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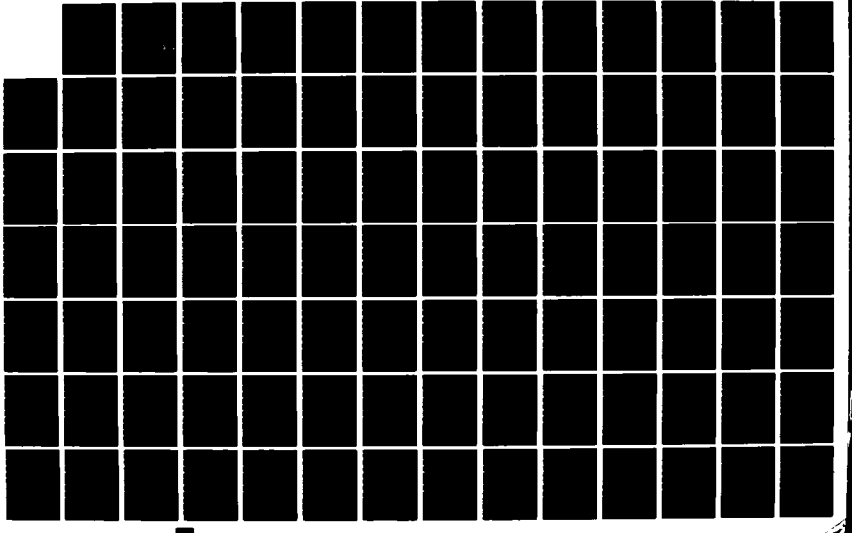

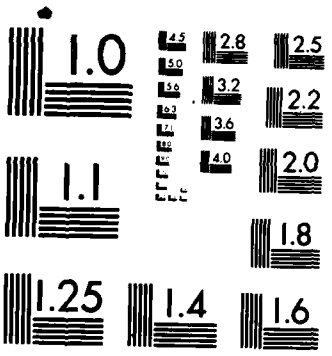

THE COMBINED ARMS ROLE OF ARMORED INFANTRY

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

MASTER OF MILITARY ART AND SCIENCE

by

ROBERT J. ST. ONGE, JR., MAJ, USA
B.S., United States Military Academy, 1969
M.S., Purdue University, 1976

Fort Leavenworth, Kansas
1985

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other government agency. (References to this study should include the foregoing statement.)

ABSTRACT

THE COMBINED ARMS ROLE OF ARMORED INFANTRY, by Major Robert J. St. Onge, Jr., USA, 165 pages.

This study is an analysis to determine the proper tactical role of infantry equipped with the Bradley Infantry Fighting Vehicle (BIFV). That role is shaped by the demands of the modern battlefield including the expected Soviet-type threat, the natural setting for battle created by terrain and weather, and the effects of weapons which significantly alter that natural setting. The role is also affected by the practical requirements to fight as combined arms. The history of combined arms warfare from World War I to the present reveals the complementary and supplementary effects that each principal ground arm - infantry, tanks, and artillery - contributes to the combined arms battle.

This study concludes that there is a requirement for three kinds of infantry: light infantry which fights in close, difficult terrain; regular infantry which fights the manpower-intensive, dismounted battles such as positional defenses and attacks of fortified positions, supported by tanks and other heavy weapons; and armored infantry, equipped with the BIFV, which fights in close cooperation with main battle tanks in offensive and mobile defensive combat.

This study also concludes that the U.S. Army should seriously consider retention of M113-equipped, regular infantry forces to fight the manpower-intensive, dismounted battles for which both the new light and armored infantry are ill-designed. Heavy divisions, even brigades, should contain a mix of tank, BIFV-equipped infantry, and M113-equipped infantry battalions to meet the demands of the modern battlefield and combined arms warfare.

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CHAPTER 1

INTRODUCTION

> In most armies we see weapons evolving on no rational plan. New arms are invented and introduced without a definite tactical reason, and without a definite relationship to structure, maintenance, and control. Old weapons are maintained; the old and new are mixed irrespective of their elemental values. Proportions are not logically arrived at, but are the outcome of ignorant opposition on the one side and enthusiastic aggressiveness on the other. The whole process is alchemical, is slow and costly and inefficient; ultimately trial and error wins through.[1]
>
> J.F.C. Fuller
> 1925

This harsh indictment of military systems in general and their ability to adapt, penned in 1925 by one of the most noted military thinkers of this century, has an air of currency when one looks at the U.S. Army today. One must only review current defense related periodicals to gain an appreciation for the fact that there is ample uncertainty about the proper roles and integration of new and expensive combat systems. The Bradley Infantry Fighting Vehicle (BIFV) is such a system.

In the decade since the end of U.S. involvement in the Vietnam War the U.S. Army has experienced a period of significant change, not just in integrating new weapons, but

across the wide spectrum of its activities. As Colonel Huba Wass de Czege, principal author of the 1982 version of FM 100-5, Operations, points out, the "triad of soldiers, weapons, and doctrine constitutes the foundation of every army."[2] This paradigm proves a useful framework for discussing this period of change and the U.S. Army's adaptive efforts. Of course, changes in each of these areas impact significantly on the other two areas.

Doctrine. The last decade is characterized by major doctrinal changes. Several comprehensive reorientations of the U.S. Army's basic doctrine were introduced as FM 100-5, Operations, was substantially revised in 1976 and again in 1982. A major command, Training and Doctrine Command (TRADOC), was created in the 1970s to focus on those important functions that its title implies - training and doctrine. A series of "how-to-fight" field manuals were published to promulgate doctrine and tactical techniques for combat units down to the lowest level. Efforts to conceptualize how the Army will fight future wars began with TRADOC's "AirLand Battle 2000" and "Army 21" studies.

Soldiers. Introduction of the all-volunteer army and the elimination of the draft highlight the turbulence in the vital function of manning the force. Additionally, the officer corps was significantly cut back from its Vietnam wartime strength through a series of necessary but disruptive reduction actions. Stringent manpower ceilings imposed by

Congress coupled with the complexity of modern weapons and support systems have required emphasis on recruiting and retaining high quality soldiers and leaders in peacetime as never before in our history. The introduction of the New Manning System will have a significant impact on U.S. combat units, especially the infantry.

Weapons. Technological advances and the emergence of a massive, sophisticated Soviet ground threat during this period have forced the U.S. Army to modernize and to integrate hundreds of new and complex systems into its equipment inventories. Because new systems are expensive and defense resources are constrained, careful planning as to the type and required number of each new system is critical. Several management practices including a concepts based development philosophy in which doctrine, or concepts, form the basis for materiel needs, were initiated during this period in an attempt to procure new systems that fit the Army's conceptual view of future war and to encourage research and development efforts to focus on projected Army operational requirements.

These changes highlight a central requirement for the U.S. Army today: to be both efficient (cost effective) and effective (fight outnumbered and win) it must have a clearly articulated doctrine that guides a relatively small force of high quality soldiers and leaders to optimize the capabilities of numerically inferior but qualitatively

superior systems in fighting and winning the next war. Obviously, the U.S. Army cannot easily achieve numerical parity with the Soviets. It must concentrate on developing superior equipment that will be employed by better led and better trained soldiers and units using superior tactics and operational methods that optimize the collective capabilities of all arms.

The Problem

Perhaps no arm of our ground force has been affected as much during this decade of change as our traditional fighting arm - the infantry. While today's volunteer infantryman may be of higher quality than his predecessor, the tools of his trade continue to become increasingly complex. The variety of infantry organizations attests to the complexity of infantry tasks and myriad potential battlefield environments. Currently, there are eight different types of infantry battalions with distinctly different capabilities and limitations: ranger, light, standard, airborne, airmobile, motorized (high tech), mechanized, and armored (my term for infantry equipped with the BIFV). This variety also highlights an apparent confusion regarding infantry tasks and missions. Despite the Army's attempts to think futuristically, the infantry often discovers the weapon systems it is to employ are developed and fielded and its organizational structure determined well before the concepts of how-to-fight are clearly articulated in doctrine.

This is certainly the case with the new, highly sophisticated BIFV, and the armored infantry units equipped with it. This new type of infantry brings a unique set of capabilities and limitations to the modern battlefield. Although the U.S. Army has been in the process of procuring an infantry fighting vehicle for nearly twenty years, the BIFV is being fielded now in Europe and the United States without clearly articulated doctrine as to how it is to fight.

Purpose

The purpose of this study is to is to determine the optimal role of the BIFV-equipped infantry, or armored infantry, under AirLand Battle doctrine. The noted British soldier and contemporary military writer, Richard E. Simpkin, stated the flavor of the problem quite well in his 1980 book entitled Mechanized Infantry:

> With mechanized infantry the difficulty lies in arriving at a meaningful and lucid definition of the role of infantry in the armored battle and the way it should fight - by which I mean something at the grass roots level but rather broader than minor tactics.[3]

It is important to make a distinction between armored and mechanized infantry. The term armored infantry was used in the U.S. Army from World War II until the late 1950's for those infantry units equipped with armored personnel

carriers and assigned to armored divisions. The U.S. Army now uses the term mechanized infantry for infantry equipped with any armored personnel carrier, including both infantry with the M113 and those with the BIFV. This study makes the distinction between armored infantry in referring to those infantry forces equipped with BIFV and mechanized infantry as those equipped with the M113. This distinction not only provides convenient labels but also draws attention to the significant differences in capabilities, limitations, and complexity that characterize these two forms of infantry.

Methodology

To determine the optimal role of any arm of the overall force one must rigorously examine three areas of concern: the demands of the modern battlefield; the U.S. Army's basic how-to-fight philosophy - AirLand Battle doctrine; and the capabilities and vulnerabilities not only of that arm but of each arm of the force with which it must cooperate as part of the combined arms team.

The demands of the modern battlefield. These demands will shape the role of maneuver forces. The U.S. Army organizes, equips, and trains its forces based upon the perceived threat, terrain and weather considerations, and anticipated battlefield conditions. This can be readily seen in a strategic sense; since the end of World War II the U.S. Army has been required to maintain forces capable of

operating virtually anywhere in the world. On one hand, it has maintained heavy forces capable of fighting other modern armies in mid- to high-intensity warfare in such places as Central Europe and the Middle East. On the other hand, it has maintained (and is currently revitalizing) lighter forces capable of swift strategic deployment to peripheral combat zones often characterized by low intensity warfare in terrain which is most often not suitable for the employment of heavy forces. In this attempt to determine the optimal role of armored infantry, only its potential contributions as part of the heavy forces employed in environments like central Europe or the Middle East will be considered.

Three major factors which determine the demands of the modern battlefield are considered in this study: threat, terrain and weather, and battlefield conditions. This study will examine a Soviet type threat. Although the Soviets support wars of national liberation and other low intensity conflicts, their armed forces are predominantly heavy forces designed to fight in mid and high intensity conflicts on the Eurasian land mass. This study will focus on terrain and weather of Central Europe and the Middle East - the type of terrain on which the BIFV, as part of the U.S. Army's heavy forces, will most likely be employed against a Soviet type threat. The modern battlefield will be shaped by the potential use of nuclear weapons, and the almost certain use of chemical weapons, electronic warfare, mines and obstacles, and smoke and obscurants. It will be characterized by

non-linear maneuver battles, intense concentrations of highly lethal direct and indirect fires, high tempo of activities, disrupted command and control, and austere support[4].

AirLand Battle doctrine. FM 100-5, Operations, published in 1982, describes the U.S. Army's operation concept. This doctrine is based on gaining and maintaining the initiative and exercising it aggressively to defeat the enemy. This operational concept envisions that success on the modern battlefield will depend on four basic tenets: initiative, depth, agility, and synchronization. Collectively, they imply an offensively spirited, pro-active force that seeks to act faster than the enemy and to maximize its combat power through unity of effort of combined arms resulting in the disruption of the enemy plan and destruction of his forces throughout the depth of the battlefield.

A key aspect of AirLand Battle doctrine is combined arms. This term is used freely in military literature, often in a vague manner contributing to a general lack of understanding about it. The term combined arms includes three related elements: the concept of combined arms, combined arms organizations, and combined arms tactics and operations.[5] This study will detail these elements of combined arms and will examine them as they pertain to tactical cooperation between the primary combat arms: tanks, infantry, and artillery. The vital contributions of other combat arms, including aviation, air defense and engineers,

are recognized but will not be the focus of this study. A review of the history of tank-infantry-artillery cooperation from World War I through the recent Israeli excursion into Lebanon will reveal patterns that will help clarify how U.S. forces should plan to fight in combined arms. These patterns of tactical warfare will be considered as functions of the three physical elements of war enumerated by J.F.C. Fuller[6] - mobility, protection, and offensive power - or in current terms of FM 100-5 as the elements of combat power: maneuver, firepower, and protection. The fourth element of combat power, leadership, is a moral factor and is described in FM 100-5 as the crucial element by which the effects of the first three are optimized.[7] These patterns of tactical warfare will be key to determining how the U.S. Army must combine the capabilities of its available forces to optimize their collective combined arms potential.

An analysis of infantry. The study of battlefield conditions, the demands of combined arms warfare, and the lessons of 20th Century warfare help establish some broad requirements for infantry in the future. An analysis of the capabilities of our various types of infantry matched against these requirements should suggest a proper role for armored infantry. This analysis will provide a clearer picture of how armored infantry should be employed, and it will lead to suggestions for organizing, equipping, leading, and training armored infantry to best accomplish this optimal role.

As stated above, combat systems are often fielded before there is a clear understanding of how they are to fight. The U.S. Army finds itself in that dilemma now as it attempts to write how-to-fight doctrine for the armored infantry. This study will attempt to provide meaningful insights to solving this current BIFV doctrinal dilemma.

ENDNOTES - CHAPTER 1

1. J.F.C. Fuller, The Foundations and Science of War (London: Hutchinson and Co., 1925), p. 147.

2. Colonel Huba Wass de Czege, "Toward a New American Approach to Warfare," (Ft. Leavenworth, KS: Command and General Staff College, 1983), p. 10-1-46.

