The Heavy Division Engineer Regiment —
A Key To Tactical Freedom Of Action

A Monograph
by
Major Marc R. Hildenbrand
Corps of Engineers

School of Advanced Military Studies
United States Army Command and General Staff College
Fort Leavenworth, Kansas
First Term AY 91–92

Approved for Public Release; Distribution is Unlimited
**REPORT DOCUMENTATION PAGE**

<table>
<thead>
<tr>
<th>AGENCY USE ONLY (Leave Blank)</th>
<th>I. REPORT DATE</th>
<th>J. REPORT TYPE AND DATES COVERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Leave Blank)</td>
<td>20 DEC 1991</td>
<td>MONOGRAPH</td>
</tr>
</tbody>
</table>

**TITLE AND SUBTITLE**

**THE HEAVY DIVISION ENGINEER REGIMENT**

**A KEY TO TACTICAL FREEDOM OF ACTION**

**AUTHORS**

MAJ MARC R. HILDENBRAND, USA

**PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**

SCHOOL OF ADVANCED MILITARY STUDIES

ATTN: ATZL-SWV

FORT LEAVENWORTH, KANSAS 66027-6400

COM (913) 684-3437 AUTOVON 552-3437

**SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)**

**Supplementary Notes**

<table>
<thead>
<tr>
<th>12b. DISTRIBUTION CODE</th>
<th>APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED</th>
</tr>
</thead>
</table>

**ABSTRACT** (Maximum 200 words)

**SUBJECT TERMS**

DIVENG REGIMENT

FREEDOM OF ACTION

MOBILITY

NORMANDY

WACHT AM RHEIN

HEAVY DIVISION

**SECURITY CLASSIFICATION OF REPORT**

UNCLASSIFIED

**SECURITY CLASSIFICATION OF THIS PAGE**

UNCLASSIFIED

**SECURITY CLASSIFICATION OF ABSTRACT**

UNCLASSIFIED

**LIMITATION OF ABSTRACT**

UNLIMITED

**NUMBER OF PAGES**

54

**PRICE CODE**

UNLIMITED

7540-01-280-5500

Standard Form 298 (Rev. 2-89) Prepared by AIA, Inc. 220-18 220-182
Title of Monograph: The Heavy Division Engineer Regiment--A Key to Tactical Freedom of Action

Approved by:

Professor James J. Schneider, MA

COL James R. McDonough, MS

Philip J. Brookes, Ph.D.

Accepted this 20th day of December 1991
ABSTRACT

THE HEAVY DIVISION ENGINEER REGIMENT--A KEY TO TACTICAL FREEDOM OF ACTION by MAJ Marc R. Hildenbrand, USA, 54 pages.

This study answers the following question related to the "Engineer Restructure Initiative": Is the proposed division engineer (DIVENG) regiment capable of creating the conditions necessary to maintain the heavy division's tactical freedom of action on the AirLand battlefield?

In answering the foregoing question, the monograph first examines applicable theory to establish the relationship between mobility, engineer support in offensive operations, and tactical freedom of action. Second, two historical examples--the 1944 American Normandy campaign and the 1944 German Ardennes counteroffensive--illustrate the role engineers play in maintaining tactical freedom of action. Next, the DIVENG regiment's organization, command and control, tactical doctrine, and equipment are analyzed. Finally, appropriate conclusions and recommendations are made.

Overall, the monograph concludes that the DIVENG regiment helps maintain the heavy division's tactical freedom of action. From the study conducted, three major additional conclusions and recommendations emerge. First, the Army must develop an in-stride obstacle breaching capability. Second, the Army must modernize engineer equipment. Finally, the obsolescence of most engineer equipment highlights the need to harmonize all of the Battlefield Operating Systems' components. Until such harmonization occurs, the full potential of AirLand Battle doctrine will never be reached.
ACKNOWLEDGEMENTS

In addition to my director, Professor James Schneider, LTC(P) James Dubik provided me valuable insight in the development and writing of this monograph. I am indebted for their generous assistance; however, any faults in the form or content of the study are purely my own.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Applicable Theory</td>
<td>4</td>
</tr>
<tr>
<td>Historical Examples</td>
<td>11</td>
</tr>
<tr>
<td>The 1944 American Normandy Campaign</td>
<td>11</td>
</tr>
<tr>
<td>The 1944 German Ardennes Counteroffensive</td>
<td>15</td>
</tr>
<tr>
<td>The Heavy Division Engineer Regiment</td>
<td>21</td>
</tr>
<tr>
<td>Conclusions and Recommendations</td>
<td>34</td>
</tr>
<tr>
<td>Appendix 1. Applicable Theory Reference Material</td>
<td>37</td>
</tr>
<tr>
<td>Appendix 2. Normandy Reference Map</td>
<td>38</td>
</tr>
<tr>
<td>Appendix 3. German Counteroffensive Reference Maps</td>
<td>39</td>
</tr>
<tr>
<td>Appendix 4. DIVENG Regiment Reference Materials</td>
<td>40</td>
</tr>
<tr>
<td>Endnotes</td>
<td>41</td>
</tr>
<tr>
<td>Bibliography</td>
<td>48</td>
</tr>
</tbody>
</table>
INTRODUCTION

Since World War II, most Army combat systems have experienced order of magnitude improvements in speed. For example, both the Abrams Tank and the Bradley Fighting Vehicle can travel faster than 40 miles per hour. Additionally, AirLand Battle doctrine is offensively oriented, and the defense is only a temporary expedient prior to resuming offensive operations.

In harnessing combat system speed in offensive warfare, the concepts of mobility and tactical freedom of action must be understood. Unfortunately, both concepts are frequently misunderstood. For example, mobility is often viewed strictly as a function of how fast combat systems can move. As technologically splendid as the Abrams and Bradley are, vehicular speed alone does not ensure a combat formation's mobility or tactical freedom of action. Instead, many factors determine the degree of mobility and tactical freedom of action a combat unit possesses. Further, engineer operations may well be the key to achieving tactical freedom of action on the AirLand battlefield.

Today, the Army is completely reorganizing the way engineers support the combined arms team. The reorganization's specifics, known as the "Engineer Restructure Initiative", are contained in the February
1991 coordinating draft of Field Manual 5-71-100, Regimental Engineer Combat Operations. This study answers one question related to the "Engineer Restructure Initiative", to wit: Is the proposed division engineer (DIVENG) regiment capable of creating the conditions necessary to maintain the heavy division's tactical freedom of action on the AirLand battlefield? If the heavy division cannot maintain tactical freedom of action, a major AirLand Battle doctrinal strength will be eroded. Therefore, answering the foregoing research question is important.

