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Tactical Automation On The Battlefield; Who Is In Control?

A Monograph
by
Major Robert N. Townsend
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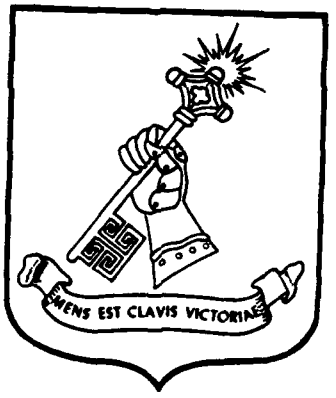

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ABSTRACT

Tactical Automation on the Battlefield; Who is in Control?, by Major Robert N. Townsend, USA, 47 pages.

The purpose of this study is to determine whether the Army has developed and adequately articulated a doctrine for the employment of the automated Maneuver Control System (MCS). Although MCS has been fielded in three U.S. Corps and taken to war, there is little guidance for its use in doctrinal publications. This study analyzes Army command and control doctrine against six criteria: publications, training systems, personnel policies, fielding strategies, sustainment experiences, and tactical use of technology.

The study determines that the Army has been hesitant to incorporate MCS into command and control doctrine. Emerging Army doctrine is confused as to exactly where automation fits into the command and control system. Some doctrinal publications present MCS as the system itself, while others portray it as the commander's tool in the command and control facility.

The study concludes that the intentional evolutionary fielding process for MCS has resulted in a doctrinal delay. However, this delay is not unlike the evolution of doctrine for technical innovations like the tank and the helicopter. Foremost among the implications of this study is how fast and comprehensively the Army can articulate doctrine for MCS. This speed and comprehensiveness will be determined by the degree of top level support MCS receives.

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I. Introduction

> The side deploying a less advanced command and control network but one which has been exercised and used may beat a side just finding out how to use a more technologically sophisticated one. (1)

The Army's role in war is to apply combat power against the enemy's center of gravity through swift synchronized action. In fulfilling this role, U.S. Army forces have focused on preparing to fight battles of increasing scope and intensity throughout the operational continuum.[2] U.S. forces have traditionally sought to capitalize on advanced technology to dominate the battlefield.

Until recently, the functions related directly to weapons systems benefited the most from technology. Command and control (C2), being traditionally a human decision process, has been slow to take full advantage of technology. Emerging automation and communication systems technology may represent a significant enhancement to the Army command and control system and a potential increase in available combat power. However, if the process of designing, integrating and employing these systems is not adequately addressed in tactical command and control doctrine, this potential combat multiplier could become just another source of friction.

In establishing an automated plan for command and control, the Army is developing the Army Tactical Command

and Control System (ATCCS) consisting of five automated Battlefield Functional Areas (BFA). These five areas are: maneuver, fire support, intelligence, combat service support and air defense. Each area will eventually have a dedicated and integrated automation system. The automated Maneuver Control System (MCS), under development since the 1960's, is the most mature of these systems. MCS is currently fielded down to the brigade and separate battalion level in three U.S. Corps. Despite its widespread fielding, MCS only receives passing mention in U.S. Army doctrinal manuals including, FM 101-5 Staff Organizations and Operations, FM 100-15 Corps Operations, and FM 71-100 Division Operations.

Army C2 doctrine has cycled between centralized and decentralized control. Historically automation has been at odds with the idea of decentralized control. For example, during the Viet Nam War, automation was an integral part of a centralized command and control process. Since 1976, U.S. Army Command and Control doctrine has increasingly emphasized centralized planning and decentralized execution. Some Army leaders fear that automation will bring us back to centralized control and remove the human from the command and control process.[3] The reluctance of senior leaders to articulate a doctrine for the employment of automation may be indicative of this fear.

The introduction of automation into the uniquely human

aspect of command is an emotional issue. The main obstacle is the psychological problem of resistance to automated decision making from commanders. There is a fear of reduction to electronic servitude.[4] Many of those opposed to MCS feel that they must not surrender command to a machine. They would argue that building a C2 system around this machine will force the Army to change its command and control doctrine.[5] General Foss, former Commanding General of Training and Doctrine Command (TRADOC), felt that technology and electronic devices would push the Army toward too much control. He went on to state, "The control path appears safer but will lead to caution, a more deliberate manner, and an emphasis on process as opposed to outcome."[6]

Other commanders have argued that computer technology has not evolved sufficiently to be reliable enough for the battlefield. For example during Dessert Storm, the MCS terminals could not operate on the move or in the attack. These commanders concluded that for the near term, automated C2 is a failure and should be shelved until the system is improved.[7]

Those who favor MCS see it as merely a tool to assist the commander and staff in their decision making process. To its proponents MCS is no different than the grease pencil and chart or a typewriter. In this case, supporters argue, there is no need to modify our doctrine, because the machine supports existing doctrine.[8]

The problem for the tactical commander might be that automated command and control equipment is present in his headquarters but there is not enough doctrinal guidance as to what to do with it. This paper will focus on this perceived doctrinal shortfall concerning the Maneuver Control System. The specific question this paper attempts to answer is whether the Army has developed and adequately articulated a doctrine for the employment of the automated Maneuver Control System.