3. Richard E. Simpkin, Mechanized Infantry (Oxford: Brassey's Publishing Ltd, 1980), p. 2.

4. U.S. Department of the Army, Operations Field Manual 100-5 (Washington,D.C.: U.S. Government Printing Office, 1982), pp. 1-1 through 1-3.

5. Jonathan M. House, Towards Combined Arms Warfare: A Survey of Tactics, Doctrine, and Organization in the 20th Century (Ft. Leavenworth, KS: Combat Studies Institute, Command and General Staff College, 1984), p. 2-3.

6. J.F.C. Fuller, The Foundations of the Science of War, p. 148.

7. Field Manual 100-5, p. 2-5.

CHAPTER 2

THE DEMANDS OF THE MODERN BATTLEFIELD

> And therefore I say: 'Know the enemy, know yourself; your victory will never be endangered. Know the ground, know the weather; your victory will be total.' [1]
>
> Sun Tzu

This ancient Chinese dictum, which extols knowledge of the battlefield, is recognized as just as wise today as it was when written over 2000 years ago. FM 100-5, Operations, identifies four basic challenges for the U.S. Army: the battlefield, leadership, readiness, and training.[2] The battlefield is the most basic of these challenges; leadership, readiness, and training challenges are, for the most part, derivative of it.

What will the mid- and high-intensity battlefield of tomorrow be like? The futuristic view in FM 100-5 is sobering and produces thoughts of a chamber of horrors. Future battles are envisioned as non-linear maneuver engagements between mobile forces wielding highly lethal direct and indirect fire systems operating deep in each other's traditional rear areas. Lethality of modern weapons includes the growing threat of nuclear and chemical weapons

of mass killing and destructive power complemented by new precision weaponry with increased range and destructiveness, such as precision guided munitions and eventually directed energy weapons. These potent forces will rely on sophisticated sensor and communication systems to see the battlefield and to synchronize the effects of their combat power on their adversaries. Battles will rage not only for control of the ground, the sea, and the air but also for use and denial of a medium of increasing importance, the electromagnetic spectrum. The relatively unimpeded use of this spectrum will be vital to command and control and to the effective employment of an ever increasing array of high technology weapon systems. Non-linearity of the battlefield will strain command and control and logistical operations. Modern forces will become more dependent on specialized support not available from local environments, captured enemy stores, or even from allies. Modern forces will often be required to operate at the end of long, vulnerable lines of logistical support.[3]

A closer examination of threat, terrain and weather, and other battlefield conditions is necessary to any analysis of how the U.S. Army is to fight.

The Threat

Any brief description of the Soviet threat, such as this one, risks error through over-simplification or omission.

There are many excellent texts on the Soviet threat available today; the U.S. Army's new FM 100-2 series is comprehensive, current, unclassified, and readily available to U.S. military personnel. Only a general overview of the Soviet threat as it contributes to defining the challenges of the modern battlefield will be outlined here.

Traditionally, ground forces are the focus of the Soviet armed forces with naval, air, and other specialized forces employed primarily in support roles. Although forced on the defense in the early stages of World War II, the Soviets have long preferred the offensive as illustrated by the 1936 Field Service Regulation Soviet Army. [4] When it reverted to the general offensive in World War II, Soviet forces sought to achieve surprise, to operate in the enemy's rear with special troops, and to achieve massive combat superiority at the decisive point. Soviets relied heavily on reconnaissance and security troops and advanced detachments to pinpoint enemy defenses and reserve formations before committing the main force to the attack. Once the attack began, momentum was maintained through massing overwhelming combat power at the point of penetration. Massed formations of tanks, sometimes organized as combined arms maneuver groups, would break through at these points of penetration to attack deep into the rear of enemy defenses to pursue, exploit, or encircle the enemy. The Red Army sought a high tempo of operations to keep the defenders disorganized and unable to recover and reconstitute a defense.

During the post World War II period in which the United States enjoyed relative superiority in nuclear weapons over the Soviets, the Soviet Army reorganized to deal with what it perceived as new requirements of nuclear war.

> The massing of combat formations, a historical characteristic of Soviet operations, was viewed as a critical vulnerability and the concept of concentrating for a breakthrough was abandoned in favor of dispersed multiple axes of advance across the breadth of the front.[5]

Strategic rocket forces received priority and the tank, which could survive and exploit the effects of nuclear war, became the centerpiece of the Soviet ground forces at the expense of their traditional arms, the infantry and artillery.[6] Infantry forces were converted to full mechanization and a new branch, motorized infantry, was formed in 1963.[7] The BMP was introduced in the mid-1960s as the world's first true infantry fighting vehicle to complement tanks and to provide infantry with the protection necessary to survive on the nuclear battlefield. It had the mobility and firepower to exploit nuclear weapons effects along with tank forces.

By the mid to late 1960s the Soviets began to consider a conventional variant to their single view of war in the nuclear age. Recognizing the undesirable effects that nuclear war would have on the Soviet Union and the political conditions that would probably delay employment of nuclear

weapons by NATO, the Soviets began to increase the combat power of their conventional ground forces. During the period that the United States was pouring its defense resources into the Vietnam War, the Soviets were refitting and reorganizing into a massive, sophisticated force with increased capabilities to fight a conventional land-air battle under the threat of sudden escalation to nuclear war.

Soviet tank and motorized rifle divisions became totally mechanized combined arms units. Even airborne divisions were equipped with the light armored troop carrier, the BMD. The Soviet artillery supporting these divisions was transformed from towed to self-propelled to complement more closely the protection and mobility capabilities of the maneuver forces. Anti-tank, helicopter, engineer, air defense, and chemical defense components were upgraded to produce a complete combined arms force.

The 1973 Arab-Israeli conflict caused the Soviets to debate openly their tactical doctrine and force structure, especially in light of the apparent advantage of new antitank weapons over tanks and other armored vehicles. Interestingly, the vehicle that the Soviets determined to be most vulnerable in this kind of battlefield environment was not the tank but the BMP infantry fighting vehicle.[8]

Despite these apparent changes in operational outlook, several constants pervade the Soviet methods. First, the

Soviets organize and train to fight as combined arms. A review of Soviet doctrinal literature from the 1936 Field Service Regulation Soviet Army to Savkin's 1972 text entitled Basic Principles of Operational Art and Tactics, demonstrates their early and continued appreciation of and commitment to combined arms.

Second, Soviet tactics are characterized by reliance on norms. Based on the combination of dialectic method, the scientific approach, and historical analysis of war and exercise experiences, the Soviets have determined that for any given combat situation there is a correct response. Soviet commanders are taught these norms and are expected to take proper action in combat based upon the approved higher commander's plan and the application of norms. How much initiative a Soviet commander may display when confronted with unexpected situations in combat is undoubtedly a function of the correctness of the prescribed norms and the degree to which that commander is trained to apply them.

Third, Soviet equipment is notoriously simple, reliable, rugged, and easy to maintain. It is adapted by design not only to their tactical and operational methods but also to the battlefield environments in which it will potentially fight. For example, Soviet armored vehicles are noted for their low silhouette and limited elevation and depression capabilities of their main armament. U.S. analysts often cite these as weaknesses considering the hilly terrain of

Central Europe, but these vehicles are perfectly suited for the endlessly flat terrain of the Soviet steppe for which they have been engineered. Because Soviet tanks are offensive weapon systems which will only temporarily seek defilade or defensive positions, low silhouette and limited gun elevation and depression are intentional engineering criteria in keeping with simplicity, low cost, and crew protection.[9] Despite the requirements of simplicity, Soviet equipment may be more sophisticated than is commonly suspected in NATO. Victor Suvorov has warned that equipment the Soviets distribute to allies is much less sophisticated than those models with which Soviet forces are equipped.[10]

Lastly, the Soviets can be expected to operate in accordance with several principles. The principles listed below are summarized from the The Basic Principles of Operational Art and Tactics by V. Savkin. Although the book focuses on the nuclear battlefield, its lessons are just as valid for a conventional battle, especially in light of the ever present threat of escalation to nuclear war. Soviet forces can be expected to attempt to:

-achieve and sustain rapid movement and a high tempo of operations to keep the enemy off balance and under constant pressure.

-concentrate effort to create superiority of forces and means over the enemy at the decisive place and time.

-surprise the enemy by taking action when and where

least expected while ensuring security of friendly forces, i.e. denying the advantages of surprise to the enemy.

-achieve combat activeness through boldness, initiative, and decisiveness inherent in offensive action.

-protect the force and sustain its combat effectiveness.

-conform goals of the operation to the actual combat situation.

-coordinate all arms and elements to achieve cooperation, mutual assistance, and maximum combat power.[11]

In summary, the Soviet threat on the modern battlefield can be expected to be a heavily mechanized combined arms force which will attempt to surprise its enemy and to maintain a high tempo of activity. The Soviets prefer offensive action and only defend when the offense is not possible. They prefer to attack enemy weaknesses to focus overwhelming power at the decisive point, and to operate against flanks and deep in the enemy's rear. The Soviets are heavily dependent on reconnaissance and security troops and employ sizeable advanced detachments to reconnoiter and fix the enemy. They are capable of employing massive amounts of artillery in support of the primary maneuver efforts.

Terrain and Weather

> Weather and terrain have more impact on battle than any other physical factor, including weapons, equipment or supplies.[12]

FM 100-5 Operations (1982), from which this striking remark is quoted, goes on to state that terrain and weather will present opportunities to both sides. The commander who understands the effects of terrain and weather on his unit capabilities and those of the enemy and then adapts, uses and reinforces these effects will stand a far better chance of success. Interestingly, in an historical study of 200 successful combat actions, conducted by the United States Military Academy in support of the 1983-84 Officer Professional Management System Study Group, "terrain sense" was rated as one of only five factors which correlates highly with success in combat.[13]

Many excellent texts detail the effects of terrain and weather on military operations. FM 30-10, Military Geographic Intelligence (Terrain), is among the best readily available to U.S. Army personnel. Additionally, numerous area studies provide data on specific potential battlefield environments. The intention here is to examine significant factors which effect the tactical employment of heavy forces in two strikingly different areas in which they will most likely be employed: Central Europe and a Middle East or Southwest Asia desert environment.

Of the five military aspects of terrain, this analysis will concentrate on cover and concealment, obstacles and mobility, and observation and fires. These three factors when studied in light of the nature of the military operation

contemplated, will usually determine the other two military aspects of terrain: key terrain and avenues of approach. These three factors also are closely related to the three physical elements of combat power: observation and fields of fire relate most directly to firepower, cover and concealment to protection, and obstacles and mobility to maneuver.

Central Europe

Battlefield Central Europe, or more specifically the Federal Republic of Germany, is one of the most densely populated and built up areas in Europe. This compact L-shaped country is 850 kilometers from north to south. East to west it is narrow in the north and central regions (225 kilometers in the narrow center) and widest (450 kilometers) across the southern region. Overall, the FRG has three essential characteristics that effect military operations:

(1) There is lack of depth of area between the border with the Warsaw Pact countries and the Rhine River.

(2) There are numerous terrain-dependent natural invasion corridors from the east.

(3) Several features of the terrain, such as woods, urban areas, and hydrography, have a significant effect on military operations.[14]

The first of these characteristics has operational and strategic implications but no inherent tactical effects with two possible exceptions. First, this lack of depth has caused NATO, especially the West Germans, to insist on a forward, linear defense which could possibly limit military options. Second, lack of operational depth has enticed the Soviets to consider a "daring thrust" strategy - a quick, unexpected attack without the normal warnings in order to seize deep objectives before NATO forces could either fully occupy and prepare forward defenses or exercise all the decision making apparatus necessary to use nuclear weapons.

The second characteristic, the existence of several natural invasion corridors from the east, also has primarily strategic and operational impact. 41% of the FRG's borders are shared with communist Czechoslovakia and East Germany.[15] Along the border there are at least twelve invasion gaps formed by the terrain.[16] The North German lowland, a wide relatively flat plain, appears to be the most favorable terrain for an attack by the Soviets. In the central uplands natural gaps, such as the Fulda Gap, offer narrow, high speed approaches to the Rhine River. In the alpine foothills the Danube River valley offers a ready approach into key area of southern Germany. It is along these natural invasion routes that the Soviets will find the terrain favorable for high tempo operations with their highly mechanized forces.

The third essential characteristic impacts the most on the tactical employment of forces. The 1978 US/German Army Concept Paper concerning military geography of the FRG states that forests, urban areas, and hydrography have significantly greater effects on tactical operations than do other factors such as weather, soil composition, and other terrain characteristics.[17]

Observation and fields of fire. In his book Battlefield Central Europe, German General Franz Uhle-Wettler argues convincingly for the use of light infantry forces on the European battlefield. A main point in this argument centers on terrain and, more specifically, on line of sight considerations. Line of sight is affected not only by the terrain but also by forests and built up areas. Uhle-Wettler states that approximately 30% of the FRG is forested and 11% is built-up areas.[18] This has made actual line of sight distances much shorter than one might expect. Bundeswehr Military Geographical Office reports reflect the following average line of sight distances for the FRG:

0-50 meters	30%
50-200 meters	9%
200-500 meters	16%
500-1000 meters	18%
1000-1500 meters	10%
1500-2000 meters	7%
2000-3000 meters	6%
	96%

While these figures show that 96% of the lines of sight are less than the current maximum range of the TOW antitank missile (3000 m.), they also show that most of the lines of sight are far shorter. 73% are less than 1000 meters, the maximum effective range of the DRAGON antitank missile.[19] These figures only include line of sight limits caused by forests and built up areas, not by terrain features such as hills or by weather conditions.[20]

This situation is not a static one; the "terrain" is steadily changing as urban growth continues. J.A. English notes:

> What has passed practically unnoticed to many military eyes since World War II is the gradually altered nature of the very terrain over which the next war may be fought. The phenomenal and relentless process of urbanization of Europe, already with 374 cities of 100,000 or more, has radically changed the face of the potential battlefield.... Moreover, with Central European urban growth projected at a rate of two or three times the population rise, there will be, by 1995, a 50% increase in total urban area.[21]

Paul Bracken points out that at the same time "government afforestation programmes have increased forested areas by about 0.8% per year."[22]

Weather conditions, primarily precipitation and fog, effect visibility and therefore line of sight.