In answering the research question, the fundamental tenets of AirLand Battle doctrine--INITIATIVE, AGILITY, SYNCHRONIZATION, and DEPTH--serve as analytic criteria. The rationale for using AirLand Battle tenets as analytic criteria is developed in the monograph's applicable theory section. Each tenet is defined as follows:

**INITIATIVE** - setting or changing the terms of battle by action.

**AGILITY** - acting faster than the enemy.

**SYNCHRONIZATION** - the arrangement of battlefield activities in time, space, and purpose to produce maximum relative combat power at the decisive point.

**DEPTH** - the extension of operations in space, time, and resources.

*Field Manual 100-5, Operations* discusses each tenet in greater detail.
Following the introduction, the monograph is divided into four main parts: applicable theory, historical evidence, the heavy division engineer regiment, and a combined conclusions and recommendations section. Overall, the monograph concludes the DIVENG regiment is capable of creating the conditions necessary for the heavy division to maintain tactical freedom of action. Further, the DIVENG regiment represents a significantly improved use of currently available engineer resources. However, inadequate engineer equipment—particularly the lack of a true in-stride minefield breaching capability—inhibits AirLand Battle doctrine from reaching its full potential.
APPLICABLE THEORY

As highlighted in the preceding section, current AirLand Battle doctrine is offensively oriented. To appreciate the engineer role in offensive warfare, two concepts must be understood: tactical freedom of action and mobility. This section briefly examines both concepts and illustrates the relationship between tactical freedom of action, mobility, and engineer support in offensive operations.

Tactical freedom of action is the first concept requiring examination. Unfortunately, what constitutes tactical freedom of action is often misunderstood. Part of the misunderstanding regarding tactical freedom of action is attributable to the way Field Manual 100-5, Operations, uses the term. Although Field Manual 100-5 refers to freedom of action, the meaning of tactical freedom of action is never defined. Instead, Operations frequently implies tactical freedom of action results from travelling by unexpected routes and striking where the enemy "has taken no precautions." Such a view is too simplistic; combat units will rarely discover places where the enemy is completely susceptible to attack. More commonly maneuver units will be forced to fight for tactical freedom of action. If the previous statement is true, what is tactical freedom of action? In this study, tactical
freedom of action is defined as: the ability of a combat formation to execute—despite enemy actions to the contrary—a selected course of action. When a force completely executes a selected course of action, total freedom of action exists. When a force partially executes a selected course of action, some degree of freedom of action exists. When a force cannot execute a selected course of action, no freedom of action exists.

A relationship exists between tactical freedom of action and the tenets of AirLand Battle. Evidence for the foregoing relationship is derived from the following statement in Field Manual 100-5:

they [AirLand Battle tenets] are the basis for the development of all current US Army doctrine, tactics, and techniques ...All combat, combat support, and combat service support doctrine are derived directly from, and must support, these fundamental tenets.8

The previous quote indicates AirLand Battle tenets are the basis for all US Army doctrine; the concept of freedom of action is part of current Army doctrine. Therefore, tactical freedom of action must be a function of the tenets of AirLand Battle. The previous idea can be expressed as:

Tactical Freedom of Action is a $f(I, A, S, D)$ where $I$, $A$, $S$, $D$ represent INITIATIVE, AGILITY, SYNCHRONIZATION, and DEPTH respectively. Logically
then, increasing *INITIATIVE, AGILITY, SYNCHRONIZATION,* and *DEPTH* enhances tactical freedom of action—the ability of a combat formation to execute a selected course of action. Further, a combat unit incapable of executing operations in accordance with the tenets of AirLand Battle doctrine is incapable of achieving tactical freedom of action. The preceding ideas set the stage for examining the second key concept related to engineer support in offensive operations—mobility.

Mobility is frequently viewed in terms of how fast combat systems can move. Such a view is incomplete. Instead, a unit's mobility is a complex function determined by many variables including equipment capabilities, maintenance proficiency, weather conditions, and unit movement skills. In this light, a combat formation's mobility potential is the aggregate of all factors enabling a unit to move. In modern warfare, existing and reinforcing obstacles are the dominant factors influencing a unit's ability to move.

Within the Army, engineers have the primary responsibility for overcoming both existing and reinforcing obstacles. Existing obstacles dominate large portions of the earth's surface, and such obstacles include rivers, urban areas, swamps, woodlands, and mountains. Germany's terrain illustrates the potential impact of existing obstacles.
In Germany, attacking divisions will encounter an average of five gaps greater than 20 meters, five gaps between 6 and 20 meters, and fifteen gaps between 2 and 6 meters for every twenty kilometers moved. Also in Germany, major water obstacles occur every three kilometers in east-west movements and every five kilometers during north-south movements. Besides existing obstacles, reinforcing obstacles--such as mines, intentional urban rubble, and blown bridges--will be strewn across the battlefield. An especially significant challenge for maneuver commanders are smaller, more lethal, scatterable mines. Such mines can be quickly emplaced by soldiers, artillery, and aircraft. For example, in only minutes a single Soviet multiple rocket launcher battery can produce an effective four square kilometer scatterable minefield. Currently, more than twenty-two countries possess scatterable mines, and one study concludes attacking brigades may be forced to breach three minefields every 24 hours.

The impact of existing and reinforcing obstacles on a unit's mobility is threefold. First, obstacles tend to favor the defender. Second, unlike the essentially instantaneous effect of direct and indirect fires, an obstacle's influence persists until the obstacle is either breached or by-passed. Finally, without extensive engineer support, the combined arms
team cannot advantageously exploit mobility potential--no matter how fast combat systems can move. For example, an attacking division encountering a major river without floating bridge assets has no forward mobility. Therefore, engineer support in offensive operations--breaching obstacles, crossing dry and wet gaps, and constructing and maintaining routes--is a prerequisite to exploiting mobility potential.

When engineer operations improve a combat formation's ability to exploit mobility potential, the tenets of AirLand Battle are enhanced. Again, the case of a heavy division crossing a river illustrates the previous idea. By enabling maneuver forces to cross a river, engineers help expand the battlefield's **DEPTH**. When **DEPTH** is increased, the heavy division's ability to achieve **INITIATIVE**--set or change the terms of battle by action, **AGILITY**--act faster than the enemy, and **Synchronization**--maximize relative combat power at the decisive point--is also increased. With adequate engineer support, the ability of the combined arms team to conduct operations characterized by the tenets of AirLand Battle is increased. Without adequate engineer support, the probability of executing operations in accordance with AirLand Battle tenets is always decreased and sometimes totally eliminated. Consequently, engineer operations are vital for a
combat formation to exploit mobility potential to advantage.

