requirements against the capabilities of the MCS/P and ASAS-RWS, modifications occur throughout the estimate process except on the course of action comparison and approval step. The largest amount of modifications occur during the mission analysis process. Additionally, the analysis yields some specific themes as a result of the impacts the MCS/P and ASAS-RWS have upon the Force XXI decision making criteria.

The largest impacts occur during the mission analysis process for two reasons. First, the mission analysis, if done correctly, produces more products than any other step of the estimate process. Since there are more products, this step naturally gains the most from the enhancements the MCS/P and ASAS-RWS offers. One must also consider the broad scope of the mission analysis. Staffs commence planning with numerous unknowns. The staff's goal is to begin the process of answering these unknowns by conducting the mission analysis. This initial analysis involves each staff officer's own analysis of his situation compared to the enemy's. Not only must the process span across the entire staff, but the process actually starts from scratch (especially under deliberate planning conditions). For example, at the battalion TF level, missions received from brigade are literally torn apart and are put back together starting with the mission analysis process. The other reason why the largest impacts occur during mission analysis is due to the software capabilities of the MCS/P and ASAS-RWS. The design of these systems enable major portions of the mission analysis to become automated, digitally transmitted, and received. Additionally, the design of the ATCCS network allows enormous amounts of information sharing to occur. Both of these characteristics of the MCS/P and ASAS-RWS enhance planners to execute the mission analysis more efficiently.

The analysis also identified some common themes as a result of the modifications. These themes centered around implementing *collaboration* as a planning technique and the use and benefits of *possessing a RCP*. Collaboration, collaborative updates, and collaborative planning were all common themes as a result of the analysis. Why? Mainly because the ATCCS is an information based system. Collaboration, or the act of aggressively (proactively) sharing critical combat information, is a technique to capitalize on the digital system's abilities to produce and disseminate information. Additionally, collaboration, used in conjunctions with parallel planning, makes information sharing even more effective. The significant conclusion this research yields is that an effective abbreviated planning process within the ATCCS architecture should use the collaborative techniques described in chapter four.

Another common theme within the analysis was the impact the RCP has on the abbreviated planning process. Essentially, this research concludes that the RCP enables the commander to develop, synchronize, and wargame one friendly COA instead of attempting to develop numerous COAs. The RCP provides enough clarity and certainty to accomplish this. Therefore, this research concludes that the RCP has the most effect on the COA development process under abbreviated planning conditions. The commander, afforded the clarity and certainty from the RCP, can effectively launch into developing a single COA. He then can wargame and synchronize this single COA against more enemy COAs instead of spending time developing additional friendly COAs.

Another theme which began to develop during the later stages of the analysis concerning the use of the RCP was filtering information. Although filtering information was highlighted as an important step during mission analysis, it was recognized that re-filtering information requirements (especially the CCIR) becomes necessary throughout the entire estimate process. This thesis concludes that commanders and staffs have to filter and re-filter information throughout the estimate process. Re-filtering information is essential during the COA development and analysis processes to maintain a dynamic RCP and information dominance.

Digital Systems as Enablers

The remaining significant conclusion this thesis identifies is that the MCS/P and ASAS-RWS act as decision making enablers. These systems automate, digitize, and facilitate the MDMP. However, these systems are not a panacea to executing proper analysis to develop feasible, acceptable, and suitable COAs. The significant conclusion here is that humans still have to apply judgment and analysis towards the MDMP. No system can provide these elements of proper decision making.

The MCS/P and ASAS-RWS are extremely adaptable to the needs of the decision maker during the MDMP. In order for the decision maker to capitalize on the abilities of these systems, however, he or she must understand two things: Each systems capabilities and the current MDMP. Commanders and staffs cannot become techno-phobic. They must aggressively learn to employ these systems' capabilities to enhance the Army's war fighting methodology. They must become intimately familiar with each systems' capabilities. Additionally, today's Force XXI environment demands that commanders understand how to adapt the MDMP to meet their decision making needs. This entails a thorough understanding of the products and process of the current MDMP. Commanders who choose to dislocate themselves from thoroughly analyzing and visualizing the battlefield will become even more displaced once the battle commences.

Another conclusion this thesis identifies regarding the abilities of the MCS/P and the ASAS-RWS to act as enablers is that both systems seem to work best in an abbreviated planning environment. Supporting this conclusion is evidence that the systems create significant amounts of clarity and certainty within a given battlespace. Simultaneously, these systems can produce, share, and disseminate enormous amounts of information. Therefore, these systems, along with the remaining ATCCS systems, seem to warrant use within an abbreviated planning process.

Recommendations

The analysis and conclusions of this research produce four recommendations. These recommendations include: Keeping the current FM 101-5 (Final Draft, August 1996) in draft until all division level AWEs are completed, convincing doctrine writers to think out of the box before finalizing further Force XXI decision making doctrine, adopting a flexible abbreviated decision making process to suit the needs of the Force XXI environment, and reviewing the 1997 Mobile Strike Force planning methodology as a possible solution to implementing a suitable decision making process within the ATCCS. Whenever the next draft of FM 101-5 is written, it should account for the capabilities all of the ATCCS systems provide. This thesis has demonstrated that the MCS/P and ASAS-RWS affect tactical decision making . Most likely, other ATCCS will have the same effect. Failing to develop doctrine which supports our new capabilities will cause enormous frustration for the Army's field commanders because they will have no azimuth to direct their application of the ATCCS. The Army's doctrine writers should begin to shape this azimuth now.

Keeping the Current FM 101-5 in Draft

Doctrine writers should have a clearer picture the impacts ATCCS will have on the MDMP upon completion of the EXFOR AWE rotation at the NTC. They should have an even clearer picture once the division AWE is completed in late 1997 or early 1998. Publishing the current final draft *before* these capstone AWEs are completed would be dysfunctional to the Force XXI process. The Army needs to conduct the complete AAR process and fully understand how it needs to adjust the current MDMP to suit the needs of the Force XXI commander. Additionally, the Army should accept or reject the Force XXI decision making guidelines offered by this thesis. These guidelines set the foundation to understand exactly where and how modifications to the MDMP could occur. If these guidelines are rejected, the Army should identify its own guidelines before adjusting the MDMP any further.

Thinking Out of the Box

The revolution and evolution in military affairs, especially within the C2 process, requires the Army to adjust its current decision making methodology. The adjustments, however, are not drastic. This thesis simply recommends that the Army retain its current estimate of the situation process but add technical and procedural adjustments to the process accounting for the unique capabilities of the ATCCS (especially the MCS/P and ASAS-RWS). The techniques and procedures within this thesis are a foundation in beginning to determine which techniques or procedures are actually necessary. Once the Army gathers the lessons learned from the previous AWEs, it will be able to determine which techniques and procedures are absolutely necessary.