> Fog, in terms of visibilities of less than 1000 m, occurs on an average of 100-120 days throughout the year, predominantly between September and March, with a maximum in October and November.[23]

In summary, observation and fields of fire are now limited and will get worse. The standoff advantage of the long range anti-tank weapons over the tank is eliminated in the vast majority of situations in Central Europe.

Cover and Concealment. The previous discussion of line of sight correctly suggests that concealment is not a major problem in the FRG. Forests, urban areas, and the natural undulations offer plenty of concealment. Urban areas and forests also offer cover. The soil in the FRG is conducive to the construction of field fortifications except in the extremely cold or wet seasons or in the mountain areas which are predominantly rock with little soil. There is ample material available for the construction of fortifications and overhead cover.

Obstacles and Mobility. The FRG has one of the best highway networks in Europe, with over 670 meters of road per square kilometer.[24] This road net is increasing by about one percent per year.[25] Despite the fact that the majority of large roads (more than two lanes) tend to run north-south along the long axis of the country, all-weather roads are dense enough that they support movement of military forces in all directions.

Besides the superb system of roads and bridges, several factors tend to make mechanized armies roadbound in the FRG.

Mobility is hampered significantly by extensive forestation, by the ever increasing amount of builtup areas and urban sprawl, and by hydrography.

Forestry in the FRG is an intensively managed industry. Most forests are dense but are generally passable because of the existence of a relatively well developed network of trails. While forest areas have a more significant impact on cover and concealment and observation and fires, they force mechanized forces to slow down, concentrate and become channelized. Obstacles which require little equipment and manpower and are easy to install can cause forests to become impassable if covered by fire - a standard infantry task.

Urban areas have a variety of effects on mobility; most of them are adverse effects. On one hand, the greatest density of roads are in the urban areas; most autobahns and a great percentage of large roads are within or connect urban areas. On the other hand, in the event of war urban areas can become major obstacles. They may become impassable due to congestion of civilian, refugee, and military traffic. Urban areas become difficult obstacles when rubble litters the streets or when defended by infantry. The areas with greatest population density in the FRG, and those experiencing the greatest growth, are east of the Rhine River.

Areas covered by water are only about 2% of the total

area of the FRG, but these bodies of water can affect military operations to a great extent.[26] In the North German lowlands the value of these water obstacles is formidable. About 40% of the streams and rivers are wider than 30 meters and more than 2.5 meters deep.[27] These figures are important because virtually all armored vehicles cannot ford streams deeper than 1.5 meters; those that can ford deeper waters, swim, or snorkel must halt and undergo preparations that are time consuming and interrupt operations.[28] All armored vehicle launched bridges (AVLB's) currently found in both threat and allied forces lay bridges less than 30 meters long.[29] Additionally, the lowlands are replete with marshes and moors. Significant amounts of engineer equipment and effort are required to sustain mobility in this region.[30] In the central uplands water obstacles are of limited value. In the alpine foothills of southern Germany the Rhine-Main-Danube Canal and the alpine rivers south of the Danube are significant obstacles and crossings require major effort. Waterways in this region are widest of the three regions (52% are greater than 30 meters wide) and are relatively deep (36% are 2.5 meters or more deep).[31]

In summary, the FRG's three different regions provide distinctly different settings for battle. The northern lowlands are invitingly flat but present significant water and urban obstacles to maneuver. Visibility and line of sight in this sector are rated as poor to good. The central uplands

have far fewer major water obstacles or built-up areas, but undulations and forests impede offensive operations. Cover and concealment is excellent; visibility and lines of sight range from extremely poor to marginal. The alpine foothills contain many impediments to maneuver, especially rivers. Cover and concealment is adequate, and visibility and line of sight are rated poor to satisfactory.[32]

Desert Environments

Deserts environments are, in military respects, nearly the antithesis of the Central European battlefield. Deserts require different tactics primarily because of terrain and weather. Deserts also have much different effects on personnel and equipment. The location of the National Training Center in the Mojave Desert of California underscores the anticipation that U.S. heavy forces may have to fight in the desert areas of the Middle East or Southwest Asia. The most recent clashes of heavy forces have been in these areas: the Arab-Israeli Wars and the Iran-Iraq War.

Desert environments vary, but in general they lack traditional key terrain. Key terrain in the desert, with the notable exception of watered areas such as oases, is determined by the other military aspects of terrain.

Deserts are austere regions with no forests, few settlements, and few roads or other combat service support

accommodations for military forces such as power sources, building materials, supplies, or water. Desert climates are characterized by high temperatures, extreme ranges of temperature, lack of precipitation, low humidity, and wind. Extreme temperature and low humidity adversely affect soldiers and their equipment, especially sophisticated electronic equipment.

Observation and fields of fire. The relatively flat desert terrain affords virtually unlimited visibility and, therefore, weapons employment at maximum ranges. It is not absolutely flat, however, due to the presence of wadis, rock formations, some sparse ground cover, and slight undulations. Rugged mountain ridges also break up the flatness of most desert areas. Weapons and observation posts have an advantage when sited on higher ground, even if only a few meters above the surrounding terrain. Observation can be hampered by several unique desert effects. Accurate range estimation is difficult, heat and temperature variations cause severe image distortions, and dust, sandstorms, and battlefield smoke can make direct observation impossible for extended periods of time. Dust clouds created by weapons firing and impact make sensing and adjustments of fire much more difficult. Burst on target corrections may be almost impossible most of the time.

Cover and concealment. There is a general lack of cover in the desert. Terrain masking behind mountain ridges

and large sanddunes or in wadis provides the only cover while moving. The desert provides virtually no materials for overhead cover. The difficulty of digging in armor vehicles is often aggravated by large areas of predominantly rocky soil.

Concealment is vital in the desert because of the excellent observation. Camouflage efforts must take into consideration not only contrast and color but also shape, shadow, and shine. Light and noise are not attenuated as much in the desert and are sensed at greater distances. Movements create dust clouds visible for many miles.

Obstacles and mobility. Tactical mobility is the key to success in desert operations. Major portions of the desert "permit true two dimensional movement by ground troops similar to that of a naval task force at sea."[33] Natural defensive positions are rare, limiting the use of positional defenses. While the harsh, abusive desert does not preclude maneuver of tracked vehicles it does limit movement of heavy wheeled vehicles. In many areas resupply vehicles and towed artillery may be restricted to the few roads and trails.

The rugged mountains that compartmentalize most deserts become major obstacles to movement. Mountain passes and the few roads through these passes become key terrain. Lava beds and salt marshes, which preclude surface movement, are also major obstacles. Man-made obstacles and minefields are most

effective when tied to these natural terrain obstacles reinforcing their effects.

In summary, U.S. heavy forces are destined to fight in two very different settings, each demanding different tactics because of the effects of terrain and weather. As English, Uhle-Wettler, and others have pointed out, heavy forces will face many conditions in Central Europe which will not allow their capabilities to be maximized. Forests, urban areas, and other terrain features limit mobility, observation, and long range fires. Many areas are more suited for positional defenses. In desert environments the opposite is the case. The general flatness and nearly unlimited visibility and fields of fire are particularly suited to maneuver warfare.

Battlefield Conditions

While terrain and weather constitute the basic physical settings of battle several other factors can substantially alter the battlefield. First, nuclear weapons can create an environment of unparalleled destruction, confusion, and stress. Second, chemical weapons not only create mass casualties but, like nuclear weapons, may deny use of contaminated portions of the battlefield. Third, use of electronic warfare to control the electromagnetic spectrum can destroy and disrupt command and control. Fourth, use of smoke and sophisticated mine warfare, such as cannon or air delivered mines, can change or reinforce the natural effects

of terrain and weather quickly and unexpectedly.

Nuclear Weapons. The immediate effects of nuclear weapons are blast, thermal radiation, initial nuclear radiation, and electromagnetic pulse (EMP). These forces not only cause injury, death, and destruction but also alter the battlefield through tree blowdown, urban destruction, fires, radiological contamination, and possibly flooding.

Protection. The degree to which the physical effects of nuclear weapons impact on military units is dependent on several factors including the distance of the force from the impact, or ground zero, and the extent to which soldiers and their equipment are shielded. Soldiers gain protection when within heavy armored vehicles, field fortifications, and buildings of heavy construction. In Europe all of these forms of protection are available; only armored vehicles and digging in are feasible in the desert. Despite the protection they afford troops, armored vehicles themselves can be damaged or rendered unusable by nuclear weapons. Blast and thermal radiation can damage or destroy these systems; EMP can destroy their unshielded electronic components at even greater ranges. Adequately warned, a mobile force can quickly disperse, increase distance from the suspected ground zero, or seek terrain that masks the unit.

Maneuver. Nuclear weapons can not only destroy or damage vehicles through blast, thermal radiation, and EMP

(which can damage electrical automotive components), but these weapons also drastically alter the trafficability of the terrain. In builtup, forested Central Europe tree blowdown and urban rubble could reduce mobility to a walking pace. Additionally, the destruction of dams and disruption of the flow of waterways by nuclear weapons could flood flat, open areas further degrading limited mobility. In desert environments maneuver would be far less effected by nuclear weapons. Key mountain passes, roads, and bridges could be destroyed or contaminated, however, making movement of vehicles through these key areas impossible or extremely risky.

Firepower. Beside direct destruction of weapon systems, the only predictable degradation of firepower will be caused by EMP effects on sophisticated fire control systems including artillery computers, fire control circuitry in modern vehicles, and systems that depend on battery power such as anti-tank guided missiles (ATGM's). Destruction of radios and other command and control hardware will also reduce the ability of commanders to synchronize weapons employment.

Chemical Weapons. Soviet forces are reportedly well equipped and trained for offensive and defensive chemical warfare. Indeed, they "consider chemical munitions to be 'conventional' weapons when discussing employment doctrine."[34]

Protection. Non-persistent agents primarily affect personnel. Properly equipped and trained soldiers may be only minimaliy effected compared to poorly trained or equipped troops or the civilian populous. On the other hand, persistent agents affect personnel, equipment, and terrain. Effects are relative to the degree to which units are equipped and trained for chemical defense. Decontamination of troops and equipment is not only time consuming and personnel intensive but also requires much water. Water for decontamination will definitely be a problem in the desert. A unit which engages in more than a hasty decontamination will often have to be temporarily relieved of its mission.

Maneuver. Persistent chemicals can rapidly degrade vital automotive components made of rubber and other materials, such as tires, road wheels, and seals. Persistent chemicals also create hazardous areas which become obstacles to maneuver.

Firepower. Persistent chemicals can also damage some weapons or weapon components. Additionally, the wearing of a protective mask degrades a soldier's ability to employ individual or crew served weapons. U.S. armored vehicles are not equipped with overpressure systems that would obviate the crew requirement to mask. Firepower can be degraded by the mere threat of enemy chemical use as many units require that a certain percentage of all soldiers mask during suspected

chemical attacks, such as air or artillery attacks.

Electronic warfare (EW). The primary effect of EW is disruption of the command and control. EW can directly effect units by reducing the commander's capability to coordinate and synchronize their maneuver and fires. Indirectly, EW can contribute to weapons being jammed and to units being targeted.

Smoke and obscurants. These weapons are oriented on visibility; they provide concealment and reduce the effects of firepower. As advances in technology produce more sophisticated obscurants such as thermal defeating smoke, the adverse effects on firepower will be increased.

Mine warfare. Obviously, mines are used to delay, channelize, and damage an enemy force. Units stopped even temporarily by minefields are subject to direct and indirect fires. Air or cannon delivered scatterable mines have a much greater potential as they can be delivered on an unsuspecting enemy after its reconnaissance elements have checked out an area. Also, they can be employed after an enemy unit has been committed to a course of action thus reducing its flexibility to resort to an alternate plan. A potential weakness in the employment of scatterable mines is the possibility that they would not be covered by observed fire.

In summary, special weapons will substantially alter the

future battlefield and will effect the employment of heavy forces. Weapons of mass destruction will put a premium on protection of troops and their fighting systems. Special weapons will have their next greatest effect on mobility and maneuver, especially in Central Europe. At the same time, mobility will be increasingly important on the integrated battlefield as heavy forces must quickly disperse or mass. EMP and electronic warfare will degrade firepower and further strain command and control.

Summary

Terrain and weather constitute the basic physical setting for battle; threat forces and the conditions caused by the employment of special weapons complete the description of the challenging and dynamic future battlefield. These demands affect combat power.

Threat characteristics shape the requirements for opposing forces. The heavily mechanized Soviet combined arms threat with its penchant for offensive operations at a high tempo against the flanks and the depth of its opponent's defenses appears to dictate that opposing forces also be highly mobile, be able to protect themselves from sophisticated weapons, and be equipped with armor defeating weapons.

Battlefield Central Europe, small, compact and lacking

depth, is crowded with potential obstacles and impediments to maneuver by heavy ground forces. Special weapons will enhance the obstacle value of this European battlefield; maneuver by heavy forces will be severely restricted. It provides a substantial degree of cover and concealment yet extremely limited observation and fields of fire. Most long range direct fire weapons, such as tanks and ATGM's will not be able to be employed at their maximum ranges; the range advantage of ATGM's over tank main gun is virtually eliminated. As English, Simpkin, Uhle-Wettler and others have argued, it is an environment suited for operations against Soviet forces not only by mobile heavy forces but also by lighter forces in positional defenses. Terrain characteristics require forces capable of manpower intense combat operations in cities, forests, and mountains, as well as in open terrain. Restrictive terrain often favors the employment of static defenses from which forces can control, canalize, and stop enemy forces. These actions break the tempo of Soviet operations, tie up his forces, and provide opportunites for counterattacks by mobile forces.

On the other hand, the vast expanses of generally flat desert terrain seem more suited for maneuver warfare. Mobility is the key to success in desert operations, but as Luttwak points out, in large desert environments with a low force density the forces with the most mobility may be light forces transported by air.[35] Excellent visibility and line of sight allow weapons to be employed at maximum ranges.

