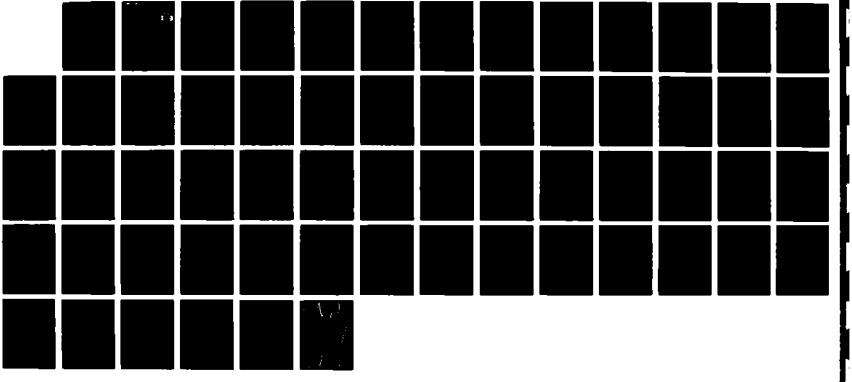
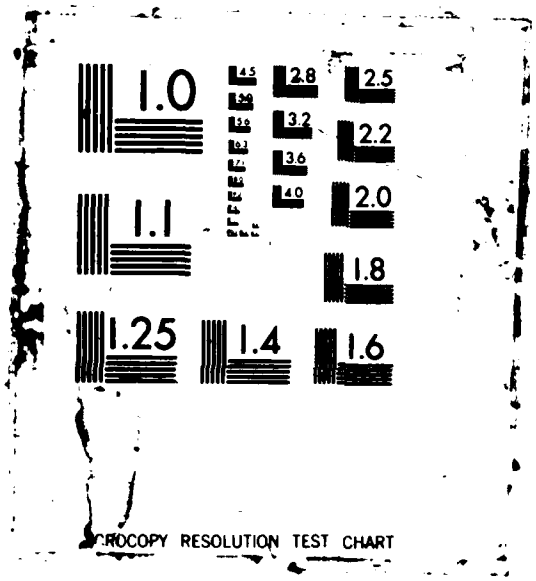
AD-A179 415 E-FORCE: HOW AGILE IS IT?(U) ARMY COMMAND AND GENERAL STAFF COLL FORT LEAVENWORTH KS SCHOOL OF ADVANCED MILITARY STUDIES K K PIERCE 15 JAN 87 1/1

UNCLASSIFIED F/G 15/7 NL

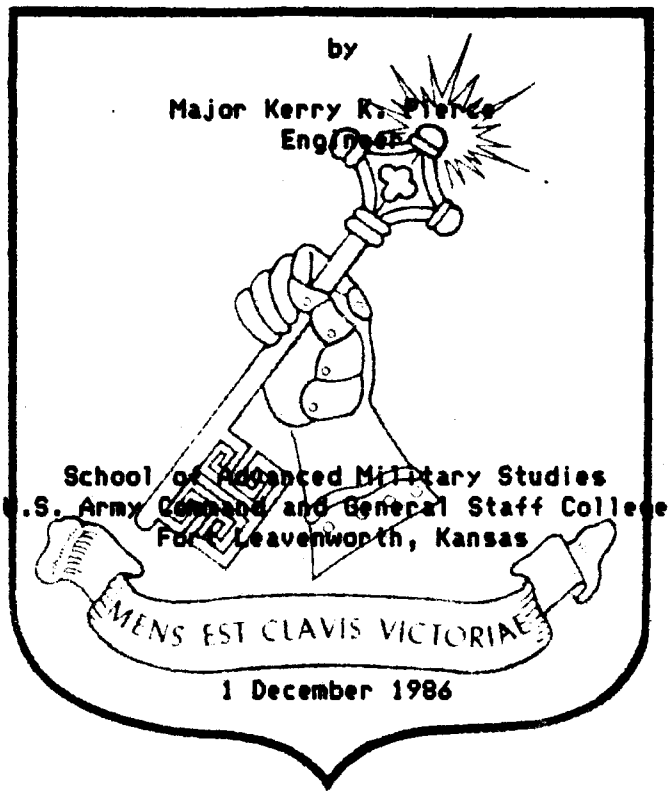



1.0
1.1
1.25
1.4
1.6
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.8
ROCOPY RESOLUTION TEST CHART

E-Force: How Agile Is It?

by

Major Kerry K. Pierce
Engineer



School of Advanced Military Studies
U.S. Army Command and General Staff College
Fort Leavenworth, Kansas

1 December 1986

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

A179 415

REPORT DOCUMENTATION PAGE

Form Approved
OMB No 0704-0188
Exp Date Jun 30, 1986

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION School of Advanced Military Studies, USAC&GSC 6b. OFFICE SYMBOL (If applicable) ATZL-SWV	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) Fort Leavenworth, Kansas 66027-6900	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)
E-FORCE: How Agile Is It? (U)

12. PERSONAL AUTHOR(S)
MAJ Kerry K. Pierce, USA

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Monograph	FROM _____ TO _____	87/1/15	51

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	agility, mobility, E-FORCE, combat engineers, engineer command and control, Armored Engineer Battalion (WW II), countermobility

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This monograph analyzes the proposed engineer reorganization at Division level - E-FORCE - in light of the modern battlefield's requirement for agile combined arms formations. The study first examines the theoretical basis and importance of tactical agility and its implications for the combat engineer. From this discussion three factors - mobility of engineers, capability to alter terrain over time, and command and control - are singled out as the key determinants of the ability of engineers to enhance agility. The monograph assumes that the operations of the U.S. Army's armored divisions in France and Germany during 1944-45 provide appropriate examples of the complexity and intensity of conflict envisioned by Airland Battle doctrine in FM 100-5. Included in the historical section is a brief account of the engineer experiences of the Germans and Russians on the Eastern Front. As a result of this analysis of engineer operations, several deficiencies in the engineer's ability to enhance tactical agility are presented, most of which were also noted by the Army's official study of its conduct of the (continued on reverse side)

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL MAJ Kerry K. Pierce	22b. TELEPHONE (Include Area Code) (913) 684-2138
	22c. OFFICE SYMBOL ATZL-SWV

DD FORM 1473, 84 MAR

83 APR edition may be used until exhausted
All other editions are obsolete

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

19 (continued)

Second World War, the General Board.

The monograph continues by describing current engineer doctrine and capability to support the agility needs of the Heavy Division and compares it with the previously identified deficiencies in the areas of mobility, capability to alter terrain, and command and control. The organizational changes associated with E-FORCE are seen as significantly improving the combat engineer's ability to speed up the tempo of combined arms operations. The monograph then discusses further enhancements which the author recommends that E-FORCE should adopt in order to achieve the most favorable contribution towards agility. These include greater mobility for specialized engineer equipment, greatly enhanced minefield breaching capability, more extensive intelligence and reconnaissance capability within the E-FORCE S-2 section, improved communications throughout the engineer force structure, and a change in doctrine to speed up the entire obstacle planning and execution sequence. The monograph concludes by endorsing E-FORCE as a necessary enhancement to the agility requirements of the modern battlefield, but suggests that it does not go far enough. E-FORCE, in fact, represents the middle ground between the current philosophy behind engineer force design and the concept that permanent combined arms teams should be formed at the brigade/regimental level. The final and only relevant arbiter of this issue and the many others involving E-FORCE is its impact on the agility of the division.

E-Force: How Agile Is It?

by

Major Kerry K. Pierce
Engineer

School of Advanced Military Studies
U.S. Army Command and General Staff College
Fort Leavenworth, Kansas

1 December 1986

87-2103

School of Advanced Military Studies
Monograph Approval

Name of Student: Major Kerry K. Pierce
Title of Monograph: The E-Force: How Agile is it?

Approved by:

Charles C Cannon Jr

Monograph Director
Lieutenant Colonel Charles C. Cannon, Jr., M.S.

Richard Hart Sinnreich

Director, School of
Colonel Richard Hart Sinnreich, M.A. Advanced Military Studies

Philip J. Brookes

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

Accepted this 15th day of January 1992.

ABSTRACT

E-FORCE: HOW AGILE IS IT? by MAJ Kerry K. Pierce, USA, 51 pages.

This monograph analyzes the proposed engineer reorganization at Division level - E-FORCE - in light of the modern battlefield's requirement for agile combined arms formations. The study first examines the theoretical basis and importance of tactical agility and its implications for the combat engineer. From this discussion three factors - mobility of engineers, capability to alter terrain over time, and command and control - are singled out as the key determinants of the ability of engineers to enhance agility. The monograph assumes that the operations of the U.S. Army's armored divisions in France and Germany during 1944-45 provide appropriate examples of the complexity and intensity of conflict envisioned by Airland Battle doctrine in FM 100-5. Included in the historical section is a brief account of the engineer experiences of the Germans and Russians on the Eastern Front. As a result of this analysis of engineer operations, several deficiencies in the engineer's ability to enhance tactical agility are presented, most of which were also reported by the Army's official study of its conduct of the Second World War, the General Board.

The monograph continues by describing current engineer doctrine and capability to support the agility needs of the Heavy Division and compares it with the previously identified deficiencies in the areas of mobility, capability to alter terrain, and command and control. The organizational changes associated with E-FORCE are seen as significantly improving the combat engineer's ability to speed up the tempo of combined arms operations. The monograph then discusses further enhancements which the author recommends that E-FORCE should adopt in order to achieve the most favorable contribution towards agility. These include greater mobility for specialized engineer equipment, greatly enhanced minefield breaching capability, more extensive intelligence and reconnaissance capability within the E-FORCE S-2 section, improved communications throughout the engineer force structure, and a change in doctrine to speed up the entire obstacle planning and execution sequence. The monograph concludes by endorsing E-FORCE as a necessary enhancement to the agility requirements of the modern battlefield, but suggests that it does not go far enough. E-FORCE, in fact, represents the middle ground between the current philosophy behind engineer force design and the concept that permanent combined arms teams should be formed at the brigade/regimental level. The final and only relevant arbiter of this issue and the many others involving E-FORCE is its impact on the agility of the division.