The overall relationship between mobility, engineer support in offensive operations, and tactical freedom of action can now be summarized. Without engineers the battlefield's existing and reinforcing obstacles make the successful exploitation of mobility potential difficult at best and impossible at worst. In contrast, engineer reduction of obstacles liberates a combat unit's mobility potential. Once mobility potential is liberated, friendly forces are better able to achieve INITIATIVE, AGILITY, SYNCHRONIZATION, DEPTH, and eventual positional advantage over the enemy. Once positional advantage is attained, firepower can be used to destroy the enemy. Further, since tactical freedom of action is a function of AirLand Battle tenets, engineer operations enhance—but because of possible enemy counteractions do not guarantee—overall tactical freedom of action. Appendix I-A illustrates the relationships between mobility, engineer support in offensive operations, and tactical freedom of action.

From the theoretical analysis conducted, three primary interim conclusions emerge. First, without adequate engineer support, a combat formation is unlikely to advantageously exploit mobility potential, and the possibility of achieving INITIATIVE, AGILITY, SYNCHRONIZATION, and DEPTH is remote. Second, tactical
freedom of action is a function of the tenets of AirLand Battle. Therefore, engineer enhancement of the tenets of AirLand Battle enhances overall tactical freedom of action. Finally, there is an inter-relationship between mobility, engineer operations, tactical freedom of action, and AirLand Battle tenets. Therefore, INITIATIVE, AGILITY, SYNCHRONIZATION, and DEPTH are appropriate analytic criteria for this study.

At this point, a theoretical appreciation of the relationship between mobility, engineer support in offensive operations, and tactical freedom of action has been established. In the following section, two historical examples further illustrate the foregoing relationship.
HISTORICAL EXAMPLES

Military history provides an invaluable database for better understanding war. In this monograph, two World War II Western European operations illustrate the role engineers play in creating the conditions necessary for maintaining freedom of action: the 1944 American Normandy Campaign preceding Operation COBRA and the 1944 German Ardennes counteroffensive.

THE 1944 AMERICAN NORMANDY CAMPAIGN

In the early morning hours of June 6, 1944, the Allies launched the greatest invasion in history. The Normandy invasion represented the first step in the final trek towards destroying Nazi Germany, and restoring peace in Western Europe. The American portion of the Normandy invasion force was the most mobile army of its day. All elements of a typical American division--except infantry units--were completely motorized. By attaching only six additional truck companies, infantry units became fully motorized as well. In contrast, the German infantry divisions defending Normandy depended on marching and horse transport for tactical movements.

By early July 1944, the Normandy lodgement contained almost a million Allied soldiers, half a million tons of supplies and more than 177,000
However, this massive combat power was constricted within an area approximately sixty miles long by ten miles deep. In places the beachhead extended less than five miles inland.

The shallow Allied beachhead was primarily due to Normandy's terrain. The Norman bocage—small fields surrounded by massive hedgerows, about twelve feet high and eight feet thick—was reinforced by German obstacles, roadblocks, minefields, antitank guns, and fortifications. These obstacles forced American soldiers to fight forward hedgerow by hedgerow. Each time a hole was smashed through the bocage the German defenders retreated and placed additional obstacles in the attacker's path. Under these conditions clearing the hedgerows became a tense, slow affair performed at close range.

Throughout June and July 1944, American engineers, in concert with their armor and infantry brethren, waged "the grueling positional warfare of the battle of the hedgerows." To protect dozer operators while breaching hedgerows and other obstacles, bulldozers were equipped with makeshift "armored" cabs. Using armored dozers and other sapper tools, engineers breached obstacles obstructing the American advance. Infantry and tanks then poured through the breach and attacked the German defenders. This "ongoing around-
the-clock mission" continuously expanded the Allied beachhead.\textsuperscript{31}

As operations continued General Omar Bradley devised a plan to pierce the German defensive cordon. Bradley's intent was to initiate an offensive campaign capitalizing on the US Army's mobility potential. The plan, codenamed Operation COBRA, envisioned using airpower to blow a hole one mile deep by five miles wide in the German defenses. Before the enemy could react, American mechanized and motorized columns would surge through the resulting gap and shatter the Normandy stalemate.\textsuperscript{32} By July 10, Bradley chose the village of St Lo as COBRA's starting point.\textsuperscript{33}

From July 10th onwards engineer units supported the American drive towards St Lo. Subsequent ground gains were not without cost. In the forty-eight days between June 6 and July 24 the Allies suffered 122,000 casualties.\textsuperscript{34} Nonetheless, despite the German's possession of an extensive natural obstacle system--the bocage--reinforced with countless man-made obstacles, American progress toward St Lo could not be stopped. By July 24, the conditions required to launch COBRA were set, and the next day COBRA was launched. Within weeks the course of the war in Western Europe was completely changed, and by early September the Allies were nearing Germany itself (Appendix 2-A).\textsuperscript{35}
In Normandy American engineers helped the combined arms team maintain the INITIATIVE. Despite a strong and determined German defense, sappers overcame obstacles, and created the conditions necessary to maintain tactical freedom of action. During the push towards St Lo engineers permitted Bradley's forces to set or change the terms of battle by action, and the Americans constantly took the fight to the Nazis.

American engineers also helped maintain AGILITY. Although the American advance was not a "bloodless" affair, the Germans defending Normandy were seldom able to act faster than the Allies. The continuous Allied advance along a broad front—frequently spearheaded by engineers—"prevented the enemy from building strong mobile reserves and concentrating them in offensive action against any one point."3

SYNCHRONIZATION characterized American operations preceding COBRA. Substantial numbers of engineers were positioned well forward—often in front of maneuver elements. Once sappers created a gap in the bocage or other obstacles concentrations of armor and infantry soldiers rushed through the breach and attacked the German defenders.

Finally, engineer operations in Normandy increased the battlefield's DEPTH. From D-day forward, engineer operations assisted the expansion of the Normandy
lodgement. In so doing, the conditions necessary for launching Operation COBRA were created.