Having set the stage for future battle, this study will next examine the theory and historical practice of combined arms. Operating as combined arms is an integral part of the doctrine of the U.S. Army, its allies, and the Soviets.

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CHAPTER 3

DEMANDS OF COMBINED ARMS WARFARE

As the changing nature of the battlefield demands certain force characteristics, so too the concept of how an army is expected to fight shapes its character. Although never optimally practiced, the U.S. Army espouses a concept based development philosophy in which doctrine forms the basis for materiel requirements and force structure.

A doctrinal concept which has come to maturity in this century and has been a subtle, but central, issue in U. S. Army doctrine is the concept of combined arms. This concept is often praised, seldom understood, and routinely shoved aside as service rivalries, branch parochialisms, and weapon systems marketing have been strong motives in the quest for dollars and priorities. Noted military historian and Soviet analyst John Erickson wrote,

> It is doubtful if the theory and practice of 'combined arms' is fully grasped in Western circles, or, strangely enough, even in the Soviet armed forces, the proclaimed home of the idea in the first place.[1]

As the history of twentieth century warfare amply demonstrates there are no weapons, combat arms, or military services that can so dominate a war as to be able to go it

alone, despite the claims of their various advocates. Certainly single weapon systems or branches may dominate in a type of terrain or against a particular opponent in an engagement, but in the aggregate each system or arm of the military has limitations upon which the enemy can capitalize.

FM 100-5, Operations, only addresses combined arms briefly as an important means of battle control by which commanders synchronize their forces. Still, the necessity to fight as combined arms pervades the manual.

> Victory on the battlefield will hinge on fully synchronized combat forces. Weapons and units are more effective when they operate jointly than when they function separately.[2]

What does "combined arms" mean? What is its essence? Captain Jonathan House helps to clarify the notion and eliminate the vagueness by discussing three related elements of "combined arms" - concept, organization, and tactics and operations.[3]

The combined arms concept is the basic idea that a combination of two or more weapons or arms in mutual support produce complementary and supplementary effects that each cannot produce separately. Properly employed, different arms or weapons can enhance the effects of each other and can minimize each other's vulnerabilities. For example, the rifle squad uses grenade launchers and mines to cover or to engage targets in dead space that machine guns cannot reach.

The effects of grenades and mines complement the effects of the machine gun. Grenades and mines supplement or reinforce each other; while they both cover the deadspace, they are unique weapons that accomplish the same task differently. As FM 100-5, Operations, states:

> Complementary combined arms should pose a dilemma to the enemy. As he evades the effects of one weapon or arm, he places himself in jeopardy of attack by the other.[4]

All arms and weapons fit into the equation of the combined arms concept. This study will be limited primarily to the combined arms interaction between the traditional combat arms: infantry, armor, and artillery.

Modern armies form combined arms organizations either through fixed, permanently organized units or by temporarily task-organizing different type units as the tactical situation dictates. While combined arms effects are realized at the lowest levels of organization, as the rifle squad example above demonstrates, normally the lowest fixed, autonomous combined arms unit in the U.S. Army is the division. The U.S. heavy division is permanently assigned a fixed number of tank, mechanized infantry, self-propelled artillery and other types of single arm battalions plus combat support and service support units. Combined arms sub-units are then task-organized as brigade and battalion task forces and as company teams. These temporary groupings are tailored as the factors of mission, enemy, terrain,

troops available and time dictate. The Soviets lowest fixed unit of combined arms is the regiment with similar cross reinforcing taking place at sub-unit level. The underlying purpose of these combined arms groupings is to put at the immediate disposal of the combined arms force commander all the weapons and capabilities that are needed to win in battle.

Combined arms tactics and operations are the actual roles performed by the different arms in support of each other. Combined arms tactics as House points out are of paramount interest and concern to professional soldiers "yet this is the area where historical records and tactical manuals often neglect important details."[5] Combined arms tactics change as technology and other factors change weapons and their capabilities. In the U.S. Army combined arms tactics are often not well understood because different arms often train separately. Additionally, safety and costs cause training environments to fail to closely resemble actual combat and therefore the true effects of combined arms tactics are often not realized.

The study of the general evolution of combined arms tactics during the 20th Century reveals patterns of tactical warfare that may contribute to determining how armored infantry can best be employed.

World War I

European armies entered the war with three principal arms: infantry, artillery, and cavalry. Understandably, each arm viewed its previous experiences through its own eyes, causing each to have a different view of war that would prove to be inappropriate in the Great War. In general, combined arms cooperation was non-existent. Speaking of the British Army Bidwell and Graham state,

> they were unaware of the principle of co-operation, and did not grasp how to co-ordinate the different arms. The art of orchestrating the fire of different weapons was not studied and in consequence the close interaction between fire and manoeuvre not understood.[6]

The three arms effectively "dined at separate tables."[7] What was lacking in most armies was an overall doctrine on how armies were to fight.

In 1914, French General Herr described his country's view of the coming war:

> The war will be primarily a struggle between two infantries...the army must be an army of personnel and not of machines. The artillery will only be an accessory arm.[8]

The French, still mesmerized by the offensive successes of Prussia in 1870-71, were convinced that offensive maneuver, rather than firepower, would dominate battle. Technological changes, however, coupled with other factors would cause

firepower to dominate the battlefield quickly after the opening campaigns on both fronts.

Infantry, the traditional fighting arm of the European armies, had undergone numerous changes in the decades leading up to World War I. Magazine-fed, breech-loading rifles accurate to ranges in access of 400 meters[9], and the machine gun obviated the infantry practice of volley fire and the use of the bayonet. This accurate long range firepower also rendered obsolete the massed infantry formation: the rigid square, column and line were no longer appropriate battle formations. The infantry no longer needed to mass in order to protect itself from cavalry because infantry firepower could destroy the lance, saber, carbine, and pistol equipped cavalry at greater ranges. The resulting "open order" tactics increased protection through dispersal but greatly increased command and control requirements. Proper execution required well trained soldiers and, more importantly, well trained junior leaders as well as improved command and control means. Mobilization of partially trained reserves and massive conscription of civilians made leaders, especially in the French and British armies, believe that the open order tactics were too difficult. This and the firm belief in the offensive led to great carnage caused by human wave assaults directly into deadly fire.

> The firepower of breech-loading, magazine fed rifles and machine guns had greatly outstripped the mobility and survivability of footmobile infantry.[10]

Despite extensive movement of troops by rail and truck, tactical mobility of infantry was at walking speed. Thus, reserves could be rushed forward by rail or truck to plug a gap before forces attacking on foot could exploit any successful penetration. The resulting system of entrenchments reduced the predicted "war of maneuver" to static proportions; by late 1914, open flanks and opportunities for envelopment were gone. The defense became the dominant mode of warfare. As Theodore Ropp put it,

> Now there were no flanks to go around. Improvised trenches ran from Switzerland to salt water. When these were reinforced with barbed wire and concrete, the war in the west became a war of attrition, one of the longest and bloodiest in history.[11]

After several abortive attempts to penetrate enemy defenses with the weight of massed infantry attacks, the immediate solution to breaking the stalemate was sought in more firepower, thus massive artillery.

> The artillery arm, though also compelled to seek protection in the bowels of the earth or behind the cover of hills, became more and more dominant as the range of guns increased and a more scientific indirect method of fire was adopted. As the fire of machine guns tended to bring most advances to a halt, so a greater weight of artillery fire was gradually brought to bear to smash defending lines.[12]

Most armies entered the war with a predominance of light, direct fire artillery that fought up front in close proximity to the infantry. It was light enough to be pulled by horses and to keep up with the marching infantry. It was primarily employed to suppress the enemy. Heavy artillery

was far less mobile and was used to reduce forts or to defend coastlines and other fixed locations. However, technological advances were changing the potential of artillery. New recoil and sight systems allowed for the more scientific methods of indirect fire to deliver quick, accurate, and massed fires on a target instead of the direct fire methods that had been the standard.

Once the infantry attacks failed, many expected that massive artillery fire could create a penetration by destroying enemy obstacles, trenches, and the forces in them so that infantry could mop up and cavalry could exploit. Tactics, it appears, had made a sharp turn about from the views of General Herr noted earlier as French Marshal Petain expressed a quite different notion about the relationship between infantry and artillery: "Artillery conquers, infantry occupies."[13]

These changes could not be incorporated overnight. New artillery pieces had to be designed and produced, massive amounts of artillery ammunition had to be manufactured, and artillery units had to be organized and trained in the more complicated methods of indirect fire. Additionally, a system of communications between observers and the batteries had to be created so that the artillery could be positioned out of range of enemy infantry and artillery direct fire. This also required the development of accurate maps with a compatible grid reference system.

Massed indirect artillery fire, once employed, had unexpected results. Preparations, which often lasted for days prior to an attack, tore up the ground to such an extent that infantry forces could not move quickly on the subsequent attack of the enemy entrenchments.

> The nineteen-day British bombardment at Third Ypres (1917) used 321 train loads of shells, a year's production for 55,000 war workers. The whole battle area reverted to a swamp in which the British army took 45 square miles in five months at a cost of 370,000 men, or 8,222 per square mile.[14]

High explosive ammunition was not effectively killing the enemy, as German defenders simply moved troops to trenches in depth or deeper into the ground. The British and French were amazed to find German defenders manning what was left of their forward trenches just minutes after the artillery fire was lifted. At the Somme, in July 1916, the British introduced the "creeping barrage" of shrapnel fire behind which the infantry attacked as German positions were suppressed. Unfortunately, while shrapnel was safer to march behind because its effects were projected forward, it had virtually no effect on barbed wire or trenches. Difficulty in coordinating infantry advances with the pre-planned and ever forward-shifting artillery fire often left the infantry tangled up in wire in front of the German positions as the suppressive fire moved away.

Thus, perhaps the greatest problem was in

artillery-infantry cooperation. Lack of experienced staff officers caused planning to take place at a high level of command; maneuver plans were created first and artillery was then tasked to support that plan often with little consideration for the artillery's capability to support it. Responsive communications, key to exploiting the potential of quick firing indirect artillery, were generally lacking. There was little ability to adjust from the initial plan of maneuver and fire support. Without flexibility, artillery and infantry were often unsynchronized and thus not effective. On those occasions when the initial coordinated attacks did succeed infantry often outran the fire of its relatively immobile artillery and ground to a halt. Horse drawn, wheeled artillery, no longer the light pieces of pre-war direct fire days, found it almost impossible to cross the morass of no-man's land that it had created. German defenses in depth and the rapid movement of reserves effectively prevented the long sought Allied penetration that could result in exploitation by the cavalry.

Cavalry clung to its missions of reconnaissance and security, shock action, and pursuit as tightly as it did to the horse,saber and lance. Significant forces of cavalry waited out the static trench warfare for their golden moment which never came on either front. The firepower of the other arms and the lack of flanks negated their previous advantage over infantry in open terrain. Mobile fire and shock action was to play a role in World War I in the form of an armored

motor vehicle, the tank.

The development of the tank was a direct result of trench warfare conditions. Obsessed with the spirit of the offense the Allies needed a means of destroying machine guns, crushing barbed wire and breaching trenches. The initial tank concept centered on mobile, protected firepower. Few saw the tank as a maneuver force in its own right; it was merely a specialized weapon to support the infantry in accomplishing a breakthrough. The French, in fact, regarded the tank as mobile assault artillery, originally designating them as artillerie d'assaut. [15]

It was recognized early that tanks had to capitalize on surprise, mass, and psychological impact as well as their physical effects on the enemy. Surprise in this war was gained primarily by limiting the artillery preparation. The initial tank attacks on the Somme in 1916 were a total surprise and a major blow to the morale of the German units that they attacked. This experimental first use did not accomplish mass as only forty-nine tanks started the attack, most of which went out of action because of mechanical failure. While gaining experience in tank employment, the Allies may have prematurely lost the greater effects of surprise by the time 474 tanks were used in mass at Cambrai in November, 1917. By this time the Germans had devised some anti-tank tactics and some special weapons, including an armor piercing rifle and machine gun round, the "K" bullet.

Although the massed, surprise attack of tanks at Cambrai succeeded in creating a penetration, the British were unable to exploit for a host of reasons.[16]

One noteworthy tank attack at Cambrai was an abject failure due to the lack of effective mutual support between the various arms of the British force. First, the aeroscouts failed to find and engage the German field guns known to be in the area. Second, the tanks became separated from the infantry which was to suppress by fire the German anti-tank positions. Had the infantry been advancing closely under the cover of the tanks, it could have been in position to engage German direct fire artillery with small arms and machine guns. The German artillery knocked out sixteen tanks quickly with direct fire artillery.[17] This incident did much to promulgate the idea through the inter-war years that tanks are infantry support weapons and must work in close cooperation with infantry.

The continued inability to maneuver, especially the infantry's inability to penetrate enemy defenses, caused many innovations. Advancements in artillery methods, the development of the tank, and the military use of airpower were in great measure attempts to add capabilities that would break the stalemate. Over the course of the war infantry also evolved most notably in the nature of its organization and in its tactical employment.