Table of Contents

SECTION I: INTRODUCTION

> Those who have attempted to describe in a single phrase the tactics of the most complex war in history refer to WW II as "an air war," "a mechanized war," "an amphibious war," and most inclusively, "a mobile war." Because its military campaigns accented movement, whether by air, by sea, or by land, and because the primary combat mission of the Corps of Engineers is to aid or impede movement, WW II has also been called "an engineer war." 1

> Airland Battle doctrine stresses combined arms operations over large areas. Its four tenets - agility, initiative, depth and synchronization - accentuate the role of the combat engineer on the modern battlefield. This comes at a time when combat engineers are at a watershed. The Army has embraced a new 'warfight' doctrine that stresses maneuverability and is equipping with more mobile and lethal fighting systems. Yet, the combat engineer - the man who converts mobility to maneuverability - finds himself supporting a rapidly modernizing battlefield with a cumbersome World War II organizational architecture and antiquated equipment. In short, today's combat engineers are the weakest link in the battlefield combined arms team. 2

According to MG Richard S. Kem, commandant of the Engineer School, combat engineers have not kept pace with the mobility demands of modern warfare. He concludes that, "If the Army is going to execute Airland Battle doctrine ... then engineers must be truly available at the FLOT (Forward Line of Own Troops) - ready to obtain freedom of maneuver - agility - for the ground force." [3] In response to this deficiency, the Engineer School is developing a comprehensive plan known as E-FORCE to reconfigure engineer assets throughout the battlefield. This new organizational concept integrates the needs of Airland Battle doctrine,

observations from exercises like those at the National Training Center and REFORGER, analysis of worldwide engineer requirements, and the opportunities of new equipment productivity.[4] The purpose of this paper is to determine if the **E-FORCE** proposal adequately addresses the battlefield imperative for agility.

This study will first examine the theoretical aspects of **tactical agility**, especially from a combat support perspective. With this theoretical foundation, engineer support to armored divisions in the European Theater of Operations (ETO), World War II will provide the laboratory in which to analyze the agility contributions of combat engineers. Field Manuals of that period describe the support doctrine, while after-action reports and selected unit histories discuss actual procedures as modified by the realities of combat. A brief look at the experiences of the German and Russian armies on the Eastern Front will round out the historical discussion.

Following the war, engineer doctrine and organization were studied in great detail and several recommended changes were published by the General Board, U.S. Forces European Theater (USFET). Their important study summarized the key deficiencies of engineer support to divisions and corps and underscored the agility related lessons learned from the war.

The paper will then review current doctrinal engineer support to the Heavy Division and analyze the proposed E-FORCE in light of the identified historical deficiencies in tactical agility. It will conclude with some suggested areas for agility enhancement not specifically addressed by E-FORCE.

In order to limit the scope of the paper, the following constraints and

assumptions will apply:

1. The analysis focuses on a mid to high intensity conflict, which according to FM 100-5 may be very short and violent.
2. Engineer support to Light Divisions, Airborne Divisions, and Air Assault Divisions is not addressed.
3. The study is concerned with combat engineering at the tactical level, hence engineer support to the COMMZ (Communications Zone) is not addressed.
4. Detailed analysis of agility in river crossing, reorganization as infantry, and amphibious operations is not considered.
5. The battlefield realities of ETO and the Eastern Front during the Second World War provide numerous examples of the kind of combat envisioned in Airland Battle doctrine.
6. Engineer support to the armored division in World War II is emphasized because the latter most closely resembles the Heavy Division of today, in terms of both structure and requirement for agile combat support.

SECTION II: TACTICAL AGILITY: A THEORETICAL BEGINNING

> Speed is the essence of war. Take advantage of the enemy's unpreparedness; travel by unexpected routes and strike him where he has taken no precautions. 5

Although Sun Tzu is an acknowledged advocate of deception in war, the quotation above illustrates that he recognized rapid movement as the key battlefield means of achieving surprise at the point of attack. It was, in short, one of the commander's tactical means of deception. FM 100-5 describes this asset as **agility**, and defines it as, "the ability of friendly forces to act faster than the enemy."[6] The army's capstone 'how to fight' manual continues, "agility is the first requisite for seizing and holding the initiative,"[7] making it the only tenet of Airland Battle doctrine which determines another. The method here sounds very much like Sun Tzu, but the desired end, seizing the initiative, is pure Clausewitzian. For this German theorist war was a struggle of wills, the object being to impose one will upon the other. The syllogism for success, then, runs as follows: agility is required to secure the initiative, which enables an army to apply combat power at critical points of enemy weakness, which is an essential means of imposing one's will on an adversary.

Agility involves quickness, speed, and nimbleness. It is a fundamental

concern for any army, but particularly one which is outnumbered. In theory, firepower alone cannot defeat greater numbers unless the firepower differential is tremendously skewed. All other things being equal, mass eventually overwhelms a smaller adversary in a war of attrition. This is especially true in a protracted conflict where the learning curve phenomenon can correct earlier deficiencies in the military system. Although Lee achieved great victories in the early years of the American Civil War, the Union was able to adjust its leadership and tactics to the point where mass eventually decided the issue.

Success, especially for the outnumbered side, depends heavily upon finding a way to strike a portion of the enemy's force with the bulk of one's own, or at least create opportunities for the inferior force to achieve local numerical advantage. Agility is an essential means to accomplish this. Repeated instances of agile engagements not only reduce the enemy's numbers, but also contribute to the disruption of his cohesion and command and control. The cumulative effect of this methodology establishes the conditions for great victories. In itself agility offers little, but in concert with firepower and good generalship it contributes to battlefield success.

The complexities of modern warfare also make it essential to approach the subject of agility from a combined arms perspective. There are some who will insist that agility of the whole is not necessarily related to each component arm's agility, or put another way, that the force is only as agile as its least agile member. This argument points out that an adversary without an air force, for example, places no agility demands upon friendly air defense units. While this is true in a scenario specific

sense, this paper is primarily concerned with the mid-high intensity conflict which presents the greatest challenge to American arms. A Soviet style adversary can present a military threat at least as capable as ours, and demands a highly integrated combined arms organization to confront the range of capabilities it will pose on the battlefield. In this environment tactical success is related to the quickness not just of combat elements, but also of combat support and service support units.

Turning now to the role of the combat engineer which is the focus of this paper, it is evident that his combat multiplication function is rooted in the terrain. The traditional engineer missions of mobility, countermobility, and survivability can be consolidated under the label of **terrain architecture.** In this function terrain and time present both opportunity and impediment to success. The engineer is continually trying to make favorable use of the terrain while wrestling against the tyranny of time. In mathematical terms this relation would be expressed as: **ENGINEER AGILITY = f(TERRAIN ARCHITECTURE/TIME).** Additionally, because of his responsibility both to enhance friendly agility and to impede that of the enemy, the combat engineer is concerned with relative or comparative agility. All too often an aggressive, offensive-minded commander dismisses the agility enhancement of countermobility effort when this represents at least half of the potential for operating faster than the enemy.

Terrain architecture, which is the engineer's stock in trade, is temporally affected by two different variables. The **speed** at which engineer units travel on the battlefield and the **capability** to alter the terrain over time both directly affect the ability of engineers to accomplish their mission swiftly. It would seem that improvements to

engineer speed and capability are related mainly to physical aspects of agility, as they involve primarily equipment or technological innovation. A single bulldozer, for example, can produce more tank ditch per hour than an entire company of engineers equipped with shovels. Yet this same dozer must be transported to the work site by a slow moving tractor-trailer requiring surfaced roads. At the best of times it travels at half the speed of the maneuver forces. Obviously, a self-propelled dozer with cross country speed equivalent to that of the combat elements provides a better contribution to tactical agility.

FM 100-5, however, points out that agility involves a mental dimension as well as a physical one. The manual describes mental agility as a continuous reading of the battlefield and the ability to make decisions quickly. The agile mind is capable of risking commitment without complete information and adjusting decisions to conform with new information, even if the new data runs contrary to previous assumptions or estimates.[8]

Besides this basic attitude of flexibility, there are many other manifestations of mental agility. Doctrine, unit SOPs (Standing Operating Procedures), and concepts of command and control (C2) all affect the mental apparatus of the military organization and can contribute to a faster pace of operation.

The commander of the combined arms force must fully understand this two dimensional aspect (mental and physical) of the myriad of activities within his organization, not the least of which are those of combat support and service support elements. In the final analysis, agility in military operations is achieved to the degree that separate tactical activities can be quickened and then effectively synchronized with all other related

activities.

As already discussed in this paper, the pace of engineer activities is affected by the **speed** (mobility) of engineer units and their **capability** for terrain architecture. To these we can add a third variable, **command and control**, which directly speaks to the integration of physical and mental capabilities within the engineer unit and of the unit within the larger military organization. In the historical section which follows, these three variables form the analytical framework for investigating the engineer agility experience of World War Two.

SECTION III: WORLD WAR TWO AND ENGINEER AGILITY

The attrition orientation of World War I had focused engineers on countermobility, but the advent of a new style of maneuver warfare in 1939 would require a shifting of engineer effort towards mobility missions.[9] Indeed, American engineer doctrine, organization, and tactical employment underwent significant changes during the period 1935-44. The chief catalyst of this almost continuous reorganization was the Chief of Staff of the Army, LTG Malin Craig (1935-39), whose aim was to exploit the mobility potential of the gasoline engine powered vehicle.[10] This technology seemed to provide a way to increase the agility of future military operations, thereby avoiding the stalemate of the trenches.

Major change began with the 1936 reorganization of the Infantry Division, reducing that large 22,000 man 'square' formation to a three regiment structure numbering 13,500. The organic engineer regiment was streamlined to a single battalion of 518 soldiers.[11] Engineer strength in the division would continue to erode with successive changes until it reached its nadir in December, 1939.

In fact, LTG Craig wanted to eliminate engineers altogether from the divisional structure, or at least reduce them to a company sized unit. He argued that early identification of obstacles through reconnaissance would enable the mobile armored forces to bypass them easily. Engineers would be employed only in rare emergencies for road repair. In opposition to this

view stood the Engineer Board and Engineer School at Fort Belvoir, who were responsible for mobility doctrine, training, and equipment. They insisted that vehicles would be more vulnerable to the effects of obstacles and that more, not fewer roads would be required to take advantage of the increased agility of mechanized forces.[12]

Dramatic events in Europe settled the dispute for a time. The successful use of combat engineers in the German panzer divisions provided the model for the American armored engineer battalion which featured a headquarters company, four line companies, and a bridge company.[13] One of these battalions was organic to each of America's first two armored divisions, formed in July, 1940.[14]

The revitalization of interest in combat engineers resulted, in part, from a series of articles by Captain Paul W. Thompson who had observed German formations before the war.[15] He analyzed in great detail blitzkrieg theory and practice and argued for a similar combined arms focus in the American army.

