(2)

The Mechanized Infantry Battalion: Is Change Necessary?

A Monograph
by

Major Christopher Tucker
Infantry

School of Advanced Military Studies
United States Army Command and General Staff College
Fort Leavenworth, Kansas

First Term AY 91–92

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	31/12/91	MONOGRAPH

4. TITLE AND SUBTITLE
THE MECHANIZED INFANTRY BATTALION:
IS CHANGE NECESSARY?

5. FUNDING NUMBERS

6. AUTHOR(S)
MAJ CHRISTOPHER TUCKER, USA

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
SCHOOL OF ADVANCED MILITARY STUDIES
ATTN: ATZL-SWV
FORT LEAVENWORTH, KANSAS 66027-6900
COM (913) 684-3437 AUTOVON 552-3437

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

SEE ATTACHED

14. SUBJECT TERMS
MECHANIZED INFANTRY
FORCE STRUCTURE
BATTALION DESIGN
BATTLEFIELD CONDITIONS
DOCTRINE
AIRLAND OPERATIONS

15. NUMBER OF PAGES
72

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNLIMITED

SCHOOL OF ADVANCED MILITARY STUDIES

MONOGRAPH APPROVAL

Major Christopher Tucker

Title of Monograph: The Mechanized Infantry Battalion: Is Change Necessary?

Approved by:

Dennis W. Tighe, Monograph Director
COL Dennis W. Tighe, MS

James R. McDonough, Director, School of Advanced Military Studies
COL James R. McDonough, MS

Philip J. Brookes, Director, Graduate Degree Program
Philip J. Brookes, Ph. D.

Accepted this 31st day of December 1991

ABSTRACT

The Mechanized Infantry Battalion: Is Change Necessary? by MAJ Christopher Tucker, USA, 72 pages.

As the Army transitions to the 21st Century, it will make changes based on new threats and technologies, the world environment, and the national security strategy. These changes help generate a warfighting concept, which then provides the foundation for changes in U.S. Army doctrine, training, organization, materiel, and leader development (DTOML). AirLand Operations is the latest warfighting concept. This monograph examines the future as projected by the AirLand Operations Concept to determine if the maneuver structure of the mechanized infantry battalion should change from four to three companies.

The study first examines theories of the modern battlefield and organization theory to identify factors that cause organizations to change. The study then examines span of control theory to determine if there is an optimum span of control for the modern battlefield. Next, the study analyzes the "pentomic" structure and Army 86, where warfighting conditions similar to those projected by AirLand Operations were the basis for changing the mechanized battalion. The monograph then compares AirLand Battle Doctrine and the AirLand Operations Concept to identify relevant differences which would indicate a need to change the number of maneuver companies in the mechanized infantry battalion. Finally, the study compares the existing four-company organization to an alternative three-company structure to determine the advantages and disadvantages of each on the future battlefield. Three of the components of combat power--maneuver, firepower, and protection--serve as the criteria for each analysis throughout the study.

Although AirLand Operations is different from AirLand Battle, the study concludes that the changes in battlefield conditions are not significant enough to warrant a change from four to three maneuver companies. Based on this conclusion to maintain the status quo, the monograph concludes with some implications for force structure, tactics, techniques, and procedures (TTP), and training.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

ADA.....Air Defense Artillery
ALB-F.....AirLand Battle-Future
AOE.....Army of Excellence

BOS.....Battlefield Operating System

CBRS.....Concept Based Requirements System
CGSC.....Command and General Staff College
CONARC.....Continental Army Command
CONUS.....Continental United States
CTC.....Combat Training Center

FC.....Field Circular
FM .....Field Manual

NTC.....National Training Center

SAMS.....School of Advanced Military Studies

TRAC.....TRADOC Analysis Command
TRADOC.....US Army Training and Doctrine Command

I. INTRODUCTION

> We are in a period of great change--coming from many directions and of many dimensions. The critical challenge for the Army is how to deal with this change.[1]
>
> General John W. Foss, 1990

> Change is a constant for today's armed forces. With frequent shifting requirements as well as advancing technology, it is important that any reforms contribute to a force's ability to operate on the battlefield.[2]
>
> General Donn A. Starry, 1983

AirLand Operations is the Army's operational concept for how it will fight from 1995 into the early 21st century.[3] The concept is a broad description of what operations Army forces must execute on the future battlefield.[4] As such, it sets the framework for how the Army will change to meet the challenge of fighting on the future battlefield. This paper examines the changes projected for the future--by the AirLand Operations Concept--and their impact on the organization of the mechanized infantry battalion.

In the future, the strategic role of the Army is likely to change, based on the evolution of the National Security Strategy. The changes in the Soviet Union, the development of regional powers, and a shift in domestic priorities will combine to affect the future security structure of the United States.[5] Within this strategy the Army can expect to have global responsibilities to employ tactical forces to deter or win conflicts and wars.[6]

As the Army adapts to the changes in the balance of power caused by the dissolution of the Soviet Union and the lessons learned from Operation DESERT SHIELD/DESERT STORM, it should also

weigh J.F.C. Fuller's 1951 warning against the possible requirements of the future battlefield:

> The only way to prevent ossification of the mind is to accept nothing as fixed, to realize that the circumstances of war are everchanging, and that consequently organization, administration, strategy, and tactics must change also. . . . Adherence to dogmas has destroyed more armies and lost more battles and lives than any cause in war.[7]

The Army makes changes based on inputs from many sources. Changes in the threat, technology, and world conditions--combined with guidance from agencies such as the Joint Chiefs of Staff and National Command Authority--frame the Army's requirement to adjust its warfighting concept. The process used to translate the changes and guidance into new concepts is the Concept Based Requirements System (CBRS) (Figure 1).

U.S. Army Training and Doctrine Command (TRADOC) uses CBRS to identify and prioritize Army warfighting requirements for doctrine, training, organization, materiel, and leader development (DTOML).[8] CBRS supports the Army's efforts to plan and program for the future by projecting the requirements of the future battlefield--as envisioned in the operational concept--and identifying warfighting needs that pertain to each element of DTOML.[9]

Because evolving concepts of future war may require major changes in DTOML--or none at all, the purpose of this monograph is to determine whether the Army should change the number of maneuver companies in the mechanized infantry battalion from four to three, based on the battlefield conditions projected by the AirLand Operations Concept.

Changing the structure of an organization is a difficult task.[10] It must be considered carefully to determine if reorganization is the best course of action for adapting to change. As Earnest Dale states in his book, Planning and Developing the Company Organization Structure, "Too often the decision to reorganize is based merely on a hankering for a new order or procedure or simply on the desire for change."[11] Therefore, my analysis of the topic will consider a number of areas.

My methodology for analyzing this question focuses on theory, history, doctrine, and maneuver force structure. First, I will examine theories of the modern battlefield and organizational theory to identify future warfighting conditions and factors that cause organizations to change. Given this information, I will examine span of control theory to determine if there is an optimum span of control for maneuver elements on the future battlefield. Next, I will introduce the Wass de Czege Combat Power Model to develop the components of combat power--maneuver, firepower, protection and leadership--into my criteria for conducting the historical, doctrinal, and force structure analyses. Third, I will examine two periods from the Army's recent history in which warfighting conditions, similar to those projected by AirLand Operations, were used to change the structure of the battalion. The purpose of this analysis is to illustrate how and why the structure changed to adapt to those conditions.

Fourth, a comparison between AirLand Battle Doctrine and the AirLand Operations Concept should reveal any relevant differences between the concepts. I will analyze these differences to determine if they indicate a need to change the number of maneuver companies in the mechanized battalion's structure.

Finally, my criteria from the combat power model will help me compare the existing maneuver organization of four companies to an alternative three-company structure developed by TRADOC. The purpose of this analysis is to determine if a structure change is necessary, given what we expect to see on the battlefields of the future.

My conclusions will synthesize the results of the historical, doctrinal, and force structure analyses. These conclusions should imply what needs or does not need to be done in the areas of future force structure, training, and doctrine.

My study is significant because it supports on-going TRADOC force structure analyses. Moreover, force design is a key factor in building and preparing forces for future conflict. As Colonel Lewis Jefferies notes in his article, "A Blueprint for Force Design," "[Force design] determines a unit's proper internal composition so that it can best accomplish its intended battlefield purpose."[12] Thus, the answer to my question could have a significant impact not only on the doctrine, training, and procedures for the mechanized battalion of the future, but also on how it accomplishes its mission.

II. THEORETICAL PERSPECTIVE

Because theories provide a basis for understanding, they can be aids to clear thinking and can assist in developing rules for action.[13] As such, they can form a foundation for studies, research, and analyses. In fact, theory serves as the basis for U.S. Army doctrine.

Consequently, I will discuss two theories in this section which may assist in understanding the design of military organizations. Theories of the modern battlefield offer visions of the conditions that might be present in future conflicts. These conditions can determine requirements for organizations such as the mechanized infantry battalion. The second theory, organization theory, should illustrate why organizations change. Secondly, it may indicate an optimal structure size by examining appropriate spans of control for the modern battlefield.

Modern Battlefield

Theories about the modern battlefield are important because they define the conditions that the mechanized infantry battalion may face in future conflicts. Furthermore, they can serve as a foundation for force design because they illustrate the relationship among such factors as the threat, terrain, weapons' lethality, and the impact of technology.[14]

In the future we can expect the characteristics of the battlefield to reflect changes in technology and the composition of military forces. In The Future of Land Warfare, Chris Bellamy speculates on the environment of the next battlefield:

> The future battlefield will look very empty. [H]ere and there a target appearing, being engaged by an anti-tank missile or perhaps a laser designator, and then . . . an explosion as an invisible artillery shell plummets to its target.[15] In immediate terms the battlefield must be fairly empty, except for limited moments when forces concentrate for attack.[16]

The improved lethality, range, and accuracy of weapons on the future battlefield will contribute to dispersion, since units must spread out to improve their chances of survivability. Even today, satellites can acquire exact target locations. Once these targets are detected, precision guided munitions can quickly destroy them from hundreds of miles away. Because of these significant capabilities any force can be detected and attacked well before it reaches direct fire range.[17] The more the force is concentrated, the more likely it is that it will suffer a larger number of casualties.

James Schneider, a theory professor at the U.S. Army School of Advanced Military Studies (SAMS), concurs with Chris Bellamy and details the development of this theory in his article, "The Theory of the Empty Battlefield." The essence of the article explains how observations from a series of 19th Century conflicts indicated that battlefield conditions were becoming characterized by a "great dispersion of troops on the battlefield."[18] Mr. Schneider believes this trend has continued.

The improvements in weapons--the rifled musket and Minie ball--combined to cause this "empty battlefield" phenomenon. While the above weapons and ammunition increased lethality, the magazine and smokeless powder increased soldier survivability and reduced casualties through battlefield dispersion.[19] Subsequent

advances in technology continued to expand the empty battlefield. In the 20th Century, the invention of nuclear weapons and precision guided munitions increased lethality--and thus dispersion--even more, while the invention and continued improvement of radios tightened command and control of dispersed forces.

In addition to changes in lethality and dispersion, the size and composition of opposing forces will probably change on the future battlefield. Arms control agreements and future budget constraints may result in smaller armies fighting on an already "empty" battlefield. Consequently, units may face situations where large gaps will exist between forces and within units.[20]

The conditions of the modern battlefield generate many of the requirements for future force design. According to Major General Stephen Silvasy, former deputy chief of staff for Concepts, Doctrine, and Development at TRADOC,

> The more open, less structured battlefield places a premium on mobility, agility, flexibility, and rapid generation of combat power. Commanders will need . . . to operate in a rapidly developing situation. The commander will earn his pay by moving his force quickly . . . and generating combat power much faster than the enemy.[21]

One question that arises is, do these future conditions and requirements warrant a change in structure? Moreover, is there an optimum span of control for the organization given the conditions of the modern battlefield? The answer may come from organization theory, which provides some insight into organizational change and span of control.