Adopt an Abbreviated Planning Process

FM 101-5 (Final Draft, August 1996) is very prescriptive in its application of the MDMP. Force XXI operations, however, require flexible, versatile warriors capable of running a "run and shoot" type of operation. Therefore, this thesis recommends FM 101-5 include an abbreviated planning process which can capitalize on the MCS/P and ASAS-RWS capabilities. This process needs to account for the ability to share information, sending collaborative updates, and using the RCP. Any abbreviated planning process adopted, however, should consider the impacts that possessing clarity and certainty have on developing a COA. In order to keep pace with the optempo demands of Force XXI operations, the traditional approach to COA development (that commanders *must* execute every step of the estimate process) may not be a suitable solution.

Mobile Strike Force Planning Methodology

The final recommendation this thesis offers is to review the 1997 Mobile Strike Force's (MSF) planning model. This model retains the current MDMP methodology but implements adjustments which capitalize on the benefits the ATCCS offers. The specific adjustments the MSF model makes are to use collaborative updates, aggressively execute the parallel planning process, and implement the use and benefits of the RCP. As these recommendations are being written, the MSF continues to plan for the upcoming 1997 Prairie Warrior. When Prairie Warrior '97 is completed, the MSF will have executed and refined their initial planning process. The final MSF product should offer more insights into how successful the use of collaboration, parallel planning, and the RCP were during the planning and execution of operations.

Recommendations for Further Study

This thesis has two recommendations for further study. The first recommendation deals with the implications the Naturalistic Decision Making Process (Recognition Prime) could have on decision making within the Force XXI environment.[1] During the conduct of research for this thesis, various reports from the Army Research Institute (ARI) and other research material

(McMullin) were reviewed which talked about using the Naturalistic approach to decision making as an alternative to the traditional MDMP. Naturalistic decision making (NDM) is designed around how humans naturally make decisions. NDM is similar to the "expert model" from Lord and Maher's research, Leadership and Information Processing, Linking Perceptions and Performances discussed in chapter two. NDM is a flexible, quick, and effective way to develop decisions. Although there are risks associated with NDM (the validity of the decision depends upon the level of expertise the decision maker possesses), further study of this decision making process could yield applications to the Force XXI decision making environment.

The other recommendation for further study relates to the use and implementation of CCIR and information filters within the estimate process. Early into the development of chapters two and three of this thesis, it was realized that developing and maintaining CCIR and information filters would play an increasingly important role in developing tactical decisions within the ATCCS. This realization occurred because of the amount of information the ATCCS is capable of producing. Research identified that information overload was an associated risk of using digital systems. In order to reduce this risk, this thesis identified the need for manual and software information filters. Since there were no known software information or CCIR filters, this thesis focused on the use of manual filters.

A completely unexpected find was the Army's recent consideration of using software to filter information. The software system, known as Know-Bots, is designed to search existing information data bases to gather answers to the CCIR. The software design simply allows the CCIR to be answered. These answers are then digitally transferred to the commander who nominated these information requirements.[2] Currently, the system remains in its conceptual stage until the Department of Defense authorizes the commercial company in charge of Know-Bots to develop a prototype digital data manager.

This thesis supports the concept of developing software to help commanders filter information to answer ~~his~~ their CCIR. The Know-Bots digital manager would provide three additional benefits to using the ATCCS. First, Know-Bots would help reduce the risk of information overload. If the commander tailors his CCIR accordingly (and does not ask for too much information), he could feasibly receive automated answers to his CCIR. Second, Know-Bots reduces the need for manual queries. This saves time and enables staff officers to focus on analyzing data instead of inputting or extracting it. The other possible benefit Know-Bots could provide would be its ability to contribute to the refinement of the IPB process. Essentially, Know-Bots possess the capabilities which can focus the intelligence collection plan. Currently, commanders who share the same battle space normally possess similar PIRs. Therefore, there is a great deal of redundancy of effort in answering these PIRs. With Know-Bots, the Army could reduce this redundancy. If a PIR is answered (and like PIR were known for a given battle space), this PIR could be immediately disseminated to all commanders within the same battle space. This enables commanders to refocus their PIR and prevents collection assets from being wasted or even put at risk by attempting to answer similar PIR. This methodology could even reduce the need for units to possess numerous UAV or other mechanical and expensive collection assets within a given battle space. This methodology would then promote asset sharing as well as intelligence sharing.

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[1]J.J. Follesen, Overview of Army Tactical Planning Performance Research, (Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA, 1993), 3.

[2]James R. Fricke, "Implementation of the 'Know-Bots' for the Tactical Internet," Volume I Technical Proposal (Falls Church, VA, Mysteck Associates, 8 August 1996), 1-1--1-3.