The first step in the methodology for answering this question is to establish a common set of definitions as well as review some of the theory and philosophy behind command and control. Next, the evolution of automation on the battlefield is reviewed. It is important to understand how doctrine and technology have influenced each other to bring the Army to where it is today. An examination of AirLand Operation requirements helps determine where automation can fit into the command and control process of the future. Finally, the Army's command and control doctrine is analyzed against six criteria: publications, training systems, personnel policies, fielding strategies, sustainment experiences, and tactical use of technology. These six criteria provide a method to test the adequacy of our doctrine for the employment of the Maneuver Control System. The conclusions and implications are based on this doctrinal analysis.

II. Definitions and Theory

The terms that are commonly used in Army doctrine requiring definition include: "command", "control", "command and control", and "command and control system". The word "command" comes from the Latin commendare, "to entrust". Command as defined in JCS Pub 1 is:

> The authority that a commander in the military lawfully exercises over subordinates by virtue of rank or assignment. Command includes the authority and responsibility for effectively using available resources and for planning the employment of, organizing, directing, coordinating and controlling military forces for the accomplishment of assigned missions. (9)

The word control comes from the French contre and rolle "to check an account". Control as defined by the U.S. Army is:

> The process by which commanders and staffs direct the activities of subordinates and supporting units and ensure they are consistent with the will and intent of the commander. (10)

The term command and control (C2) comes from 1950's technocrats who were building the United States Continental Air Defense system of command centers, radars, missiles, and intercept aircraft. Nuclear weapons, national policy, political authority and new methods of communication were pieces of a puzzle that were assembled together in a system of national C2. The term became forever linked with military endeavors.[11] Command and control is currently defined as:

> The exercise of authority and direction by a properly designated commander over

> assigned forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating and controlling forces in the accomplishment of the mission. (12)

Through command and control, commanders transform potential combat power into actual combat capabilities applied against enemy forces. The purpose of C2 is to implement the commander's will in pursuit of the unit's mission. The final measure of a command and control system is whether the unit functions faster and more effectively than the enemy.[13] This command and control system consists of:

> The facilities, equipment, communications, procedures, and personnel essential to a commander for planning, directing, and controlling operations of assigned forces pursuant to missions assigned. (14)

The terms command and control are so much a part of daily military language that we seldom stop to think about what they entail. Command and control as a battle operating system is often thought of as a single term. As the definitions indicate however, the two words command and control each have their own distinct connotations. Command and control are not synonymous. How they relate makes a great deal of difference. Getting the relationship right can make the difference between victory and defeat.[15] The Army Command and Control Master Plan states that control is inversely proportional to command. The more control imposed on a subordinate; the less

freedom he has to command.[16] A good commander allows freedom of action, but is prepared to take control quickly when required.

The theory of command and control has been directly influenced by the changing character of the battlefield and the introduction of advancing technology. Historically, as weapon lethality increased, armies spread themselves out on the battlefield with an increased emphasis on using terrain cover. In ancient times, one man probably occupied ten square meters of battlefield. This spacing increased little until the nineteenth century when one man occupied over 200 meters in the American Civil War. By World War I, the spacing grew to 2,000 meters and by World War II, to 20,000.[17]

The increasing size and complexity of armies, force dispersion and dimensions of the battlefield combined to degrade the commander's ability to directly control his forces. These historical changes in the nature of battle made positive control by the commander increasingly difficult. Therefore, positive control was replaced with procedural control. Positive control means the commander can see and influence the entire battle from his command post. Procedural control is reliance on previously arranged steps or orders.[18]

The introduction of the radio was by far the most important answer to C2 on a dispersed battlefield. Its effect was truly revolutionary. For the first time in

history, armed forces were equipped with hardware that in principle, enabled them to communicate from place to place regardless of distance, topographical obstacles, weather, time of day, and the movement of headquarters in relation to each other. All this could be done in what can be called real time.

Initially the radio boxes containing the power sources and circuitry were large and cumbersome. Their use was restricted to the immobile headquarters of major units. The early sets also suffered from weak power, with corresponding limitations on range. The process which enabled these limitations to be overcome was slow and painful. It did, however, result in a situation where towards the end of World War II small platforms such as vehicles and light aircraft were routinely equipped with radios.[19]

However, the mobility, lethality, and complexity of armies continued to increase at a faster pace than our command and control technology. The dispersion of forces and more complex force structures forced increasing information demands for the commander to see the battlefield and control his forces. Like the radio, computers offered the Army a commercially developed technology with the potential to solve control problems on a dispersed battlefield.

Beginning in the 1950's, the Army embarked on a number of efforts to introduce automation on the battlefield.

Advances in sensors, tactical communications, and automation made a greater degree of centralization possible and served as a catalyst for even greater information requirements.[20]

Contemporary military theorists have highlighted the influence of technology and the changing nature of the battlefield on command and control. Van Creveld describes an ideal command and control system on today's battlefield as one that provides inputs consisting of information which can be selectively acquired quickly and accurately. This information is then processed in a manner which quickly confirms the reliability and relevancy of the information, and displays it for users in a clear and concise format. The system must allow the user to visualize the information in a matrix for analysis which reflects reality (not preconceptions) and then leads to the identification of objectives which are both desirable and obtainable. The output is a decision which is correct, but which allows deviation based on circumstances. This decision must be transmitted in unambiguous and concise orders. Execution is monitored to ensure compliance, but not in a manner which stifles the initiative necessary for subordinates to deal with the inevitable battlefield friction.[21]

Furthermore, Van Creveld points out that as warfare has become more complex, the means of command and control have evolved to meet the needs of armies. These means can

be categorized as organizations, procedures, and technical devices for command and control. Organizations are general staffs which have developed to support the commander's control process. Procedures include standard reporting measures or decision support methods. Technical means include tools like the radio and computers. Together these means provide commanders the ability to execute their missions. Automated systems blur the line between organizational, procedural or technical means.[22]