Organization Theory

Organization is a fundamental component of an Army. The purpose of an organization is to maintain troop control and facilitate the employment of fire and maneuver against an enemy force.[22] Organizational theorists William Scott and Terence Mitchell define an organization "as a system of coordinated activities of a group of people working together toward a common goal under authority and leadership."[23]

According to the theorists, organizations are designed to employ resources in order to achieve an objective or provide a service.[24] The structure is generally based on the mission, the conditions in which the organization operates, and the tasks that must be accomplished to attain the objective.[25] Once designed, the organizational structure usually remains constant until some sort of change occurs.[26]

Explanations for organization changes are generally based on the theory that change occurs either through internal or external factors.[27] Internal factors include: personnel losses, management dissatisfaction, and organizational inefficiency. External factors may consist of changes in the operating environment, mission, or tasks that support the mission.[28] Moreover, changes often require a change in the division of labor and a resultant change in structure to accomplish a new or adjusted series of tasks.[29] If a change in structure is necessary, the organization must then determine the appropriate design and span of control based on the tasks and the environment.[30]

To facilitate control the organization assigns tasks or activities to its subordinate units. In a military unit for example, tasks are often assigned to subordinate units based on the organization's mission. In an attack, the mechanized infantry battalion may assign tasks such as main attack, supporting attack, attack by fire, and reserve to its four subordinate companies. However, there may be an appropriate number of subordinate units which will achieve a balance between mission requirements and the leader's need to command and control the organization effectively. By determining what that appropriate span of control is we may be able to identify if the current maneuver battalion structure should change to support AirLand Operations.

Organization theory defines span of control as "the number of subordinates effectively controlled by a supervisor."[31] Span of control theory recognizes the fact that leaders have limitations --specifically, time, energy, and the number of subordinates among which he can effectively divide his attention.[32] Furthermore, theory suggests that an appropriate control structure depends on the competence of the leader, the quality of his subordinates, the quality of the communication means, and the complexity of the situation.[33]

In his book, Ernest Dale recognizes these aspects of theory and recommends an optimum span of control of between three and six subordinates.

> The number of subordinates whose tasks are interdependent and who can be directed . . . effectively by one individual is limited. It should not exceed five

> or six. The ideal number . . . for all superior authorities appears to be four.[34]

Another view of span of control comes from noted author, Martin van Creveld. He discusses the aspects of span of control and its impact on modern battle in Command in War. In comparing different spans of control, van Creveld believes that a decentralized, dispersed battlefield, such as TRADOC envisions for the future, requires a narrow span of control.[35] Said another way, decentralized battle, with isolated units that are spread over large distances, requires a smaller leader-to-led ratio.

Nevertheless, van Creveld also believes that wide spans of control are acceptable under specific conditions. For example, if the commander and subordinate leaders are highly competent and the organization is well trained, a wider span of control may be appropriate.[36]

Currently, the US Army has no specific doctrine for span of control. The general guideline is that each headquarters should be able to control from two to five subordinates.[37] For example, FM 71-3, The Armored and Mechanized Infantry Brigade states:

> As a rule, each brigade can control two to five battalions . . . . However, as the battle increases in intensity, the commander's span of control must be limited to a controllable number . . . generally not more than four.[38]

In determining an appropriate span of control for the battalion, an article written during the interwar period may be useful. In the 1936 article, "Field Service Regulations of the Future," Major E.S. Johnston discussed some of the issues

associated with controlling a particular number of maneuver units. Two subordinate units provide one to fix and one to maneuver, while three subordinate units can provide one to fix, one to maneuver, and one as a reserve.[39] Four subordinate units provide a more flexible organization in that it provides sufficient force to mass two units in the main attack, while one unit fixes the enemy and one remains in reserve.[40] Conveniently enough, his view closely relates to organization theory, which recommends from three to six subordinates.

TRADOC expects the modern battlefield to be "more open, less structured, with changes occuring rapidly."[41] Given these conditions and our discussion of organization theory and span of control, an appropriate span for maneuver units is clearly two to five subordinate units. Moreover, since our vision of the future projects the need for dispersion, it would seem that more subordinate units on the battlefield are better than fewer. Such a conclusion would imply four or five subordinates. Furthermore, FM 71-3 says that the span should be no more than four, while Johnston recommends four to enhance flexibility. Theoretically, then, it appears that four subordinates form an appropriate span of control.

III. COMBAT POWER MODEL

An organization with an optimum span of control is not the only recipe for success on the modern battlefield. Success will depend on an organization with a leader who effectively employs all available combat power. As stated in FM 100-5, Operations,

"the dynamics of combat power decide the outcome of . . . battles and engagements. Combat power is the ability to fight."[42] Essentially, it measures the effect created by combining maneuver, firepower, protection, and leadership against an enemy force.[43] One aid to understanding the effects of combat power is the theoretical model developed by then-Colonel Huba Wass de Czege. In this section I will use his model to develop criteria for measuring that power. These criteria will be the basis of my analyses throughout the rest of this paper.

"The outcome of battle depends on the difference in combat power of the antagonists."[44] The Wass de Czege Combat Power Model is important because it represents a qualitative method for analyzing units. That is, it provides a different way of looking at combat potential because it avoids the number crunching, operations research approach--"simplistic thinking based on judgements about only quantifiable aspects of the battlefield."[45] As stated by then Colonel Wass de Czege:

> Although numbers are important, relative combat power is determined . . . [by how] potential strength and resources are brought to bear against the enemy.[46]

FM 100-5 identifies the advantages of such an approach:

> [W]hile quantitative measures of available capability are important, the quality of available capabilities, the ability of the leader to bring them to bear, and the ability . . . to avoid the enemy's efforts . . . may be equally or more important.[47]

The model states that the outcome of battle is the result of the friendly (f) and enemy (e) ability to combine the effects of firepower (F), maneuver (M), and protection (P) under effective

leadership (L), while simultaneously attempting to avoid each other's ability to degrade (D) these effects. (See Figure 2). The model expresses the relationship of the relative combat potentials to the battle outcome in the form of a conceptual equation:

Lf(Ff+Mf+Pf-De)- Le(Fe+Me+Pe-Df)= Battle Outcome.[49]

I will expand Wass de Czege's definitions of maneuver, firepower, and protection by including some of the organizational characteristics expressed in the AirLand Operations Concept. These expansions will help tailor the criteria to meet the needs of my problem. For the purpose of this analysis, I will assume that leaders of an organization are competent and skilled, as long as the span of control remains less than or equal to five. Therefore, I will only define the criteria of maneuver, firepower, and protection.

MANEUVER. Maneuver is the dynamic element of combat. The effect is achieved by concentrating forces at the critical time and place to gain an advantage over the enemy.[49] Among other factors, it includes mobility, agility, flexibility, and span of control. Thus, this criterion will focus on determining: 1) How effectively does the organization maneuver to a specific location on the battlefield; 2) How constrained is the organization by terrain and suitability of movement routes? 3) How flexible is the organization in employing different maneuver formations?

FIREPOWER. Firepower provides the enabling, violent, destructive force essential to realizing the effects of maneuver. It is the means of suppressing enemy fires and destroying his capability to

fight. It includes volume and lethality of fires, acquistion capability, and the means to flexibly employ the organization's weapons systems.[50] In analyzing firepower, I will attempt to determine: 1) Does the organization enhance the unit's capability to destroy enemy forces by providing a greater volume of fire? 2) How capable is the unit of acquiring enemy forces? 3) Does the organization allow for the flexible employment of its available weapons systems?

PROTECTION. Protection is the shielding of the fighting potential of the force and contains the components of agility, concealment, and security. It provides the means of protecting the organization so that it can be employed at the decisive time and place.[51] The criterion should, then, help me determine: 1) Does the organization limit the enemy's ability to acquire and engage it? 2) How effective is the organization at mitigating the effects of enemy counter-action after it is acquired? 3) How capable is the organization of conducting all-round security, whether moving or stationary?

IV. HISTORICAL PERSPECTIVE

To understand the future, study the past.[52]

Martin van Creveld

Throughout the history of warfare the introduction of increased lethality to the battlefield has been accompanied by changes in organization and tactics.[53]

BG William F. Train

U.S. Army doctrine and force developers place much emphasis on the value of history. As they analyze the uncertainties of

the future, they must consider appropriate warfighting principles learned from analyses of past military operations.[54] In a similar manner, I will evaluate two reorganizations from Army history--the change to the pentomic structure in the mid-1950's and the shift to the Army 86/Army of Excellence structure in the 1980's.

During both of these periods the Army predicted that battlefield conditions would become 1) more lethal and 2) more dispersed or "nonlinear." As a result, the Army restructured the battalion in anticipation of those conditions. My goal is to illustrate how the Army restructured the battalion and why they selected a certain number of maneuver companies. Using my criteria as a framework, I will analyze the resultant structures to determine if these organizations can provide any lessons which may assist in determining whether the mechanized battalion should have four or three comapnies to fight on the modern battlefield.

The Pentomic Organization

By the conclusion of the Korean War, Army echelons were organized to face a conventional combined arms threat. The battalion consisted of three rifle companies and a headquarters company, and was designed to fight as part of a regiment on a predominantly linear battlefield--such as in Korea or Central Europe.[55]

Following the Korean War, however, the Army responded to potential combat environment changes that would shape its doctrine and force structure for the remainder of the decade. President Eisenhower's decision to base the national security

strategy on "massive retaliation" forced the Army to adjust to the requirements of the nuclear battlefield. The result was the "Pentomic Division."[56] The Army chose the term to signify the concept of five subordinate units that could fight on an atomic and non-atomic battlefield. The conditions of "atomic" combat were the driving force behind the changes in unit design.[57]

The picture of the atomic battlefield was very similar to the current view of the modern battlefield.[58] Lethal conditions were projected as a result of the large number of nuclear weapons available and their effective damage radius.[59] For example, the diameter of effect of a bomb similar to the one used at Nagasaki corresponded roughly to the area of a Korean War era, dispersed, U.S. battalion.[60] Furthermore, dispersion and lethality were expected to increase due to the deployment of long range weapons such as the 280mm cannon and the Corporal missile to corps and divisions.[61] As a result, the Army expected large gaps between forces on the battlefield.[62] As stated by General Willard Wyman, Commanding General of Continental Army Command (CONARC):

> We see no lines . . . as we have known them in previous wars. Only a battle area. Within the battle area, to a depth of as much as 100 miles or more, we see small mobile units deployed at intervals measured in miles instead of yards.[63]

This change in conditions from the linear conflicts of World War II and Korea required a new organization. Tactical unit design would be based on three requirements: dispersion, mobility, and flexibility.[64] As A.J. Bacevich points out in his book, The Pentomic Era: "The trick was to mass forces rapidly at the critical time and place, to deliver the decisive blow, and

then just as quickly, disperse again."[55] The Army, therefore, had to find a means for dispersion and flexibility, and still retain an effective command and control system.[56]

These requirements led to changes in the maneuver and command and control (C2) structures. Army commanders wanted to streamline the C2 structure to speed the information flow to subordinate units.[57] On the other hand, the Army leadership also believed that dispersion and flexibility required an increase in the number of subordinate units. As Bacevich points out:

> The Army hoped that with a greater number of units . . . a commander would have more options for deploying forces in depth or for disposing them to fight . . . on a non-linear battlefield.[58]

Consequently, with more units per command, the span of control increased at all levels from company to division. Believing it would streamline C2, CONARC force developers eliminated the regiment and replaced the battalion with the battle group. The new structure consisted of five maneuver companies, a headquarters company, and a mortar battery (See Figure 4).[59] Similarly, five battle groups comprised the division.