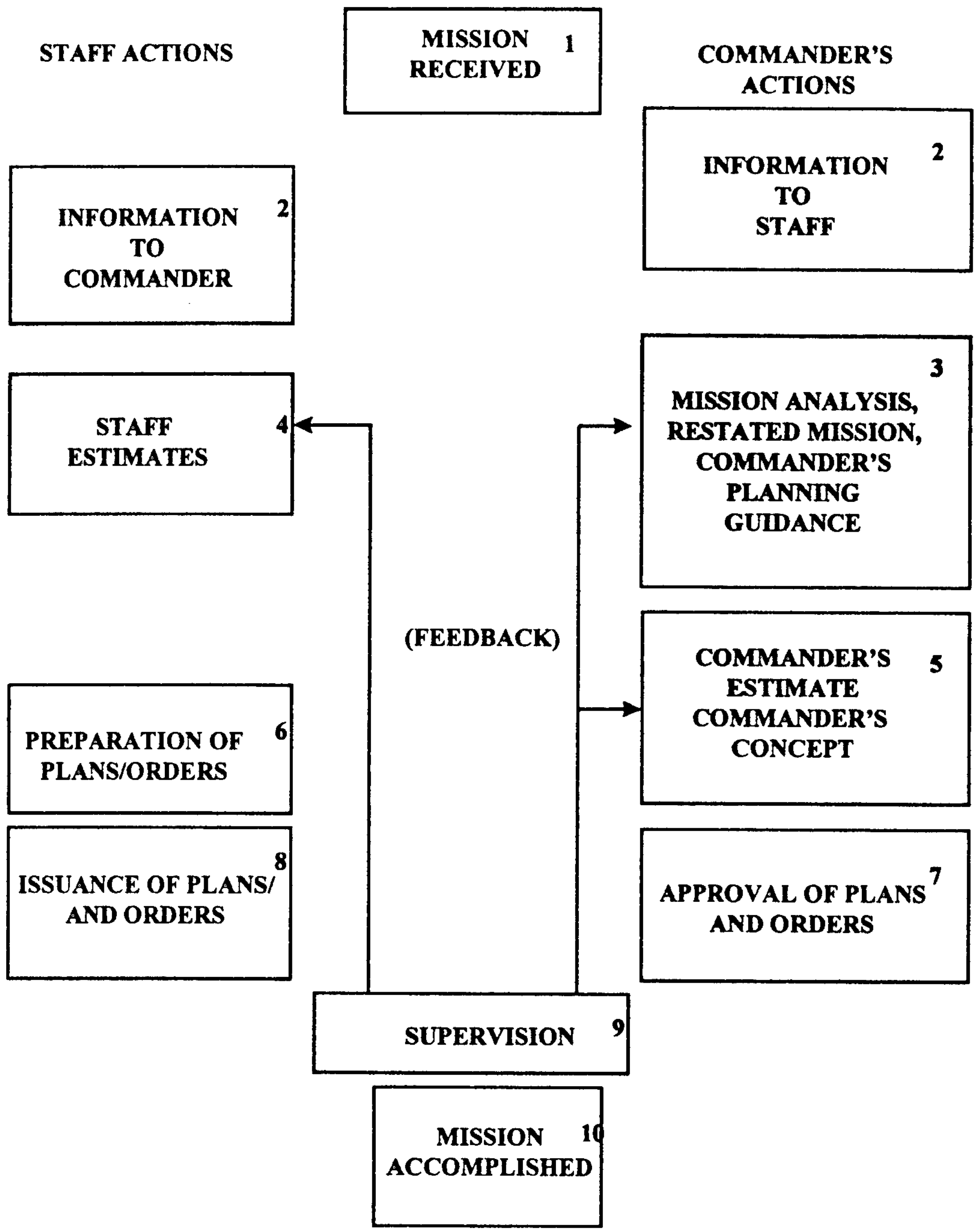

Fig. 1. Military Decision Making Process. Source: U.S. Army, FM 7-20, The Infantry Battalion (Washington, DC: Headquarters, Department of the Army, 1991, 2-7.

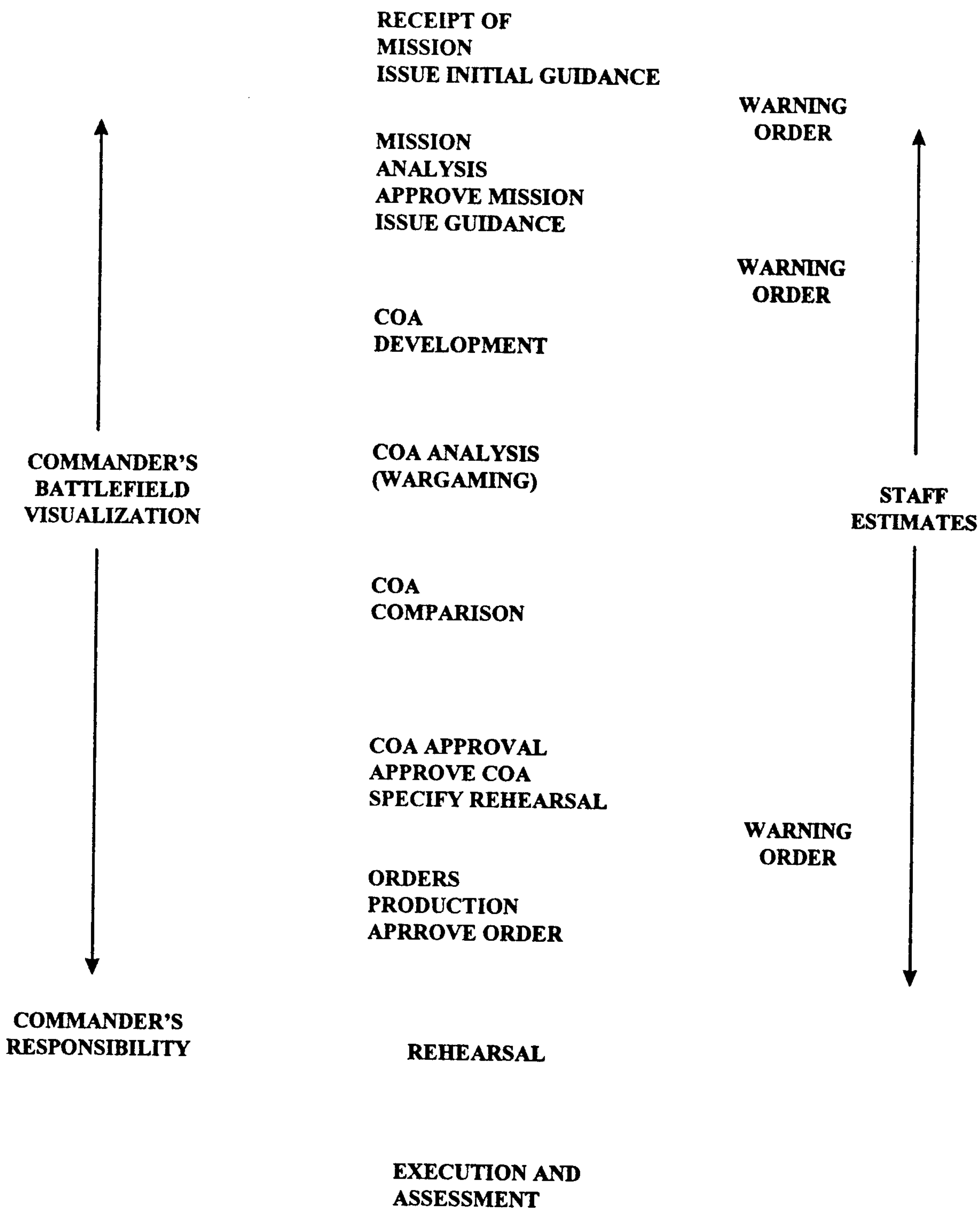

Fig. 2. Military Decision Making Process. Source: U.S. Army, FM 101-5 (Final Draft), "Staff Organizations and Operations" (Ft. Leavenworth, KS: U.S. Army Command and General Staff College, August 1996), 5-7.

STEP 1. RECEIVE THE MISSION

STEP 2. ANALYZE THE MISSION

STEP 3. DEVELOP THE COURSE OF ACTION

STEP 4. ANALYZE THE COURSE OF ACTION

STEP 5. COMPARE THE COURSE OF ACTION

STEP 6. APPROVE THE COURSE OF ACTION

STEP 7. PRODUCE THE ORDERS

Fig. 3. The Steps in the Military Decision Making Process. Source: U.S. Army, FM 101-5 (Final Draft), "Staff Organizations and Operations," (Ft. Leavenworth, KS: U.S Army Command and General Staff College, August 1996), 5-6.