> There is one conclusion...which is incontestable (and obvious). It has to do with the intimate coordination which must exist between members of the combat team. The German blitz campaigns have demonstrated this fact more forcibly, perhaps, than it ever before has been demonstrated. And as a corollary fact, the campaigns have demonstrated that the engineers are now an elite member of the team. 16

American experience in ETO from 1944-45 was primarily that of an offensive war. With few exceptions, the lodgement on the continent at Normandy began a continuous series of offensive engagements which led to

the end of the war in Europe. There were no Kursks or Stalingrads on the Western Front and American defensive doctrine and tactics were not severely tested.

Many of the historical observations in this paper, therefore, deal with offensive agility. American engineer experience in World War II will now be evaluated in terms of the mobility of engineer units, their terrain architecture capability, and command and control.

A. MOBILITY

The armored engineer battalions of the armored divisions possessed a far superior degree of mobility than their sister units at corps and in the infantry divisions. They employed the same tracked vehicles as armored infantry troops and were fully supported by wheeled logistical vehicles. As such, combat engineers were able to match the speed of armored formations on the battlefield. Attaching engineers to brigade sized Combat Commands (CCs) helped reduce the time for engineers to arrive at a mission site. As the need arose for rapid engineer support at even lower levels, the inherent mobility of these sapper units enabled commanders to push them down to maneuver battalions without suffering a degradation in the agility of the entire combat formation.

Unfortunately, mobility is only one component part of the agility equation. Being able to move sappers quickly is one thing, but being able to accomplish a combat support mission quickly is something quite different. Terrain architecture equipment such as the dozer was in short supply throughout the war. For the most part this equipment was not nearly

as mobile as the engineer troops and it was not survivable on the European battlefield. While sappers were responsive to the simple combat engineering tasks, their pronounced deficiency in breaching capability hampered the supported combat unit when it ran up against a complex barrier system. In other words, combat engineers were unable to translate transport mobility into effective combat maneuverability.

B. TERRAIN ARCHITECTURE CAPABILITY

The United States entered the Second World War with equipment, tactics, and doctrine based on past experience and a theoretical view of the battlefield. Although war is an effective catalyst for change, American production of new equipment and doctrine lagged behind the battlefield innovations fostered by the necessities of combat. The engineer branch was certainly no exception to this general trend.

Since World War I, manual labor in the engineer field was slowly replaced, first by horse drawn implements like the scraper and ultimately by the mechanized earth mover. In 1923 the first tracked dozer was introduced in the United States. The army adopted a 7 1/2 ton version in 1938 which was to become the workhorse of World War II.[17] While it was slow and cumbersome, the tremendous increase in terrain architecture capability it provided more than offset its lack of mobility. The dozer underwent many modifications throughout the war, including the attachment of an armored cab in 1943 to protect the operator.[18] The Armored Division was authorized three dozers in the engineer battalion.

The mid-intensity war in Europe and the demands for agility, however,

revealed a need for an all-purpose assault breaching vehicle. By late 1943 industry had developed a dozer blade for the M-4 tank.[19] It was to see extensive service throughout the European campaign in 1944-45. Though an improvement, the tank dozer could not meet the full requirement for breaching support. The quest for such a piece of equipment was continually hampered by budget constraints, design difficulties, and disputes over where to place it in the organizational structure. By the end of the war, the first two models of a vehicle known as the "doozit" were belatedly ready for deployment.[20] This versatile piece of equipment was configured with a dozer blade, a mechanical device for emplacing explosives, and a rocket launcher for assault breaching.[21]

It is interesting to note that the British took an entirely different track in their development of engineer equipment. Having experienced first hand the failure of Dieppe, they recognized an imperative for breaching obstacles under fire. Speed, not perfection, fueled their research and development, and throughout the remainder of the war their effort produced a wide variety of specialized breaching equipment. All were mobile, armored for protection, and specifically geared for a particular type of obstacle.[22]

The American preference for combining several functions on a single vehicle can perhaps be traced to a lack of urgency fostered by the nature of the unopposed landings in North Africa and Italy.[23] Whatever the reason, American engineers entered the continent in 1944 without the services of agile engineer vehicles as compared with their British counterparts.

In the area of tactical bridging, only the armored division received organic steel treadway bridging, based on that unit's assumed independent

role and the necessity for speed. All other fixed and floating bridge assets were consolidated at the corps level and above.[24] Even this agility enhancement, however, was removed by the 1943 reorganization of the armored engineer battalion.[25]

North Africa represented the first trial of American combat arms. Only the 1st Armored Division saw duty in this theater, but it provided the experience for all other like units in subsequent campaigns. The major dilemma facing engineers in Africa was the difficulty in breaching minefields. The agility of the offense was often reduced to the speed of a single engineer on foot employing a mine detector. During the Louisiana maneuvers of 1941, the 16th Armored Engineer Battalion's official history noted, "Nearly everything was included except that all important enemy mining which was overlooked completely."[26]

Attempts to restore agility took two forms: better technique and new technology. Improved methods of mine detection and probing, although helpful, proved inadequate for the pace of armored columns. Using engineers the night before an attack to clear and mark lanes through minefields was also attempted with some success. The real need, however, was for an effective breaching device. An explosive breacher known as the 'snake' performed the best. It consisted of sections of pipe filled with TNT which were assembled by engineers and pushed into the minefield by a tank.[27] Once detonated, it could clear a lane the width of a vehicle. Unfortunately, mechanical attempts such as the flail tank and the roller failed to achieve an equal degree of reliability.

In the field of countermobility, many problems surfaced around the inability to integrate the entire combined arms team towards reducing the

enemy's agility. At Sidi Bou Sid, for example, C Company, 16th Armored Engineer Battalion was left alone to guard its own minefield without the benefit of covering fires from combat units. It was eventually overrun by attacking German infantry and armor, resulting in the loss of all men and equipment.[28] Engineers also experienced great difficulty in coordinating the turnover of reserve demolition targets to maneuver units and the marking and recording of friendly minefields.[29]

It was not until 1943 that combat experience began to influence doctrine and equipment development.[30] The lessons from North Africa and the Eastern Front helped drive the search for more agile terrain architecture assets. Very little, however, was accomplished in this area by war's end. Engineers were simply not equipped to breach obstacles under fire. The bangalore torpedo, the snake, and the dozer were merely the best of an inadequate lot. The brief periods of static warfare following the breakout and pursuit across Europe were not incentive enough to accelerate the development of the assault engineering vehicles needed to support the armored division.

C. ENGINEER COMMAND AND CONTROL

During World War II, the Army consisted of Army Ground Forces, Army Air Forces, and Army Service Forces, all of which maintained engineer units. The maneuver division, which is the level of focus of this paper, looked to its organic engineer battalion for habitual sapper support.[31]

The armored engineer battalion of the armored division initially

consisted of a battalion headquarters, headquarters and service company, four line companies, and a bridge company. Its organization was to change six times throughout the war, the most significant of which reduced the battalion to just three companies and moved the bridge element to corps.[32] (See figure 1 on page 37)

The heart of engineer support to committed divisions lay at corps. The corps engineer was doctrinally both a staff officer and commander, responsible for all engineer units assigned to the corps or its subordinate engineer groups. His role was changed in 1944 to that of staff officer only, but actual practice often ignored the new distinction.[33] Subordinate to the corps engineer element were two or more engineer combat groups, each consisting of from two to six engineer combat battalions and smaller units.[34] These battalions were designed to provide the bulk of engineer support to committed divisions.

As engineer units were pushed forward, their work responsibilities were controlled under one of five doctrinal conditions:[35]

1) Area - responsible for all work in a geographic area.

2) Task - responsible for one or more specific tasks.

3) Combination - responsible for an area, but emphasis on a specific task in that area.

4) Attachment - same as defined today.

5) Support - engineer unit responds to the requests for engineer work by the supported commander.

Engineer doctrine provided for an engineer company from the armored engineer battalion to be attached to each brigade sized Combat Command

(CC), based on the anticipated independent nature of its operations. In practice this was usually the same company, allowing for close coordination and teamwork within the combined arms CC.[36] The remainder of the engineer battalion was used to support the division as a whole, while corps provided additional engineer battalions as needed.

From the Normandy Invasion on, committed divisions, particularly armored ones, discovered that the division engineer did not have enough resources to complete all his tasks. This situation created a recurring theme throughout the remainder of the war, in which engineer units were continually pushed well forward. In its advance to the Ardennes in January, 1945, for example, VII Corps habitually supported each of its divisions with an additional engineer battalion.[37] Indeed, it was normal for all divisions in contact to have at least one additional engineer battalion. This requirement for forward pushing of resources became even more critical after the reduction of the armored engineer battalion to three line companies in 1943.

The practice of decentralized forward support, however, was in conflict with a basic engineer desire for flexibility. Because of the scarce nature of their resources, corps engineers preferred to control support centrally and allocate it on a need basis to provide more efficiency. This usually meant that corps units were assigned support relationships instead of attachment. Armored divisions, however, seldom received support in this manner. Their independent nature and agility of operations required a more responsive form of engineer support, hence attachment was normal.

It was common for the same corps unit to remain attached to an armored division for long periods, creating a habitual association and teamwork.

Even further, engineer companies often stayed with the same Combat Command (CC) in similar extended fashion. In the 4th Armored Division, the 24th Armored Engineer Battalion usually had the 995th Treadway Bridge Company attached.[38] The 6th Armored Division habitually attached one engineer company to each CC and most of the time it was the same one. In the 6th Armored Division's crossing of the Our River in February, 1945, two corps engineer combat battalions were attached to CCA while a corps battalion and a divisional engineer company were attached to CCB.[39]

In the armored divisions specifically, attachment of engineers frequently went further down than CC level. In the 4th Armored Division, an engineer platoon was routinely attached to each battalion sized task force to build bridges at night for tanks and sweep roads in the day.[40] The 6th Armored Division also created two or three combat teams of battalion size per CC, each with an attached engineer platoon. This bond with engineer assets was so strong and expected that when a CC was cross-attached to another unit, it took its support slice, including engineers.[41]

Of 14 operations conducted by 14 armored divisions in World War II, over 95% of the time the CC's organization included the attachment of at least one engineer company. Over 90% of these times, further subattachment of an engineer platoon to each battalion sized task force occurred.[42]

From this brief look at command and control of engineer units, it is clear that they were considered vital to the agility needs of the armored divisions. This recognition was so strong that habitual association became the norm, creating flexible, integrated combined arms organizations. Speed of decision and action were further enhanced by the attachment of corps

engineers, rather than employing them in the support relationship called for by doctrine. This practice occurred within a general environment of engineer scarcity, posing a continual dilemma for engineer and maneuver commanders. They were pulled between the demands for tactical agility on the battlefield which required quick responsive support, and the desire to maintain flexibility of a scarce commodity. The one argued for attachment while the other demanded centrally controlled support relationships. Throughout the war, the agility needs tended to overshadow flexibility, at least in the combat zone.