At the beginning of the war infantry units at brigade and lower levels had consisted purely of infantrymen armed with rifles. Machine guns were few and were primarily used in an economy of force role, e.g. to protect an open flank.[18] The demands of trench warfare soon caused the infantry to be armed not only with machine guns but also with trench mortars, grenades, light automatic weapons, and, on the German side, anti-tank weapons. The grenade, traditionally an engineer weapon, became the master weapon in the trenches.[19] Perfected late in the war, the rifle grenade proved to be the most effective machine gun killer.[20]

Light mortars, such as the British 3 inch Stokes mortar, provided infantry battalions with responsive high trajectory fire with which to bomb enemy trenches out to a range of about 400 meters. Heavy mortars were retained in batteries and were employed by artillerymen in allied armies and by engineers in the German army.[21] Light automatic weapons gave infantry mobile automatic fire to suppress enemy fires during an assault. The German infantrymen were also provided anti-tank weapons including long barrelled Mauser rifles and low trajectory mortars capable of being fired in the direct or the indirect modes.[22]

The infantry squad and platoon developed over the course of the war from a single weapon entity to a combined arms unit. It had a number of different weapons which

complemented and supplemented each other to create the synergistic combined arms effects. For example, Australian infantry captured Mont St. Quentin in August 1918, by suppressing enemy machine guns with fire from Lewis light automatic rifles and destroyed them with rifle grenade fire.[23]

The second infantry evolution was in tactics. There was virtually a simultaneous realization in several armies that attrition warfare tactics of attacking strength with strength in order to inflict unacceptable casualties on the opponent was only bleeding both sides to no advantage. An alternative tactic was to have small forces of infantrymen armed with light automatic weapons and grenades worked their way forward to find enemy weak points and to attack key machine gun positions. This idea was first published in the west in an unofficial pamphlet by an unknown French captain named Laffargue.[24] Unfortunately, the French and British were slow to change their tactics. Equally unfortunate for the Allies, the Germans had captured a copy of the pamphlet and were quite ready and willing to adopt these new and more promising methods. As Timothy Lupfer points out the Germans were uniquely adept at altering tactical procedures in the midst of the struggle and therefore "usually achieved a relative advantage over the Allies with respect to tactical change."[25] The German army had attempted "infiltration" tactics as early as Verdun, but their most successful uses were on the Eastern front at Riga, against the Italians at

Caporetto, and in von Hutier's crushing defeat of the British Fifth Army in March, 1918.[26]

German infiltration tactics depended on close artillery-infantry cooperation. Artillery batteries were assigned point, not area, targets such as command and communications facilities, forward observer positions, transportation modes, and reserves. Preparatory fires were limited and were shifted periodically along the line to disguise the main effort. Infiltrating forces were combined arms units of infantry, engineers, and signal troops which bypassed or eliminated strong points and relayed information about the enemy back to the attacking main force. They were equipped with a variety of weapons including mortars, light automatic weapons, grenades, flamethrowers, and demolitions. Once the precise area for the main attack was determined, the infantry troops advanced under the cover of a creeping barrage. Ironically, infiltration tactics were so successful that they were doomed to failure. The key role of the artillery could not be sustained as rapidly advancing troops outran their supporting fires. Mobile firepower would become an obsession in the German Army between the wars.

On the Eastern front in the summer offense of 1916, General Brusilov made drastic changes in Russian offensive methods by attacking with small forward elements at many places across a broad front after a brief artillery preparation. These infiltration groups destroyed key

positions and found weak points for the commitment of the follow-on main attack. By attacking across a broad front enemy reserves were effectively frozen in place, not knowing which was the main effort until too late. The brief artillery preparation helped insure surprise.[27]

World War I amply demonstrated the requirement for all arms to cooperate. Each arm was unsuccessful when acting alone, including the somewhat fragile, neophyte tank. Although the age of machines in ground combat took a giant leap forward in this war, the infantryman proved his vital role in the partnership of combined arms by the war's end. Determining the appropriate part each arm was to play in future wars became the major focus of military thinkers between the world wars. Overwhelming infantry casualties, however, disguised the infantryman's potential contribution in future battles.

Interwar Years

The period between the wars was marked by an unprecedented number of brilliant men who attempted to interpret the lessons of World War I, predict the type forces required for future war and to convince their respective governments to integrate new weapons and doctrine into their forces. The intensity of thought by those Lord Carver called the "prophets without honor"[28] was counterbalanced by many factors, some common to almost every nation and some unique,

which retarded military modernization and change.

People were repulsed by the human waste of World War I. This revulsion caused popular disinterest in all things military. The huge costs of war materiel and the large stockpiles of surplus equipment, at least on the side of the victors, made politicians and voters alike unreceptive to investment in expensive modernization. Later, the economic problems of the worldwide depression meant that little money was available for the development of modern armed forces. Technological advances were, at the same time, revealing the military potential of new systems; airpower, mechanization, and wireless communications were but a few of the areas in which expensive military hardware could be developed to match new warfighting concepts. The advocates of change themselves, however, did not agree in concept or on the types of forces and weapons which were required in the future. Lastly, each nation certainly had its share of powerful traditionalists within the military hierarchy who resisted change because they wanted things to remain as they were.

Great Britain produced the most prolific thinkers and writers of the period in the personage of J.F.C. Fuller and Basil Liddell Hart. These "apostles of mobility"[29] were instrumental in causing some experimentation with mobile warfare and with mechanized forces[30], especially tanks. Most notable were the maneuvers of 1927-28, which had a profound effect on German and American observers. Their

collective efforts met with only partial success.

> Revulsion at the thought of ever engaging again in mass continental warfare led to emphasis on a return to the Army's true function of securing the Empire, for which, it was held, the old-fashioned arms of cavalry and infantry were better suited.[31]

Great Britain was also in an economic pinch. Its defense expenditures were primarily spent on forces, especially the navy, to support rule of England's largest empire ever. In the 1920s the British were also committing defense resources for the development of the first independent air arm, the Royal Air Force (RAF). What was grossly lacking was a plan for modernizing its ground forces.

> The post-war reductions and economies in defence and the 'Ten Year Rule' (which governed defence planning and expenditure on the basis of an assumption that no major war was likely for a decade...) were sensible and prudent. What was not justifiable was the virtual suspension of any rational analysis of what the future needs of defence might be. There was no clearly expressed or coherent policy to guide the armed forces.[32]

The future role of ground forces was subject to heated debate that lasted for two decades. Even among the "apostles of mobility" there was substantial disagreement. Their extreme positions alienated those they needed to convert, the military commanders and politicians whose focus was on the Empire and not on continental war. Fuller espoused an all-tank force supported by airpower which would attack deep to destroy enemy command and control and rear areas in a battle of annihilation. He saw little or no need for infantry or cavalry which was in direct opposition to the

traditionalists. Liddell Hart envisioned a fully mechanized force but recognized the need for a balanced team of tanks, artillery, and infantry supported by airpower. He also advocated avoiding attrition warfare by striking enemy weakness in an "expanding torrents" fashion. Meanwhile, the RAF was developing an air doctrine that was based on the writings of the Italian, Giulio Douhet. British air strategy stated that the most economical and effective way to wage war was by strategic bombing of the enemy's homeland. The independent Royal Air Force, therefore, resisted attempts to develop the capability to conduct tactical air missions in cooperation with the army, except for reconnaissance.[33]

In the end both the traditionalists and those demanding mobility had their way. The bulk of armored vehicle development had resulted in armored cars, light tanks suitable for reconnaissance, and machine gun carriers to support infantry. These vehicles were used by infantry and cavalry units and were quite suitable for colonial duty. The infantry received tracked, three-man Bren gun carriers and the cavalry began to organize mechanized cavalry brigades of lightly armored reconnaissance tanks and cars. The "all-tank" enthusiasts were satisfied by the formation, in the late 1930s, of the tank heavy armored division. It consisted of brigades of light cruiser tanks and heavy Matilda tanks for infantry support. There was very little infantry in this division, a deficiency recognized after the battles in France and North Africa but never effectively

remedied. British mobile infantry throughout the war rode almost exclusively in trucks.[34]

France came out of World War I with a much changed attitude concerning the merits of the offense versus the defense. Faced with an unstable German neighbor and with potential allies in the Low Countries, it decided to build the Maginot Line defense system along its common border with Germany. These initial defenses would give France time to mobilize if Germany attacked. This often criticized fixation on static defense was a huge drain on French defense spending in the interwar years and yet was never completed. Marc Bloch, in his book Strange Defeat, expressed a Frenchman's perspective of the Maginot Line after the stunning German sweep past it to the sea in 1940.

> If we were short of tanks, aeroplanes, and tractors, it was mainly because we had put our not inexhaustible supplies of money and labour into concrete. [35]

As House points out, the apparently impregnable fortification had a significantly negative impact on French military thinking as it reinforced the belief that "France should avoid any aggressive actions and be content to defend its frontiers."[36]

The French determined that war would best be conducted based on detailed plans and extensive preparation. Despite the urgings of military thinkers Etienne and DeGaulle, French

doctrine was based on the marching infantry. Its view of combined arms was that all arms support the forward movement of infantry. Its 1921 doctrine, for example, stated:

> The infantry is charged with the principal mission in combat. Preceded, protected, and accompanied by artillery fire, aided where possible by tanks and aviation, it conquers, occupies, organizes, and holds terrain.[37]

Despite this mindset and the economic burdens imposed by the Maginot Line and later the Great Depression, France did take steps toward mechanization of its forces in the 1930s. In fact, it produced some of the best tanks of the era. It modernized slowly piecemealing most of the tanks to infantry support. When the Germans rolled through Poland in 1939, French doctrine was still based on the "primacy of infantry, the careful organization of artillery and the methodical advance of all elements in accordance with an elaborate plan."[38] Its frantic efforts to put together more armored formations could not overcome their lack of doctrine and training.

Like its European allies the U.S. Army found its efforts to modernize in the interwar years hampered by budget constraints, general anti-war sentiment, doctrinal confusion, and the bias of cavalry and infantry traditionalists. America's isolationist attitudes led to a focus on naval power; active ground forces were few and were primarily policing America's few overseas holdings and training reserves.

Doctrinally, the U.S. Army was profoundly influenced by the French. Combined arms was given faint praise and, like the French, tanks were subordinated as infantry support vehicles and put under the control of the infantry branch by the National Defense Act of 1920. The Army even issued field manuals that were direct translations of French manuals.[39] The active army was reduced in size and was spread across America in regimental and battalion size units. There were no active divisions until just before World War II. The Army's general concept of future war, however, envisioned large infantry armies attacking on parallel routes, supported by massive artillery, tanks, and airpower; directed by electronic communications; and transported and supplied by motor vehicles.[40]

Despite fiscal constraints the army established a shortlived experimental mechanized force in 1928 and collocated it with the Infantry Tank School at Camp Meade, Maryland, to determine the proper equipment and doctrine for a mechanized force. A second experimental brigade was formed at Ft. Eustis in 1930 and existed until 1932, when, under the leadership of Chief of Staff General Douglas MacArthur, the experimental mechanized force was reorganized into a mechanized cavalry regiment and moved to Ft. Knox. By law, infantry retained responsibility for the tank; cavalry began to develop "combat cars." Other branches began to study the impact of mechanization. During the 1930s tank development

centered on the trade off between heavily armed and protected tanks versus light, fast tanks. With cavalry in the vanguard of developing mechanized units it is not suprising that the light tanks were favored by most. Thus, U.S. tanks in World War II were generally "reliable in terms of mobility but vulnerable in armor and armament."[41]

When war broke out in Europe the U.S. Army had a scattering of light tanks, no major armored formations, and had not conducted large scale maneuvers of armored forces. The initial armored division was formed around the nucleus of the experimental units. Initially tank heavy (25 tank companies to 7 infantry companies), after the 1941 maneuvers it was remodelled after the 1941 panzer division with a balance between tanks and mobile infantry units, complemented with self propelled artillery, an engineer company and support units.

World War I and the resulting treaty left Germany with much of its former territory occupied or in the hands of other nations. It had massive internal economic and political turmoil and the sour taste of a humiliating defeat. The German Army, left impotent by the treaty, was authorized a 100,000 man home defense force, was not permitted its General Staff, and was severely restricted as to the kinds of weapons and forces it could develop and possess. While forbidden to develop sophisticated forces that might be used in offensive action against its neighbors, the German Army,

nevertheless, digested the military lessons of the war and planned for the future. As John English wrote of the German Army in the interwar years,

> its very weakness became a strength; in so small a force, no effort was spared to encourage intellectual activity and the pursuit of professional knowledge.[42]

German military thinkers were influenced by their own experiences, military history, and culture as well as numerous foreign military theorists. J.F.C. Fuller and Basil Liddell Hart are popularly credited with having an enormous influence on the development of <u>blitzkrieg.</u>

Post war German commanders, especially von Seeckt, ascertained that improved battlefield mobility would have made the "soft spot" infiltration tactics of 1918 work decisively. They also realized the need for mobile supporting fire and saw the aircraft as a possible solution. Their future view of war in the early 1920s was of large, mobile infantry forces employing infiltration tactics using aircraft to project firepower forward. With Germany physically fragmented by treaty (Danzig Corridor, Rhineland, et al) there were no natural borders left to defend. It is not surprising that the Germans saw the next war as a fluid, mobile, primarily offensive war that risked being fought on several fronts again.

The emerging military thinker of interwar Germany was

Heinz Guderian, commonly credited as the father of the panzer forces and the creator of blitzkrieg. An infantryman, with war experience in wireless signal communications, and a General Staff officer, he was posted to the Motor Transport Department in the early 1920s. He studied tactical mobility and over time became Germany's leading advocate for mechanization. He acknowledged the influences of foreign theorists whom he read profusely.

> It was particularly the books and articles of the Englishmen, Fuller, Liddell Hart, and Martel, that excited my interest and gave me food for thought. These far-sighted soldiers were even then trying to make of the tank something more than a infantry support weapon.[43]

Guderian did not fall into the Fuller "all tank" trap as Liddell Hart seemed to have done, as he realized early in his studies that a combined arms force was paramount.

> In the year 1929, I became convinced that tanks working on their own or in conjunction with infantry could never achieve decisive importance. My historical studies, the exercises carried out in England and our experiences with mockups had persuaded me that tanks would never be able to produce their full effect until the other weapons on whose support they must inevitably rely were brought up to their standard of speed and cross-country performance. In such a formation of all arms, the tank must play the primary role, the other weapons being subordinated to the requirements of armour.[44]

As Jonathan House wrote,

> it might seem inevitable that once combined with the German experience of the psychological effects of tanks during World War I, the German infiltration tactics, the belief in massing on a narrow front, and decentralized execution would lead to blitzkreig.[45]

This is an especially tempting argument in light of the early recognition of the potential of airpower.

There remained in the German Army, however, a considerable number of high commanders who still saw mechanization as special weapons to support marching infantry divisions. The other branches of the army wanted a share of the new mechanized and motorized systems, especially for cavalry and infantry divisions. Guderian's most significant battles may well have been his fight to concentrate Germany's limited mechanized systems into the panzer units and not to dissipate them to all divisions as the French had done. Guderian had the opportunity to demonstrate panzer tactics to Hitler in the mid 1930s and won his support.