A more precise analysis of the theory of command and control in modern warfare is provided by Richard Simpkin. He says there are basically five systems of control: minimal, directive, mission type, forward command, and detailed orders tactics. The system exercising the least control is the minimal control of forces which possesses no positive control over tactical forces other than a general understanding of the commander's intent. Directive control depends on subordinate commanders being able to execute the higher commander's guidance without additional instructions. Another system is mission type control. This method, often referred to as Aufragstaktik, gives the subordinate his mission and constraints at the outset and then permits him to execute his mission as he sees fit as long as he adheres to the guidelines. The concept of the forward commander has the commander constantly forward where he may actually take control of the battle from subordinates at critical points on the

battlefield. Finally, the detailed orders tactics dictates the greatest measure of control from the highest level possible.[23]

To Simpkin, an ideal theoretical system would straddle the spectrum between directed control and forward command. This would permit the subordinate freedom of action, unconstrained by overly restrictive OPORDS or SOPs, yet afford the senior the opportunity to intervene at critical junctures in the battle. The extended battlefield with uncertain communications requires a doctrine of command and control that gives significant latitude to the subordinate.[24] Figure 1 is a graphical display of this spectrum of theoretical command and control concepts.

Simpkin's Ideal

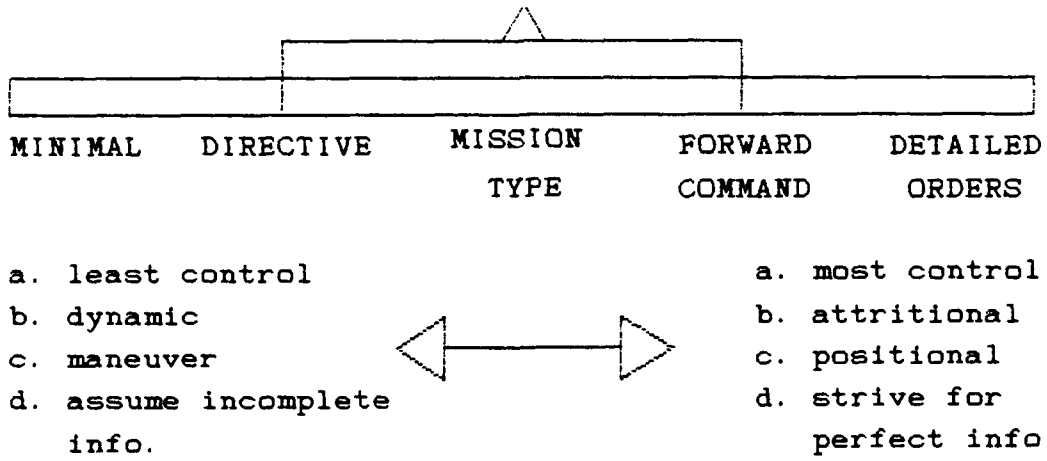

Figure 1
Command and Control Model

This theoretical discussion shows that the U.S. Army has a wide spectrum of choices in defining its philosophy toward command and control. To avoid confusion and therefore promote responsiveness, the Army must determine and clearly articulate what form of command and control philosophy it will follow in its doctrine. This doctrine will drive the means used to command and control forces. The means include the organization, processes and technology adopted. If the Army does not clearly articulate a C2 doctrine, the growth of automation could push the Army inadvertently toward a command and control doctrine that it does not want.

The Army must also express what it wants automation, as part of the technological means, to accomplish. This technological means is represented by the Maneuver Control System. The MCS represents the potential for the commander to supplant procedural control with positive control of his forces.

III. The Automated Maneuver Control System

The Maneuver Control System is an automated corps to battalion system to help maneuver commanders and their battle staff control combat forces. It is being developed to enable the command staff to collect, store, process, display, and disseminate critical battlefield information and to produce and communicate battle plans, orders, and enemy and friendly situation reports.[25]

The MCS now being fielded is evolutionary, designed to

put capability in the hands of the user today, with planned enhancements already under development for the future. The original MCS design was to be completely hardened for tactical use. Costs were prohibitive so a compromise position was adopted which combined military specification (MILSPEC) and non-developmental items (NDI) or off-the-shelf material. This NDI equipment consists of a Tactical Computer Processor (TCP) and an analyst console (AC) which is connected to the TCP to provide additional work stations. A typical heavy division has received 43 TCP's and 48 AC's issued to brigade and separate battalion level.

This NDI and early MILSPEC equipment is currently being replaced by completely new MILSPEC equipment. The newest version of the MCS is called the Transportable Computer Unit (TCU) which is also being fielded from Corps down to brigade level. A smaller handheld terminal will eventually be fielded to battalion level.

A key characteristic of MCS includes sufficient memory storage capacity for creating a tactical data base. To build this data base, the MCS employs a standardized message set. In order to minimize information overload, it allows the staff and commander to acquire and track the commander's critical information requirements. MCS also displays unit status screens and battlefield graphics. As new information is acquired and put into a particular computer, the database is automatically updated at

successive echelons.

The most obvious advantage over a manual system is MCS's ability to store information in an accessible and organized manner. It handles standard reports which can be updated periodically, providing commanders and their staffs information they need to control the force. The devices possess a query capability allowing operators to pull information from other terminals without having to bother personnel at the other end. The Maneuver Control System is designed to work within the existing communications systems. Each terminal is compatible with all communications security devices and can transmit data over Area Common User Nets and FM nets utilizing digital burst or voice transmission.