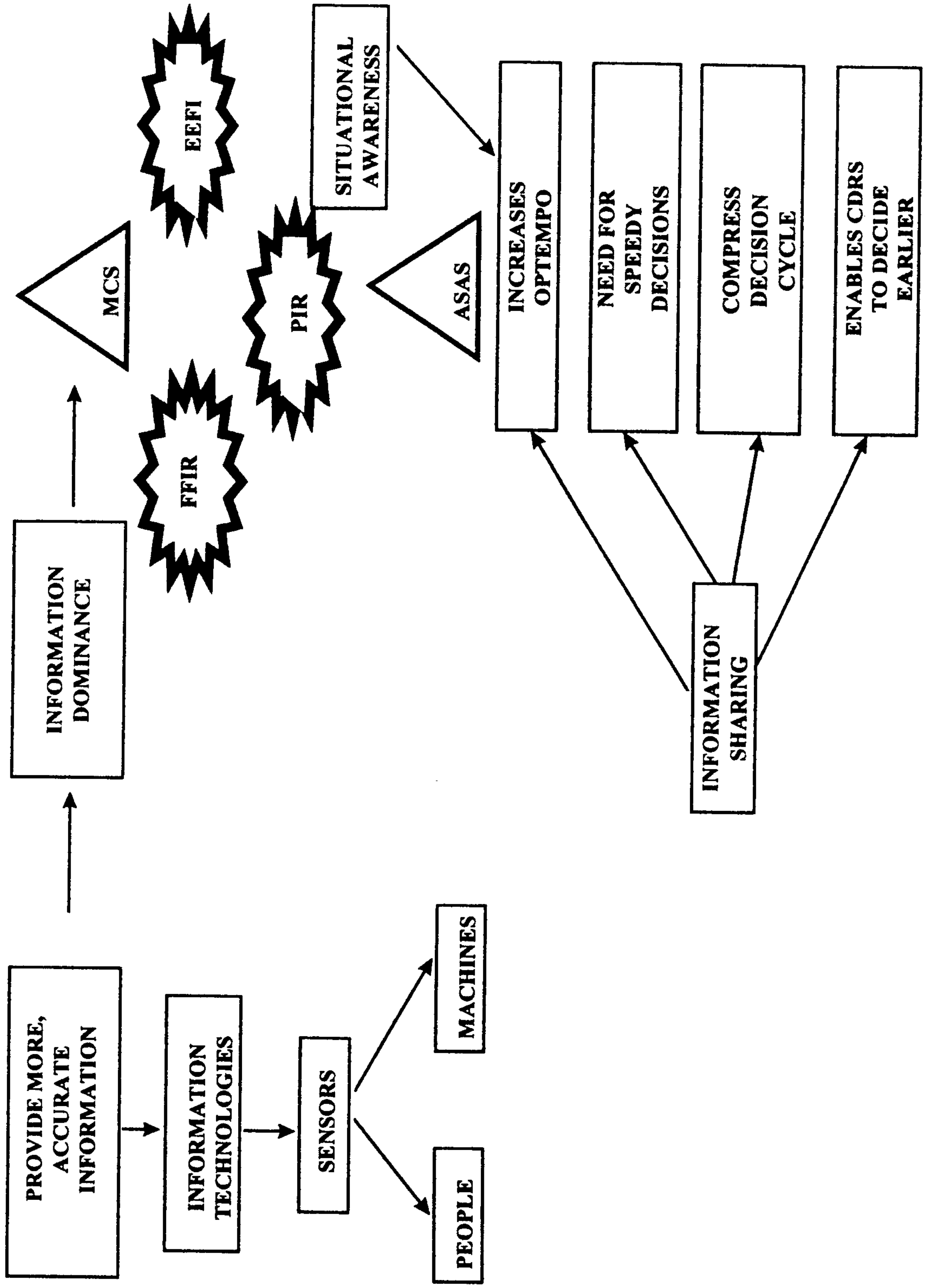

Fig. 4. The Link Between Information Technologies and Force XXI Decision Making Criteria.

FM 101-5, 1932	FM 101-5, 1984
1. MISSION 2. OPPOSING FORCES a. Enemy forces b. Own forces c. Relative combat strength 3. ENEMY SITUATION a. Plans open to enemy b. Analysis of enemy's plans c. Enemy's probable intentions 4. OWN SITUATION a. Plans open to you b. Analysis of plans 5. DECISION	1. MISSION 2. SITUATION AND COA a. Considerations (1) Area of Operations (a) Weather (b) Terrain (c) Other factors (2) Enemy Situation (a) Disposition (b) Composition (c) Strength, Reinforcements (d) Significant activity (e) Peculiarities and weaknesses (3) Analysis of COA (a) Disposition (b) Composition (c) Strength (d) Significant activity (e) Peculiarities 3. ANALYSIS OF COA (a) List of enemy capabilities (b) Analysis of each COA vs. Enemy capability 4. COMPARISON OF COA (a) List advantages & disadvantages of each COA (b) Conclusion of COA 5. DECISION (Recommendation)

Fig. 5. Format of the Estimate. Source: Rex Michel, Historical Development of the Estimate of the Situation, (Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 1993), 5.