Throughout the Normandy campaign engineers increased the US Army's AGILITY, INITIATIVE, DEPTH, and SYNCHRONIZATION. Consequently, American tactical freedom of action was enhanced and maintained, and Bradley's forces were able to set the conditions necessary for launching Operation COBRA.

THE 1944 GERMAN ARDENNES COUNTEROFFENSIVE

In the fall of 1944, Hitler devised an ambitious counteroffensive plan—codenamed Operation WACHT AM RHEIN (Watch on the Rhine) for deception purposes—to turn the Western European war in the Nazi's favor. The WACHT AM RHEIN plan was divided into three main phases. The first phase required a rapid penetration of Allied defensive positions in the Ardennes. The next phase called for the establishment of bridgeheads across the Meuse River between Liege and Namur. In the last phase the Meuse bridgeheads would serve as springboards for seizing the strategic port of Antwerp (Appendix 3-A). The Sixth Panzer Army was selected as the counteroffensive's main effort (Appendix 3-A). Colonel Peiper's Kampfgruppe Peiper—with over one hundred and forty tanks—would spearhead the Sixth Panzer Army drive to the Meuse River.
Kampfgruppe Peiper's soldiers were not martial novices. Peiper had served as a battalion commander in Russia, and most of his troops were also Eastern Front veterans. Furthermore, the 1st SS Panzer Division to which Kampfgruppe Peiper belonged was the oldest unit of Hitler's praetorian guard, and the 1st Panzer's soldiers were dedicated Nazi's. As such, Kampfgruppe Peiper could be expected to complete its mission of seizing crossing sites over the Meuse River near Huy. The timetable for Peiper's mission was ambitious: one day to achieve penetration and breakout, one day to cross the Ardennes, the Meuse River to be reached by the third day, and crossing sites to be secured by the fourth day (Appendix 3-B). Although Kampfgruppe Peiper's task organization included engineers, Peiper positioned his sappers to the rear of his column.

Peiper's placement of engineers proved to be a critical mistake.

In the early morning hours of December 16, 1944, a jolting artillery barrage signaled the start of the WACHT AM RHEIN counteroffensive. At 1930 hours on the same day, Kampfgruppe Peiper was committed to battle. Peiper's planned route lay along the axis LOSHEIM-LIGNEUVILLE-TROIS PONTS-WERBOMONT-HUY (Appendix 3-C). By 1300 hours on the 17th, Peiper's column reached Ligneuville. Peiper's next objective was Stavelot. Early in the evening of December 17, three German tanks
rushed the Stavelot bridge. When the lead German tank was destroyed, Peiper's vanguard fell back and assumed defensive positions. At this time, Kampfgruppe Peiper was only forty-two miles from the Meuse River.

The following morning Peiper's soldiers began fighting their way into Stavelot. Before fully securing Stavelot, Peiper dispatched tanks at top speed towards Trois Ponts. As Peiper states:

*If we had captured the bridge[s] at Trois Ponts intact [emphasis added]...it would have been a simple matter to drive through to the Meuse River early that day [December 18].*

Shortly before noon, twenty Kampfgruppe Peiper tanks approached the outskirts of Trois Ponts. However, Peiper's soldiers discovered all three of Trois Ponts' bridges destroyed (Appendix 3-C). Lacking any engineer assets, Peiper was forced to divert Kampfgruppe Peiper north towards La Gleize (Appendix 3-C). At this point in time, Peiper's tactical freedom of action was seriously eroded.

Near La Gleize German reconnaissance elements located an intact bridge spanning the Ambleve River. Only one last potential obstacle--the Neufmolin Bridge over the Lienne Creek--stood between Peiper and an open road to the Meuse (Appendix 3-C). At 1645 hours on December 18, Peiper's lead tanks discovered the Neufmolin Bridge destroyed. Additional German attempts
to find an intact bridge over the Lienne Creek proved fruitless.

Lacking the means to cross the Lienne, Peiper had no alternative but to reorient his entire force eastwards. By the evening of December 18, American airplanes located Peiper's entire column, and two American infantry divisions tightened the noose around *Kampfgruppe Peiper's* neck. In the days before Christmas 1944, Peiper and his men--having completely failed in their mission--abandoned their fuelless vehicles and began walking towards Germany. Less than eight hundred of *Kampfgruppe Peiper's* original seven thousand soldiers safely reached the German lines.

*Kampfgruppe Peiper's* experience yields some interesting insights. First, throughout *Wacht am Rhein*, Peiper's command rarely possessed the *Initiative*. During the battle, American soldiers thwarted Peiper's every move: delaying *Kampfgruppe Peiper* at Stavelot, diverting Peiper's force north at Trois Ponts, and completely blocking Peiper at the Lienne Creek (Appendix 3-D). Without engineers, Peiper was unable to effectively set or change the terms of battle by action.

Peiper's lack of engineers also gave the American defenders the advantage of *Agility*. The Americans--despite the complete surprise of the initial Nazi attack--consistently acted faster than *Kampfgruppe Peiper*....
Peiper. On December 17, Peiper's force stood a mere forty-two miles from the Meuse River—the primary initial objective for the entire WACHT AM RHEIN counteroffensive. Lacking forward deployed engineers Kampfgruppe Peiper was unable to attain AGILITY, and Peiper's force was eventually destroyed.

Peiper was also unable to achieve SYNCHRONIZATION. Even by current standards, Kampfgruppe Peiper's 150 tanks represented a potent armored force. However, the failure to place engineers forward made producing maximum relative combat power at the decisive point problematic at best.

Finally, Peiper's failure to position engineers forward removed the possibility of achieving DEPTH. Simply reinforcing secondary bridges along the Lienne Creek would have allowed Peiper to continuing moving westward. Instead, Peiper's inability to increase the battlefield's tactical DEPTH at the Lienne Creek forced Kampfgruppe Peiper to turn east in defeat.