SECTION IV: THE EASTERN FRONT EXPERIENCE

Combat engineers made a significant contribution to the agility of warfare on the Eastern Front. The Germans in particular, recognized the essential nature of key support arms and felt that they should not be wasted in secondary or improvised missions. In their postwar evaluations, several German generals felt that engineers had been used as infantry far too often, and that it was usually a mistake to commit them as such.[43]

According to one analysis of German blitzkrieg tactics, the combat engineer lay at its heart. The '**Pioniere**' was a highly trained specialist who was equipped with a variety of equipment to enhance his ability to speed along advancing armored columns.[44] Armed with flamethrowers, mines, explosives, smoke generating devices, and barbed wire, the combat engineer accompanied the spearhead of the attack.[45] General construction and repair of roads were normally left to manual labor units.

Panzer Divisions were the most versatile of the combined arms forces in the German army and were well suited for offensive action. Extensive subdivision of these units into battle groups was common practice. The 5th Panzer Division, for example, habitually organized a battle group around a rifle regiment, a panzer regiment, engineer company, artillery battalion and a signal element.[46] Close coordination among the arms was made possible by the radio and constant combined arms training.

The Russians also acknowledged the importance of combat engineers. As a

result of their setbacks in the Finnish War, however, the Russian High Command concluded that their force structure was plagued by two critical problems. Current division commanders were incapable of effectively orchestrating combined arms forces, and there was an acute shortage of trained sappers.[47]

The solution to this dual problem lay in the creation of independent Engineer Sapper Brigades. Removal of engineers from the divisional organization simplified the commander's normal management of combat operations and also permitted the Army Commander to control centrally a critical, though scarce resource.[48] Although somewhat slow and unresponsive, this new engineer structure did allow for the concentration of engineer assets in the defense. Noted for their ability to lay minefields rapidly, these sapper brigades contributed significantly to the high casualty rates among attacking German divisions throughout the war on the Eastern Front.[49] By focusing engineers at the point of attack, Russian commanders were also able to obtain a greater density of offensive support than armies routinely achieved on the Western Front. Russian units, however, regained their organic engineer support by war's end. The emergence of capable commanders and increasing numbers of trained sappers allowed the Red Army to reestablish its combined arms focus at the divisional level.

SECTION V: POSTWAR EVALUATION

Following the war, the U.S. Army established a special committee known as the General Board. It was chartered to evaluate the American Army's conduct of the war, with an eye towards improving future organization and tactics.[50] Two of the 132 studies of this analysis group dealt with engineer considerations: Engineer Organization and Engineer Tactical Policies. Many of their recommendations were directed at the agility needs of the force and how engineers might contribute to more effective support.

There was universal acknowledgement within the engineer studies that the division engineer lacked the organic assets needed to accomplish his normal missions.[51] ETO experience indicated that each armored division needed at least two engineer battalions, one divisional and one from corps. In practice the deficiency was usually corrected by physically locating a corps combat battalion in the division's area of operations for extended periods. During the Italian Campaign, the 16th Armored Engineer Battalion was frequently detached from the idle 1st Armored Division and spent most of its time reinforcing the engineer units of committed infantry divisions.[52]

> To fulfill his responsibility he (the division engineer) should have permanently under his command all the engineer means required for all the normal engineer work. He should have available upon request to higher echelon the

engineer support necessary to meet any special requirement. 53

The board recommended the replacement of the divisional battalion with an engineer regiment consisting of a headquarters and service company and two battalions.[54] The regiment would contain 1443 personnel and maintain some bridging assets within the headquarters.[55] (See figure 2 on page 38) Not only was this change indicated by historical need, but it was unanimously endorsed by 1st, 3rd, 7th, and 15th armies.[56] Although the board acknowledged the routine practice of attaching engineers directly to CCs and even battalion task forces, they felt that recommending a permanent engineer support structure for these forces would be going too far.[57] Yet the language of the narrative indicated an understanding that such organization was not only acceptable, but often necessary.

While the board did not directly critique engineer equipment and its performance during the war, it noted that unit histories and after-action reports highlighted the slowness with which sappers responded to battlefield needs. The dozer, tank dozer, and mine detector were indeed, invaluable assets in the breaching of obstacles, but more agile alternatives were required for future conflicts. Engineers departed World War II with the same breaching tools with which they entered it: the mine detector and the bayonet probe.

Even with the formation of engineer regiments at divisional level, the board recognized the continuing need for corps engineer units. They provided flexibility and the capability to mass assets at a critical juncture. The members saw the independent engineer battalion as the proper sized element for adding support to committed divisions and recommended

that these be maintained at corps under a regimental headquarters.[58]

The practice of pushing corps units forward during the war had created a mobility problem which the board also recognized. Corps engineers were not equipped with the same tracked vehicles as their armored engineer counterparts, degrading their support effectiveness. Depending on the terrain and speed of the armored advance, corps sappers fell behind and hence were not able to enhance the tactical agility of the supported force at the point of attack. By placing more armored engineers in divisions, the board felt it had addressed this mobility mismatch.

It was in the area of command and control (C2), however, that the board made its most significant recommendations. As already noted, the lack of engineers within the division set off a continuous forward movement of assets throughout the theater. Divisions were obliged to push their engineer units down to Combat Commands (CCs) and even battalion sized task forces (TFs). Corps, in turn, sent battalions down to the division. Even Field Army assets were sent forward, sometimes directly into the divisional area. Thus, engineers from several echelons became intermingled without a definite unified engineer commander.

Doctrine held the divisional engineer responsible for all the engineer work within his area, but did not establish C2 principles to handle the situation described above. In practice, liaison officers (LNOs) from Field Army engineer groups or corps battalions went to coordinate with the divisional engineer, but disagreements were not easily sorted out under the doctrinal support relationships.[59] Cooperation was based more often than not on temporary arrangements and the parameters of personality. All too frequently various engineer units were operating within a single geographic

area under several different command headquarters. An example of how disaster could result from this dilemma was the Rapido River crossing in January, 1944. The actual crossing was planned by corps engineers who for the most part ignored the division engineer, even though he had a better understanding of the terrain. Actual support to the assault regiments was provided by corps engineers who responded at times to directives both from the division commander and the corps engineer.[60] Undoubtedly, some of the blame for the failure that followed can be leveled against a lack of unity of command.

In addressing this impediment to agile organization, the board asserted three principles of command and control. First, the unit engineer must command all engineer troops under direct control of his headquarters. Secondly, the unit engineer should perform both command and staff functions. Finally, the unit engineer must be responsible for all engineer operations in his area.[61] These principles were used to justify the increased divisional engineer assets already mentioned, but they were also the basis for recommending that the corps engineer command all engineers assigned to the corps.

The command responsibility of the corps engineer had been removed from engineer doctrine in December of 1944.[62] It proved to be an unworkable change and was largely ignored in practice. Corps engineers either commanded in fact or exercised control through such innovative arrangements as 'operational control', which had no roots in doctrine.

SECTION VI: E-FORCE: A BETTER WAY TO INCREASED AGILITY?

As mentioned at the beginning of this paper, the combat engineer of today is the least agile member of the combined arms team. Since the Vietnam War, the Army has fielded an entirely new generation of combat equipment, introduced a new doctrine which emphasizes agility and offensive action, and created a vigorous battlefield testing ground at the National Training Center to validate them. Most of the weaknesses of the engineer system in World War II, however, remain unresolved, and recommendations for improvement sound vaguely like the words of the General Board of forty years past. While combat engineers have failed to address World War II identified requirements, the battlefield environment has continued to evolve towards greater lethality, speed, and uncertainty.

The Soviets, on the other hand, view the combat engineer as an indispensable member of the combined arms force and have provided organic engineer support to all levels down to the regiment, including all reconnaissance elements. Equipment development has also kept pace with the demands of battlefield engineering. The Soviet division of today carries with it 20,000 mines armed with a sophisticated array of fuzing devices.[63] Engineers can lay up to one kilometer of minefield from protected vehicles within ten minutes.[64] Soviet doctrine relies heavily on mining the flank in the offense and rapidly digging in vehicles at the halt. Scatterable mine systems and a family of rapid ditching equipment complete an impressive

list of countermobility assets available to the tactical commander.

As currently equipped, American armored forces cannot counter such quantity and quality of obstacle creating assets. By some estimates, friendly units could expend up to a quarter of their vehicles in breaching the kind of obstacle complex which Soviet engineers could erect in but a few hours.[65] Additionally, combat support and combat service support elements have no present ability to breach scatterable minefields which could be placed on top of them. Now more than ever, combat engineers are essential to the task of translating the increased mobility of armored forces into genuine maneuverability. Only by doing this can the combined arms team achieve the agility demanded by Airland Battle doctrine.

The E-Force proposal recognizes the need of focusing upon the combat zone, especially at the point of attack. Unlike artillery and aviation which have increased their ranges of fires and support, the combat engineer still must physically occupy the terrain which he will influence. In order to accomplish his mission, the engineer must possess the terrain architecture capability to do the job quickly, achieve a degree of mobility equal to that of the combat units he is to support, and be fully integrated into the command and control structure of the combined arms team.

Current doctrine, like the General Board of 1945, recognizes the need for additional engineer support to the division. This need is articulated in FM 5-100, Engineer Combat Operations, studies conducted by numerous agencies, and the reports of actual field exercises.[66] As in World War II, most of the additional engineer units come from higher, specifically Engineer Brigades which are normally attached to an Engineer Command or the various Corps HQs. Engineer combat battalions and other engineer units are

pushed down to the divisions under a variety of command and support relationships very similar to those used in World War II. In normal situations engineer support to a single heavy division will consist of five engineer battalions. For example, the Division 86 Study anticipates a corps mechanized engineer battalion and a divisional battalion (see figure 3 on page 39) operating in the Main Battle Area (MBA) and Covering Force Area (CFA), while two corps engineer battalions, a heavy battalion, and two bridge companies provide support as required.[67]

Although the division requires more engineers, it is the way they are provided which is critical to the attainment of agility. Current doctrine does provide the division with additional engineer assets, but does so in a manner which creates serious command and control problems and adversely affects the agility of the force. Historical experience has shown that without habitual association the mental agility and teamwork which are essential to an agile combined arms team cannot be fully developed. This factor alone can be the critical element in the effort to operate faster than the enemy.