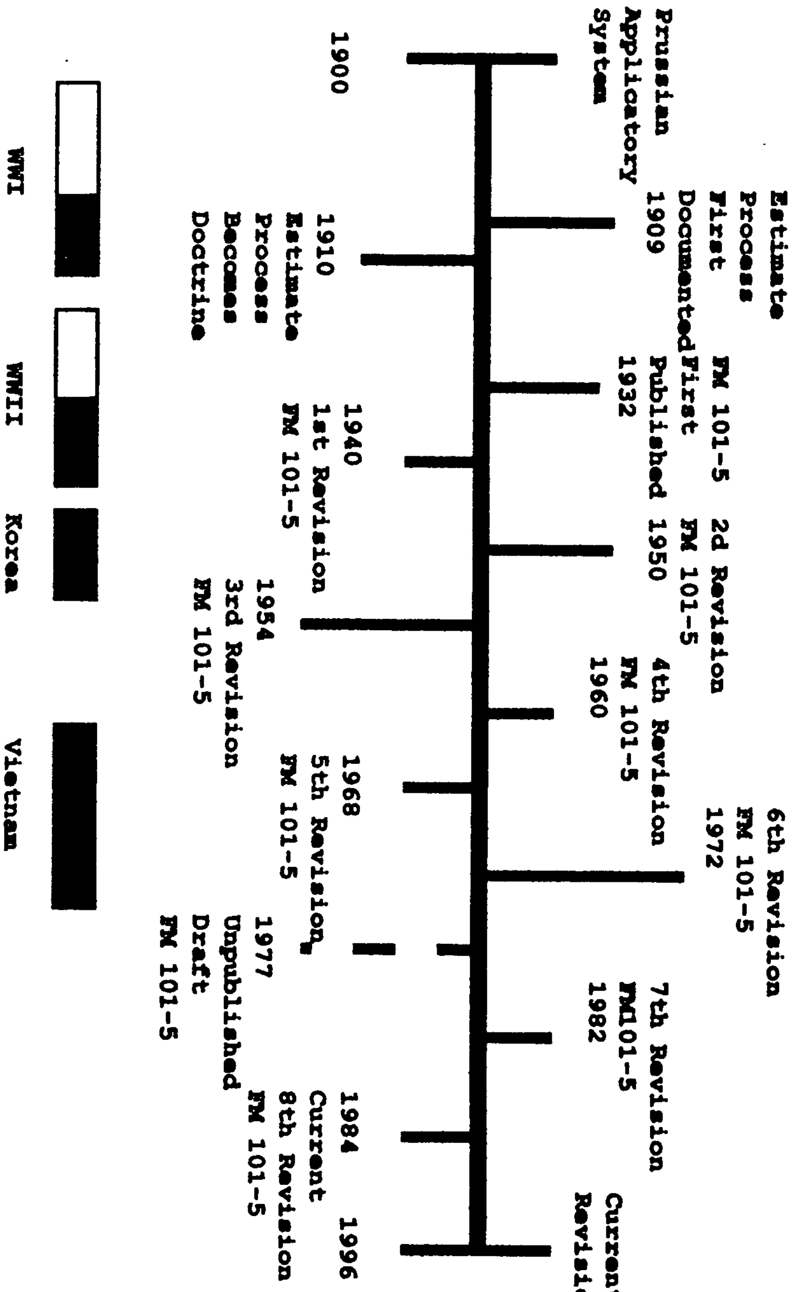

Fig. 6. History of the Estimate. Source: Rex Michel, Historical Development of the Estimate of the Situation, (Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences, 1993), 2.

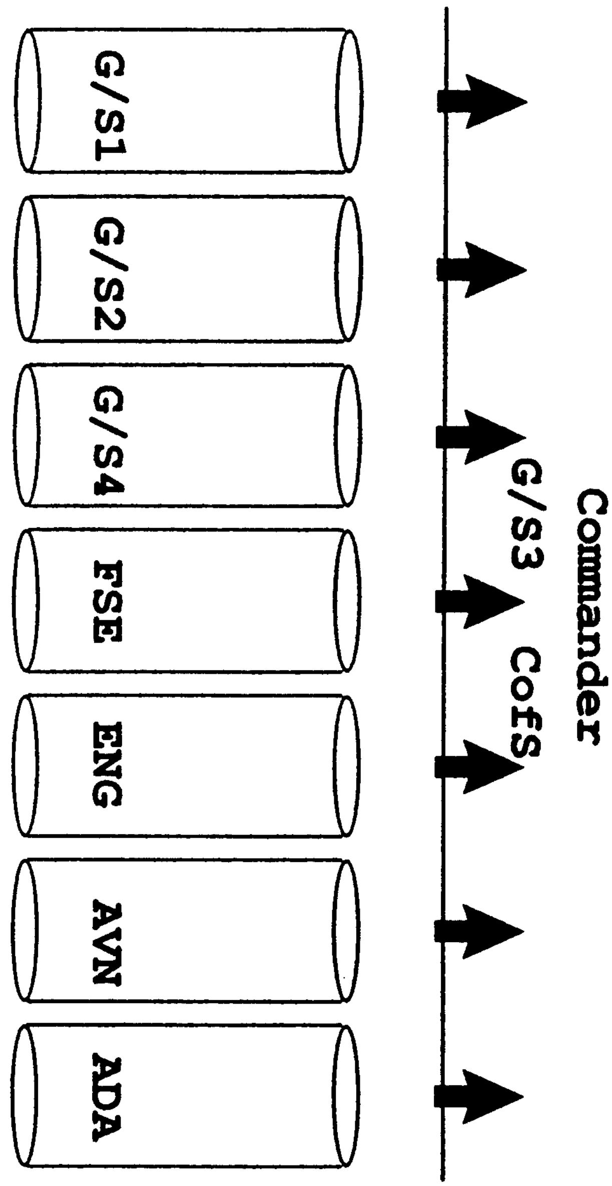

Fig. 7. The Stove Piped System. Source: U.S. Army, Battle Command Battle Lab Briefing Slides, Battle Command, Where Tomorrow's Victories Begin, (Ft. Leavenworth, KS, October 1996.)