The TCU stores and displays battlefield graphics on maps ranging in scale from 1:25,000 to 1:1,000,000. The maps are digitized and stored in the computer on disks. This gives the commander the ability to have an electronic map display which not only allows tracking the tactical situation but also the wargaming of courses of action.

An integrated business package is built into the software to allow the staff to do word processing, construct spreadsheets or create graphics. Virtually any additional DOS base application can be added as a utility, provided the computer memory is available. A Battlefield Planning System software package allows the staff to analyze visibility and avenues of approach, taking into

account terrain and enemy forces.

The MCS represents a significant investment by the Army. Some proponents of the system promote it as a cure-all for any ills in the command and control process. However, this innovation is only as good as the quality and timeliness of information it gives the decision maker. The Army's doctrine must look beyond the capabilities of this technical device and incorporate the hardware into an information management concept.[26]

IV. Automation and the Evolution of C2 Doctrine

Automation has been entwined in the evolution of command and control doctrine since the 1950's. The evolutionary fielding process has led to a wide range of of developmental equipment and software, making it difficult to write doctrine. The 1954 version of Field Manual (FM) 100-5, Field Service Regulations-Operations, emphasized centralized control of subordinate operations. This doctrine, which was in effect when the need for major tactical automatic data processing (ADP) systems was identified, was the result of World War II and Korean War experiences and of the threat of war on the atomic battlefield.[27] FM 100-5 identified procedures for decentralized control. However, it specifically stressed centralized control procedures.[28]

The Atomic Field Army-1 (1956) and PENTANA studies continued the emphasis on centralized control at the

tactical level during the 1950's. These studies were influenced by the following factors: world-wide strategic missions, constraints associated with strategic lift assets, the threat of fighting outnumbered, the combined mission and threat of fighting on a nuclear battlefield, and modern technology that would improve firepower, mobility, and control. Proponents sought a surviving division with increased strategic deployability and a streamlined command structure. Their efforts resulted in greater centralization of control.[29]

The 1962 version of FM 100-5, Field Service Regulations-Operations, did not significantly change the orientation of centralized battlefield control. While decentralized control was identified as a desired technique, total coordination of effort was required to apply combat power effectively. The amount of centralization was determined by a number of factors. The most important of these was the type of operation, offensive or defensive, with the latter requiring tighter control.[30] Two key reasons for this tight control were the focus on the defense of Western Europe and the belief that nuclear weapons would be used against massed enemy forces.

The U.S. Army's trend toward centralized command and control continued into the late 1960's and early 1970's. The factors responsible for this phenomenon included utilization of the helicopter to increase the mobility of the commander, political and high level military interest

in minor affairs, and extensive use of automation to collect statistics as a measure of tactical effectiveness.[31]

The automated Tactical Operations System (TOS) was introduced in 1965. TOS was developed to assist commanders and their staffs in decision making and control of operations. The system, which was dependent upon master data bases located at division, corps and field army headquarters, employed a centralized architecture.[32]

The General Accounting Office reviewed the TOS program in late 1979 and recommended that system development not be continued. Program management problems included a failure to finalize requirements, the linkage of system design to preselected hardware and software, and a failure to consider the severe environment in which the system would be operated.[33] Despite this setback, the Army remained determined to automate its command and control system. By 1985, as a result of a System Program Review, the requirements document for the Maneuver Control System was initiated.[34]

While automated command and control equipment continued to evolve, so did the Army's doctrine. AirLand Battle doctrine recognized an even more lethal and fast paced battle than ever before. The Army needed an agile and responsive command and control doctrine to answer the challenges of AirLand Battle. However, the automated equipment was not mature enough yet; the Army had to rely primarily on a manual process. Therefore, to cope with

the complex command and control challenge of AirLand Battle, the Army shifted toward a more decentralized doctrine.

The doctrine contained in the 1986 FM 100-5 provided a much more decentralized view of command and control. The AirLand Battle Tenets offer examples of this point. Individual initiative requires: "A willingness and ability to act independently within the framework of the higher commander's intent." It also states that: "In the chaos of battle, it is essential to decentralize decision authority to the lowest practical level because over centralization slows action."[35]

However, the U.S. Army's interest in tactical command and control automation had not diminished. Our tactical doctrine demanded a command and control system that must be reliable, secure, fast and durable. This system also must, "collect, analyze, and present information rapidly."[36] The Army continued funding, developing, testing, and fielding MCS based on these requirements.

Today, as in the past, the commander must see the battlefield to practice positive control. For the most part seeing the battlefield involves collecting information. This information can be obtained from first hand observation, from subordinate command posts, or from listening to the command radio nets. Since the battlefield has become so large and complex, the commander requires more information than ever before to control the

battle. Additionally, the dispersion of forces complicates the commander's ability to coordinate and synchronize the battlefield operating systems.[37]

The application of MCS to the command and control system is an attempt to retain the ability to control dispersed forces. Automation is critical for the execution of the Army's proposed complex AirLand Operations doctrine. Like the PENTOMIC doctrine, AirLand Operations envisions a non-linear battlefield with smaller dispersed forces. These forces will require the agility to rapidly mass against the enemy and then disperse again.

V. Airland Operations Requirements

The need to articulate a doctrine for the application of the Maneuver Control System to the command and control process will become even more important in the future. Proposed doctrinal publications are emphasizing the importance of automation to the execution of complex tactics. Exactly how this automation will be used remains a clouded issue.