CONARC designed the structure to meet the conditions of a lethal, nonlinear battlefield. Streamlined C2 would increase mobility and agility by reducing the time required to pass orders and information between echelons. Moreover, five maneuver companies would provide a means for attacking the enemy while still retaining sufficient forces to deal with unforeseen enemy action.[70]

The battle group structure had many effects on the organization's ability to generate potential combat power. An analysis using the above criteria as a framework should illustrate the advantages and disadvanatges of increasing the structure from three companies to five companies.

MANEUVER. The primary adavantage of the new structure was its flexibility. With five companies the battle group had a greater number of units and more options for deploying forces laterally and in depth. In the attack, for example, the commander could create depth by maintaining a reserve. Moreover, he could establish a reserve of one or two companies, depending on the situation.

The disadvantages in the structure were the increased time it would take to concentrate the larger force at a specific point and the span of control. The new structure required the commander to control five maneuver companies, a mortar battery and coordinate fires and attachments from division. The increased span of control ultimately degraded the maneuverability that the structure was designed to achieve.[71]

FIREPOWER. The pentomic battle group significantly increased firepower. The larger organization had the ability to create a greater volume of fire and acquire and engage more enemy forces.[72] Moreover, the structure gave the commmander more options for employing his weapons systems. In the defense, for example, he could establish three company positions forward with two in depth, or one in depth and one in reserve.

PROTECTION. The protection effect increased with the battle group structure. Although its size presented a larger target, by being able to disperse over more terrain, the organization could avoid the massive damage of a nuclear strike.[73] The loss of one company would still leave four companies to provide protection to the battle group. Moreover, security was enhanced by the number of companies. If threatened on the flank or rear, the commander could divert one or two companies to fix the enemy while the battle group continued the mission.[74]

Although the organization increased the firepower and protection effects, an excessive span of control degraded the maneuver effects and the overall performance of the organization. The battle group could fight on the dispersed battlefield, but the span of control made it difficult.[75]

Many of the same conditions that brought about the Pentomic structure resurfaced following the Vietnam War. As a result, the Army again worked to adapt organizational structure to nonlinear warfare.

Army 86/Army of Excellence

In the late 1970's, the vision of the battlefield began to change. At that time the Army had been organized under the Reorganization Objective, Army Division (ROAD) concept, which replaced the Pentomic Division in the early 1960's. The concept eliminated the battle group and established the combat arms battalion as the largest fixed maneuver organization.[76]

The battalion structure consisted of three maneuver companies, a headquarters company, and a combat support company

which was responsible for the scout, mortar, and antitank platoons. (Figure 5) CONARC designed the organization to fight in a mid-intensity, mechanized, and possibly nuclear environment in Europe.[77]

In 1974 General William Depuy, Commanding General of TRADOC, recognized from the short, violent wars between the Arabs and Israelis and the implications of the Soviet military build-up that the Army must reevaluate its warfighting concept. Moreover, the lessons from the 1973 War indicated that future battlefields would be characterized by an increased lethality of fires, the rapid attrition of materiel, a faster tempo battle, and the need for combined arms coordination.[78]

The conditions of the battlefield and the requirements of modern warfare indicated that the structure developed during the Vietnam Era would be insufficient for the 1980's and 1990's. As stated by TRADOC historian, John Romjue, "General Depuy felt that the ROAD organization could no longer harness the combat power of the 1970's, much less meet the conditions envisioned for the future."[79]

The conditions projected for the future were lethality and nonlinearity.[80] Lethality came from the realization that the 1973 War demonstrated the unprecedented destructive power of modern weaponry more than the Vietnam War had.[81] Meanwhile, the Soviet and Warsaw Pact build-up would lead to larger numbers of weapons and munitions, whose range and accuracy would necessarily increase dispersion.[82] Consequently, battlefield requirements were expected to change.

The 1976 edition of FM 100-5, however, only focused on the requirement for "increased lethality."[53] General Donn Starry, the new TRADOC Commander, disagreed with this view. He believed future wars would require organizations that were not only more lethal, but more maneuverable and could operate over larger distances.[54]

In 1978, General Starry, initiated the Army 86 study to prepare the Army for the future.[55] During the process TRADOC defined the basic parameters of tactical organization: "The battalion/task force would be the basic building block and . . . integrated combat action would be coordinated at the battalion level."[56] The battalion would be organized to achieve a balance among lethality, flexibility, and agility. As stated in the Division Restructuring Study (DRS):

> The maneuver battalion should be more flexible and responsive . . . . Smaller companies, organized around a single weapons system, will provide a better leader to weapons ratio, which increases fire distribution.[57]

In response to the new warfighting conditions the battalion changed significantly. To increase firepower and maneuver flexibility, and provide depth against a numerically superior opponent, the battalion increased from three to four maneuver companies. Furthermore, force developers added an anti-tank company to increase the battalion's firepower and protection capability. Additionally, companies became smaller to improve control, agility, and increase the leader-to-led ratio.[58]

Using my criteria as a framework, my analysis of the four-company maneuver structure provided the following information.

MANEUVER. The new structure provided both advantages and disadvantages for maneuver effects. The addition of a fourth maneuver company gave the battalion more flexibility to respond to the changing situations expected on the battlefield.[89] Four companies also increased the number of possible maneuver formations and enhanced its ability to task organize with an armor battalion. For example, the new structure could establish three different task organizations with an armor battalion--three mechanized companies and one armor company, two mech companies and two armor companies, and one mech company and three armor companies.

The battalion design had maneuver deficiencies similar to those observed in the pentomic battle group. With more companies and more vehicles than a three-company structure, the battalion should take more time to concentrate at a specific point and it could be more hindered by restrictive terrain.

FIREPOWER. The increase in the number of companies led to an increase in firepower.[90] With more systems the battalion could generate a greater volume of fire and have a better ability to acquire enemy forces on the battlefield. Moreover, the structure provided more flexibility for generating firepower effects. In the offense, for example, the commander could place two companies in the main attack, one in the supporting attack, and maintain one in reserve.

PROTECTION. The protection effects improved through the increased options for security and the ability to disperse the battalion over increased distances.[91] In the defense, the

commander could enhance security by establishing a counterreconnnaissance force with one company while the remaining companies prepared the main battle area.[22] Once again, the primary disadvantage was the larger size of the battalion, which could make it easier to acquire when it was massed on the battlefield.

Force structure changes often occur based on changes in the Army's warfighting concept. In the 1950's and 1980's the warfighting concept changed in response to the conditions projected for the "next war". Force developers projected increased lethality and dispersion which would lead to a "nonlinear" battlefield. In each era, the Army increased the number of maneuver companies at the battalion level as one method of adapting to the conditions.

My analyses indicate that both organizations--five company and four company--improved the effects of maneuver, firepower, and protection. The five company structure, however, degraded some of these effects through its larger size and increased span of control.

Thus, the historical analysis indicates that the modern battlefield probably requires more rather than fewer subordinate companies in a battalion. However, there may be a limit to the number a battalion should be able to control and still operate effectively, given the battlefield conditions. In the future, then, TRADOC may want to carefully consider whether a reduction in maneuver companies is the correct course of action when designing the next battalion structure.

History, however, is only one factor that assists in determining the requirements for change. Evolving warfighting concepts and doctrine also assist in identifying future force design.

V. DOCTRINE ANALYSIS

> An army's fundamental doctrine is the condensed expression of its approach to fighting campaigns . . . battles and engagements. Tactics, techniques, . . . organizations, equipment and training all derive from it.[93]

The basis for U.S. Army doctrine comes from the careful application of theory and history. Moreover, doctrine, through the synthesis of theory, history, and anticipated warfighting conditions defines broad requirements for our combat organizations. Before we can determine if the Army should change the mechanized infantry battalion, a review of current doctrine and future concepts seems in order.

In this section, I will compare AirLand Battle Doctrine and the AirLand Operations Concept to identify their similarities and differences. My purpose here is to determine if the differences in the tactical battlefield implied by the AirLand Operations Concept are significant enough to justify a change from four to three maneuver companies in the mechanized battalion structure.

AirLand Battle was born out of the changes identified in warfare during the 1970's. The Soviet build-up in Eastern Europe and the lessons drawn from the Yom Kippur War of 1973 had an influence on doctrine development.[94] Owing to the changing conditions, General Depuy had TRADOC develop and publish a new FM

100-5 in 1976. The concept of this doctrine was called the "active defense."[95] The term and doctrine were based on a defensive scenario in Europe, in which NATO would defend initially against the superior numbers of the Warsaw Pact.[96]

In 1978, General Starry recognized that the doctrine of "active defense" did not meet the U.S. Army's projected requirements for future wars. The Soviets planned use of massed, echeloned formations and the U.S. Army's requirement to meet threats both in and out of Europe required a new doctrine.[97] The result was the development and publication of AirLand Battle in 1982.[98]

The operational concept which provides the foundation of AirLand Battle is stated in the current edition of FM 100-5:

> AirLand battle doctrine describes the Army's approach to generating and applying combat power at the operational and tactical levels. It is based on securing or retaining the initiative and exercising it aggressively to accomplish the mission. The object of all operations is to impose our will on the enemy to achieve our purposes.[99]

From the concept we can derive five major characteristics of AirLand Battle: destruction of the enemy force; securing and maintaining the initiative; an aggressive offensive spirit; rapid maneuver, and a focus on commander's intent.[100] To achieve these characteristics, planning must orient on decisive objectives, stress flexibilty, and create favorable friendly opportunities by concentrating against enemy weaknesses.[101] Success at the battalion level will depend on the ability to apply the dynamics of combat power and fight according to the tenets of initiative, agility, depth, and synchronization.[102]

Like the AirLand Battle Concept, the AirLand Operations Concept was written to orient the Army on future conflicts. This concept, however, reflects the changing environment in which the Army will operate in the future. As stated in TRADOC Pamphlet 525-5, AirLand Operations focuses more on the Army's strategic and operational role and on the requirement to conduct operations with other services, agencies, and foreign countries.[103]

The development of AirLand Operations began in 1989 when General Foss issued guidance to the major integrating centers in TRADOC for the evolution of AirLand Battle within the concept known as AirLand Battle-Future (ALB-F).[104] He based his guidance on three issues: the recession of the Soviet threat in Europe, the resultant shift in the National Security Strategy, and the continuing improvements in technology.[105]

After twenty months of development, TRADOC published the operational concept in August 1991. The concept is an extension of AirLand Battle and defines the Army's warfighting role from 1995 into the 21st Century:

> AirLand Operations seeks opportunities to dictate how the Army will fight--seeking nonlinear conditions by applying operational fires and maneuver to destroy enemy forces. The concept demands we seize and maintain the initiative.[106]

The concept has a different focus from AirLand Battle--operational rather than tactical--and emphasizes the following characteristics: focus on enemy forces rather than terrain, develop initiative at all levels, maneuver and concentrate rapidly to conduct decisive operations.[107]

Although AirLand Operations focuses more on the operational level, it provides concepts for the tactical level which are very similar to AirLand Battle. The battlefield conditions, organizational requirements, and missions at the battalion level are very similar in both AirLand Battle and AirLand Operations.