At the start of the Polish campaign the Germans had only a few panzer divisions; although tank heavy, they contained motorized infantry, towed artillery, anti-tank forces, engineers, reconnaissance and signal units. The German air forces had dive bombers specially designed for the close air support role.

The Soviet Union and its Red Army were born in the aftermath of World War I. Interwar developments were shaped by civil war which lasted until 1921. The wide expanses of Soviet terrain and understrength forces led to maneuver warfare during the civil war. The successes of the Red Army led its pre-eminent military thinker, M.N. Tukhachevsky, to

study mobile combined arms, initially focusing on the interactional processes that explain the interdependence of infantry and artillery. As John Erickson has written,

> The term 'combined arms' came into general use in the 1920s during the period of intense investigation into the experiences of World War I and the Civil War and not least as a part of the efforts to develop and implement a unique Soviet/proletarian theory of warfare.[46]

Though the Soviets under Stalin were committed to developing the Soviet Union internally first, the Red Army was intended to eventually become a vehicle for spreading its political doctrine to other nations, especially Europe. The primacy of the offense, therefore, became a driving force in developing a doctrine for this military machine. The fluid maneuver battles of the Civil War convinced Tukhachevsky that operations must be conducted in depth. This theory of operations in depth welded a number of other operational imperatives such as offensive action, shock, and surprise to an expanding view of combined arms, one that included mechanized forces and airpower. The 1936 Field Service Regulation, Soviet Army is the culminating piece of Tukhachevsky's efforts and is a masterpiece of pre-World War II combined arms doctrine. He envisioned a combined arms force of infantry, tanks, and artillery attacking in mass on a narrow front to penetrate enemy defenses, followed by a second echelon of mechanized forces to exploit to destroy enemy rear area forces such as reserves, artillery, headquarters, and support installations.

Infantry was still envisioned as the centerpiece of the combined arms team.

> The infantry in close cooperation with the artillery and tanks, by decisive action in attack and by maintaining the position in the defense, decides the outcome of the battle. Therefore, the other types of forces operating jointly with the infantry are carrying out their missions in the interests of the infantry, enabling it to advance in an offensive action and to maintain itself in defense.[47]

The Soviets rated artillery as "the most efficacious and powerful arm." It was seen as the arm that "paves the way for all ground forces in an advance," and was the primary means of destroying tanks, fortifications, and enemy personnel, weapons, and vehicles in the open.[48]

The Soviets envisioned tanks as having two distinct roles. In support of infantry they took advantage of protection and firepower to destroy machine guns and obstacles, especially wire. Tanks in massed formations supported by other mechanized arms would break through to attack in depth. These tanks the Soviets referred to as strategic tanks.[49] While these strategic tank formations were to contain motorized infantry, the

> principal method of action of a mechanized force in battle is by a tank attack covered by organized artillery fire...and...should be supported by aviation.[50]

The tendency for Soviet tanks to attack and leave their

infantry behind would result in many tactical failures in their fight against the Germans.

Unfortunately for the Soviets, several factors caused this mature combined arms doctrine to become unexecutable by the outbreak of World War II. Stalin's purges eliminated Tukhachevsky and many of those who understood his teachings. Second, apparent lessons of the Spanish Civil War caused doubts about the doctrine. Third, by the time of the German invasion of Poland the Soviets had disbanded most of their strategic tank corps. Some motorized divisions were created to replace them, but for the most part tanks were relegated to infantry support roles.

The purges, reorganization, and doctrinal changes left the Red Army in sad condition as the abortive actions to occupy Poland and to defeat Finland demonstrated. Only in the highly successful action against the Japanese in Manchuria in 1939 did Soviet forces, under the leadership of Tukhachevsky's disciple General Zhukov, mass mechanized forces and conduct a well executed, combined arms battle in the opening phases of the war.

Thus, the interwar period was one of thought and examination of methods to avoid a repetition of the trench warfare of the previous war. Mobility, more precisely mobile firepower, was the apparent answer. Although nations understood to varying degrees the need to fight as combined

arms, there was a wide variety of "how to" doctrine.

World War II

Infantry, by force of economics and doctrine, was still the principal fighting arm of all armies at the outset of World War II. The bulk of all armies remained the marching infantry division supported by horse or vehicle towed artillery. Mobile forces existed in each army but in 1939 only Germany had concentrated most of its mechanized forces into all arm mobile divisions that were capable of fluid, high tempo operations. The desire to provide mobile, protected firepower to its infantry divisions precluded most armies from forming large mechanized formations. After the German attack into Poland, the French, British, and American armies scrambled to create similar forces, and the Soviets moved to reconstitute their mobile forces. The French who had piecemealed most of their superior tanks to infantry formations were still frantically trying to form armored divisions when Guderian and company drove through the Ardennes to the sea.

Blitzkrieg tactics were essentially the infiltration tactics of World War I executed by a combined arms mechanized force which sought to penetrate the crust of forward defenses, bypass strong resistance, and quickly attack into the enemy rear areas. Surprise was vital for the initial penetration; speed and the maintenance of momentum were key

in paralyzing the enemy, affording him no time to reconstitute a defense. In both Poland and France the panzer divisions depended on speed. The divebomber provided a substantial part of the needed firepower, as much of the German artillery was horse drawn. Rather than wait for marching infantry to effect a penetration, armored formations led the attack; infantry divisions followed on foot to consolidate gains, clear pockets of resistance, and keep the supply lines open. To maintain a high tempo and to exploit mobile striking power, the panzer formations did not delay the continued attack but drove deep relying on their organic, but limited, motorized infantry and engineer elements to maintain forward mobility and to provide local security for the tank spearheads. Marching infantry divisions closed with the fragmented enemy as quickly as possible to complete the destruction and to consolidate gains.

Despite shocking success in these early campaigns, the Germans learned many valuable lessons. Their foremost concerns were in the areas of organization, tactics, and equipment. The tank heavy panzer division (four tank, three truck mounted infantry, and two towed artillery battalions) was too unwieldy, and the light division (two motorized infantry regiments and one tank battalion) lacked combat power to sustain operations. The panzer divisions did not have enough mobile infantry. As General F.M. von Senger und Etterlin stated in his forward to Richard Simpkin's Tank Warfare;

> the failure of the panzer divisions in Guderian's corps to encircle the British forces at Dunkirk provides the most striking proof of the imbalance of tanks and infantry in the old divisions. By the time they reached the Channel coast his panzer divisions had so few infantry available that the corps was not in a position to push forward across the marshes and take Dunkirk.[51]

German tanks had also proved to be too light and unreliable. The Mark I and II tanks used in the Polish campaign were virtually immobile at the end due to supply and maintenance problems. In the campaign in France some newer and more reliable tanks were available, but the older ones still constituted the bulk of the force. During the march to the Channel coast Rommel's forces were struck in the flank by a small force of heavier British tanks. The light German tanks were out matched and only the improvised use of direct fire artillery and direct ground fire of the anti-aircraft guns (88's) turned the British back. Kenneth Macksey cites this engagement as a contributing factor in the German decision to put more powerful armament on their tanks so that they could combat other tanks.[52]

There were also unexpected benefits. Not only had the 88's proved to be deadly anti-tank weapons, but the half tracked armored vehicle, used in panzer divisions as an artillery prime mover, proved to have superb cross country mobility. It became an ideal vehicle to transport infantry in armored battles, replacing the truck which had very limited cross country mobility compared with the tank and

offered no armor protection for the troops. Two such panzergrenadierwagen were produced, the light Sd.Kfz.250, which could carry 6 men, and the heavier Sd.Kfz.251 which could carry 12 men.[53] Yet, as the number of panzer divisions and the ratio of armored infantry to tanks increased, the Germans were never able to equip more than a portion of their panzer division infantry with these half tracks.

Although not without problems in execution, the concept of dive bombing Stukas providing firepower for advancing panzer formations proved vital. The most notable incident occurred when air attacks on French positions aided the German assault crossing of the Meuse River at Sedan.

The battle at Sedan also graphically highlights the critical role of infantry and engineers to sustain the forward movement of armor. Dismounted armored infantry and engineer units crossed the Meuse in rubber boats to secure a critical bridgehead.

In March 1941, the Germans issued a manual detailing the importance and the proper employment of motorized infantry.

> Motorized infantry units form the offensive infantry element in the armored division. Their strength lies in their speed and cross-country performance, together with the possession of numerous automatic weapons and protective armor...
>
> Motorized infantry is characterized by ability to alternate rapidly between fighting from carriers and

> fighting on foot, and also to combine these two methods of combat...
>
> The chief task of motorized infantry is close cooperation with tanks. By following up closely they can quickly exploit the tanks' success...
>
> Motorized infantry...prepare the ground for the employment of tanks by clearing a way though country difficult or impossible for tanks...[54]

The invasion of Russia in 1941 was a massive undertaking for which Germany was not prepared despite the fact that its army was in its best condition ever. The Germans planned for, but failed to achieve, another quick victory. The eastern front by 1942 became a large scale war of attrition that Germany was destined to lose. The vast expanses of the Soviet Union, the harsh climate, the long supply lines, the limitations of German manpower and industrial capacity, and the pigheaded refusal of the Soviets to be beaten all contributed to eventual German failure.

The German offensive tactics of 1941-42 were improved versions of the tactics that had succeeded in Poland and France. Equipped with more versatile and reliable equipment and organized into more balanced panzer divisions, the Germans quickly had the surprised Soviets reeling. The Germans used combined arms battle groups to lead the attacks; once penetrations or flanking movements had succeeded, the panzer forces encircled large Soviet formations. The insufficient amount of German mobile forces, however, permitted many Soviet forces to slip out of these encirclements. The panzer forces were forced to wait for the

arrival of the foot mobile infantry divisions to deal with the large number of bypassed, encircled and captured enemy. These pauses, while the infantry marched across the endless Russian terrain, slowed the tempo of operations and allowed the Soviets to patch together defenses that eventually stopped the Germans in front of Moscow.

As previously discussed, the Red Army was not in good shape when the Germans attacked. After the heavy losses of 1941, it had to virtually start over in rebuilding its forces, especially its armored forces. These losses further depleted the limited number of trained and knowledgeable officers it needed to employ the combined arms forces that it could regenerate. A stop gap solution was to create infantry units and to pool specialized weapons and units under higher headquarters where they could be employed by more experienced commanders. This resulted in a near total breakdown of combined arms, especially at the tactical level.[55]

While the Red Army remained primarily an infantry force, the Soviets produced two of the most advanced tanks of the era, the T34 and the KV1. Too few of these tanks had been produced by 1941 so the Germans initially encountered light, outmoded models. As the Soviets struggled to halt the German advance the few tanks that became available were hastily organized and piecemealed into battle, usually in support of infantry.

Once the Soviets halted the Germans they began to rebuild tank corps and armies. These formations were intended to be used as mobile groups to exploit penetrations and to attack deep into the German rear. Tank production increased and the Soviets had both a qualitative and quantitative edge by late 1942. The Germans, however, retained a decided advantage over the Soviets in trained crews and experienced commanders until at least 1943, and although outnumbered, usually inflicted disproportionate losses on the Soviets.

Soviet armored formations remained tank heavy throughout the war. Part of the problem was their lack of trucks, production and lend lease of which never came close to meeting demands. As a result the Soviets did not develop a credible armored infantry partner for its tank forces. A typical Soviet armored attack is described by General von Senger und Etterlin in Simpkin's Tank Warfare:

> The Soviet tanks broke through the thin line of German infantry and penetrated fairly deeply. Having reached this depth without infantry of their own they quickly fell victim to hastily regrouped German armored reserves, or to the 88mm guns...They were helpless because their infantry following on foot became separated from the tanks at the near edge of the combat zone. Whenever German artillery was in action with reasonable supplies of ammunition and scope for observation, it succeeded in pinning down or annihilating the unprotected infantry...The tanks were not handled flexibly enough to make up for the absence of infantry, or for that matter of other arms.[56]

General von Senger und Etterlin sums up the problems of the

Soviet armored formations in this manner:

> Through the whole of World War II the Soviets had no armored infantry. Their tanks were some if not most of the time technically superior to the Germans'; as time went on they came to be well handled. Yet their tanks alone did not have the capability to succeed at the tactical level, let alone the operational....the Soviet Army, despite its superior equipment, was primarily handicapped by the structural imbalance of its mechanized formations. It lacked the capability of bringing infantry to battle under armor. [57]

Without mobile means for its infantry, the Soviets had to improvise to insure that at least some infantry accompanied tanks. Infantry began to habitually ride into battle, at considerable risk, on top of the tanks. While this was not exclusively a Soviet practice, it became institutionalized in that army while remaining an improvisation in others. "Tank landing troops,"[58] as these soldiers were designated, were susceptible to the effects of artillery, mines hit by the tank, any direct fires at them or at the tank and the tank itself as it traversed its turret or sped cross country over rough ground.