The Army in its 1991 TRADOC Pam 525-5, AirLand Operations, outlines a smaller Army that must be a more capable than ever before.[38] As forces become fewer and more dispersed on a non-linear battlefield, there will be an increased premium on knowing the enemy location and its capabilities, attacking its critical assets, and setting the conditions for decisive operations. Additionally, diminishing battlefield force densities will require

enhancement of synchronization capabilities to ensure that units maximize their warfighting potential and capitalize on the synergism of integrated operations.[39]

This smaller, more dispersed force must achieve this synchronization with a system that is currently mostly manual. This command and control system is reasonably effective within the range of the communications means available. Short messages are passed quickly to all who have a station in the command net. A second message to higher headquarters alerts them to the change in status. The effectiveness begins to deteriorate, as longer messages or more detailed information must be relayed. Overlays must be copied and then passed by courier because of the complexity and need for accuracy. Timeliness becomes a function of the efficiency of the creation/ duplication process and the distance/ transportation means available. As a result of this process, commanders who must support the maneuver units receive their information after two relays or not at all. The information received is subject to the error of multiple manual processing steps.[40] This manual process will become more inadequate as AirLand Battle becomes more dynamic and complicated.

Army command and control planners have concluded that the present and future battlefield requirements will rest on the following premises:

a. Conflict requires joint and combined cooperation

to ensure success.

b. The increased likelihood of regional conflicts requires the Army to be able to conduct operations across the full continuum of warfare, with emphasis on low-intensity conflict and special operations.

c. There is a need for both heavy and light forces that can operate at varying levels of conflict in any theater.

d. Current and evolving space systems will add a further dimension to the land battle.

e. Technological advances will continue to increase weapons lethality and extend the distances over which the battle must be fought.[41]

A scenario might help to portray how C2 automation technology could fit into the AirLand Operations. Given the dispersed nature of the battlefield, the reorientation of a brigade following an attack will be common. Consider a mechanized brigade which has the mission to reorient and move 70 kilometers to conduct another attack. The operations officer must plan the movement and begin planning his future attack mission.

The movement of his brigade is the immediate and complex task facing the operations officer that will draw his energy away from the attack. The movement plan becomes a time intensive, and laborious process. This effort must be accomplished accurately because over 1500 vehicles will be involved in restricted terrain. To add

to the difficulty of his task, the operations officer has not slept in 18 hours and is on his fifteenth cup of coffee.

As an alternative, using MCS, the operations officer could move a light pen between the start and end points across an electronic display map. The computer will query the officer as to how many routes he desires. After being told the number of routes to examine, the computer will scan a digitized map and select the best routes based on mission, enemy, terrain and time. For example, it will take into account the bridge classifications and terrain restrictions. The computer will then compute and provide movement tables based upon the equipment in the current unit status reports in its data base. An overlay will be automatically created and displayed for review. If approved by the operations officer, he can electronically transmit the order with tables and overlay to his subordinate and higher headquarters. The operations officer is now free to spend his valuable time planning future operations with his intelligence officer.

This scenario depicts only one small aspect of the potential tactical application for the automated Maneuver Control System. In this case, the input/output devices are simple, intuitive, and closely replicate the current method of task performance. This is a case of the man in control rather than in the loop. The decision maker has not become a slave to his machine.[42]

According to FM 100-5, Operations (1986), to support the execution of AirLand Battle doctrine, the command and control system must facilitate freedom to operate, delegation of authority, and leadership from any critical point on the battlefield.[43] In order to accomplish these imperatives, the command and control system must:

a. Be reliable, secure, fast, and durable.

b. Collect, analyze, and present information rapidly, providing a common, accurate picture of the battlefield to all echelons of command.

c. Provide the commander and staffs at each force level, accurate, real time information on the enemy.

d. Communicate orders, coordinate support, and provide direction to the force with a span of control covering three battles (rear, close, and deep) despite enemy interference, destruction of friendly command posts, or loss of a friendly commander.

e. Enhance the force's ability to function more effectively and more quickly than the enemy.

f. Be fully adaptable to integrating with joint and combined C2 systems.[44]

These characteristics must be present in a command and control system whether they are manual or automated. Combat developers have used these characteristics as guidelines for designing the MCS equipment and software. Whether the equipment and the doctrine that supports its use fits these characteristics will be the focus of the

next section.

VI. Analysis and Evaluation

> We must keep saying to ourselves, and to each other, that computers are only tools of C2, just like grease pencils, acetate, status boards and field phones. And unlike some other things, familiarity with them will breed confidence, not contempt. (45)

This statement is indicative of the contradiction that exists concerning the role of automation on the battlefield. This contradiction is just where do computers fit into the command and control system. The fear is that computers will become the command and control system unto themselves, and therefore push the Army toward computer dependency in the name of control.

Automation of the command and control system would appear to be similar to the evolution of computerized chess games. Traditionally, chess was a game of wit and skill between two human players. Computers have given us a game with an automated system that can not only challenge us but also physically move pieces in reaction to our moves. If this computerized opponent could not only store and process information to play the game, but also apply knowledge, thought and learning (artificial intelligence), it would certainly be a formidable adversary.

As artificial intelligence continues to develop, the Maneuver Control System will not only process information but also develop courses of action and make recommen-

dations. Ultimately, Army commanders should decide what role automation will play in command and control. Will the commander continue to make the moves or will he rely upon the computer to assist him in the decision process? The Army's current doctrine indicates that the commander will make the moves.