AirLand Battle (ALB) is based on the conditions we developed in the theory of the modern battlefield. Although nonlinear operations were expected to be normal in ALB, tactical forces had to be able to fight linear battles as well as engagements of considerable movement.[108] Furthermore, potential enemies were expected to possess large numbers of highly accurate, lethal weapons systems.[109] The threat projected for the AirLand Battlefield was likely to consist of mechanized forces such as the Soviet Army and the Warsaw Pact, or less mechanized irregular forces located in many regions throughout the world.[110]

Similarly, AirLand Operations is based on the assumption of a nonlinear nature of modern war. The factors which define nonlinearity, however, are different in the AirLand Operations Concept. Arms control agreements, smaller armies, and the increasing ranges of weapons systems are expected to reduce the density of forces on the battlefield.[111] Moreover, technology will continue to improve the range and lethality of weapons. In the future we can expect weapons such as precision guided munitions (PGM)--which can destroy targets at great ranges with a single round--to become more prevalent.[112] Furthermore, the effectiveness of these weapons will be enhanced by improvements in acquisition systems.[113]

Although they at first seem similar, a closer analysis of the current doctrine and the new concept reveals some differences. Although both identify the existence of linear and nonlinear operations at the tactical level, the AirLand Operations Concept places a greater emphasis on nonlinearity.

> We must . . . seek to create the nonlinear environments which allow us to exploit the advantages of nonlinear operations--conducting operational maneuver, [and] avoiding the mutual attrition of linear operations . . . .[14]

Another difference is the threat. Unlike AirLand Battle, AirLand Operations does not strictly focus on the Soviet Army; rather, it recognizes its presence but also indicates the increasing potential for other threats in other regions of the world.[15]

From the battlefield conditions, force developers can identify requirements for a particular echelon or force structure. The organizational requirements are similar in both concepts. Both AirLand Battle and AirLand Operations outline the requirement to fight on an extended battlefield where the battalion's focus is on maneuver in the close battle area.[16] Moreover, they both focus on maneuver and firepower to take advantage of opportunities to engage enemy weaknesses, while possessing agility to concentrate rapidly against his forces.[17] Furthermore, in both concepts the battalion should use the extended battlefield to engage the enemy throughout the depth of his formations while ensuring that fire and maneuver are synchronized to strike the enemy at the decisive point and time.[18]

The principle difference in requirements is that AirLand Operations places more emphasis on speed and agility. The less structured battlefield projected by the AirLand Operations Concept "places a premium on force mobility, agility, and the flexibility to react to rapidly changing situations."[119] According to Major General Silvasy:

> Emphasizing the importance of maneuver, we seek to avoid "head-to-head," attrition warfare. When we do attack we will hit his flank and rear. Our goal is to gain and maintain the initiative.[120]

The battlefield conditions, requirements, and doctrine form the basis for the development of the battalion's mission. Because both AirLand Battle and AirLand Operations predict similar battlefield conditions, they both expect the same mission for the mechanized infantry battalion.

> The mechanized infantry battalion is to close with enemy by means of fire and maneuver in order to destroy or capture him or repel his assault by fire, close combat and counterattack.[121]

Given the warfighting requirements, the battalion will accomplish its mission within a battlefield framework. Although the terms used to depict the organization of the two battlefields are different, the battalion's focus is the same. AirLand Battle Doctrine defines the battle in terms of close, deep, and rear operations.[122] AirLand Operations, on the other hand, separates the battlefield into five areas: joint intelligence and air attack area; joint battle area; shaping area; close battle area; and the dispersal area (Figure 7).[123] In both concepts, however, the battalion focus is on the close battle, because "this is where decisive operations are conducted."[124]

A comparison of AirLand Battle and AirLand Operations reveals that the two concepts have a common foundation and similar focus for the employment of the battalion. AirLand Operations, however, illustrates a different battlefield where nonlinear conditions and the requirements for maneuver change from AirLand Battle. Moreover, AirLand Operations seeks to establish nonlinear conditions at the tactical level to exploit operational level maneuver.[125] Consequently, there is a change in the requirements for the battalion. Given the AirLand Operations Concept, the battalion should achieve a better balance among mobility, agility, and flexibility while at the same time, improve firepower to be able to rapidly complete the destruction of the enemy.

The balance of requirements sought by the AirLand Operations Concept, however, may not necessitate a change in the number of maneuver companies within the battalion. Mobility and agility could be enhanced through improvements in materiel, changes in doctrine, and increased training. Nevertheless, force structure, is another way that enhancements may be realized; therefore, a comparison of a four-company organization against a three-company structure seems in order.

VI. FORCE STRUCTURE ANALYSIS

Although my analysis to this point does not seem to indicate a requirement to change the number of companies in a mechanized battalion, TRADOC force developers believe the conditions and requirements projected by AirLand Operations demonstrate a need

to at least evaluate an alternative design. As stated by Major General Silvasy,

> If we are to adapt our organizations to the future, we need to look at ways to apply newer concepts. To enhance mobility and agility, a move to smaller maneuver battalions . . . appears to merit further testing.[126]

In continuing to analyze the viability of the current battalion structure in AirLand Operations, I will compare it to the organization proposed by TRADOC using the criteria in the Wass de Czege Combat Power Model. My data for the comparison will include lessons learned from the NTC and Operation DESERT STORM and the results of simulations conducted by TRADOC Analysis Command (TRAC).

Current Organization

The current mechanized infantry battalion evolved from AirLand Battle Doctrine. The Army designed the battalion to fight on a nonlinear, lethal battlefield where both opponents maintain large quantities of equipment capable of mobile, maneuver warfare.[127]

To accomplish its mission, the battalion consists of four maneuver companies, an anti-armor company, and a headquarters company (See Figure 6). The design comes from the projection of the future fight as envisioned by TRADOC in 1979.[128] Moreover, the structure was to provide the battalion agility and flexibility and increase the leader-to-led ratio.[129] Based on its organization, the battalion has certain capabilities and limitations. The current mechanized battalion is capable of conducting rapid offensive operations, limited penetrations, and

exploitation and pursuit as part of a larger force. The battalion can also conduct defensive operations and, for limited periods, independent operations.[130]

Because of the number of tracked and wheeled vehicles, the battalion has certain limitations: restricted mobility and firepower in urban terrain; limited strategic mobility; and high consumption rates for supplies--especially, fuel, ammunition, and repair parts.[131]

Given the battalion's organization, capabilities and limitations, FM 71-2, The Tank and Mechanized Infantry Battalion Task Force, tells us how the battalion should perform according to doctrine. One important question for force developers, however, is how does it perform? More important, have problems been identified in performance that suggest the need for a change in organization? Results from training exercises, the National Training Center (NTC), and Operation DESERT STORM should provide some answers to those questions.

Since 1982, the mechanized infantry battalion has undergone numerous observations during realistic training exercises. According to force developers at the Infantry and Armor Schools, after action reports and observations indicate three problem areas for the current force structure.[132] First, commanders do not understand how to employ four maneuver companies, which results in poor maneuver in the attack and poor use of firepower in the defense. Second, the battalion has too many subordinate units; therefore, it takes too long to concentrate against the enemy in offensive operations. Third, four maneuver companies

make the battalion too difficult to command and control during combat operations.[133]

Reports and analyses from the NTC, however, do not support the contention that the problem is with the maneuver structure. Lessons learned indicate that the four-company organization is successful both in the attack and the defense for the following reasons. Four companies provide increased firepower and maneuver flexibility. Furthermore, the four-company structure provides the commander more options to develop the situation once contact occurs.[134] For example, in a movement to contact, the commander can use one company as an advance guard to develop the situation while he maneuvers the combat power of three companies against the enemy or bypasses the enemy and continues the operation. Observations identify poor staff planning, a lack of training at the company and battalion/task force level, and weak execution by the commander and staff as causes for the battalion's maneuver problems.[135]

Supporting the above views are initial lessons learned from Operation DESERT STORM, which indicate the current organization is very effective in conducting AirLand Battle Doctrine in combat. According to the US Army Armor School After Action Report:

> The effectiveness of the four maneuver company heavy battalion/task force was validated in Southwest Asia. Commanders feel that four maneuver companies are needed to fix the enemy, have enough combat power to maneuver against him, and maintain continuous operations. Additionally, the . . . organization facilitates more effective task organization and allows the commander to maintain a reserve.[136]

Although the current organization has demonstrated success on the AirLand Battlefield, we must continually look ahead. A large maneuver battle in Iraq may not, in fact, give us the correct picture of the future. According to Major General Silvasy, "One way [to apply newer concepts] is to have a clear alternative organization for testing, to be compared to our current organization."[137]

AirLand Operations Structure

The TRADOC "clear alternative" is based on the design considerations contained in the AirLand Operations Concept. The design requirement is for "ground maneuver units which are more agile, more mobile, and more capable of rapidly transitioning from tactical movement to decisive close combat."[138] To achieve these requirements and simplify command and control, the battalion organization consists of three maneuver companies and a headquarters company, and an antitank platoon (See Figure 5 for a diagram of the battalion structure).[139] Furthermore, to enhance agility and reduce the size of the battalion, much of the previously organic combat service support (CSS) capability would be moved to the brigade, leaving the battalion with only emergency fuel and ammunition vehicles.[140]

Based on the design proposal, the alternative battalion should have capabilities and limitations which are similar to the current organization, with the following exceptions. The battalion should be able to move faster and cover less road space because of its smaller structure. With fewer systems to move, it should be able to concentrate faster against the enemy than the

current mechanized battalion. On the other hand, the battalion is unable to conduct independent operations and may have difficulty conducting continuous operations unless sufficient CSS is attached from brigade.[141]

Although the alternative structure is only a concept, simulations conducted by TRAC can provide an idea of what the battalion's strengths and weaknesses would be in a wartime situation. Thus, as part of the Alternate Base Case Study, TRAC conducted a series of simulations for the new organization.

The purpose of the analysis was to compare the three-company battalion to a four-company structure in an offensive scenario using projected AirLand Operations doctrine. The battalion's mission was to attack as part of a brigade counterattack against a tank regiment in a hasty defense. The conditions were set on central European terrain and provided both battalions with a 2004 AirLand Operations force structure at full strength against the projected threat structure at 50 percent strength.[142]

Naturally, the results apply only to this specific situation. However, a summary of the results tends to track with my earlier findings. The results of the comparison indicate that the three-company battalion possesses some advantages over the four-company maneuver structure (See Figures 9 & 10 for the detailed results). TRAC's conclusion was that the three-company structure is more agile and can concentrate faster. However, the four-company structure has better flexibility to respond to changes on the battlefield and possesses greater firepower.[143] Finally, both

battalions accomplished the mission, given the scenario's conditions.[144]

Comparison of Alternatives

Given this brief comparison overview of the two battalion organizations, I can now compare them in more detail using the criteria developed earlier in this paper. Before conducting the comparison, some assumptions are necessary. First, each organization has similar equipment, since I am analyzing concepts and unit structures rather than weapons systems and equipment. Second, AirLand Operations does not focus on a specific threat; therefore, the combat power effects generated by an enemy force are the same for both organizations. To clarify numerical differences in weapons, personnel, and equipment, the strengths of each battalion are listed in Table 1.

Table 1. Battalion Strengths (Maneuver Companies only).

ITEM	4 COMPANIES	3 COMPANIES
Total Personnel	424	390
Infantry Fighting Vehicles	54	44
HMMWVs	8	3
Trucks (Cargo/Fuel)	8	3
Infantry (dismountable)	240	180

MANEUVER. Both organizations have the ability to concentrate forces at the critical time and place to gain an advantage over the enemy.[145] The four-company structure however, has better flexibility. With four companies, the commander has more possible maneuver combinations during an operation.