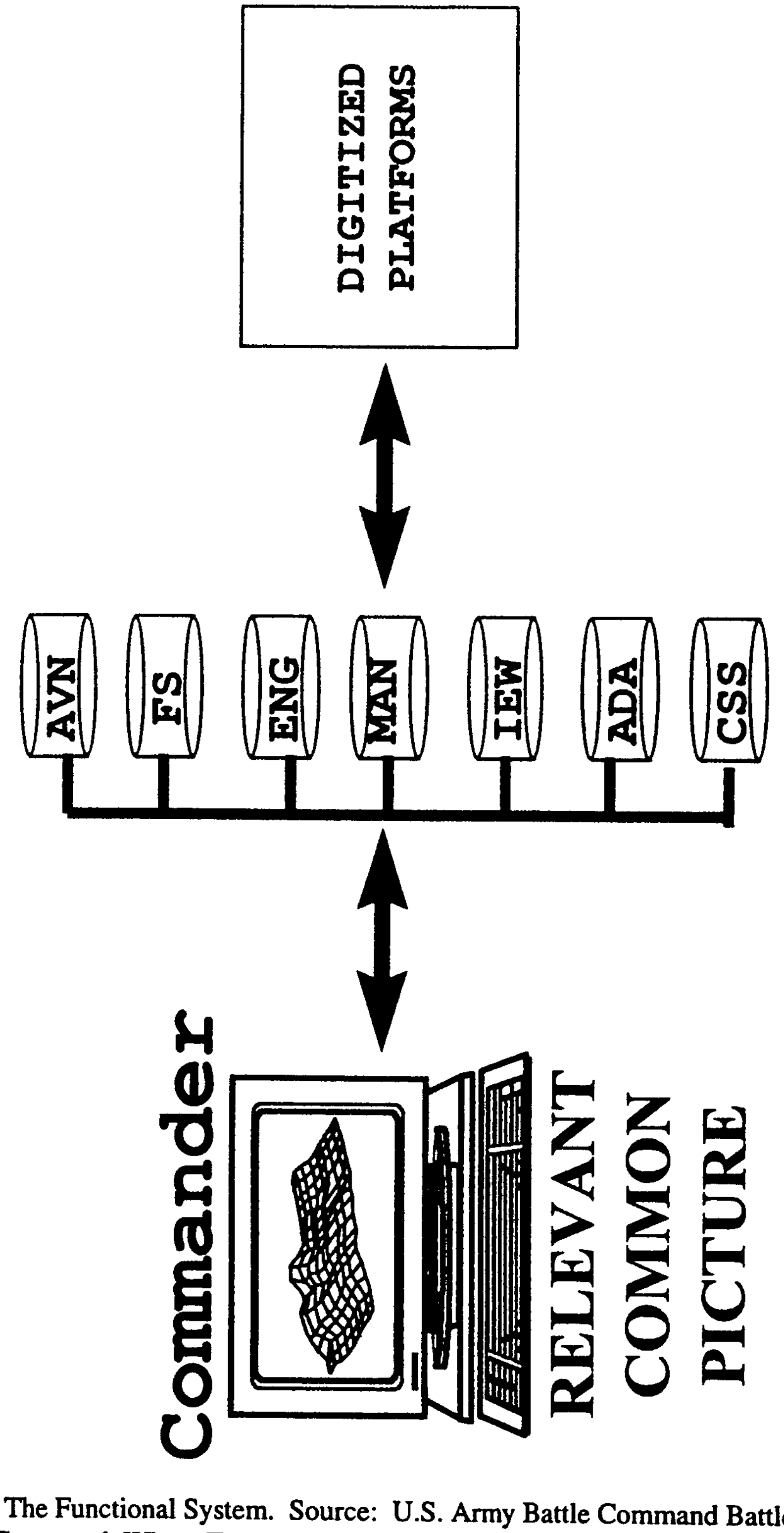

Fig. 8. The Functional System. Source: U.S. Army Battle Command Battle Lab Briefing Slides, Battle Command, Where Tomorrow's Victories Begin, (Ft. Leavenworth, KS, October 1996.)

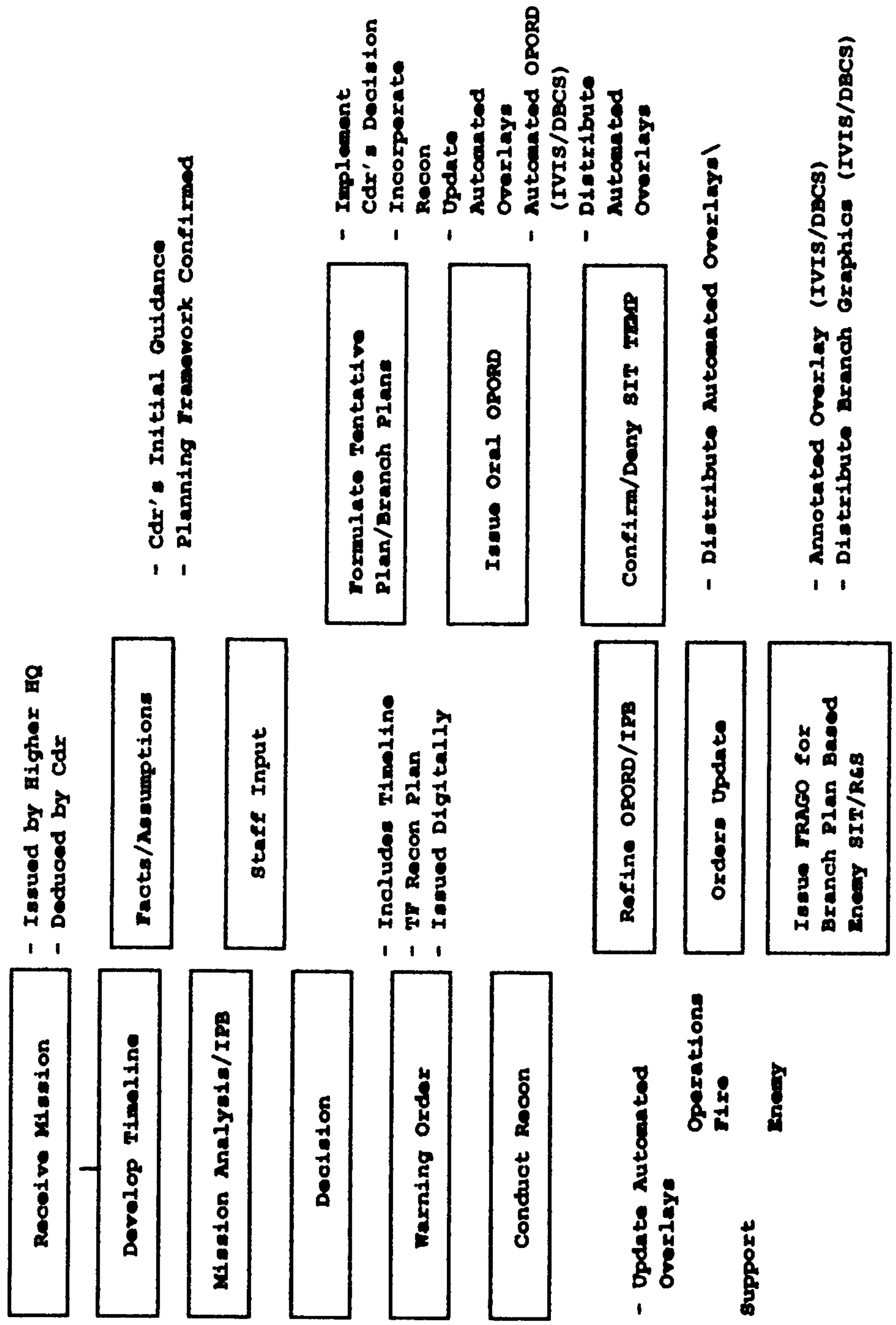

Fig. 9. Abbreviated Decision Making Process. Source: U.S. Army, FSKM 71-2-1, "The Digitized Battalion Task Force," (Ft. Knox, KY: U.S. Armor School, December 1995), 2-17.