The E-Force concept, on the other hand, rests upon a common sense principle in the creation of permanent combined arms entities. If it can be shown that an organization needs the support of a functional asset for a majority of its anticipated missions, an excellent case can be made for attachment. World War II experience and recent observation validate the notion that divisions routinely need more than one battalion of engineers. E-Force would provide three organic battalions to the heavy division, allowing each maneuver brigade to work habitually with an engineer battalion.[68] (See figure 4 on page 40)

Current pushing of corps assets down to task force level overburdens the task force engineer who is a second lieutenant at present. He is the least experienced engineer in the division, possesses no staff, and lacks the communications to coordinate the diverse activities in his area. In short, he is unable to coordinate and control the various engineer units from several echelons which might be assigned to his sector. E-Force would provide an engineer company to the task force commander which eliminates most of the problems of the current system.

Because engineer units needed by the division would be permanently assigned to the division, most of the communications, C2, and logistical problems can be simplified. Under present doctrine, corps engineer elements sent forward continue to draw their own logistical support from the Corps Support Command (COSCOM). The realities of time-distance factors, however, force these nondivisional units to request support from the Division Support Command (DISCOM) which is not structured to provide it. Under the E-FORCE concept, all the engineers would belong to the division and the DISCOM would be organized to provide full support to engineer activities.

Terrain architecture capability is linked not just to the number of units but also to the quality of those units: mobility of the engineers, and their capability to alter the terrain. E-Force couples a new structure with the introduction of a new family of engineer equipment. Items such as the M-9 Armored Combat Engineer Vehicle (ACE), Counter Obstacle Vehicle (COV), Tactical Explosive System (TEXS), and VOLCANO mine dispensing system represent a significant gain in agility generating potential in both the offense and defense.

Summarizing to this point, E-Force addresses many of the shortcomings of the engineer system in World War II as described by the General Board and validated by current experience. The proposal provides on a permanent basis more engineers at the divisional level which is consistent with mission requirements, logistical constraints, and the necessities of effective command and control. The fixed arrangement creates habitual association between engineers and maneuver elements, fostering a more mentally agile force. Physical agility is enhanced by the increased terrain architecture capability of the new engineer equipment associated with E-Force. In light of these enhancements, however, does E-Force adequately fulfill the battlefield requirements for agility? The following comments represent some suggested areas where E-Force could go further towards increasing the tempo of operation of combined arms forces.

Within the combined arms team a mobility differential would still remain between engineers and combat elements. The question is, how significant is this disparity? According to Martin Van Creveld, mobility differentials are not that pronounced in actual combat as only a portion of the maximum speed can be utilized on the battlefield.[69] Under E-Force, the M-113 Armored Personnel Carrier would continue to transport the sapper squad, and while it cannot keep up with the M-1 or M-2 combat vehicle in a battlefield rush, the speed differential is not critical for most situations. What is required, however, is rapid obstacle breaching equipment which enables the combined arms team as a whole to operate at a faster tempo than the enemy. Most of the terrain architecture vehicles within the E-Force structure are far less mobile than those which carry engineer personnel. The Combat Engineer Vehicle (CEV), Armored Vehicular Launched Bridge (AVLB) and

Counter Obstacle Vehicle (COV) would have great difficulty keeping up with armored units traveling at only half their maximum combat speed. As in World War II, mobility of specialized engineer systems continues to be a major problem.

In the area of terrain architecture, E-Force would remain deficient in mobility support to the force. Because of our NATO commitment and resource constraints, engineer focus has been of a defensive or countermobility nature. Under E-Force, combat elements would enjoy increased ditching capability through better mechanical diggers and TEXS (Tactical Explosive System), and more mine laying capability through the VOLCANO system and a proliferating family of scatterable mines. Given the current Soviet ability to employ mines and their historic propensity to use them in massive quantities, however, E-Force requires more enhanced capability to breach minefields. This is especially true for a doctrine which envisions bold offensive action to seize the initiative on the Central European battlefield.

Countermine development is one of the most frustrating examples of engineer equipment research and procurement over the past twenty years. The current explosive breaching device, MICLIC (Mine Clearing Line Charge), is nothing more than an updated version of the World War II 'snake'. Neither this device nor proposed mechanical methods adequately address the requirement for a quick, survivable minefield breacher.

The fields of reconnaissance and communications represent two other areas of needed enhancement to E-Force. As has been pointed out before, engineer support has a maximum effective range of zero, requiring time to achieve its agility related goal. The pace of modern combat demands

effective prior planning which translates into timely intelligence. The S-2 section of the divisional E-Force would need to be greatly enhanced from its scope of operation in the current engineer battalion. If the divisional engineer is to keep abreast of future battle locales and the requirements for either obstacle or counterobstacle effort, he must be able to call upon such intelligence assets as Remotely Piloted Vehicles (RPVs), satellite data and enhanced engineer scout sections with faster, survivable vehicles. Timely engineer reconnaissance was the hallmark of the German Panzer Divisions; it must also become an integrated part of the combat structure of the current heavy division.

Although not specifically addressed by the E-Force proposal, communications enhancement would be required in order to take full advantage of the new organization. The current family of radios is totally inadequate for the pace and distances of battle. Increasing the density of engineers within the division's area of operation does shorten the communication range required by engineer units, but a lack of AM capability and secure radios must be resolved in the future.

Equipment and organization offer many opportunities for increased battlefield agility, but doctrine goes a long way towards determining how the entire structure fits together and operates. The current doctrine for planning a division or corps level obstacle system is a slow and cumbersome activity which represents one example where a change in doctrine could improve agility. In recent years there has been a great deal of debate in professional engineer journals about the need to streamline this system. Current doctrine stresses the need for a detailed engineer estimate which forms the basis for assigning engineer assets to the division. In order to

create such an estimate, tactical units at the battalion level produce obstacle plans which are then consolidated at division and corps. Besides justifying the assignment of units, the resulting corps barrier plan forms the justification for allocating engineer materials.[70] In a fast paced conflict, this up and down procedure is simply too slow.

E-Force to a great extent eliminates the need for detailed engineer estimates because the required number of engineers for most battlefield scenarios are permanently assigned to the division. Standard obstacle packages of barrier materials could be developed and pushed down to divisions based on a cursory estimate by the corps engineer. The key to more agile obstacle systems, however, is to integrate a general barrier plan within a corps concept of operations. One method which has been suggested is to designate obstacle zones at the corps level. These areas would be situated astride major avenues of approach and represent the focus of engineer effort. Tactical commanders assigned sectors within these zones would be responsible for siting and emplacing specific obstacles.[71] Such a top-down approach to planning not only reduces the time to complete an obstacle system, but also allows the local commander flexibility in the exact location of obstacles. The Corps Commander is also able to communicate his own plan of maneuver at the earliest possible time through the location of generalized obstacle zones.

Finally, the very idea of E-Force begs the question as to whether the proposal has gone far enough. In addressing the requirement for more engineers at division, E-Force also recognizes, as did the General Board of 1945, the utility of habitual association of engineers at even lower levels. The current size of the heavy division and the lethality of modern

combat systems suggest that the most efficient combined arms organization may be other than the division. Proposals such as MOD-96 (Maneuver Oriented Division) which was produced by students from the National War College and the Industrial College of the Armed Forces point to a more streamlined division which fights permanently organized RCTs (Regimental Combat Teams) composed of all arms.[72] In the view of this author, MOD-96 represents a further enhancement to tactical agility and allows engineers to integrate more fully within the combat team. E-Force appears to lie in the middle ground between full attachment at the brigade level (as under the Soviet system) and the current organizational structure. This may in fact represent the omnipresent engineer desire to maintain flexibility of a historically scarce resource.

SECTION VI: CONCLUSIONS

E-Force does significantly enhance the tactical agility of combined arms units, and is an improvement over current organization. While the proposal does not increase the mobility of engineer units themselves, it does have an impact on both terrain architecture capability and command and control.

E-Force provides more engineers to the division, but even further, the increased numbers are more effectively organized around a new family of engineer equipment. Sub elements like the assault section of the engineer company are functionally structured to employ agile breaching systems on the battlefield, while others are equipped to rapidly emplace obstacles. (See figure 5 on page 41)

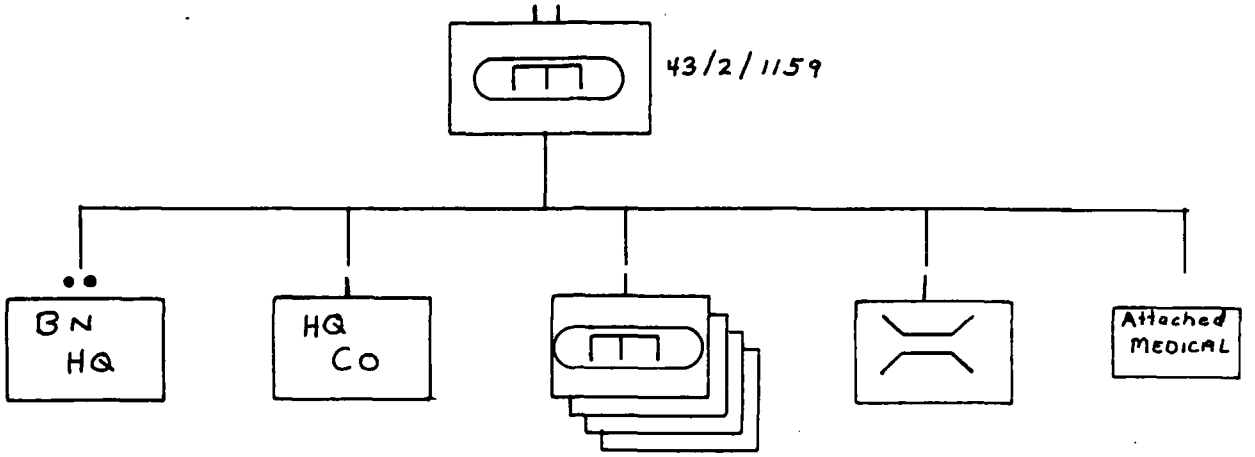
The command and control of engineer assets is made easier by providing battalion headquarters to each of the brigades and as required, company headquarters to battalion task forces. Not only are these more capable elements for coordinating activities, but they will be the same ones all the time. Habitual relationships can provide for common operating procedures, integrated training, and a reduction of the personality turbulence associated with current task organization methods.