In contrast, the three-company structure possesses better mobility and agility. Given fewer systems and a smaller organization, the battalion should need less time to concentrate, thereby allowing the organization to act faster than the enemy. Furthermore, the battalion requires less road space and fewer routes when conducting tactical movements. In sum, the three-company organization should better allow the commander to move and concentrate more rapidly against an enemy force.

FIREPOWER. As shown by the TRADOC simulations, both battalions, should have the capability to destroy future enemy forces under certain conditions. The current structure has the capability for a greater volume of fire and a more flexible employment of weapons systems. First, the four-company structure has more weapons systems than the alternative. With four rather than three maneuver companies, the commander has more options for employing the battalion's weapons systems. In the defense, for example, the battalion could mass the fires of two companies in two different engagement areas or mass the fires of four companies in one engagement area. Thus, the current battalion is the better choice for providing and delivering lethal fires on the enemy force.

PROTECTION. The alternative structure has the advantage in protection because of its smaller size. With fewer systems the organization should be more agile, making it harder for the enemy to acquire while on the move.

In contrast, the current battalion better enhances security. For example, in a movement to contact, the battalion can

establish an advance guard company to lead, position one company on each flank, and maintain one company as a rear guard. Furthermore, in the defense, four companies would allow the commander to establish a counterreconnaissance screen with one company while three--rather than two--companies prepare the defense.

A compilation of the advantages and disadvantages of each structure illustrates that the three-company structure has an advantage in maneuver while possessing disadvantages in firepower and protection effects. In contrast, the four-company structure enhances firepower and protection while its size degrades its maneuver effect. Consequently, the three-company battalion should be able to mass faster, but the four-company battalion should be able to destroy enemy forces faster, while being better prepared to protect itself and to react to the changing nature of the future battlefield.

Decisive operations require the effective application of combat power to defeat enemy forces.[146] Although it may not concentrate as fast, the four-company structure has the capability to better apply the effects of maneuver, firepower, and protection against enemy forces on the modern battlefield.

VII. CONCLUSIONS AND IMPLICATIONS

> Still it is the task of military science in an age of peace to prevent the doctrines from being too badly wrong.[147]
>
> Michael Howard

> We trained hard but it seemed that every time we were beginning to form up into teams, we would be

> reorganized. I was to learn later in life that we tend to meet any new situation by reorganizing, and a wonderful method it can be for creating the illusion of progress while only producing confusion, inefficiency, and demoralization.[149]
>
> Roman Warrior

As it begins to prepare for future conflicts, the U.S. Army faces similar dilemmas. To be ready for the future, we must anticipate requirements now so we are ready when conflict begins. However, as we analyze future requirements, we should first weigh any potential changes against the possible turbulence caused by those changes--turbulence that may negate the intended effect of the change. As organization theorist Earnest Dale states,

> Change is always disturbing, however good its purposes may be. Changes may be made at the wrong time, in the wrong way; they may hit carefully established and smoothly working . . . patterns.[149]

The purpose of this paper was to determine whether the Army should change the number of maneuver companies in the mechanized infantry battalion based on the battlefield conditions projected by the AirLand Operations Concept. Resolution of the question required a thorough analysis of theory, history, doctrine, and force structure. Theory was useful because it postulated what the conditions of the future battlefield might be, and reflected some of the factors that cause organizations to change. Moreover, it examined the different possibilities for an appropriate span of control for a more open, less structured battlefield.

Given this theoretical basis, history then proved useful since it identified that changes in battlefield conditions have a direct impact on force design. In fact, the examples illustrated

that on two previous occasions the Army increased the number of maneuver companies at the battalion level in response to a projection of lethal, nonlinear warfare. Given the similar conditions between the periods discussed and those projected by the AirLand Operation Concept, it would appear that the current structure of four companies--rather than the smaller three-company force--is an appropriate number of subordinate maneuver units for operations on the future battlefield.

Theory and history provide the foundation for our doctrine, and the latter has an impact on the development of the Army's force structure. Although a comparison of AirLand Battle Doctrine and the AirLand Operations Concept revealed that the two concepts are very similar, AirLand Operations does have some differences. The differences, however, are not significant enough to warrant a change from four to three maneuver companies in the mechanized battalion.

Finally, force structure identifies the size and composition of an organization. Results from training exercises, computer simulations, and battlefield experience indicate the current four-company structure has demonstrated success in the application of combat power. Moreover, the structure has not shown any major deficiencies which might demand a need for change. In this study, a comparison conducted with a three-company alternative structure using the criteria of maneuver, firepower, and protection illustrated that the four-company structure has some advantages in the application of combat power.

Furthermore, the alternative did not demonstrate enough advantages to recommend replacement of the current structure.

My conclusion, then, is that a change from four companies to three companies is not necessary. Based on this conclusion, I derived some implications for force structure; tactics, techniques, and procedures (TTP); and training. My conclusion that we should maintain the status quo may reduce the impact on other force structures. As illustrated by Colonel Jefferies,

> The TOEs of different types of units are interdependent because units are designed to support each other. Therefore, a change in one TOE usually leads to changes in several others.[150]

For example, if the mechanized battalion does not change, there may be no need to change the maneuver structure of the tank battalion, because of their habitual relationships and closely related missions.

As the tactical doctrine to support the AirLand Operations Concept evolves, TRADOC should look at ways to improve the mobility and agility of the four-company structure. By revising TTP for the battalion, TRADOC could improve agility through simpler operations, revised tactical formations, and improvements to command and control procedures.

In addition, my conclusion has an impact on training. By maintaining the current structure, training will not require change, as much as it will a revision. As we adjust doctrine and TTP for the future, battalion/task force training must focus on the future battlefield. At the combat training centers (CTC), for example, TRADOC should revise scenarios to include more

nonlinear operations and it should attempt to replicate the lethality associated with long-range weapons systems.

Tactical change is a dynamic process. It involves changes in battlefield conditions, the threat, and technology. Moreover, it may result in changes in doctrine, training, organizations, materiel, and leader development (DTOML). As we prepare for the future, we should probably begin by first examining our existing structures and organizations by continually asking the question: Is change necessary?

The Concepts-Based Requirements System

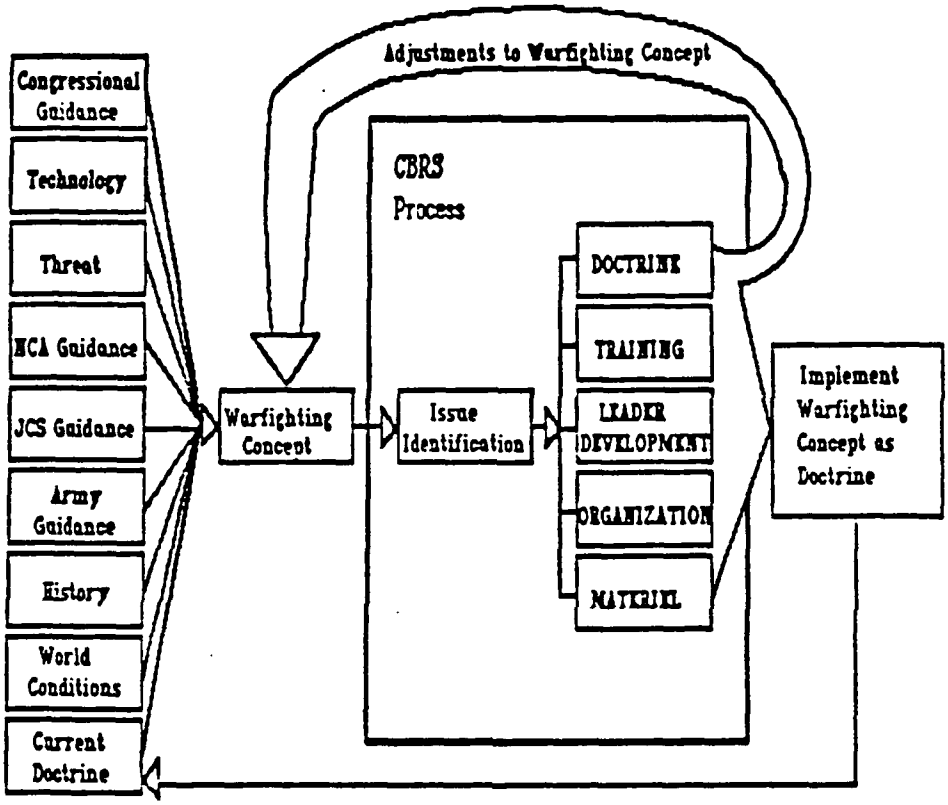

Figure 1. Concept Based Requirements System

SOURCE: TRADOC Regulation, 11-15, The Concept Based Requirements System (US Army TRADOC, 1989), 4.

The Wass de Czege combat Power Model

$$L_f(F_f+M_f+P_f-D_e) - L_e(F_e+M_e+P_e-D_f) = \textit{The Battle Outcome}$$

L_f = the friendly leadership effect

F_f = the friendly firepower effect

M_f = the friendly maneuver effect

P_f = the friendly protection effect

D_e = the enemy's degradation of friendly firepower, maneuver and protection effects

L_e = the enemy leadership effect

F_e = the enemy firepower effect

M_e = the enemy maneuver effect

P_e = the enemy protection effect

D_f = friendly force's degradation of enemy firepower, maneuver and protection effects

Figure 2. Wass De Czege Combat Power Model.

SOURCE: COL Huba Wass de Czege, "Understanding and Developing Combat Power," Monograph, SAMS (Ft Leavenworth, KS, 1984), 12.

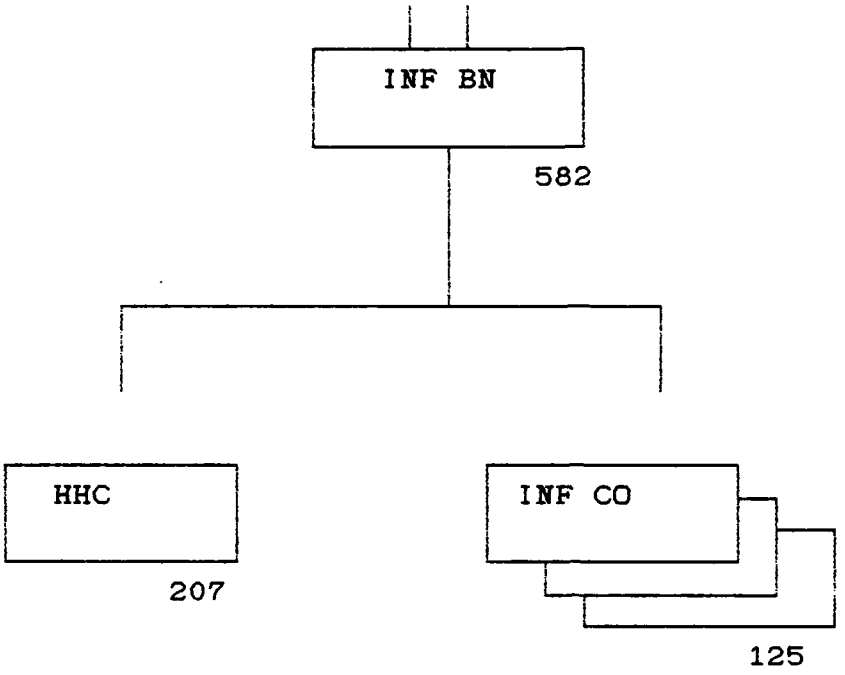

Figure 3. Armored Infantry Battalion, 1953.