1. REVIEW THE HIGHER HEADQUARTERS ORDER.
2. CONDUCT INITIAL INTELLIGENCE PREPARATION OF THE BATTLEFIELD.
3. DETERMINE SPECIFIED, IMPLIED, AND ESSENTIAL TASKS.
4. DETERMINE THE AREA OF INTEREST.
5. REVIEW AVAILABLE ASSETS.
6. DETERMINE CONSTRAINTS.
7. IDENTIFY CRITICAL FACTS AND ASSUMPTIONS.
8. CONDUCT RISK ASSESSMENT.
9. DETERMINE INITAL COMMANDER'S CRITICAL INFORMATION REQUIREMENTS.
10. DETERMINE THE INITIAL RECONNAISSANCE PLAN.
11. PLAN USE OF AVAILABLE TIME.
12. WRITE THE RESTATED MISSION.
13. CONDUCT A MISSION ANALYSIS BRIEFING.
14. APPROVE THE RESTATED MISSION.
15. DEVELOP THE COMMANDER'S INTENT.
16. ISSUE THE COMMANDER'S GUIDANCE.
17. ISSUE A WARNING ORDER.
18. REVEIW FACTS AND ASSUMPTIONS.

Fig. 10. The Mission Analysis Process. Source: U.S. Army FM 101-5 (Final Draft), "Staff Organizations and Operations," (Ft. Leavenworth, KS: U.S. Army Command and General Staff College, August 1996), 5-10.

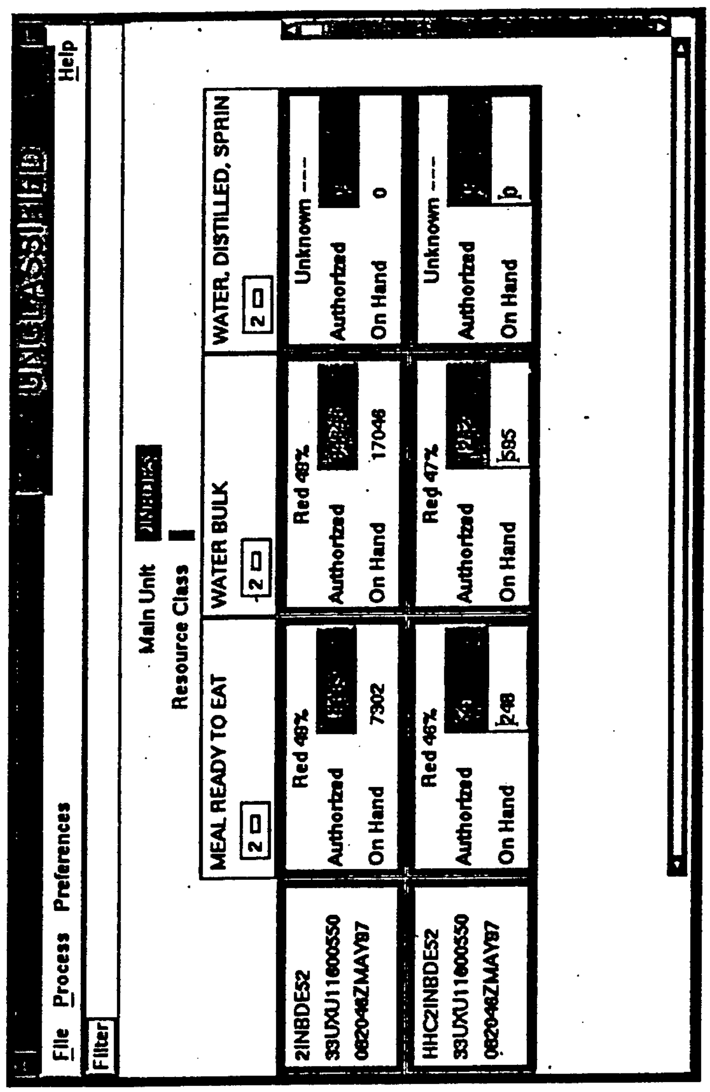

Fig. 11. Chicklet Report. Source: U.S. Army Command and General Staff College Prairie Warrior Exercise, (Ft. Leavenworth, KS: Mobile Strike Force Maneuver Control System/ Phoenix, 1997).