It is important, however, that engineers recognize that E-Force alone is not the answer. Further improvements in areas such as engineer mobility, communications equipment, and intelligence are necessary if engineer units are to increase their ability to promote tactical agility. Doctrinal

changes such as the adoption of obstacle zones described earlier will be critical in shortening the entire planning-to-execution process. In short, the full spectrum of activities found within the combined arms team must be analyzed for ways to shorten their duration. This will require inter-branch cooperation, dialogue, and broad thinking.

In the final analysis, **TIME**, in all its manifestations, is the real enemy to the notion of tactical agility.

ARMORED ENGINEER BATTALION
ARMORED DIVISION (WW II)
1 MARCH, 1942



ARMORED ENGINEER BATTALION
ARMORED DIVISION (WW II)
SEPT, 1943

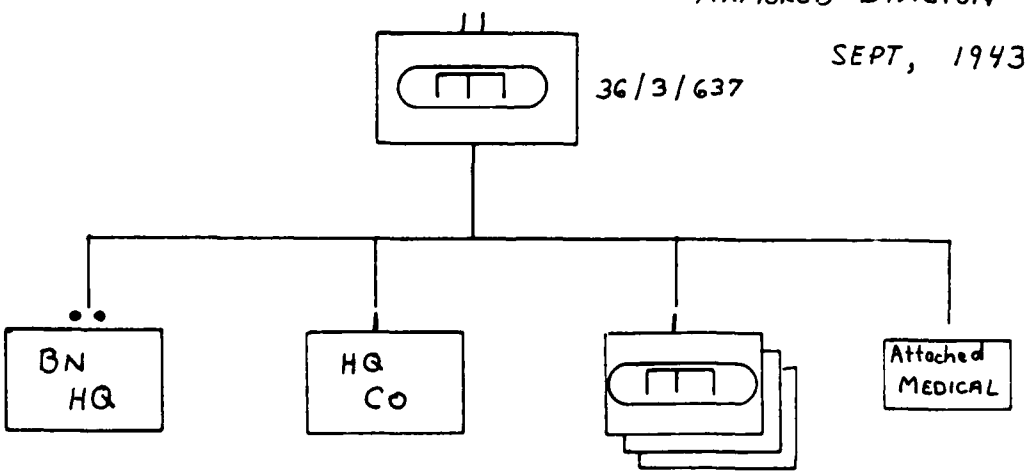


FIGURE 1

PROPOSED DIVISIONAL ENGINEER REGIMENT, 1945

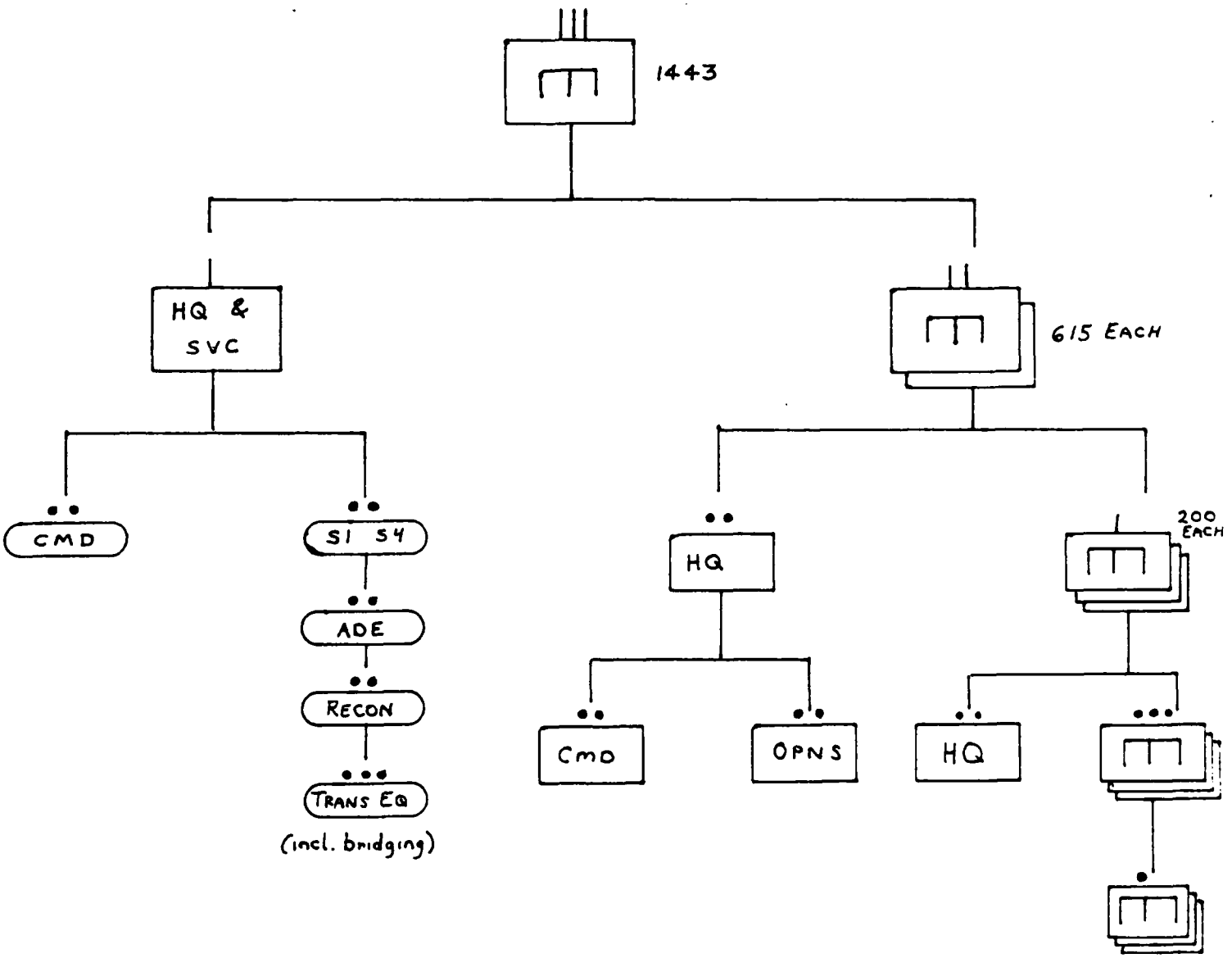


FIGURE 2

CURRENT ENGINEER BATTALION, HVY DIVISION

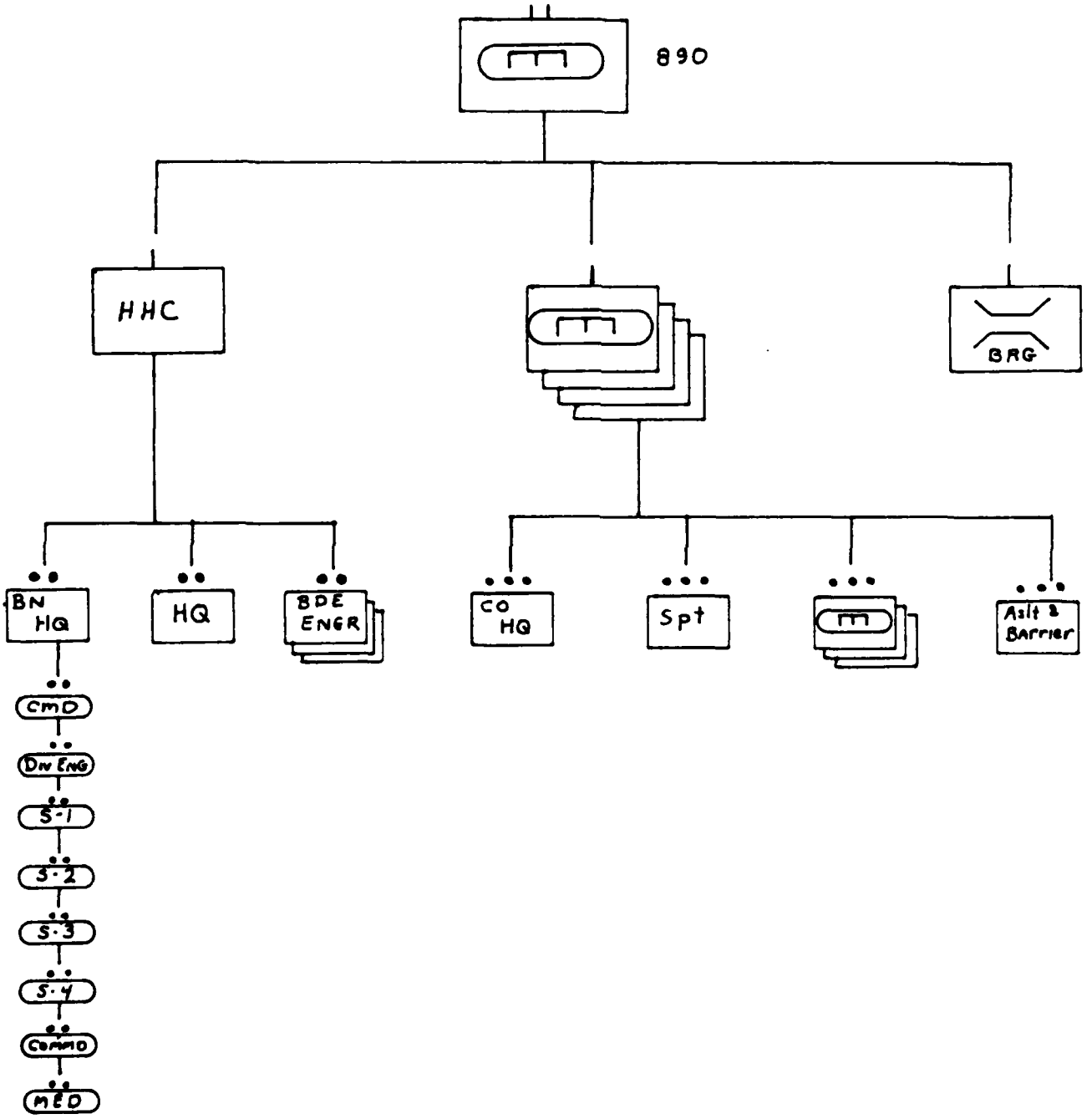


FIGURE 3

E-FORCE (HEAVY DIVISION)