Doctrine stems from theories and principles and is the basis for how the Army fights. This doctrine is expressed in overarching concepts, by which military forces guide their actions. Army publications, training, personnel policies, equipment fielding strategies, sustainment programs and tactical use of technology are all products of doctrine. Therefore, to fully test the adequacy of the command and control doctrine for the inclusion of the maneuver control system, it is necessary to examine each of these products.

Even though the MCS equipment is presently being used within three Army Corps, there is currently little evidence of MCS guidance in doctrinal publications. FM 100-15, Corps Operations, gives a description of the ATCCS, but little guidance for its employment. Below Corps level, doctrine for the employment of MCS is not present. FM's 71-100, Division Operations, and FM 71-3, Armored and Mechanized Infantry Brigade, do not even mention MCS. The current edition of FM 101-5, Staff Organization and Operations, the basic doctrine for staff organization and operations, does not address MCS but does

describe the Army's C2 system.

According to FM 101-5, the Army's command and control system consists of three interrelated components: organizations, processes, and facilities. The organization is how the commander organizes his staff to accomplish the mission. The commander's organization includes the role and relationships of the staff. The C2 process is how the commander and staff accomplish the mission. It is the procedures taken to find out what is going on, to decide what action to take, to issue instructions and to supervise execution. In other words, it is the decision making process. The facilities include command posts and supporting automation and communication systems. They provide processing and transmission of information and orders.[46] Command itself takes place within this command and control system.

By this doctrinal description, the Maneuver Control System equipment belongs as a part of the facilities and not as the process by itself. However, the MCS refuses to fit so neatly into one corner of the command and control system. For example, the information capability and the advent of artificial intelligence makes MCS impact on the C2 process. MCS changes how the staff gathers and passes information. This information and decision making capability actually makes MCS a part of the decision process.

Fortunately, while soldiers in the field wait for

doctrinal manuals to appear, the MCS New Equipment Training Team (NETT) has provided guidance. The MCS NETT provides the unit a comprehensive example of Standard Operating Procedures (SOP) for the employment of the MCS. The unit can then tailor that SOP to their own needs. Other than FM 100-5, Corps Operations, and the unit's own SOP, there are currently no doctrinal publications available to the tactical unit that address the employment of MCS.

It is difficult to determine why it is taking so long for MCS to be addressed in any detail in doctrinal publications. The Army's Training and Doctrine Command (TRADOC), System Training Plan, admits that the impact of MCS on command and control tactics, techniques and procedures has not been fully evaluated.[47] This statement argues that the Army simply does not know what the doctrine should be. In this case technology is driving doctrine. This would seem to say, "let's get the equipment out there and see what happens".

There are several other possible explanations for this void in the Army's doctrinal publications. One explanation may be as a result of the Army's slow process of updating and publishing manuals. For example FM 101-5 is a 1984 manual. The Army Tactical Command and Control System program was initiated in fiscal year 1986. Another explanation may be that some leaders view automation as a passing fad that will go away and should not clutter up

our doctrine. They would agree with Martin Van Creveld who argues that the advances in command have invariably resulted not from technology but rather from advances in training, doctrine and organization.[48]

The void for the employment of MCS in Army doctrine shows some promise of being filled in the future. Several draft publications that are currently being staffed do address MCS in detail. For example, the proposed doctrine expressed in a draft version of "FM 101-5, Command and Control for Commanders and Staff", dated March 1991, clearly articulates a command philosophy, and the relationship of MCS to the command and control doctrine, when it states: "The computer assists but does not control the art of command".[49] This publication also clearly places automation in the non-threatening facilities component, along with the radios and grease pencils. In this case the computer is simply a device, performing staff supporting tasks.

The Army Command and Control Master Plan, which is a directive that assigns responsibilities and provides overall guidance and information for the management and development of MCS, states that employment guidelines should be articulated in tactics and techniques manuals.[50] In fact, "FM 100-15-1, Corps Operations Tactics and Techniques" (Draft), does attempt to articulate a doctrine for the employment of the MCS.[51] However, "FM 71-100-1 Armor and Mechanized Division Operations Tactics and

Techniques" (Draft), promises to leave a void below the corps, because it does not even mention MCS.[52]

The omission of MCS from Army publications may in itself be an expression of doctrine. Since MCS can be viewed as part of the command and control facilities, it requires no more doctrinal attention than a typewriter or FAX machine. This explanation is supported by one description of MCS. According to the draft FM 100-15-1, MCS is a decision support device designed to meet the command and control requirements of the AirLand Battlefield. MCS is a tactical tool to support the commander's decision-making process. The MCS serves the commander as one of his tools for correlating, filtering, processing and extracting information.[53] Later, this same publication states: "automation must perform the same four functions of planning, directing, controlling, and coordinating that all command and control systems must accomplish."[54] In this case, the computer has become the command and control system itself. This would indicate that the ATCCS and MCS are a command and control system unto themselves. This concept is in direct contradiction to this same manual describing MCS as a commander's tactical decision support tool.

The issue of where automation fits into the command and control system is further clouded by additional guidance published in The Army Command and Control Master Plan. It states that the purpose of MCS is to enhance and

shorten the information acquisition part of the decision making cycle, improve the means of directing and synchronizing subordinate units, and aid in the identification and analysis of courses of action. This description places MCS square in the middle of the command and control process. This does not imply that the command and control process will change. MCS will help collect and store information to aid in the existing decision making process.[55]

The fact that the application of MCS is to be addressed in future doctrine is not sufficient. The adequacy of a doctrine is not defined simply by volume. The expression of doctrine must be consistent. Contradictions as to where MCS fits into the command and control system are still present in the proposed doctrine.