Lacking the benefit of a totally incompetent adversary, Peiper's failure to place engineers forward made achieving AGILITY, INITIATIVE, DEPTH, and SYNCHRONIZATION essentially impossible. Consequently, Kampfgruppe Peiper could not attain the tactical freedom of action vital to WACHT AM RHEIN's success. As a result, the main effort for the entire German counteroffensive was ultimately decimated.
Based on the previous analysis, claiming engineers are the most important element in maintaining tactical freedom of action is a gross misuse of history. However, from both a theoretical and historical perspective, engineers appear to be an important element in maintaining tactical freedom of action. In Normandy, American engineers helped Bradley maintain tactical freedom of action. By possessing tactical freedom of action the US Army was able to establish the conditions necessary to launch Operation COBRA and exploit the American advantage in mobility potential. In contrast, Peiper's mistaken placement of engineers precluded Kampfgruppe Peiper from achieving the tactical freedom of action vital to WACHT AM RHEIN's success. With the preceding ideas in mind, this study next examines the heavy division engineer regiment.
So far, applicable theory and historical evidence have been examined. Synthesizing the key ideas from the preceding sections yields three primary interim conclusions. First, in offensive operations, achieving *INITIATIVE, AGILITY, SYNCHRONIZATION, and DEPTH* requires engineers. Second, a combat unit's mobility potential is useless unless the tactical freedom of action necessary to advantageously exploit such potential exists. Finally, tactical freedom of action is a function of AirLand Battle tenets. Therefore, engineer enhancement of *INITIATIVE, AGILITY, SYNCHRONIZATION, and DEPTH* increases tactical freedom of action.

The monograph now focuses on the heavy division engineer regiment and sets the stage for answering the monograph's central question: Is the division engineer (DIVENG) regiment capable of creating the conditions necessary to maintain the heavy division's tactical freedom of action on the AirLand battlefield? In this section, the monograph is divided into four main parts. Part one highlights key aspects of AirLand Battle doctrine. The next portion briefly discusses the three major engineer offensive functions. The third part examines the DIVENG regiment's organization, command and control, doctrine, and major offensive equipment.
Finally, the analytic criteria of INITIATIVE, AGILITY, SYNCHRONIZATION, and DEPTH are used to develop applicable interim conclusions.

Current US Army warfighting doctrine is clearly offensively oriented. AirLand Battle tactical offensives are rapid, violent operations which swiftly shift the main effort and promptly exploit success. Battles and engagements are won by effectively maneuvering combat forces. Effective tactical maneuver requires the movement of combat forces to gain positional advantage over the enemy. Having attained positional advantage, firepower can be employed to destroy the enemy's ability and will to fight. Consequently, maneuver and firepower are inseparable and complementary elements. Although either may dominate portions of battles or engagements, successful operations are characterized by the coordinated use of both maneuver and firepower. Finally, to effectively use maneuver and firepower, a combat unit must possess the tactical freedom of action necessary to advantageously exploit its mobility potential.

In supporting offensive operations, engineer operations focus on three key functions:

1. Breaching existing and reinforcing obstacles
2. Crossing dry and wet gaps
3. Constructing and maintaining routes

The previous three functions are collectively entitled engineer mobility operations. The overall purpose of
engineer mobility operations is to permit friendly forces to maneuver at will. As such, engineer mobility operations are never ends in themselves. Instead, engineer mobility operations are used to create the necessary conditions for tactical freedom of action.

In executing engineer mobility operations, the heavy division's organic sapper structure is radically altered. The "Engineer Restructure Initiative" DIVENG regiment is designed with an 80 percent focus on engineer mobility operations, and a 20 percent focus on other engineer missions. However, can the DIVENG regiment truly create the conditions necessary to maintain the heavy division's tactical freedom of action? In answering the preceding question, four facets of the regiment will be analyzed:

1. Organization
2. Command and Control
3. Tactical Doctrine
4. Equipment

The DIVENG organizational structure provides a full colonel to command all of the heavy division's organic engineers. The DIVENG regimental commander is responsible—usually in a command relationship—for any engineers operating in the division's area of operations. Directly subordinate to the regimental commander are three sapper battalions, and each battalion is commanded by a lieutenant colonel (Appendix 4-A). The sapper battalions consist of a
headquarters company and three sapper companies (Appendix 4-B). Normally, each sapper battalion is habitually associated with a ground maneuver brigade. As such, the sapper battalion headquarters provides engineer advice to the brigade commander and staff, and task organizes engineers in the brigade area of operations.\(^6\)\(^7\) Within each battalion, the sapper company is the basic engineer fighting unit. Each sapper company has a headquarters section, two line platoons, and an assault and obstacle platoon (Appendix 4-C). In the offense, the sapper company is designed to conduct engineer mobility operations as part of a maneuver battalion task force.\(^6\)\(^8\)

The DIVENG regiment's organization is sound. By habitually associating a sapper battalion with a ground maneuver brigade, engineers train in peacetime as part of their wartime combined arms team. Additionally, the DIVENG regiment gives the heavy division substantial organic engineers. In short, the DIVENG organizational structure represents a significant improvement in how engineers support the heavy division.

Command and control is the second facet of the DIVENG regiment worth examining. Normally, a sapper battalion will be provided to a maneuver brigade in a command relationship. As such, the brigade commander--based on the mission, enemy, terrain and weather, troops available and time (METT-T)--can task organize
engineers to best accomplish the mission. Further, by providing a sapper battalion headquarters to each brigade, engineer communications are improved and the need to create ad hoc engineer command and control headquarters is reduced. Experienced engineer leaders are also provided to maneuver commanders—a captain at task force level, a lieutenant colonel at brigade level, and a colonel at division level. Most importantly, the command and control structure of the DIVENG regiment improves the maneuver commander's ability to act more rapidly than the enemy. A maneuver commander "cannot depend on constant direction, but must fight independently even when he cannot communicate outside his own zone." The DIVENG regiment provides maneuver commanders with significant, forward arrayed engineer assets needed to conduct an independent fight.

Doctrine is the third area of the DIVENG regiment to look at. Current offensive doctrine requires sappers to rapidly reduce existing and reinforcing obstacles impeding friendly tactical freedom of action. Whenever possible, overcoming obstacles should be done in-stride. According to doctrine, deliberate obstacle breaches—characterized by thorough reconnaissance, detailed planning, extensive preparation, and explicit rehearsals—are only conducted if in-stride reductions are impossible or have failed. The doctrinal
requirement for the DIVENG regiment to conduct in-
stride breaches is completely valid. The lethality of
today's battlefield makes deliberate obstacle breaching
operations a potential recipe for disaster.

Equipment is the final aspect of the DIVENG
regiment to be examined. The "Engineer Restructure
Initiative" provides the heavy division with
significant quantities of engineer equipment for
supporting offensive operations. The five major items
of offensive engineer equipment are:

Armored Personnel Carriers
Combat Engineer Vehicles
Armored Vehicle Launched Bridges
Armored Combat Earthmovers
Mine Clearing Line Charges

Appendix 4-D compares current heavy division engineer
equipment quantities to DIVENG regiment equipment
quantities. In all five cases, the "Engineer
Restructure Initiative" significantly improves the
quantity of the heavy division's organic offensive
engineer equipment. However, numbers alone can be
deceiving.