Actions in North Africa revealed the absolute requirement for infantry to be mobile in desert environments. The British had an easy time with the Italians, in no small part due to the fact that the Italian Army consisted almost entirely of non-motorized infantry supported by a smattering of outmoded, grossly unreliable tanks and artillery. As Rommel wrote:

> In the North African desert, non-motorized troops are of practically no value against motorized enemy, since the enemy has the chance in almost every position, of making the action fluid by a turning movement...Non-motorized formations...can only be used against a modern army defensively and in prepared positions...In mobile warfare, the advantage lies as a rule with the side which is subject to the least restraint on account of its non-motorized troops.[59]

Tactically, even motorized infantry played a supporting, though important, role in desert warfare where the range of tank and anti-tank weapons were paramount. The Germans ruled the major portion of the war in the desert by their aggressive employment of anti-tank guns.[60] Motorized infantry moved with tanks and anti-tank guns in formation and mopped up positions overrun by Rommel's forces. They were invaluable in fighting enemy in positional defenses and in removing minefields. As in other theaters, armor committed to attack without accompanying infantry or artillery support often fell victim to anti-tank guns which could have been suppressed by artillery and eliminated by infantry.[61]

Rommel himself became handicapped by large contingents of non-motorized infantry, primarily Italians but also Germans as his limited stock of armored vehicles and trucks became attrited in battle. He was constantly required in the defense or retrograde to use his limited armored forces to buy time for the withdrawal or movement of his marching infantry.[62]

It was the meticulously planned, carefully executed, combined arms operations of Montgomery that finally put the Afrika Corps on the trail to defeat. Rommel described the combined arms tactics of the British Eighth Army from El Alamein onward:

> When our defense had been shattered by artillery, tanks and air force, the British infantry attacked. With our outposts pinned down by artillery fire...highly trained sappers, working under cover of smoke, cleared mines and cut broad lanes through our minefields. Then the tanks attacked, followed closely by infantry...Everything went methodically and according to drill.[63]

As mentioned, the U.S. Army had opted to produce more mobile, reliable tanks at the expense of armament and armor protection. The initial armored division, modeled after the panzer division, was tank heavy, consisting of six light and two heavy tank battalions complemented by only two battalions of mobile infantry and three artillery battalions. Later reorganizations followed German initiatives and resulted in a balanced tank-armored infantry mix with a more flexible command structure to facilitate forming combined arms combat commands. These battle groups were formed by cross attaching companies between tank and armored infantry battalions. Often air defense artillery, tank destroyers, and engineers were added to complete the combined arms team.

The infantry division, triangular since the late 1930s, consisted of three infantry regiments and supporting artillery. General Leslie McNair, Chief of Army Ground

Forces, believed in keeping the division structure small with only the minimal essential forces permanently assigned. Tanks, air defense artillery, tank destroyers, engineers and other special units were "pooled" under higher headquarters control and were to be attached to these divisions as the tactical situation dictated. Additionally, most service support, including transportation assets, were to be controlled above division and allocated as tactical requirements dictated. The decision to keep infantry divisions lean certainly facilitated shipping them overseas but resulted in problems in combat. Commanders did not have at their immediate disposal all the types of forces necessary to fight as combined arms or to quickly respond to rapidly changing tactical situations. Once in combat in France the specialty units became more or less permanently attached to the division. A typical infantry division in the line would have tank, tank destroyer, air defense artillery, combat engineers and transportation units attached for extended periods of time. These assets often became further allocated to the infantry regiments. Thus tasked organized, these "regimental combat teams" became the combined arms battle formations of the infantry divisions.

Unlike the Germans and the Soviets, the U.S. Army did not mass its armored divisions into armored corps or armies. The typical U.S. corps in France had two to three infantry divisions, augmented as noted above, and one armored division, usually poised in reserve to exploit successes of

the infantry divisions or to counterattack.

A significant advantage of the U.S. Army was its very effective field artillery. During the interwar years U.S. artillery had developed the fire direction center (FDC) concept and an extensive forward observer system linked to the FDC by radio. The U.S. artillery was able to mass artillery fires from numerous different firing units, accurately and quickly. The development of other specialized weapons, such as the tank destroyer, also permitted the field artillery to concentrate on indirect fire support. In other armies field artillery was tasked to perform a number of divergent missions, such as anti-tank fires, which reduced their capability to mass.[64]

As U.S. tanks were not armed nor conceived as tank killers, the U.S. Army developed other weapons for its anti-tank fires. Two key U.S. developments in anti-tank warfare were the tank destroyer, a tank surrogate with a large caliber gun mounted on a half-track, and later on a tank, chassis; and the man portable "bazooka," a tube-launched, shaped charge round propelled by a rocket. Improved over the course of the war, the tank destroyer proved itself because it was mobile, was able to be employed quickly and afforded some armored protection for its crew. In addition to engaging tanks, it often served as mobile, direct fire for the infantry to which it was attached.[65]

While other armies, notably the Germans and the Soviets, developed self propelled tank surrogates for anti-tank defense, their primary anti-tank weapons were towed anti-tank guns and their upgunned, more heavily protected tanks. In general, tanks started the war as infantry support systems or were focused on destroying soft targets in the enemy rear areas; by the end of the war tanks were viewed as the principal anti-tank system in most armies.

The man portable anti-tank rocket gave the infantry squad and platoon a broader "combined arms" capability. This inexpensive system was copied by other armies ushering in a new era of infantry defense against tanks. German General Uhle-Wettler claims that the German version, the panzerfaust, may have destroyed as many as 10,000 allied armored vehicles.[66] It certainly provided the foxhole infantryman with some positive defense against tanks. Its presence on the battlefield made more absolute the requirement for infantry to accompany tanks in the attack in order to suppress and destroy enemy infantry armed with such an anti-tank weapons.

Infantry and tank cooperation required either tanks to fight at the pace of infantry, as happened when tanks were in support of infantry units, or for the infantry to fight at the pace of the tank. To accomplish the latter, infantry needed mobility similar to the tank and it needed increased protection. Development of the armored personnel carrier

(APC), however, lagged behind tank development. When faced with setting industrial priorities for production of armored vehicles, virtually every nation opted for tanks and mobile firepower over armored transport for infantry.

Trucks were the primary conveyance for mobile infantry in most armies at the start of the war, and in several armies that situation persisted throughout the war. The requirement to move infantry under some armor protection lead to the development of armored personnel carriers. Like the Germans the U.S. Army settled on a open top, half-tracked vehicle. The open top was not such a vulnerability as it may appear. The limited use of variable time fused artillery made airbursts rare, and the U.S.-invented proximity fuze was introduced late in the war. The open top was a liability primarily when attacked by aircraft or when operating in cities or hilly terrain. The standard U.S. half-track was the M3 which carried 14 men. All of the armored infantry battalions were equipped with it. This versatile piece of equipment was modified and used for many other purposes and was supplied to the allies. Over 40,000 were produced from 1941-45.[67]

World War II witnessed the emergence of tank forces as a major partner in the combined arms ground force. The absolute requirement to fight as combined arms, albeit at a more rapid pace, was a major lesson of this war. Infantry had been required to develop the mobility and protection to

fight on the same battlefield as tanks. Despite the rapid advances in weapons technology no single arm or weapon system could dominate ground warfare, not even the atomic bomb which had brought World War II to an end.

The Nuclear Age

During the period after World War II, the role of U.S. heavy ground forces entered a period of uncertainty. The advent of the atomic bomb made the need for large ground forces questionable. Behind the shield of an atomic weapons monopoly the U.S. Army found itself reduced to a state of impotence in the few years after the war. Large stockpiles of surplus weaponry had the normal post-war effect of precluding modernization of ground forces. Naval and air forces became the foci of American military might. The threat of large scale conventional warfare involving massive ground forces seemed remote in light of atomic, and later nuclear, weapons.

A new wave of low intensity conflicts coupled with manpower intensive occupation duties caused the general neglect of heavy forces in favor of lighter infantry forces. The series of peripheral conflicts, insurgencies, and wars of national liberation in places like French Indochina, Greece, and Malaya seemed to set a new tone for ground warfare in the atomic age. The U.S. baptism of fire in this era occurred in Korea.

Caught grossly unprepared, the U.S. Army fought the North Koreans and the Chinese Communists to a bloody stalemate after several years. While the Korean conflict was primarily an infantry war because of the terrain, Allied forces had been shocked at their unpreparedness to combat four battalions of T34 tanks employed by the North Koreans. Armed initially with only ineffective 2.36 inch rocket launchers, the U.S. infantry could do little to stop the tanks. The U.S. Army had learned another painful lesson in combined arms: even in infantry-dominated peripheral wars, tanks and anti-tank systems were required. Tanks were valuable in providing mobile protected firepower and were even used on occasion for indirect fires. Many of the lessons learned from World War II were relearned in Korea, including the requirement to fight as combined arms and the risk involved when infantry ride into battle on tanks. Artillery continued to be a U.S. strong suit. Airpower was in ever-increasing demand for close support of the limited number of ground troops. The U.S. Army looked to firepower, instead of maneuver, to solve its tactical problems.

During the 1950s and early 1960s, numerous tactical atomic weapons were developed and fielded in the U.S. Army. These weapons included rocket systems such as the Honest John, artillery delivered munitions, infantry support weapons such as the Davy Crockett, and even man portable special atomic munitions. Technological advances caused these weapons to become refined over time. In the field artillery,

for example, atomic projectiles initially had to be fired from a monstrous 280mm cannon, but can now be fired from standard direct support 155mm howitzers. The mass destructiveness of tactical nuclear firepower on the battlefield caused armies to reexamine its organizations and doctrine.

The development of a Soviet atomic capability caused the U.S. Army to develop doctrine and forces that would allow ground forces to function effectively on a nuclear battlefield. Tensions between the U.S. and Soviets focused on a divided Europe through the 1950s. The lessons of Korea caused the U.S. to upgrade its neglected armored forces. Faced with deployment concerns and its worldwide commitments, however, the U.S. kept the bulk of its ground forces relatively light in the form of infantry, airborne, and eventually airmobile divisions.

Armored forces seemed most suitable for the nuclear battlefield. These forces had the inherent mobility to quickly disperse to reduce vulnerability to weapons of mass destruction and to concentrate to combat enemy ground forces. Armored vehicles also protected troops from atomic weapons effects including radiation. While the armored division retained its balanced structure of tanks, armored infantry and self-propelled artillery, the infantry divisions went through a series of changes before the Reorganized Objective Army Division (ROAD) structure was adopted for all divisions

in the early 1960s.

At the height of the U.S. concerns about nuclear war in the mid-1950s, the non-armored divisions converted to a pentomic structure. The pentomic infantry division was organized and equipped to take advantage of the flexibility and mobility that the army saw necessary to fight and survive not only on a nuclear battlefield but in any hot spot in the world. The structure recognized the need for combined arms; each of the five battle groups was designed to be a self-contained unit which could be reinforced by tanks and other arms from the division troops. The division had less tube artillery but did have atomic delivery means. The division had limited aircraft, trucks, and APC's to increase it battlefield mobility.[68]

Though some divisions were so organized this concept was short lived. One of the unique aspect of the pentomic division was the introduction of APC's into the infantry division and consolidating them into a transportation battalion. This certainly underscores the U.S. view of the APC as a means of transportation or protected mobility for infantry.

The advent of atomic firepower put a premium on maneuver and protection. During the fifteen years following World War II, especially after the shocking North Korean use of tanks, the U.S. intensified its effort to develop its tank and APC

fleet. Armored infantry was equipped then with a series of APC's, improved over the M3 half track. In general, these were fully enclosed, fully tracked squad carriers. These vehicles were essentially battle taxis; they gave the infantry mobility and protection from small arms fire, artillery fragments, and to some extent from radiation and other atomic weapons effects.

These heavy battle taxis were replaced in the early 1960s by the M113, which has proven to be one of the most popular APC's ever fielded, judging from the number produced, its service in over 40 different armies, the number of variants produced, and its reliability in over twenty years of service. Pioneering efforts in the development of the capability to weld ballistic aluminum plate made the M113 light enough to be air transportable and to swim inland bodies of water without extensive preparation. It carried a full rifle squad and offered it the same relative degree of protection as earlier fully enclosed models.

As successful as the M113 has been (and it is still the standard mechanized infantry carrier in the U.S. Army today), it soon manifested some serious shortcomings. As the army developed its future tank in the early 1970s, it recognized that it would have more speed, mobility, and protection than the M113. Additionally, as the Soviets developed new infantry combat vehicles such as the BMP, the M113 became outclassed. Its caliber .50 machine gun could not defeat the

BMP, the M113 gunner was unprotected, it lacked vision blocks or firing ports for the squad, and its light armor was increasingly more vulnerable to a growing array of infantry weapons.

Other factors urged the U.S. Army to look toward a more modern infantry combat vehicle. The Germans were then equipping their newly organized Bundeswehr with the Schuetzenpanzer, an infantry fighting vehicle that had hatch openings from which its infantry could fight and a turret mounted 20mm automatic cannon. The French were equipping their armored infantry with the AMX-VTT, also sporting an automatic cannon and firing ports so that infantry could fire from within the vehicle.

The Soviet Army after World War II went through several stages of development. From 1945 until the death of Stalin it continued to field a massive army that was based on the lessons learned in the Great Patriotic War. Infantry, rearmed with more modern equipment including APC's and direct support tanks, was still the principal combat arm. Artillery was the main source of firepower. Tank formations were the principal arm for exploitation. Combined arms cooperation was stressed at all levels.

After developing an atomic weapons capability, the Soviets shifted priority to strategic rocket forces. Tanks became the centerpiece of the conventional forces, artillery

lost its prestigious position, and infantry began to move toward full mechanization. By 1963 infantry forces were redesignated motor rifle troops. Soviet ground forces were designed to exploit the effects of battlefield tactical atomic weapons.

Key to this capability was the infantry fighting vehicle. The Soviets began fielding wheeled and tracked infantry combat vehicles with firing ports like the BTR series of vehicles which was introduced in the late 1950s. After a series of product improved versions, in 1967 the Soviets fielded the world's first modern infantry fighting vehicle, the BMP. The impetus for the BMP was the concern for keeping infantry linked up with tanks to exploit the effects of nuclear weapons. The capability to fight mounted sustained the tempo of armored operations and reduced troop susceptibility to battlefield nuclear and chemical effects.