SOURCE: Jonathan House, Toward Combined Arms Warfare, Research Survey No.2, (Ft Leavenworth KS: USACGSC, 1984), 148.

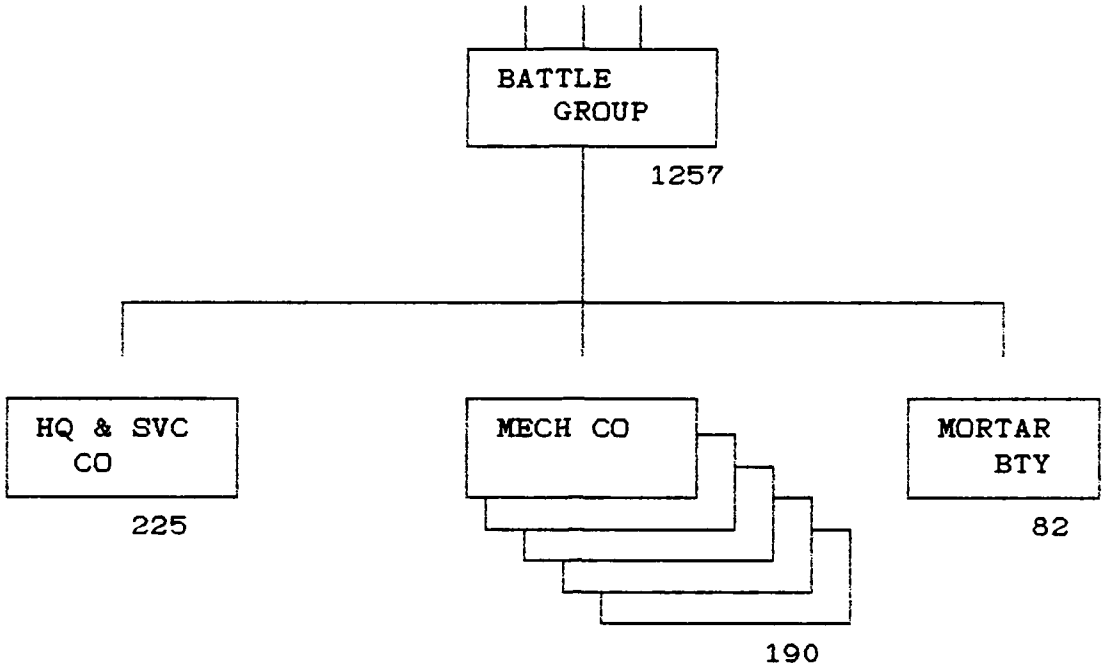

Figure 4. Infantry Battle Group, Pentomic Division, 1959.

SOURCE: House, Toward Combined Arms Warfare, 156.

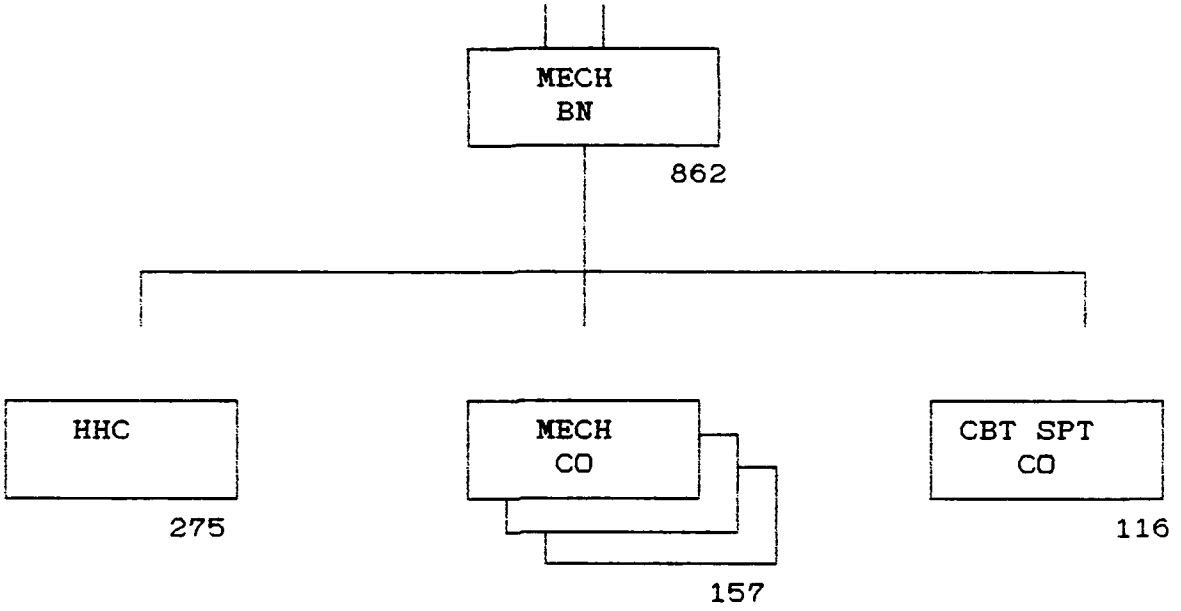

Figure 5. The Mechanized Infantry Battalion, ROAD, 1965-1982.

SOURCE: FM 71-2, The Tank and Mechanized Infantry Battalion Task Force (Washington, DC: HQDA, 1978), 3-3.

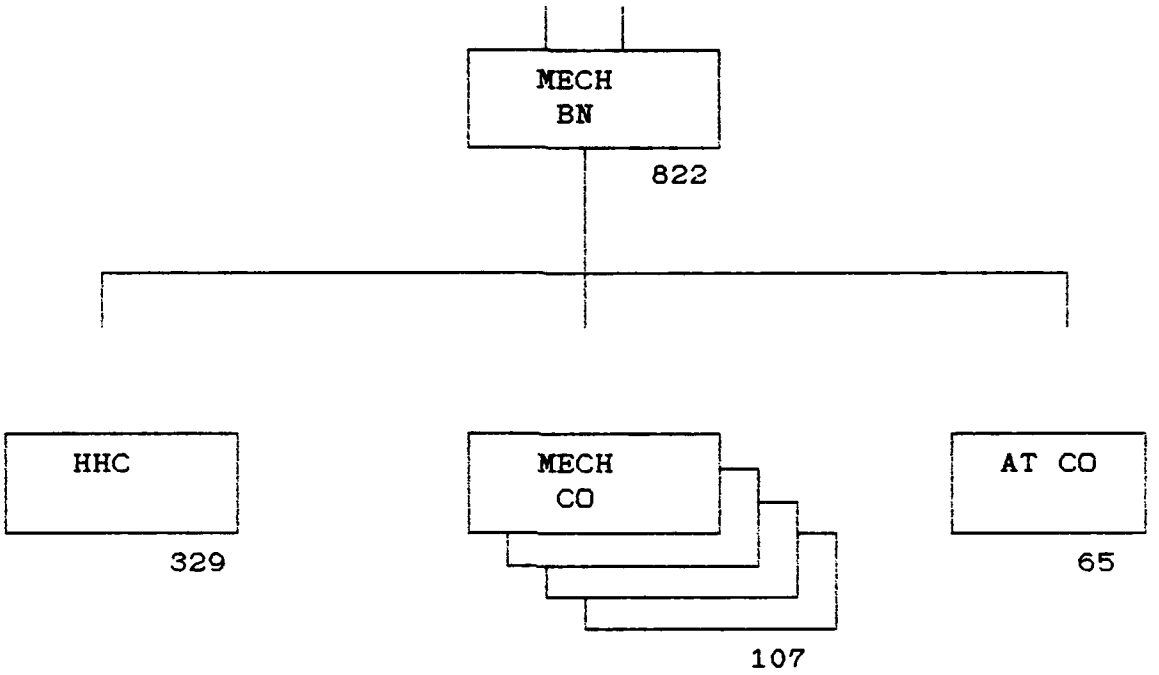

Figure 6. Mechanized Infantry Battalion, 1983-Present.

SOURCE: SH 7-176, Infantry Data Book (Ft Benning, GA: US Army Infantry School, 1989), 5-1.

One Extended Battlefield. Operations are oriented on activities and the enemy rather than terrain --

(a) The joint battle area is where Army forces fight to the depth of all their weapons systems and where Army and Air Force capabilities overlap.

(b) The shaping area must be large enough to locate and develop the enemy situation and establish and initiate the operation plan as well as to provide security.

(c) The close battle area is where the commander chooses to conduct decisive operations.

(d) Maneuver forces can be held in relatively secure staging and dispersal areas until committed.

(e) Logistics is anticipated and projected when and where needed

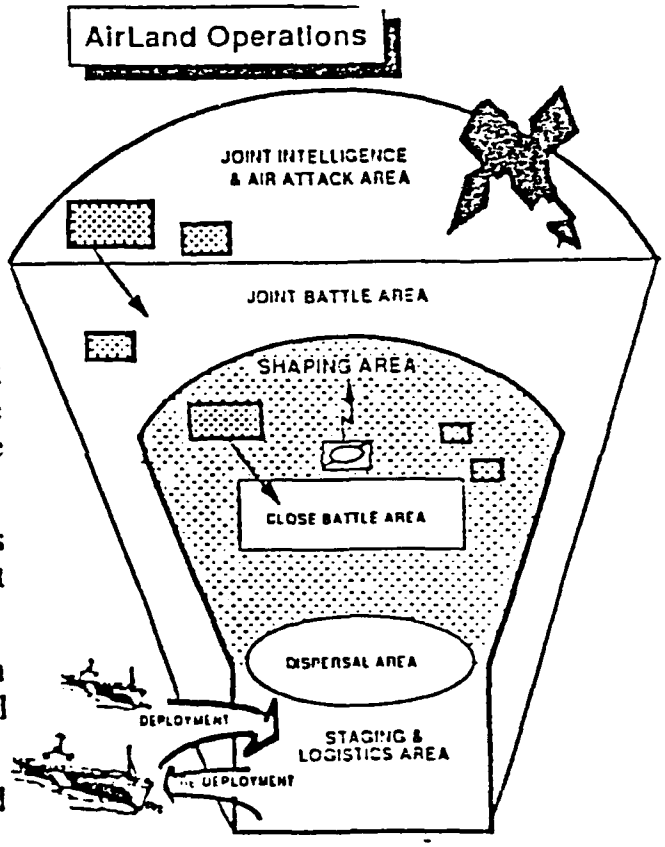

Figure 7. Extended Battlefield, Airland Operations.