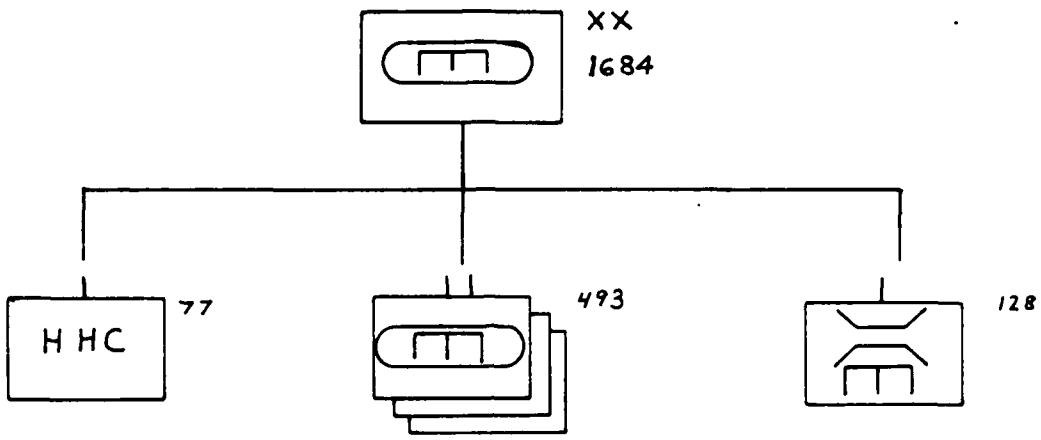


FIGURE 4

E-FORCE (DIVISIONAL ENGINEER BN)

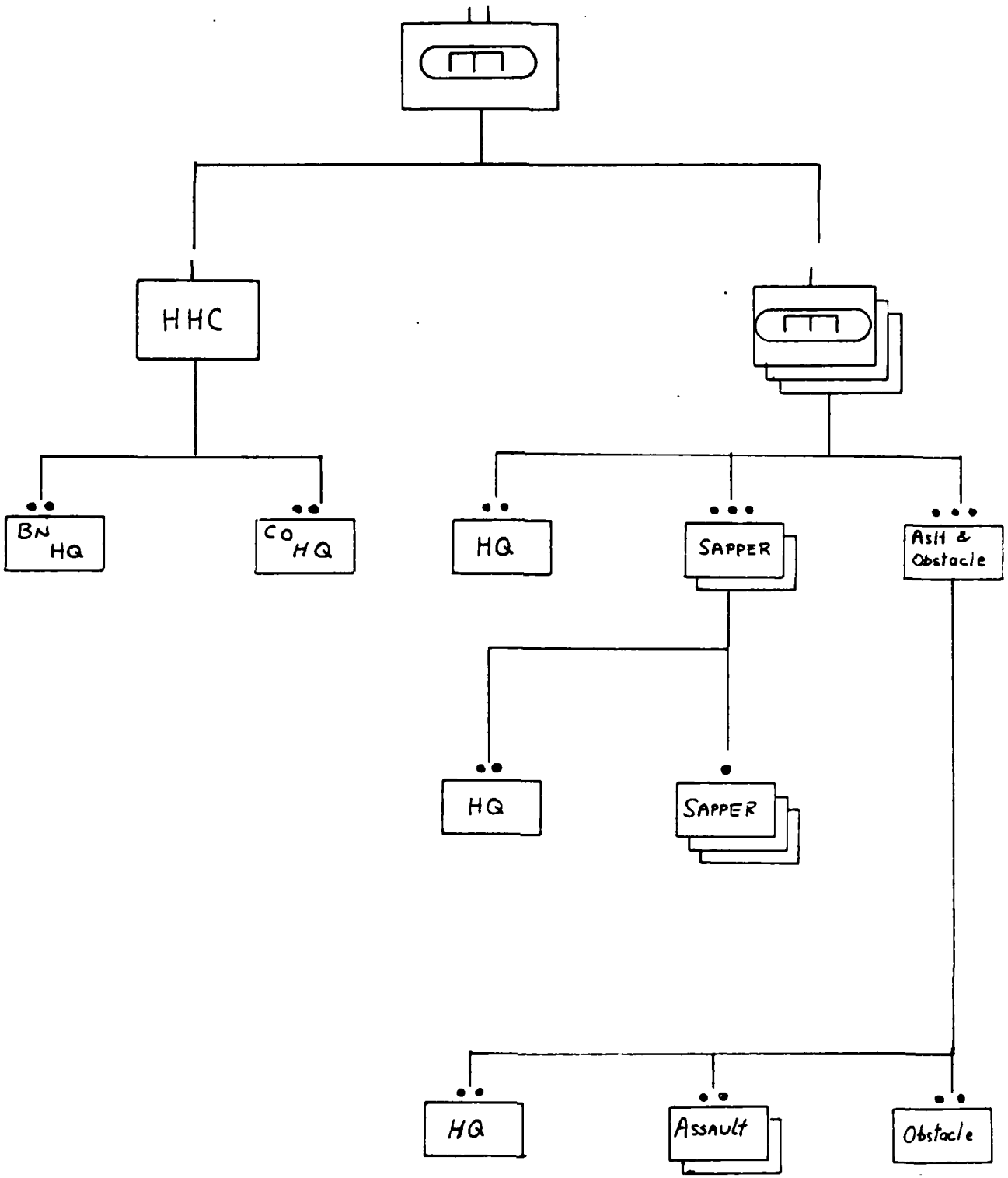


FIGURE 5

ENDNOTES

1 Blanche D. Coll et al., United States Army in World War II, The Technical Services: The Corps of Engineers: Troops and Equipment (Washington, D.C.: U.S. Government Printing Office, 1958), p. 1.

2 MG Richard S. Kem et al., "E-FORCE," Engineer, Spring 1986, p. 10.

3 MG Richard S. Kem, "We Stand at the Watershed," Engineer, Spring 1986, p. 6.

4 Kem, "E-FORCE," p. 10.

5 Sun Tzu, The Art of War (New York: Oxford University Press, 1963), p. 134.

6 U.S. Army, FM 100-5, Operations (Washington, D.C: U.S. Government Printing Office, 1986), p. 16.

7 Ibid.

8 FM 100-5, op. cit., p. 16.

9 Stanley J. Murphy and F. Marion Cain III, "The Evolution of Doctrine: Development of Engineer Tactical Doctrine and Equipment, 1939-1944," Engineer, Winter 1985-86, p. 32.

10 Coll, op, cit., p. 12.

11 Ibid.

12 Ibid.

13 Ibid., p. 20.

14 Alfred M. Beck et al., United States Army in World War II, The Technical Services: The Corps of Engineers: The War Against Germany (Washington, D.C.: Center of Military History, 1985), p. 5.

15 Coll, op. cit., p. 19.

16 Ibid., p. 20.

17 Ibid., p. 32.

18 Ibid., p. 34.

19 Murphy, op. cit., p. 37.

20 Ibid., p. 38.

21 Ibid.

22 "The Impact of Dieppe on the Development of Mobility Equipment," Engineer, Winter 1985-86, p. 41.

23 Ibid.

24 Coll, op. cit., p. 48.

25 Ibid., p. 224.

26 Advanced Course, Committee 19, Operations of Armored Engineers in ETO (Fort Knox: The Armor School, 1950), p. 19.

27 Ibid., p. 65.

28 Ibid., p. 55.

29 Ibid., p. 56.

30 Murphy, op. cit., p. 35.

31 Coll, op. cit., p. 135.

32 Advanced Course, Committee 19, op. cit., p. 11.

33 U.S. Army, FM 5-5, Engineer Troops (Washington, D.C.: U.S. Government Printing Office, 1943), change 3, p. 3.

34 Coll, op. cit., p. 225.

35 U.S. Army, FM 5-6, Operations of Engineer Field Units (Washington, D.C.: U.S Government Printing Office, 1943), change 1, pp. 2, 236.

36 FM 5-5, op. cit., p. 3.

37 U.S. Army, Engineer Operations by the VII Corps in the European Theater (Headquarters, VII Corps, 1945), Vol. I, appendix 3.

38 CPT Kenneth Koyen, The Fourth Armored Division: From the Beach to Bavaria (Munich: Herder-Druck, 1946), p. 273.

39 MAJ Clyde J. Burk, ed., Combat Record of the Sixth Armored Division in the ETO (Auschaffenburg: Steinbeck-Druck, 1945), p. 210.

40 Koyen, op. cit., p. 75.

41 Burk, op. cit., pp. 72, 73.

42 The General Board, Study No. 48: Organization, Equipment, and Tactical Employment of the Armored Division (United States Forces, European Theater, 1945), appendix 1.

43 DA PAM 20-201, Military Improvisations During the Russian Campaign (1951), pp. 48, 49.

44 Len Deighton, Blitzkrieg: From the Rise of Hitler to the Fall of Dunkirk (New York: Ballantine Books, 1979), p. 145.

45 Ibid.

46 Ibid., p. 154.

47 Edward N. Luttwak, "The Soviet Army of the Second World War: Notes on 'dissimilar' and specialist forces: Assault Engineer-Sapper Brigades," (Chevy Chase: Edward N. Luttwak Inc., 1985), p. 1.

48 Ibid., p. 2.

49 Ibid., p. 43.

50 The General Board, Study No. 71: Engineer Organization (United States Forces, European Theater, 1945), chapter 1.

51 Ibid., p. 14.

52 Advanced Course, Committee 19, op. cit., p. 73.

53 The General Board, Study No. 71, op. cit., p. 18.

54 Ibid., p. 20.

55 Ibid.

56 Ibid.

57 The General Board, Study No. 72: Engineer Tactical Policies (United States Forces, European Theater, 1945), p. 41.

58 The General Board, Study No. 71, op. cit., pp. 10-12.

59 The General Board, Study No. 72, op. cit., pp. 39, 40.

60 Martin Blumenson, United States Army in World War II, The Mediterranean Theater of Operations: Salerno to Cassino (Washington, D.C.: Office of the Chief of Military History, 1969), pp. 327-332.

61 The General Board, Study No. 71, op. cit., p. 17.

62 Ibid., p. 2.

63 Charles R. Boyer, "Soviet Engineers in Combat: The Objective is Rapid Advance," Engineer, Spring 1986, p. 32.

64 Ibid.

65 Luttwak, op. cit., p. 40.

66 MAJ Paul G. Munch, The Combat Engineer Support to an Offensive Operation (Ft. Leavenworth, Kansas: MMAS Thesis, 1982), p. 118.

67 U.S. Army Combined Arms Center, Combined Arms Development Activity, Division 86 Final Report (Ft. Leavenworth, Kansas: Combat Development Activity, 1981), p. 6-2.

68 Kem, "E-FORCE," p. 12.

69 Martin Van Creveld, Supplying War (Cambridge: Cambridge University Press, 1977), pp. 234,235.

70 David Fastabend and Ralph Graves, "Maneuver, Synchronization and Obstacle Operations," Military Review, February, 1986, pp. 41-48.