Historically, the US Army has struggled to balance
the vehicular mobility of combat, combat support and
combat service support units. Today, the same
struggle continues. In the DIVENG regiment, the
primary sapper vehicle is the armored personnel carrier
(APC). However, on a fast moving, fluid, non-linear
battlefield, the APC is not a suitable sapper transport
vehicle. Because of the significant speed differential between modern combat systems and the APC, sappers will frequently lag behind maneuver elements. Consequently, leading maneuver forces will be forced to wait for sappers to arrive at a breach site. During the intervening time period, stationary maneuver units are extremely susceptible to enemy destruction. The need for engineers to be as mobile as maneuver elements is understood. However, not until the 21st century will the resources for translating an acknowledged need into reality be available.\footnote{5}

The second major item of engineer offensive equipment is the combat engineer vehicle (CEV). Simply stated, the CEV is unsuitable for executing engineer mobility operations. In offensive operations, the CEV: reduces roadblocks and obstacles; fills craters, ditches and short dry gaps; conducts limited construction of combat trails; and clears rubble and debris. However, like the APC, the CEV is too slow to keep pace with modern maneuver units. Further, the CEV's circa 1950s technology is plagued with maintenance problems.\footnote{6} A combat mobility vehicle replacement for the CEV has an expected fielding date of 2004.\footnote{7} Until then, the Army must "live" with the CEV.

Another major item of engineer offensive equipment is the armored vehicle launched bridge (AVLB). In the
DIVENG regiment, the AVLB is the only bridge organic to the heavy division. Three major problems exist with the AVLB. First, attacking divisions may encounter as many as five gaps greater than 20 meters in width for every twenty kilometers moved. However, the AVLB is incapable of spanning a gap wider than 18.3 meters. Second, the AVLB cannot safely carry tracked vehicles exceeding military load class 60. Today, the Abrams Tank significantly exceeds military load class 60. Consequently, the DIVENG regiment's only organic bridge is not load classified to cross a key combat vehicle. Plans exist to replace the AVLB with a heavy assault bridge capable of carrying Military Load Class 70 vehicles across a 24 meter gap. However, the heavy assault bridge program is unfunded. Finally, the AVLB, like the APC and the CEV, is too slow to keep up with maneuver units.

Unlike the three previous vehicles, the armored combat earthmover (ACE) is an effective sapper vehicle. In offensive operations, the ACE's primary mission is to clear and maintain routes. In virtually all combat situations, the ACE can keep pace with modern tanks and infantry fighting vehicles. Also, the armored protection the ACE affords its operator is consistent with fighting on a modern battlefield. During Operation DESERT STORM, the ACE was the only engineer vehicle characterized as a winner.
The final major item of DIVENG regiment offensive equipment is the mine clearing line charge (MICLIC). The MICLIC is inadequate for conducting doctrinally prescribed in-stride minefield breaches. In fact, the MICLIC represents countermine warfare capability which is "essentially the same as at the end of World War II." The MICLIC is a trailer transported, rocket projected explosive line charge. When a minefield is discovered, the MICLIC is towed forward and fired. Against conventionally fused mines, the MICLIC clears a lane 8 meters wide by 100 meters deep. The process of towing forward and firing MICLICs continues until a sufficiently deep breach is achieved. From the breaching process just described, two points are apparent. First, against all but the most inept of adversaries, the MICLIC is not survivable. A basic countermobility rule is to cover minefields by fire. Under such conditions the probability of successfully positioning an unarmored trailer is low. Second, the MICLIC is too slow. If friendly commanders are to conduct doctrinally prescribed in-stride breaches, speed is of the essence. However, the MICLIC epitomizes slowness.

As a result, the US Army does not possess an in-stride minefield breaching capability. This fact is recognized by the General Officer Steering Committee on
Countermine Warfare:

By the 21st century, it is more than feasible that...obstacles to movement could be located, reported, breached, marked, and crossed in-stride and under fire.88

For the US Army, deliberate minefield breaching operations will continue as the rule rather than the exception.

One final issue regarding the DIVENG regiment's offensive equipment must be addressed. Under the "Engineer Restructure Initiative", the heavy division has no organic floating bridge assets and no capability to cross a dry gap exceeding 18.3 meters in width. Consequently, the heavy division is totally dependent on corps resources for the preceding capabilities. In war, the need to take advantage of fleeting opportunities occurs frequently. The DIVENG regiment's lack of organic bridging assets--other than the AVLB--may cost the heavy division the loss of potentially decisive opportunities. However, in a superb analysis related to this issue, a former Advanced Military Studies Program student concluded corps control of specialized bridge assets is workable.89 With proper command emphasis and proactive planning, the DIVENG regiment's limited bridging equipment should not be an offensive "showstopper."

Applying the monograph's analytic criteria to the DIVENG regiment's organization, command and control,
tactical doctrine, and equipment results in a number of interim conclusions. Foremost, the DIVENG regiment increases the heavy division's capability to execute offensive operations characterized by INITIATIVE, AGILITY, SYNCHRONIZATION, and DEPTH. In so doing, overall tactical freedom of action is increased.

The DIVENG regiment enhances the heavy division's ability to achieve INITIATIVE. The "Engineer Restructure Initiative" provides a significant level of organic engineer capability within each heavy division. This capability helps maneuver commanders concentrate rapidly, exploit enemy soft spots, act independently within the framework of the higher commander's intent, and swiftly shift the main engineer effort to exploit success.90

The "Engineer Restructure Initiative" also increases the heavy division's AGILITY. With three organic sapper battalions, maneuver commanders are better able to act faster than the enemy. However, two factors hinder the heavy division's ability to achieve the full degree of AGILITY envisioned by Field Manual 100-5. First, with the exception of the ACE, the DIVENG regiment lacks modern engineer equipment. At present, the regiment's major items of offensive equipment are, for the most part, representative of circa 1950s technology. Such obsolete equipment is poorly suited to support, in essence, 21st century
combat systems like the Abrams Tank and Bradley Fighting Vehicle. Second, although doctrine calls for in-stride obstacle reductions, the heavy division will experience great difficulty in conducting anything other than deliberate breaching operations. At the National Training Center, 72% of all combined arms breaching operations were rated below standard or lower. Against a competent adversary, the lack of an in-stride breaching capability could be catastrophic.