SOURCE: TRADOC Pamphlet 525-5, AirLand Operations, 15

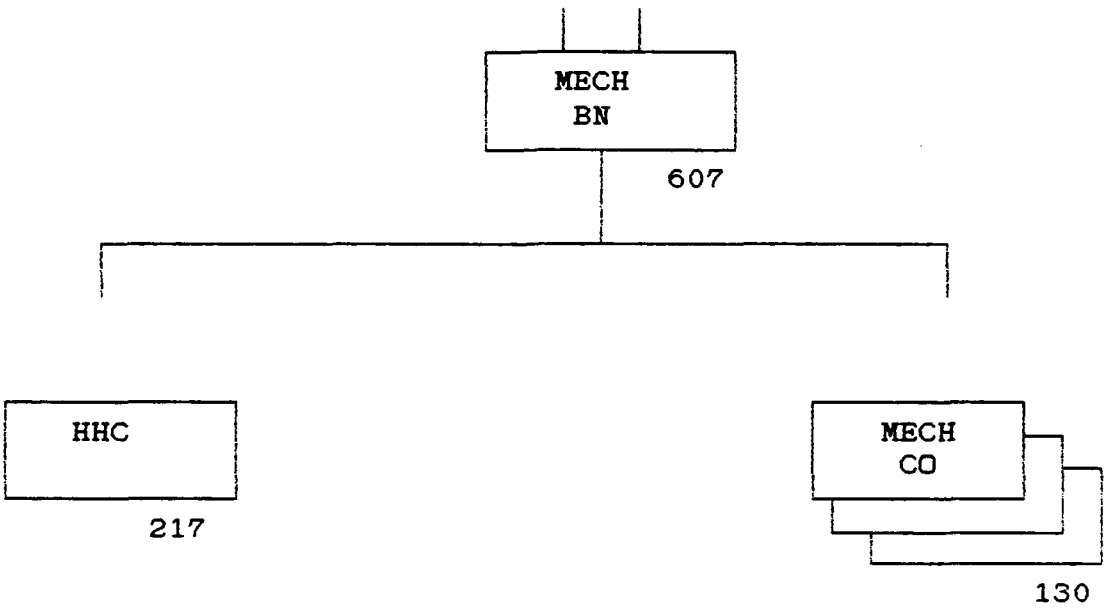

Figure 8. Mechanized Infantry Battalion, Clear Alternative, AirLand Battle-Future.

SOURCE: "AirLand Battle-Future, Alternative Base Case Study, Phase IX" (Ft Leavenworth, KS: US Army CACCD, 1991), V-6.

	LETHALITY	SURVIVABILITY
VIC (CORPS MODEL)	Threat Destroyed (<10% Remaining)	4x Finished @ 84% 3x Finished @ 77%
EAGLE (DIV MODEL)	Threat Destroyed (<5% Remaining)	4x Finished @ 69% 3x Finished @ 65%
JANUS(T) (BDE MODEL)	Threat Destroyed (<10% Remaining)	4x Finished @ 67% 3x Finished @ 65%

TRAC Conclusion: Both forces are adequate to accomplish enemy destruction given the conditions of this analysis.

NOTE: The results are from the same scenario run on three different models.

Figure 9. Ending Conditions, 3 Company Battalion versus 4 Company Battalion Analysis.

SOURCE: "AirLand Battle-Future, Alternative Base Case Study Phase VIII," (Ft Leavenworth, KS: US Army CACCD, 1991), VI-5.

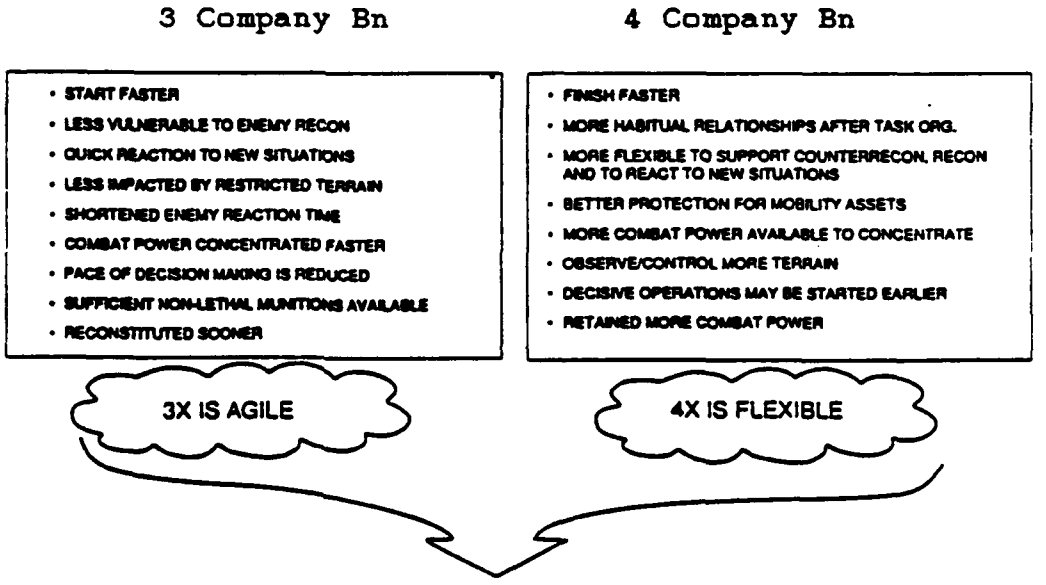

Figure 10. Summary, 3 Company versus 4 Company Analysis.

SOURCE: "AirLand Battle-Future, Alternative Base Case Study, Phase VIII", VI-6.

ENDNOTES

[1]US Army, "AirLand Battle-Future Base Case Study, Phase II" (Ft Leavenworth, KS: US Army Combined Arms Command Combat Developments Directorate (CACCD), 1990), VI-2.

[2]Donn A. Starry, General, USA, "To Change An Army," Military Review 64 (March 1983), 20.

[3]US Army, TRADOC Pamphlet 525-5, AirLand Operations, (Ft Monroe, VA: US Army Training and Doctrine Command, 1991), i.

[4]Ibid, i.

[5]Ibid, 2.

[6]Ibid.

[7]J.F.C. Fuller, Armored Warfare, (Harrisburg, PA: The Military Service Publishing Company, 1951), xix.

[8]US Army, TRADOC Regulation 11-15, Concept Based Requirements System, (Ft Monroe, VA: US Army TRADOC, 1989), 1-13.

[9]Ibid, 1-12.

[10]Earnest Dale, Planning and Developing the Company Organization Structure (New York, NY: American Management Association, 1952), 125.

[11]Ibid.

[12]Lewis I. Jefferies, COL, USA,"A Blueprint for Force Design," Military Review 71 (August 1991), 20.

[13]US Army, "Syllabus," AMSP Course 1, Foundation of Military Theory, SAMS, (Ft Leavenworth, KS: US Army CGSC, 1991), 1-1-1.

[14]Discussions with Mr. James J. Schneider, Professor of Military Theory, School of Advanced Military Studies conducted at Ft Leavenworth during the Advanced Military Studies Program (AMSP) Course 1, Foundations of Military Theory.

[15]Martin van Creveld, Military Lessons of the Yom Kippur War, Washington Papers Vol. III, No. 2., (London: Sage Publishers, 1975), 36.

[16]Christopher Bellamy, The Future of Land Warfare, (New York, NY: St Martin's Press, 1987), 274.

[17]Stephen Silvasy, Major General, USA, "AirLand Battle Future: The Tactical Battlefield," Military Review 71 (February 1991): 3.

[18]James J. Schneider, "Theory of the Empty Battlefield," Journal of the Royal United Services Institute (RUSI) (September, 1987): 37.

[19]Ibid, 43.

[20]Silvasy, "The Tactical Battlefield," 3.

[21]Ibid, 10.

[22]Schneider, "Theory of the Empty Battlefield," 41.

[23]William G. Scott and Terence R. Mitchell, Organization Theory, (Homewood, ILL: Richard D. Irwin Publishers, 1976), 29.

[24]Ibid, 1.

[25]Ibid.

[26]Dale, Planning and Developing the Company Organization Structure, 123.

[27]Scott and Mitchell, Organization Theory, 324.

[28]Dale, 125.

[29]Scott and Mitchell, 328.

[30]Dale, 134-136.

[31]Scott and Mitchell, 34.

[32]John Douglas and Joseph L. Massie, Managing: A Contemporary Introduction, (Englewood, NJ: Prentice-Hall, Inc. 1977), 142.

[33]Ibid, 143.

[34]Dale, 51.

[35]Martin van Creveld, Command in War, (Cambridge Mass: Harvard University Press, 1985), 87.

[36]Ibid, 88.

[37]Interview with Mr. Robert Keller, Director Force Design Directorate and Mr. Charles E. Cowens, Chief Studies and Analysis Division, US Army CACCD, conducted by Major Andrew Sandoy in August 1990 for his monograph, "Span of Control and Initiative: Is More, Less?"

[38]US Army, FM 71-3, The Armored and Mechanized Infantry Brigade (Washington, DC: Department of the Army (HQDA), 1988), 1-5.

[39]E.S. Johnston, MAJ, USA, "Field Service Regulations of the Future," Review of Military Literature, (June 1936), 29-30.

[40]Ibid.

[41]TRADOC Pamphlet 525-5, (1991), 29.

[42]US Army, FM 100-5, Operations, (Washington, DC: Department of the Army, 1986), 6.

[43]Ibid, 11.

[44]Huba Wass de Czege, COL, USA, "Understanding and Developing Combat Power," (Monograph, School of Advanced Military Studies (SAMS), US Army Command and General Staff College, 1984), 6.

[45]Ibid, 12.

[46]Ibid.

[47]FM 100-5 (1986), 11.

[48]Wass de Czege, "Understanding Combat Power," 7.

[49]Ibid.

[50]Ibid, 13.

[51]Ibid.

[52]Martin van Creveld, The Transformation of War, (New York. NY: The Free Press, 1991), 198.

[53]William F. Train, BG, USA, "The Atomic Challenge," Military Review 36 (November 1956), 4.

[54]US Army, Army Command and Management: Theory and Practice (Carlisle Barracks, PA: US Army War College, 1990), 11-1.

[55]Jonathan House, Toward Combined Arms Warfare: A Study of 20th Century Tactics, Doctrine, and Organization, Research Survey No. 2 (Ft Leavenworth, KS: Combat Studies Institute, US Army CGSC, 1984), 148.

[56]Ibid, 154.

[57]Ibid.

[58]A.J. Bacevich, The Pentomic Era (Washington, DC: National Defense University Press, 1986), 157.

[59]Theordore C. Mataxis and Seymour L. Goldberg, Nuclear Tactics (Harrisburg, PA: The Military Service Publishing Co.,1958), 100.

[60]Train, "The Atomic Challenge," 12.

[61]Mataxis and Goldberg, Nuclear Tactics, 31.

[62]Bacevich, The Pentomic Era, 71.

[63]Ibid, 67.

[64]Ibid.

[65]Ibid, 68.

[66]House, Toward Combined Arms Warfare, 154.

[67]Ibid.

[68]Bacevich, 105.

[69]House, 154-155.

[70]Ibid.

[71]Ibid, 158.

[72]Mataxis and Goldberg, 99-105.

[73]Bacevich, 67-68.

[74]Mataxis and Goldberg, 169-171.

[75]House, 156.

[76]Ibid, 158.

[77]Ibid.

[78]John L. Romjue, A History of Army 86, Volume I, (Ft Monroe, VA: US Army TRADOC, 1980), 1-5.

[79]Ibid, 2.

[80]John L. Romjue, From Active Defense to AirLand Battle: The Development of Army Doctrine 1973-1982, (Ft Monroe, VA: US Army TRADOC, 1984), 1-2.

[81]Ibid, 2.

[82]FM 100-5 (1982), 1-4

[83]FM 100-5 (1976), 3-1, 3-2.

[84]Romjue, A History of Army 86, Vol. I, 5.

[85]US Army, "Division 86, Final Report," (Ft Leavenworth KS: US Army Combined Arms Combat Development Activity, 1983), 6.

[86]Romjue, A History of Army 86, Volume I, 49.

[87]Ibid, 50.

[88]US Army, "Division 86, Final Report," 2-5.

[89]US Army, FM 71-2, The Tank and Mechanized Infantry Battalion Task Force, (Washington, DC: HQDA, 1988), 4-2.

[90]Romjue, A History of Army 86, Volume I, 50-51.

[91]FM 71-2 (1984), 1-10, 1-13.

[92]Ibid.

[93]FM 100-5 (1986), 6.

[94]Romjue, From Active Defense to AirLand Battle, 3.