71 Ibid.

72 William D. Chesarek et al., "Maneuver Oriented Corps - 1996," Briefing manuscript from a research project by a group of students from the National War College and the Industrial College of the Armed Forces, 1985.

BIBLIOGRAPHY

Books

Beck, Alfred M., Abe Bortz, Charles W. Lynch, Linda Mayo, and Ralph F. Weld. United States Army in World War II, The Technical Services: The Corps of Engineers: The War Against Germany. Washington, D.C.: Center of Military History, 1985.

Blumenson, Martin. United States Army in World War II, The Mediterranean Theater of Operations: Salerno to Cassino. Washington, D.C.: Office of the Chief of Military History, 1969.

Burk, Clyde, ed. Combat Record of the 6th Armored Division In the ETO. Aschaffenburg: Steinbeck-Druck, 1945.

Coll, Blanche D., Jean E. Keith, and Herbert H. Rosenthal. United States Army in World War II, The Technical Services: The Corps of Engineers: Troops and Equipment. Washington, D.C.: Office of the Chief of Military History, 1958.

Creveld, Martin Van. Supplying War. Cambridge: Cambridge University Press, 1977.

Deighton, Len. Blitkrieg: From the Rise of Hitler to the Fall of Dunkirk. New York: Ballantine Books, 1979.

Giles, Janice Holt. The Damned Engineers. Boston: Houghton-Mifflin Company, 1970.

Glantz, David M. August Storm: Soviet Tactical and Operational Combat in Manchuria, 1945. Fort Leavenworth: Combat Studies Institute, 1983.

Koyen, Kenneth. The Fourth Armored Division: From the Beach to Bavaria. Munich: Herder-Druck, 1946.

Liddell Hart, B.H., ed. The Rommel Papers. New York: Harcourt, Brace and Company, 1953.

MacDonald, Charles B. and Sidney T. Mathews. United States Army in World War II, Three Battles: Arnaville, Altuzzo, and Schmidt. Washington, D.C.: Office of the Chief of Military History, 1952.

Sun Tzu. The Art of War. New York: Oxford University Press, 1963.

Thompson, Paul. Engineers in Battle. Harrisburg: The Military Service Publishing Company, 1942.

Journals and Periodicals

Baehre, Michael D. "Point". Engineer. Vol. 16, No. 1, Spring, 1986.

Baldwin, William C, and Barry W. Fowle. "World War II: Engineers in the European Theater". Engineer. Vol. 14, No. 4, Winter, 1984-1985.

Bates, Jared L. and Jimmie B. Quinn. "T2S=V". Military Review. Vol. 66, No. 3, March, 1986.

Bornhoft, Stewart H. "Force Multiplier-Useless Cliche or Useful Concept?" Military Review. Vol. 63, No. 1, January, 1983.

Boyer, Charles R. "Soviet Engineers In Combat: The Objective Is Rapid Advance". Engineer. Vol. 16, No. 1, Spring, 1986.

Burns, William. "Engineer Leaders on Tomorrow's Battlefield". Engineer. Vol. 13, No. 4, Winter, 1983-84.

Coroalles, Anthony M. "Implementing A Maneuver Style of War". Military Review. Vol. 62, No. 12, December, 1982.

Dubik, James M. "FM 100-5: Comparing the Operational Concept and the Defense". Military Review. Vol. 62, No. 12, December, 1982.

Edwards, Fred. C. and Stephen E. Draper. "Corps Engineers Far Forward". Engineer. Vol. 10, No. 2, Summer, 1980.

Fastabend, David, and Ralph Graves. "Maneuver, Synchronization and Obstacle Operations". Military Review. Vol. 66, No. 2, February, 1986.

Fontenot, Gregory. "The Promise of Cobra: The Reality of Manchuria". Military Review. Vol. 65, No. 9, September, 1985.

Fuhrman, Russell L. "Countermine For The Airland Battle". Engineer. Vol. 13, No. 1, Spring, 1983.

Graves, Ralph H. "Obstacle Zones and Belts Work; Current Doctrine Does Not". Engineer. Vol. 16, No. 2, Summer, 1986.

Hall, Wayne M. "A Theoretical Perspective of Airland Battle Doctrine". Military Review. Vol. 66, No. 3, March, 1986.

Hambric, Harry N., and Edwin L. Booth. "A New Way to Breach Minefields". Engineer. Vol. 14, No. 3, Fall, 1984.

Hanne, William G. "Doctrine Not Dogma". Military Review. Vol. 63, No. 6, June, 1983.

Kanda, Richard, and Thomas P. Swaim. "Army 86 Combat Engineers". Engineer. Vol. 13, No. 1, Spring, 1983.

Kem, Richard S., Richard Capka, and Houng Y. Soo. "E-Force". Engineer. Vol. 16, No. 1, Spring, 1986.

Kem, Richard S. "We Stand at the Watershed". Engineer. Vol. 16, No. 1, Spring, 1986.

Marapoti, James A. "Combat Engineers: Obstacles to Overcome". US Naval Institute Proceedings. Vol. 107, June, 1981.

McKeever, Robert G. and Robert L. Somers. "Brigade Slice Observations At NTC". Engineer. Vol. 15, No. 3, Fall, 1985.

Mennig, John. "Getting Up to Speed". Engineer. Vol 13, No. 3, Fall, 1983.

Miller, Marion C. "New Countermine Capabilities Emerging in 1980s". Engineer. Vol. 11, No. 2, Summer, 1981.

Murphy, Stanley J. and F. Marion Cain III. "The Evolution of Doctrine: Development of Engineer Tactical Doctrine and Equipment, 1939-1944". Engineer. Vol. 15, No. 4, Winter, 1985-86.

Nahas, Alfred J. "The Division Engineer". Engineer. Vol. 14, No. 2, Summer, 1984.

Noah, Max W. "Mobility, Countermobility, and Survivability in the Airland Battle". Engineer. Vol. 11, No. 2, Summer, 1981.

Ozolek, David. "Barrier Planning". Armor. Vol. 94, No. 6, Nov-Dec, 1985.

Richey. "The Philosophical Basis of the Airland Battle". Military Review. Vol. 64, No. 5, May, 1984.

Wass de Czege, Huba, and L. D. Holder. "The New FM 100-5". Military Review. Vol. 62, No. 7, July, 1982.

Whitley, James. "Engineer Combat Multipliers For The Maneuver Force". Military Review. Vol. 62, No. 9, September, 1982.

----------. "The Impact of Dieppe on the Development of Mobility Equipment," Engineer. Vol. 15, No. 4, Winter, 1985-86.

Government Publications

Advanced Course, Committee 19. Operations of Armored Engineers in ETO. Fort Knox: The Armored School, 1950.

Center for Army Lessons Learned. Bulletin #1-86. Ft. Leavenworth: CALL, July, 1986.

Department of the Army Pamphlet 20-201, Military Improvisations During the Russian Campaign. Washington, DC: US Government Printing Office, 1951.

Department of the Army Pamphlet 20-230, Russian Combat Methods in World War II. Washington, DC: US Government Printing Office, 1950.

Department of the Army Pamphlet 20-233, German Defense Tactics Against Russian Breakthroughs. Washington, DC: US Government Printing Office, 1951.

Department of the Army Pamphlet 20-269, Small Unit Actions During the German Campaign in Russia. Washington, DC: US Government Printing Office, 1953.

Field Maual 5-5, Engineer Troops. Washington, DC: US Government Printing Office, 1943.

Field Manual 5-6, Operations of Engineer Field Units. Washington, DC: US Government Printing Office, 1943.

Field Manual 5-100, Engineer Combat Operations. Washington, DC: US Government Printing Office, 1984.

Field Manual 100-5, Operations. Washington, DC: US Government Printing Office, 1986.

Field Manual 100-15, Corps Operations. Ft. Leavenworth: USACGSC, 1984.

The General Board. Study No. 15: Organization, Equipment, and Tactical Employment of the Infantry Division. United States Forces, European Theater, 1945.

The General Board. Study No. 48: Organization, Equipment, and Tactical Employment of the Armored Division. United States Forces, European Theater, 1945.

The General Board. Study No. 71: Engineer Organization. United States Forces, European Theater, 1945.

The General Board. Study No. 72: Engineer Tactical Policies. United States Forces, European Theater, 1945.

Headquarters, Engineer School. Army of Excellence Combat Engineers: Battlefield Initiatives for the 90s. Ft. Belvoir: Directorate of Combat Developments, 1985.

Headquarters, VII Corps. Engineer Operations by the VII Corps in the European Theater. Vol. I-VII. VII Corps, 1945.

Headquarters, XIX Corps. XIX Corps Engineers. XIX Corps, 1945.

Headquarters, US Army Combined Arms Center, Combined Arms Development Activity. Division 86 Final Report. Ft. Leavenworth: Combat Development Activity, 1981.

US Army. NTC: Lessons Learned. Ft. Leavenworth: CATA, January, 1986.

US Army. NTC: Lessons Learned. Ft. Leavenworth: CATA, May, 1986.

US Army. NTC: Lessons Learned. Ft. Leavenworth: CATA, September, 1986.

Manuscripts

Cababa, Robin R. "Engineer Command/Control Alternatives and Organizational Options at the Maneuver BDE Level". Ft. Leavenworth, Kansas: MMAS Thesis, 1981.

Cottrell, Scott B. "Command and Control Relationships and Organization of Engineer Support to the Heavy Division". Ft. Leavenworth, Kansas: MMAS Monograph, 1985.

Fontenot, Gregory. "The Lucky Seventh In the Bulge: A Case Study for Airland Battle". Ft. Leavenworth, Kansas: MMAS Thesis, 1985.

House, Jonathan M. "Toward Combined Arms Warfare: A Survey of 20th Century Tactics, Doctrine and Organization". Ft. Leavenworth: CSI Research Survey No. 2, 1984.

Information Paper. "E-Force Alternatives". Ft. Leavenworth: ATZL-CAF-S, 26 September, 1986.

Luttwak, Edward N. "The Soviet Army of the Second World War: Notes on 'dissimilar' and specialist forces: Assault Engineer-Sapper Brigades." Chevy Chase: Edward N. Luttwak Inc., March, 1983.

Munch, Paul G. "The Combat Engineer Support to an Offensive Operation". Ft. Leavenworth: MMAS Thesis, 1982.

Unpublished Manuscripts

Chesarek, William D. et al. "Maneuver Oriented Corps - 1996". Washington D.C.: Research project of a group of students from the National War College and the Industrial College of the Armed Forces, 1985.

END

5-87

DTIC