It would not be sufficient to only examine the Army's publications to assess how the Army has articulated its automated command and control doctrine. An examination of training reveals that responsibilities, criteria and standards to support the Army's automated C2 process have been difficult to define or clearly present due to the evolutionary nature of the equipment and software. As MCS was fielded, each Division received a variety of developmental hardware and software. Additionally, since the majority of the Army did not have MCS until recently, it has been difficult to institutionalize and sustain training. For example, issues such as the programs of

instruction, the locations, and the grade level of courses that need to be taught are only now being resolved by TRADOC.

Problems at the unit collective level include the fact that the Mission Training Plans (MTP) do not define task, conditions and standards for using MCS or preparing an MCS formatted Commander's Situation Report. In an effort to correct these shortcoming the System Training Plan (STRAP) has been developed. STRAP is the nucleus for the structured development of all Army automated C2 equipment training. It sets the requirements for a training master plan for new and improved C2 systems. This document is being revised and published to take advantage of the wider fielding of MCS.

Unit individual and collective training currently occurs as part of the fielding by the New Equipment Training Team. In order to avoid confusion it is important to distinguish between the titles, operator and staff user. An MCS operator is a soldier whose primary mission is to operate one or more automated C2 terminals. A staff user is defined as an individual who must use the available automated C2 system terminal to assist him in performing his mission. Staff users receive some training as part of the curriculum at the Sergeants Major Academy and Command and General Staff College. Currently there is no institutional training for operators. They are trained on the job, in their units, by individuals

designated as Master Trainers through the NETT. MCS repair has been added to the program of instruction at Fort Gordon for maintenance personnel.

The goal is to simplify equipment use so that no special training is required. This can eventually be accomplished through user friendly software and embedded training. Embedded training is provided by tutorial software built into the operational system to enhance and maintain the skills necessary to operate and maintain the equipment. This embedded technology has been planned but not fielded.

The final step in the NETT unit fielding process is a Communicati[illegible] Exercise (COMMEX). This verifies the operation of the equipment and the initial training of the operators. This is not a certification exercise which would guarantee that a unit has achieved operational proficiency. Further, there is no Army directed requirement to periodically validate unit MCS training.

Despite the present complexity of the equipment, the Army currently does not have a specific Military Occupational Specialty (MOS) for Maneuver Control System operators or maintainers. The equipment is operated by personnel with MOS's already authorized assigned to command and control facilities. Maintenance duties are performed by communications repair MOS's 31V and 29J who normally repair radio electronic equipment. The evolution of the equipment with embedded training and user friendly

software will supposedly minimize any need for special skills. The Army's position, as stated in the Command and Control Master Plan, is that automation will not increase or decrease command post size. However, Desert Storm after action reports claim that, like the radio, MCS requires dedicated operators.[56]

Fielding of the MCS has been evolutionary out of necessity. Due to the dynamic nature of computer technology, size and diversity of military units, the Army has recognized that it cannot completely develop, test and field an automated system. This evolutionary fielding makes MCS unique. Waiting to develop, test and refine a complete system would result in the user having an antiquated piece of equipment. This evolutionary fielding creates considerable misunderstanding. Users lose patience with developmental equipment that has not lived up to promises. Contradictory reports appear in after action reports from the field, because there is such a wide disparity in capability between various generations of hardware and software distributed to the field.

Sustainment of the Maneuver Control System has been difficult due to the equipment acquisition process. Currently, MCS is composed of two types of computers that are not common hardware and software configurations: nondevelopmental (off the shelf, ruggedized) and militarized (custom built for military operations). militarized common hardware equipment is currently being

fielded through the late 1990's.

Soldiers in the field are experiencing the frustrations of using developmental equipment in a combat environment. For example, due to the urgency of Desert Storm and lack of new equipment, VII Corps drew old MCS equipment and software that had been retired from service. Comments from the field indicate that repair parts were not available at organizational or direct support maintenance. This occurred as organizational PLLs were not authorized, and ASLs had not been updated after the receipt of new equipment. Also, maintenance personnel were not adequately trained on repair procedures. The MCS equipment was being maintained like a piece of installation computer equipment, rather than as a weapon system. Some units in III Corps became so frustrated that they refused to use MCS.[57]

The results of the tactical use of MCS technology has been somewhat disappointing. The United States General Accounting Office found that the Army Operational Test and Evaluation Command reported that MCS has not demonstrated its effectiveness in providing timely, accurate, and useful information in a battlefield environment. It noted that MCS's primary use during the latest equipment validation was for facsimile transmissions. Also, commanders indicate that MCS provides little or no aid in controlling maneuver forces.[58]

The current generation of equipment is large, bulky

and heavy. Already cramped command posts have made space for the MCS devices. The GAO's investigation revealed that the Army's Light Divisions refused to accept the MCS due to these size and weight problems.

The MCS also could not operate on the move. Once offensive operations began, MCS could no longer be used.[59] The Desert Storm Lessons Learned Report concluded:

> MCS is seriously limited in its ability to provide command and control. Because of a variety of problems MCS cannot provide timely information during normal command post operations. MCS's excessive power requirements, interface problems, complexity, bulky size, and maintenance unreliability combined to make the system inadequate to support the commander. (60)

The heart of the problem concerning doctrine revolves around the evolutionary fielding plan. As the equipment matures and the Army gains experience, the doctrine for its application comes into focus. This is a time consuming and frustrating process, but it is not much different than our experience with the tank and the helicopter.