[95]Paul H. Herbert, MAJ, USA, Deciding What Has to Be Done: General William Depuy and the 1976 Edition of FM 100-5, Operations, Leavenworth Papers No.16 (Ft Leavenworth, KS: US Army CGSC, 1988), 78.

[96]Ibid, 79.

[97]Romjue, Active Defense to AirLand Battle, 36.

[98]Ibid, 43.

[99]FM 100-5, (1986), 14-16.

[100]Ibid.

[101]Ibid.

[102]Ibid.

[103]TRADOC Pamphlet 525-5, (1991), 1.

[104]US Army, "AirLand Battle-Future, Alternative Base Case Study Phase II (Ft Leavenworth, KS: US Army CACCD, 1990), III-2.

[105]Ibid.

[106]TRADOC Pamphlet 525-5, (1991) 14.

[107]Ibid, 15.

[108]FM 100-5, (1986), 2.

[109]Ibid, 11.

[110]Ibid, 3.

[111]Foss, Memo to TRADOC Commanders and Key Staff Officers, March 1990, 3.

[112]Ibid.

[113]"AirLand Battle-Future, Alternative Base Case, Phase II" (1990), III-3.

[114]TRADOC Pamphlet 525-5, (1991), 13.

[115]Ibid, 10.

[116]FM 100-5, (1986), 19; Silvasy, "The Tactical Battlefield," 3.

[117]FM 100-5, (1986), 15; FM 71-2, (1988), 1-4,1-6; Silvasy, "The Tactical Battlefield," 12

[118]Silvasy, 12.

[119]Ibid, 12.

[120]Ibid.

[121]FM 71-2, (1988), 1-2; The mission statement for the battalion, given AirLand Operations projected doctrine, comes from "AirLand Battle-Future, Alternative Base Case Study, Phase V, (1990), V-2.

[122]FM 100-5, (1986), 19.

[123]TRADOC Pamphlet, 525-5, (1991), 15.

[124]FM 71-2, (1988), 1-6.

[125]Ibid.

[126]Silvasy, 10.

[127]FM 71-2, (1984), 1-21.

[128]US Army, "Division 86, Final Report," 2-8, 2-10.

[129]Romjue, History of Army 86 Vol. I, 32-34.

[130]FM 71-2, (1988), 1-2.

[131]Ibid.

[132]Interview with LTC Larry Matthews, Force Development Directorate US Army Armor Center, Ft Knox, KY; Interview with Mr. Ron Matty, Force Development Directorate, US Army Infantry Center, Ft Benning GA. Both interviews were conducted via telephone on 8 October 1991.

[133]Ibid.

[134]Interview with COL Daniel E. Butler, Director, School for Command Preparation, Ft Leavenworth, KS, 15 October 1991. Prior to his current his assignment, COL Butler served as the Senior Mechanized Infantry Task Force Trainer at the National Training Center from 1987-1989 and from 1985-1987 he commanded a mechanized infantry battalion.

[135]Interview with COL Butler.

[136]Memorandum, COL Dennis Long to MAJ GEN Thomas Foley, Commanding General, US Army Armor Center, dtd 24 June 1991, Subject: United States Armor Center DESERT SHIELD/DESERT STORM Emerging Observations, 4.

[137]Silvasy, "The Tactical Battlefield," 10.

[138]TRADOC Pamphlet 525-5, (1991), 39.

[139]US Army, "AirLand Battle-Future, Alternative Base Case Study, Phase VI (Ft Leavenworth, KS: US Army CACCD, 1990), V-5.

[140]"AirLand Battle-Future, Alternative Base Case Study, Phase V," V-6.

[141]Ibid, VI-6.

[142]"AirLand Battle Future Alternative Base Case Study, Phase VIII, VI-2.

[143]Ibid, VI-6.

[144]Ibid.

[145]The statement for the four company structure is based on observations from the NTC, the interview with COL Butler, and the emerging lessons from Operation DESERT SHIELD/DESERT STORM. The observation on the three company structure is based on the simulations conducted by TRAC.

[146]TRADOC Pamphlet, 525-5, (1991), 22-23.

[147]Michael Howard, "Military Science in the Age of Peace," from his Chesney Memorial Gold Medal Lecture, 3 October 1979.

[148]Bacevich, The Pentomic Era, 157.

[149]Dale, Planning and Developing the Company Organization Structure, 125.

[150]Jeffries, "A Blueprint for Force Design," 30.

BIBLIOGRAPHY

Articles

Bolger, Daniel P. MAJ, USA. "Command or Control?" Military Review 70 (July 1990): 69-79.

Brower, Kenneth S. "Technology and the Future Battlefield: The Impact on Force Structure, Procurement, and Arms Control." The Royal United Services Institute Journal 135 (Spring 1990): 53-59.

Hobson, Victor W. and Oliver G. Kinney. "Keeping Pace With the Future-Development of Doctrine at USA CGSC." Miltary Review 37 (November 1957): 10-22.

Jeffries, Lewis I. COL, USA. "A Blueprint for Force Design." Miltary Review 71 (August 1991): 20-31.

Owens, Mackubin Thomas. "Force Planning in an Era of Uncertainty." Strategic Review XVIII (Spring 1990): 9-21.

Roos, John G. and Benjamin F. Schemmer. "An Exclusive AFJI Interview with General John W. Foss, USA, Commanding General, TRADOC." Armed Force Journal International (March 1990): 63-65.

Schneider, James J. "The Theory of the Empty Battlefield." Journal of the Royal United Services Institute for Defense Studies (RUSI), (September 1987): 37-44.

Silvasy, Stephen, MAJ GEN, USA. "AirLand Battle-Future: The Tactical Battlefield." Military Review 71 (February 1991): 2-12.

Train, William F. BG, USA. "The Atomic Challenge." Military Review 36 (November 1956): 4-14.

Books

Albers, Henry H. Principles of Organization and Management. New York: John Wiley and Sons, 1966.

Bacevich, A.J. The Pentomic Era. Washington, DC: National Defense University Press, 1986.

Bellamy, Chris. The Future of Land Warfare. New York: St. Martin's Press, 1987.

Dale, Earnest. Organization. New York: American Management Association, 1967.

_____. Planning and Developing the Company Organization Structure. New York: American Management Association, 1952.

Fuller, J.F.C. Armored Warfare. Harrisburg, PA: The Military Service Publishing Company, 1951.

Hunt, James G. and John D. Blair., ed. Leadership on the Future Battlefield. Washington, DC: Pergamon-Brassey's, 1985.

Massie, Joseph L. and John Douglas. Managing: A Contemporary Introduction. Englewood, NJ: Prentice-Hall Inc., 1977.

Mataxis, Theodore C. and Seymour L. Goldberg. Nuclear Tactics. Harrisburg, PA: The Military Service Publishing Company, 1958.

Scott, William G. and Terence R. Mitchell. Organization Theory. Homewood: Richard D. Irwin, 1976.

Simpkin, Richard E. Race to the Swift. London: Brassey's Defence Publishers, 1985.

Van Creveld, Martin L. Command In War. Cambridge, Mass: Harvard University Press, 1985.

_____. The Transformation of War. New York, NY: The Free Press, 1991.

Government Publications

Greenfield, Kurt R., Robert R. Palmer and William Wiley. The Army Ground Forces (AGF): The Organization of Ground Combat Troops. Washingtor DC: Department of the Army, 1947.

House, Jonathan M. Toward Combined Arms Warfare: A Survey of 20th Century Tactics, Doctrine, and Organization. Research Survey No. 2. Fort Leavenworth, KS: US Army Command and General Staff College, 1984.

Romjue, John L. A History of Army 86 Volume I, Division 86: The Development of the Heavy Division, September 1978-October 1979. Fort Monroe, VA: US Army Training and Doctrine Command (TRADOC), 1982.

_____. A History of Army 86 Volume II, The Development of the Light Division, The Corps, and Echelons Above Corps. Fort Monroe, VA: US Army TRADOC, 1982.

_____. From Active Defense to AirLand Battle: The Development of Army Doctrine, 1973-1982. Fort Monroe, VA: US Army TRADOC, 1984.

US Army. "AirLand Battle-Future, Alternative Base Case Study, Phase I-Phase X." Fort Leavenworth, KS: US Army Combined Arms Command Combat Developments Directorate, 1990-1991.

US Army. Army Command and Management: Theory and Practice. Carlisle Barracks, PA: US Army War College, 1990.

US Army. "Division 86 Final Report." Fort Leavenworth KS: US Army Combined Arms Combat Development Activity, 1983.

US Army. FC 100-1, The Army of Excellence. Fort Leavenworth, KS: US Army Combined Arms Combat Development Activity, 1984.

US Army. FM 71-2, The Tank and Mechanized Infantry Task Force. Washington, DC: Department of the Army, 1978.

US Army. FM 71-2, The Tank and Mechanized Infantry Task Force. Washington, DC: Department of the Army, 1988.

US Army. FM 71-2J, The Tank and Mechanized Infantry Task Force. Washington, DC: Department of the Army, 1984.

US Army. FM 100-5, Operations. Washington, DC: Department of the Army, 1976.

US Army. FM 100-5, Operations. Washington, DC: Department of the Army, 1982.

US Army. FM 100-5, Operations. Washington, DC: Department of the Army, 1986.

US Army. TRADOC Pamphlet 525-5, Airland Operations. Fort Monroe, VA: US Army Training and Doctrine Command (TRADOC), 1991.

US Army. TRADOC Regulation 11-15, Concept Based Requirements System. Fort Monroe, VA: US Army TRADOC, 1989.

Unpublished Dissertations, Theses, and Papers

Barrett, Raymond, MAJ, USA. "Coherence Between AirLand Battle and Contemporary Force Structure at Corps, Division, and Brigade." Masters Thesis, US Army Command and General Staff College (CGSC), 1985.

Harned, Glenn M., MAJ, USA. "The Principles of Tactical Organization and Their Implication on Force Design in the US Army." Monograph, School of Advanced Military Studies (SAMS), US Army CGSC, 1985.

Moores, Larry, MAJ, USA. "The Raid in Tactical Deep Operations." Monograph, SAMS, US Army CGSC, 1991.

Petrole, Gary P., MAJ, USA. "Agility Versus Endurance In Airland Battle-Future: A High Risk Trade-Off." Monograph, SAMS, US Army CGSC, 1990.

Sandoy, Andrew S., MAJ, USA. "Span of Control and Initiative: Is More, Less?" Monograph, SAMS, US Army CGSC, 1990.

Wass de Czege, Huba, COL, USA. "Understanding and Developing Combat Power." Monograph, SAMS, US Army CGSC, 1984.

US Army. "Evolution of the Army," Final Coordinating Draft. Fort Leavenworth, KS: US Army Combined Arms Command Development Activity (USACACDA), 1990.

Lectures and Interviews

Butler, Daniel E. COL. USA. Director, School for Command Preparation, US Army CGSC, Fort Leavenworth, KS: Interview, 23 October 1991.

Matthews, Larry, LTC, USA. Force Design Directorate US Army Armor Center, Ft Knox, KY: Interview via telephone 8 October 1991.

Matty, Ron R. Force Design Department, US Army Infantry Center, Ft Benning, GA: Interview via telephone 8 October 1991.

Sheperd, Charles. Director, Force Design Directorate US Army Armor Center, Ft Knox, KY: Interview conducted at Ft Leavenworh KS: 22 October 1991.

Torok, Ernie, Force Design Directorate, US Army Combined Arms Command Combat Developments Division, Ft Leavenworth, KS: Interview, 7 October 1991