The DIVENG regiment enhances battlefield SYNCHRONIZATION. Effective SYNCHRONIZATION only occurs after combined arms formations train, rehearse, and execute together. The habitual association of an entire sapper battalion with a ground maneuver brigade increases the heavy division's ability to synchronize operations.

Finally, the "Engineer Restructure Initiative" expands the maneuver commander's overall ability to achieve DEPTH. By positioning organic engineers well forward, maneuver commanders are better able to maintain offensive momentum. However, the heavy division's lack of organic assets to cross dry gaps wider than 18.3 meters and all water obstacles may hinder the creation of battlefield DEPTH. At the same time, the problems associated with limited organic bridging assets are not insurmountable. With proper command emphasis and proactive planning, relying on
corps assets for specialized bridging missions should not be a serious problem.

In summary, the DIVENG regiment's organization, command and control, and tactical doctrine are sound. However, with the exception of the ACE, the regiment's equipment is generally inadequate for meeting the challenges of supporting maneuver units on the AirLand battlefield. The monograph's central question can now be answered, and final conclusions and recommendations offered.
CONCLUSIONS AND RECOMMENDATIONS

On the modern battlefield, engineer mobility operations are a key to unlocking the benefits of tactical freedom of action. Given this fact, is the DIVENG regiment capable of creating the conditions necessary to maintain the heavy division's tactical freedom of action? The answer to the monograph's central question is yes. By enhancing INITIATIVE, AGILITY, SYNCHRONIZATION, and DEPTH, the DIVENG regiment helps maintain the heavy division's overall tactical freedom of action. Further, the DIVENG regiment unquestionably represents an improved use of currently available engineer resources in support of the combined arms team.

From the study conducted, three major additional conclusions and recommendations emerge. First, the US Army must develop an in-stride obstacle breaching capability. Even under DIVENG, a great disparity exists between doctrinal requirements for attaining tactical freedom of action and the ability of sappers to achieve such requirements. Specifically, today's Army cannot breach and cross obstacles in-stride. Consequently, deliberate obstacle breaching operations will continue as the rule rather than the exception.

Second, the Army must modernize engineer
equipment. With the exception of the armored combat earthmover, most engineer equipment represents circa 1950s technology attempting to support, in essence, 21st century combat systems. The armored personnel carrier, combat engineer vehicle, armored vehicle launched bridge, and mine clearing line charge are ill suited to supporting maneuver units on a fluid, non-linear, fast paced battlefield. In the final analysis, inadequate sapper equipment is not an engineer problem; inadequate sapper equipment is a combined arms team problem.

Finally, the obsolescence of most engineer equipment highlights the need to harmonize all of the Battlefield Operating Systems' components. General William DePuy--the first Training and Doctrine Command (TRADOC) commander--stated: "If we teach it [doctrine] and we believe it [doctrine], then we better buy the weapons that make it [doctrine] work." General DePuy's words make sense. Unfortunately, the DIVENG regiment's equipment indicates an unwillingness to bring engineer equipment to a level of excellence commensurate with the Abrams Tank and the Bradley Fighting Vehicle. In an era of scarce fiscal resources, the prospect for the non-parochial perspective required to harmonize all parts of the
Battlefield Operating System are poor. Until such harmonization occurs, the full potential of AirLand Battle doctrine can never be reached.
Appendix I - Applicable Theory Reference Material

A. Relationships Between Mobility, Engineer Support in Offensive Operations, and Tactical Freedom of Action
APPENDIX 1-A: RELATIONSHIPS BETWEEN MOBILITY, ENGINEER SUPPORT IN OFFENSIVE OPERATIONS, AND TACTICAL FREEDOM OF ACTION

WITHOUT ENGINEER SUPPORT

EXISTING OBSTACLES

REINFORCING OBSTACLES

ATTAINING TACTICAL FREEDOM OF ACTION UNLIKELY
ABILITY TO EXPLOIT MOBILITY POTENTIAL UNLIKELY

WITH ENGINEER SUPPORT

EXISTING OBSTACLES

REINFORCING OBSTACLES

MANEUVER + FIREPOWER

ATTAINING TACTICAL FREEDOM OF ACTION POSSIBLE
ABILITY TO EXPLOIT MOBILITY POTENTIAL INCREASED
Appendix 2 - Normandy Reference Maps

A. American pre- and post-COBRA Progress⁹⁹
Appendix 2-A: American pre- and post-COBRA Progress
Appendix 3 - German Counteroffensive Reference Maps

A. WACHT AM RHEIN Counteroffensive Overview

B. Kampfgruppe Peiper Timetable

C. Kampfgruppe Peiper Area of Operations

D. Kampfgruppe Peiper Planned Versus Actual Progress
Appendix 3-A  WACHT AM RHEIN
COUNTEROFFENSIVE OVERVIEW

Front Line December 15th, 1944

Allied Positions

Hitler's Secret Plan

Siegfried Line
Appendix 3-C: KAMPFGRUPPE PEIPER
AREA OF OPERATIONS
Appendix 3-D: KAMPFGRUPPE PEIPER
PLANNED VERSUS ACTUAL PROGRESS

PLANNED DAY 4 (19 DEC): SECURE MEUSE RIVER CROSSING SITES
PLANNED DAY 3 (18 DEC): REACH MEUSE RIVER
PLANNED DAY 2 (17 DEC): COMPLETE CROSSING ARDENNES
PLANNED DAY 1 (16 DEC): PENETRATE AND BREAKOUT

BELGIUM
GERMANY

Huy
Liere
Meuse River
Ambleve River
La Gleize
Stavelot
Ligneuville
Werbomont
Trome Ponts
Lienne Creek
Salm River

DELAYED 17 DEC
DIVERTED 18 DEC
BLOCKED 18 DEC
Appendix 4 - DIVENG Regiment Reference Materials

A. DIVENG Regiment Structure
B. DIVENG Sapper Battalion Structure
C. DIVENG Sapper Company Structure
D. Equipment Comparison
APPENDIX 4-A: DIVENG REGIMENT STRUCTURE

MAJOR ITEMS OF OFFENSIVE EQUIPMENT

ARMORED PERSONNEL CARRIERS 87
COMBAT ENGINEER VEHICLES 18
ARMORED VEHICLE LAUNCHED BRIDGES 36
MINE CLEARING LINE CHARGES 36
ARMORED COMBAT EARTHMOVERS 63
APPENDIX 4-B: DIVENG SAPPER
BATTALION STRUCTURE