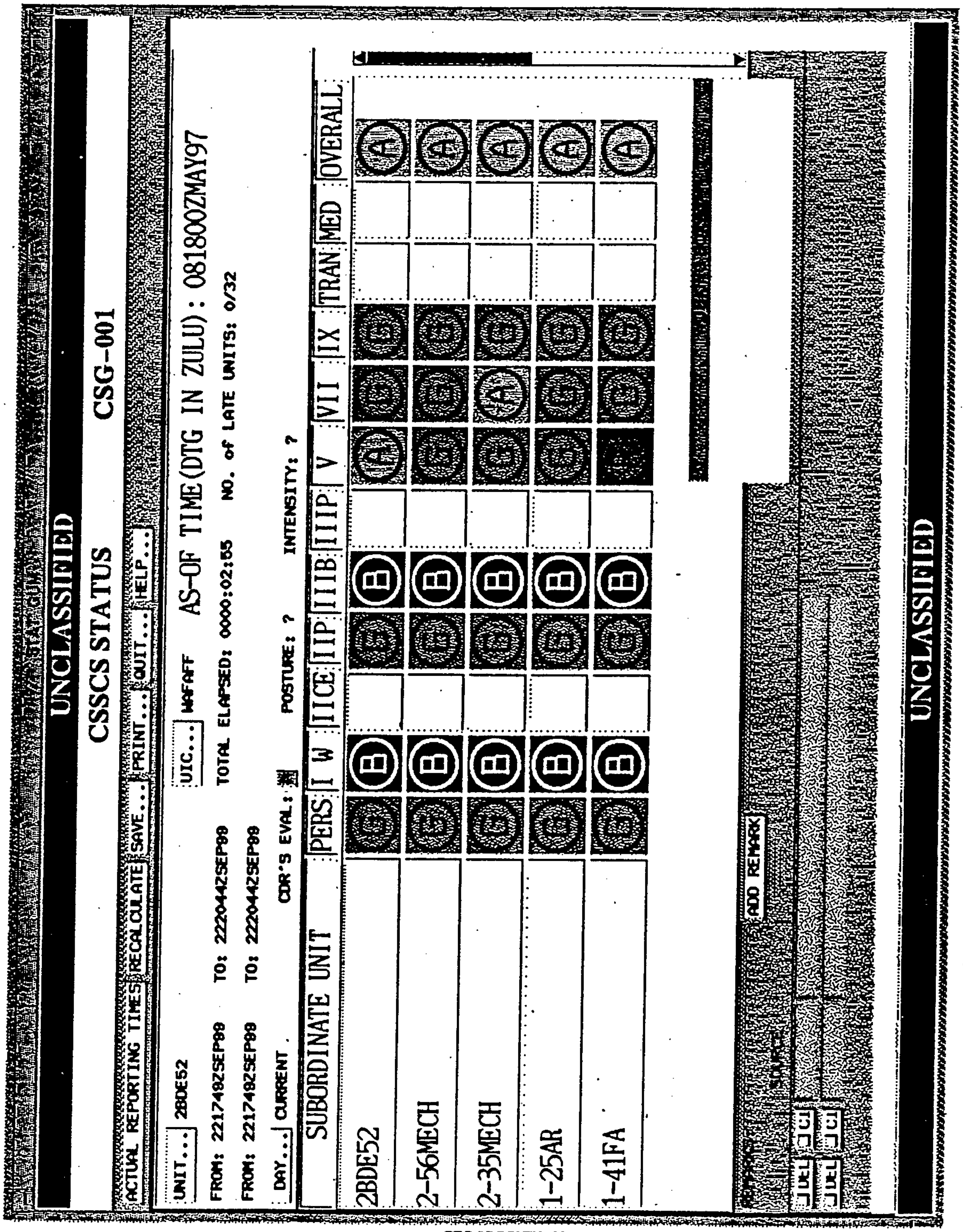

Fig. 12. Gumball Report. Source: U.S. Army Command and General Staff College Prairie Warrior Exercise, (Ft. Leavenworth, KS: Mobile Strike Force Maneuver Control System/Phoenix, 1997.)

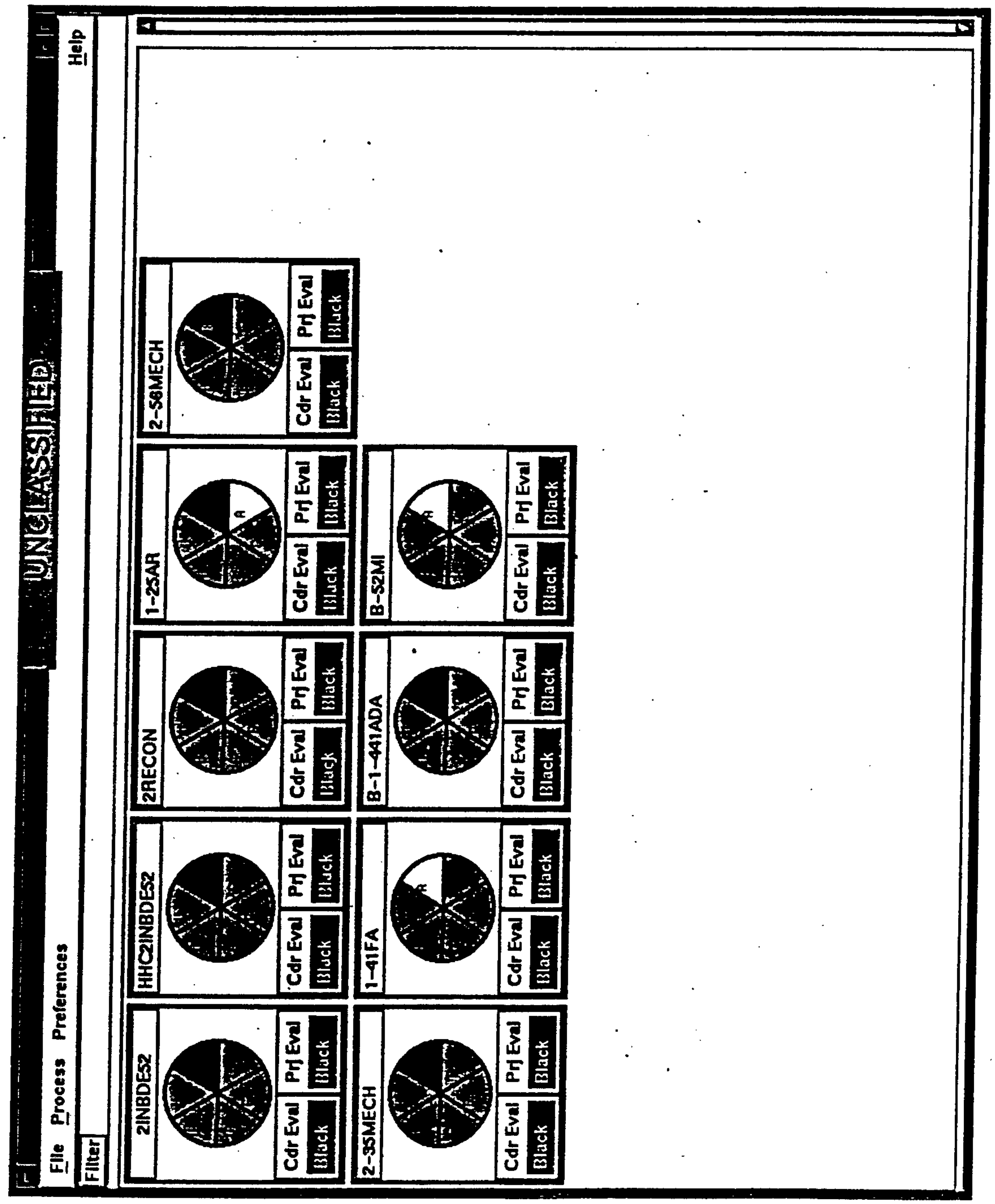

Fig. 13. Mercedes Report. Source: U.S. Army Command and General Staff College Prairie Warrior Exercise, (Ft. Leavenworth, KS: Mobile Strike Force Maneuver Control System/Phoenix, 1997.)

<u>ACRONYMNS</u>

AWE	Advanced Wafighting Experiment
NTC	National Training Center
EXFOR	Experimental Force
RMA	Revolution In Military Affairs
BOS	Battlefield Operating Systems
BFA	Battlefield Functional Areas
C2	Command and Control
MDMP	Military Decision Making Process
ABCS	Army Battle Command System
AGCCS	Army Global Command and Control System
FBCB2	Force Twenty-One Battle Command, Brigade and Below System
MCS/P	Manuever Control System/Phoenix
ASAS-RWS	All Source Analysis System--Remote Workstation
RCD	Relevant Common Picture
CCIR	Commander's Critical Information Requirements
FFIR	Friendly Forces Information Requirements
EEFI	Essential Elements of Friendly Information
PIR	Priority Intelligence Requirements
IPB	Intelligence Preparational of the Battlefield
DST	Decision Support Template

UAV	Unmanned Aerial Vehicle
GBS	Global Positioning System
EPLRS	Enhanced Positioning Location and Reporting Ssytem
NAIs	Named Areas of Interest

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