First introduced in World War I, tanks did not become the centerpiece of ground combat until World War II. The tank ultimately created new ground strategies and tactics, gave rise to new military skills and organizations, and diverted resources into new classes of weapons. The helicopter's effect on battle took about ten years. The Army moved from an organization with a few hundred aircraft in 1950 to one with several thousand in 1960.

New corps and division organizations were created that employed large numbers of helicopters to support the infantry, armor, artillery, and their administrative, medical and technical support.[61] Changing the doctrine gave both weapons systems a major role in combat. A few far sighted individuals envisioned the equipment's potential, despite its limitations. As each system's capability improved, so did our doctrine evolve.

The intent of this analysis is not to dwell on the current equipment capability of MCS but rather the adequacy of the doctrine. The Army's published doctrine clearly places the commander at the hub of the command and control system, not the machine or the process. The doctrine also defines the three components of this command and control system as the: organization, process and facilities. There is some confusion, however, as to where automation fits into this system. Some publications present MCS as the system itself, while others portray it as the commander's tool in the command and control facility.

VII. Conclusions and Implications

> Such devices (MCS) push the Army toward computer dependency in the name of control. Such a path is dangerous. (62)

Current literature revealed that some Army leaders are concerned about the effect of automation on the command aspect of doctrine. In order to determine if this concern is justified, this study examined the adequacy of U.S.

Army tactical command and control doctrine to support the automated Maneuver Control System.

The examination of the history of automation on the battlefield revealed the influence of automation on command and control doctrine. Early efforts to automate command and control supported a strong centralized control oriented doctrine. Despite early failures with automated systems the Army has continued to pursue automation. This ambition to automate the command and control process has been driven by the evolution of the battlefield requirements. Dispersion and lethality on the battlefield forced commanders to relinquish tight control of their forces. Technologies like the radio and the Maneuver Control System were introduced to regain some degree of control. The Army doctrine was control oriented when automation was envisioned for the Pentomic Division. The automation of information during the Viet Nam war reinforced the dominance of control over command. Recently, Army doctrine has attempted to shift toward a focus on command rather than control.

In fact, if our doctrine fails to clearly state the focus of automation in the command and control system, then we may find ourselves inadvertently drifting toward a control oriented force. The problem with a control rather than a command focus is that it does not broaden the subordinate commander's capability for independent action. An emphasis on control constrains subordinate leaders by

focusing on those actions which can be quantified and controlled, rather than focusing on creating opportunities for success.

Looking to the future, AirLand Operations doctrine requires a responsiveness and accuracy that manual systems alone cannot achieve. The Army has made a tremendous commitment toward automation of the command and control process. In a break with the historical trend toward a centralized control oriented doctrine, the Army has demonstrated an increasing effort to articulate a decentralized command and control philosophy that relies upon mission tactics and the commander's intent.

The examination of current doctrinal publications revealed several voids and contradictions concerning MCS. The greatest contradiction concerns just where automation fits into the command and control system. Since many of our command and control doctrinal publication are dated, additional criteria were established as indicators of the adequacy of Army doctrine. These criteria were draft publications, training, personnel, fielding, sustainment and tactical use of technology. These criteria revealed a more accurate picture of the automated command and control doctrine.

Until recently, the problem with an expression of doctrine incorporating automation has been that the technology simply has not been in place to match our design goals. It has been difficult for doctrine writers

to articulate specific guidance for equipment that has an experimental appearance, despite its widespread use. Emerging doctrinal publications are cautiously addressing the Maneuver Control System. In this case doctrine is being developed from the bottom up. That is, as units work with the system, they develop standard operating procedures and recommend changes to the equipment and software that will adapt automation to the existing command and control system. These evolutionary changes find their way into training policies and publications, sustainment practices, and organizational changes. Finally, all this is incorporated into doctrinal manuals.

Some implications for the development of doctrine for MCS are contained in a study concerning historically how fast and comprehensively the Army articulated doctrine for technical innovations.[63] Some of the conclusions were:

1. Top level support is important to the rate of progress in a major innovation.

2. The rate will be tied directly to the speed with which new equipment is put into the hands of operating soldiers for unconstrained use.

3. Technology on its own cannot force the absorption of an innovation.

The application of MCS is much like the evolution of the radio and helicopter in the command and control system. We recognized the tremendous potential of the systems, but we have always been skeptical of the

implications and frustrated by the current limitations of the equipment.

The current doctrine for the employment of the Maneuver Control System is adequate considering the evolutionary nature of the system and the maturity of the equipment. However, the Army is at a critical point in the application of automation to the command and control process. Doctrine writers must ensure that publications are consistent concerning the role of automation and that MCS is addressed at all echelons.

All the hard work by field commanders and combat developers has resulted in a piece of equipment that will eventually fit into our command oriented process. Automation and command are not mutually exclusive. The Maneuver Control System has a role as part of the command and control facilities. It serves the commander and his staff and is no more dangerous to command and control authority than a pocket calculator or a radio. Our doctrine needs to continue to clearly place automation in this light and stop presenting it as a threat to the existence of humans in the command process. If the Maneuver Control System continues to develop as part of the command and control facilities, it will support the execution of AirLand Operations doctrine by allowing the commander the freedom to operate, delegate authority, and provide leadership from any critical point on the battlefield.

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