MAJOR ITEMS OF OFFENSIVE EQUIPMENT

ARMORED PERSONNEL CARRIERS 29
COMBAT ENGINEER VEHICLES 6
ARMORED VEHICLE LAUNCHED BRIDGES 12
MINE CLEARING LINE CHARGES 12
ARMORED COMBAT EARTHMOVERS 21
APPENDIX 4-C: DIVENG SAPPER
COMPANY STRUCTURE

MAJOR ITEMS OF OFFENSIVE EQUIPMENT

ARMORED PERSONNEL CARRIERS 9
COMBAT ENGINEER VEHICLES 2
ARMORED VEHICLE LAUNCHED BRIDGES 4
MINE CLEARING LINE CHARGES 4
ARMORED COMBAT EARTHMOVERS 7
## APPENDIX 4-D: EQUIPMENT COMPARISON

<table>
<thead>
<tr>
<th>Equipment Category</th>
<th>Current Heavy Division</th>
<th>Engineering Battalion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armored Personnel Carriers</td>
<td>87</td>
<td>63</td>
</tr>
<tr>
<td>Combat Engineer Vehicles</td>
<td>52</td>
<td>24</td>
</tr>
<tr>
<td>Armored Vehicle Launched Bridges</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Mine Clearing Line Charges</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Armored Combat Earthmovers</td>
<td>18</td>
<td>50%</td>
</tr>
<tr>
<td>Percent Increase</td>
<td>+67%</td>
<td>+126%</td>
</tr>
<tr>
<td></td>
<td>+50%</td>
<td>+950%</td>
</tr>
<tr>
<td></td>
<td>+150%</td>
<td></td>
</tr>
</tbody>
</table>
ENDNOTES


4Field Manual 100-5, pp. 14 to 18.

5Field Manual 100-5, p. 131; Field Manual 100-5, p. 173.


8Field Manual 100-5, pp. 22 to 23.

9Vouno, pp. 77 to 78.

10Huba Wass de Czege, Understanding and Developing Combat Power, in Course Readings, AMSP Course 2 Tactical Dynamics Book 1 (Fort Leavenworth, Kansas: School of Advanced Military Studies, 1991), pp. 26 to 27.


Peter Boschmann, "River Crossing in the Central Region," *NATO's Sixteen Nations*, vol. 30, no. 3 (June-July 1985), p. 76.


Sheppard, p. 66.


Sheppard, p. 66.

Field Manual 100-5, p. 4.


Pergrin, p. 33.


Blumenson, p. vii.
30 Pergrin, pp. 31 to 34.
31 Pergrin, p. 34.
33 Bradley, p. 330.
34 Pergrin, p. 47.
39 Cole, p. 69; Cole, p. 75.
40 Cole, pp. 260 to 261.
41 Cole, p. 260.
42 Pergrin, pp. 141 to 142.
43 Cole, p. 264.
44 Cole, p. 77.
45 Pergrin, p. 137; Cole, p. 77.
46 MacDonald, A Time for Trumpets, pp. 160 to 183.
47 Cole, p. 264.
48 Pergrin, pp. 101 to 104.
49 Cole, p. 266.
50 Cole, p. 267.
51 Pergrin, pp. 125 to 126.
52 Cole, p. 268; Pergrin, pp. 126 to 127.

53 Cole, p. 268.

54 Pergrin, pp. 133 to 137.


56 Cole, pp. 268 to 269; Pergrin, p. 166.

57 Field Manual 100-5, p. 14; Field Manual 5-100, p. 31.

58 Field Manual 100-5, p. 35.

59 Field Manual 100-5, p. 11.

60 Field Manual 100-5, p. 12.

61 Field Manual 100-5, p. 12.

62 Field Manual 100-5, p. 41; Field Manual 100-5, p. 2.

63 Field Manual 100-5, p. 51; Field Manual 5-100, p. 9.

64 Field Manual 100-5, p. 50; Field Manual 5-100, p. 43.


66 Field Manual 5-71-100, p. 2-19; Field Manual 5-71-100, p. 2-2.

67 Field Manual 5-71-100, p. 2-20.


69 Field Manual 5-71-100, p. 2-1; Field Manual 5-71-100, pp. 2-27 to 2-28.

70 Field Manual 5-71-100, pp. 2-1 to 2-2.

71 Field Manual 100-5, p. 22.

72 Field Manual 5-71-100, p. 4-7.


78 Sheppard, p. 66.

79 Handbook, p. 3.

80 Handbook, p. 3.


82 Lowrey, p. 47.

83 Handbook, p. 72.

84 Lowrey, p. 44.


86 Handbook, p. 17.


88 "Countermine Master Plan," p. 3-2.

90 Field Manual 100-5, p. 15.


92 The idea of a need for harmony between different components of a system was stimulated by James M. Dubik, Grant’s Final Campaign: A Study of Operational Art (Fort Leavenworth, Kansas: School of Advanced Military Studies, 1991), pp. 30 to 34, and James M. Dubik, A Guide to the Study of Operational Art and Campaign Design (Fort Leavenworth, Kansas: School of Advanced Military Studies, 1991), pp. 8 to 9.


95 Pergrin, map p. 80.

96 Kampfgruppe Peiper timetable from Cole, p. 77; Map topographic features synthesized from: MacDonald, A Time for Trumpets, map p. 162; Cole, Map II; Pergrin, map p. 96.

97 Map topographic features synthesized from: MacDonald, A Time for Trumpets, map p. 162; Cole, Map II; Pergrin, map p. 96; Pergrin, map p. 130.
98 Kampfgruppe Peiper timetable from Cole, p. 77; Kampfgruppe Peiper actual progress from monograph narrative; Map topographic features synthesized from: MacDonald, A Time for Trumpets, map p. 162; Cole, Map II; Pergrin, map p. 96; Pergrin, map p. 130.


BIBLIOGRAPHY

Books


**Periodicals and Articles**


Boschmann, Peter. "River Crossing in the Central Region." _NATO's Sixteen Nations_, vol. 30, no. 3 (June-July 1985), pp. 76 to 78+.


Schneider, James J. "The Theory of the Empty Battlefield." In RUSI Journal of the Royal United Services Institute for Defence Studies, (Summer 1987), pp. 37 to 44.


Wilson, John B. "Mobility versus Firepower: The post-World War I Infantry Division." Parameters, vol. 13, no. 3 (September 1983), pp. 47 to 52.


**Government Documents, Manuals and Lectures**