Their one variant, atomic war only, view began to lose its luster in the late 1960s in the face of political realities and the assuredness of mutual destruction. The Soviets began to consider a second more plausible case in which they saw that their best chance of winning a major war with NATO was by prosecuting a quick conventional campaign before NATO could effect the decision to use nuclear weapons. In any case Soviet ground forces, already capable of fighting on an integrated battlefield, began to modernized to reestablish full combined arms capabilities that had been

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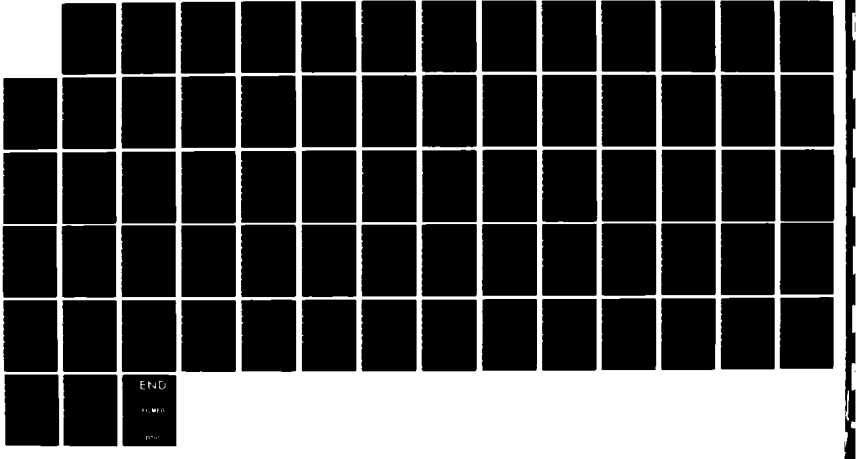

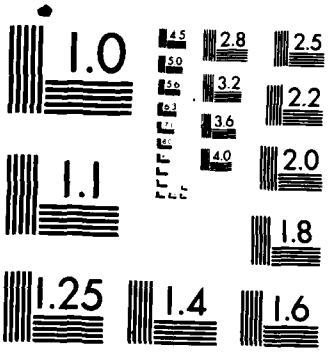

deemphasized under the one variant strategy. The combined arms army was made more balanced and artillery regained much of its former status.

The most recent series of conflicts between modern armored forces, the Arab-Israeli wars, have reinforced old lessons about combined arms warfare and have had a profound effect on the doctrine, equipment, and force structure of modern armies throughout the world. These clashes are noteworthy also because they have virtually pitted a force armed with NATO type equipment, the Israeli Defense Force (IDF), against Soviet surrogate forces.

The lightning success of IDF tank and air forces in the Six Day War of 1967 encouraged the Israelis to believe that armor "could operate freely without infantry support," a notion that General Herzog opined as "one of the most dangerous concepts that had entered Israeli military thinking..."[69] John English points out an example of the results of this faulty logic.

> With the virtual destruction of the Israeli quick reaction 190th Armored Brigade, which counterattacked unsupported by infantry and lightly supported by artillery, the 'all-tank' idea was once again shown to have serious limitations.[70]

He goes on to state that many Israeli tanks were destroyed by Egyptian infantrymen who waited until tanks were at close range and then destroyed them with RPG-7 hand held, anti-tank rockets. Certainly, supporting infantry could have

dealt with these forces and saved many tanks.

Not all tanks were destroyed at short ranges during this conflict. The Israelis were undoubtedly surprised by the effective Arab use of longer range wire-guided missiles like the Snapper and Sagger. Massed fires of these weapons took a heavy toll on Israeli vehicles, due in no small part to the lack of adequate Israeli suppressive artillery fire. This war reaffirmed the requirement to fight as combined arms. Infantry had gained a capability to take on tanks not only at close range but also at ranges outside the effective range of the tanks weapons.

The effects of these anti-tank guided missiles (ATGM's) got the world's attention, especially the superpowers. Both realized that anything that could be seen on the battlefield, could be hit. The U.S. Army was in the process of relooking its tactical doctrine as it shifted emphasis from Vietnam to Europe. In his study of the evolution of U.S. Army tactical doctrine, Robert Doughty noted that

> the startling violence and consuming nature of that war served to accelerate the transition from the previous focus on counterinsurgency to the new focus on conventional warfare.[71]

The new view envisioned that war could begin with a conventional battle and transition at some time to a conventional-nuclear phase. FM 100-5, Operations, published in 1976, was attrition oriented, was primarily

defensive in tone, and emphasized concentration, massive firepower, and movement to increase relative combat power ratios.

In light of the lethality of ATGM's, the U.S. Army significantly increased the number and quality of these systems in its infantry organizations. It developed the Improved TOW Vehicle which mounted ATGM's on a M113 variant vehicle that not only afforded the gunner light armored protection but also provided him with superb day and thermal sights. Perhaps more significantly, the army directed that the design of the new infantry fighting vehicle, then under development, include long range ATGM capability.

The Soviets entered into a lengthy debate about the effects of ATGM's on their offensive doctrine. What was seen to be at greatest risk was not the Soviet tank but the more lightly armored BMP, which they determined to be twice as vulnerable as the tank. [72] They recognized that if BMPs were more vulnerable they could be destroyed at a greater rate, forcing infantrymen to dismount sooner. This would result in either a separation of the tank-infantry team or would force tanks to operate at reduced pace, severely slowing the tempo of the attack. Not only would the dismounted infantry be at greater risk to myriad battlefield hazards but, more importantly, the whole strategy of a quick conventional campaign was suspect. The debate, therefore, developed into a discourse on motorized rifle tactics and

their effects on operational methods.

One result of these concerns was the previously mentioned increased Soviet emphasis on field artillery. The Soviets recognized that direct fire more effectively suppresses ATGM's. Therefore, the Soviets made a commitment to not only increase its artillery but to develop armored, self propelled artillery with greater direct fire capability, "a major shift in traditional Soviet thought which hitherto emphasized massed indirect artillery barrages from towed equipment."[73]

The IDF also assimilated the lessons of the 1973 War and made substantial efforts to develop a more balanced combined arms team. It developed self-propelled artillery to suppress enemy anti-tank systems and it greatly expanded its mechanized infantry component.[74] When the IDF attacked into Lebanon in 1982, it was a highly mechanized army which was prepared to fight as combined arms against modern forces in terrain like it had fought in over the last few wars. It was not properly prepared to fight in restricted mountainous terrain of Lebanon, where its large tank formations could not maneuver rapidly to strike enemy flanks and rear. Its mechanized infantry was not trained sufficiently in dismounted, much less mountain operations. It was trained to cooperate with tanks in mobile warfare but could not sustain operations in which it was the main striking force supported by tanks and artillery.[75]

As the Soviets had determined, the long range anti-tank fires employed against the Israelis in Lebanon wrecked havoc with the APC's. The M113s with light aluminum alloy armor were death traps for infantry riding inside if hit by anti-tank fire. As Gabriel noted, "the troops became so frightened of burning to death that many refused to ride in the APC's and took to walking alongside them or riding on the outside."[76] The Israelis began to use their Merkava tanks, which have a rear entry compartment that can store ammunition or carry some infantrymen, as a means of transporting limited numbers of infantrymen with tanks.

Dissatisfaction with the defensive nature of the 1976 doctrine lead to a substantial debate within the U.S. Army. Among other factors which caused the army's basic doctrine to change again were the results of numerous computer war games and other exercises that indicated that it would not result in victory. The 1982 version of FM 100-5, Operations, restressed the offense and the offensive aspects of defense, the counterattack. This new doctrine is based on gaining and maintaining the initiative and exercising it aggressively to defeat the enemy. It envisions that success will depend upon initiative, depth, agility, and synchronization. Collectively, they imply an offensively spirited, pro-active force that seeks to act faster than the enemy and to maximize its combat power through unity of effort of combined arms resulting in the disruption of the enemy plan and destruction

of his forces throughout the depth of the battlefield.

In the mid-1960s, the U.S. Army began a long study, delayed by its involvement in the Vietnam conflict, to produce a mechanized infantry combat vehicle that would be a fighting vehicle, not just transportation. The fielding of the M2 Bradley IFV coincided with the 1982 version of FM 100-5. As the U.S. Army works to incorporate these operational concepts into its other tactical manuals it also faces the task of determining how this complex new system will fight as part of the combined arms effort.

Summary

The principal lesson of this historical review is the consistent, almost absolute, requirement for the various arms to fight together to insure success. A great number of the tactical failures in this century seem to hinge on an improper application of combined arms. These failures take various forms. Some can be traced to the lack of training of the various arms to cooperate and to mutually support each other on the battlefield, as the British experienced at Cambrai; others are the result of equipment and organizational shortfalls, like the Soviets lack of armored infantry in World War II; and still others reflect the lack of a coherent combined arms doctrine, like the Israeli "all tank" orientation of 1973.

Certainly, the lessons of combined arms warfare should contribute significantly to the development of fighting doctrine for the BIFV. As the lengthy Soviet debate indicates, these will not be quick and easy decisions.

ENDNOTES - CHAPTER 3

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30. There was and is general confusion about the terms "motorized" and "mechanized". In the interwar years they were often used interchangeably. It appears that the term "motorization" was the more general term which referred to equiping forces with motor vehicles, armored or not. The "mechanization" generally referred to equiping troops with track laying, armored vehicles. That the Soviets refer to their armored infantry as "motor rifle" troops highlights the cross usage of terms.

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CHAPTER 4

INFANTRY ROLES AND COMBINED ARMS

The evolution of combined arms cooperation from World War I until today reveals some interesting trends. Ignoring for the moment the important contributions of the other arms, several aspects of tank, infantry, and artillery units and their interaction become apparent.

The Evolution of Infantry

Since the beginning of World War I infantry roles, equipment, organization, and capabilities have become more complex and diversified. In 1914, infantry companies and subunits were armed almost exclusively with rifles; they were tactically footmobile; and they gained protection from the spade. Before that war was over, infantry also fought with machine guns, mortars, grenades, light automatic weapons, and rudimentary anti-tank weapons. While tactical mobility remained basically the same, infantry did increase its protection through dispersion and open order tactics. During World War II portions of the infantry gained tactical mobility through the use of motor vehicles and the development of airborne forces. Protection was increased for some infantry through the use of armored vehicles. Infantry

added anti-tank rockets and towed guns to its arsenal along with vehicular mounted automatic weapons. During the atomic and nuclear ages infantry acquired additional firepower in the form of recoilless rifles, ATGMs, and increasingly sophisticated vehicularly-mounted weapons such as the automatic cannon. Infantry even had tactical nuclear capability when armed briefly with the Davy Crockett. Increased mobility for light infantry was achieved with development of helicopters and air assault units. The contrast between the infantry squad of 1914 and the Bradley IFV squad of today amply reflects the phenomenal increase in technical complexity, weapons diversity, and employment capabilities.

The Evolution of Tanks

At the same time tank roles, equipment, and missions have become more streamlined. In World War I tanks provided infantry support. By World War II they had developed into mobile, protected firepower systems. Such systems could not only support infantry, but also capitalize on their speed, shock action, and firepower to maneuver as tank units to attack an enemy flank or rear area, disrupting or destroying his relatively soft rear units and installations. As tank versus tank encounters increased in frequency, tank guns were enlarged to add tank killing as a major role. By the end of World War II, the tank was universally recognized as the best anti-tank system.[1] From 1945 until today tank developments

have stressed increased armor protection, speed, mobility, and firepower to permit tanks to successfully combat other tanks in battle.

While becoming more technologically complex, tanks have become less capable of engaging soft targets. The basic loads of most modern tanks today consist almost entirely of kinetic energy anti-tank rounds. Against soft targets these rounds produce gross overkills or, if no vital spot is hit, they can pass right through a target with almost no effect at all. Tanks carry neither the variety nor the amount of ammunition that are needed to have the best effects against an array of non-tank targets. The standard on-board load of main gun ammunition for an M60A3 tank is 63 rounds comprised of about 5 white phosphorous rounds used for smoke, 18 high explosive anti-tank rounds used against non-tank armored vehicles, and 40 sabot-type kinetic energy anti-tank rounds. The M1 Abrams carries only 55 rounds the majority of which are kinetic energy anti-tank rounds. When equipped with the 120mm main gun in the near future it will carry only about 40 rounds, virtually all kinetic energy rounds.[2] In the target-rich environment expected on the modern battlefield, U.S. tanks must concentrate on destroying the great number of Soviet tanks and must resist the temptation to engage with anything but machine guns the proliferation of softer vehicles that the complementary systems can destroy. Tanks have, in effect, become almost exclusively tank killers.

The Evolution of Artillery

Artillery has also changed. In World War I it went through a drastic metamorphosis from a primarily direct fire system to an indirect fire one. It became a system for mass destruction. During World War II artillery developed into a more mobile arm able to keep pace with the mechanized units that it supported. It was still the greatest killer on the battlefield because the preponderance of field armies was still the marching infantry. In the nuclear age it has been armed with nuclear warheads, giving it a true mass destruction capability. In conventional roles it has been focused on suppression as the degree of soft targets on the battlefield decreases and the threat of missiles and infantry anti-tank weapons increases. Today, artillery roles such as direct fire for suppression and indirect fire to destroy moving point targets, such as tanks, are being considered in several armies. From World War I to today, the artillery remains a vital component of combined arms. It provides firepower, it maneuvers with forces that it supports, and it protects friendly forces through suppression and counterfires on enemy artillery.

Requirements of Combined Arms

The lessons of history clearly point out the requirement for the various arms to fight together to insure success. A great number of the tactical failures in this century seem to

hinge on an improper application of combined arms. Weapons have frequently seemed to be able to fight and win by themselves. However, in practice no one weapon or type of unit has been able to successfully defeat a combined arms enemy.

Focusing on tank-infantry cooperation, it is apparent that infantry needs the mobile, protected firepower that tank or tank-like systems can provide. This original reason for tank development remains valid today. As the post-World War II General Board studies reflected, close tank support of infantry goes beyond the obvious effect of merely providing mobile, protected firepower:

> The uniformly better performance of infantry, in any operation, when closely supported by tanks is probably the biggest single tactical lesson of the European Campaign. Frequently tanks were employed primarily as close support weapons, but regardless of their role they materially enhanced the aggressiveness of infantry in the attack and its staying power in the defense.[3]

On the other hand, tanks require infantry support. As the cited examples of the British in World War I, the Russians in World War II, and the Israelis in the 1973 War amply demonstrate, tanks face an array of battlefield hazards that dictate the close support of infantry.

The necessary proportional mix of tanks and infantry (and other supporting arms and services) vary with the factors of METT-T. Certain missions, terrain, and enemy

considerations require tank-heavy forces while other conditions require infantry dominated forces. In the final analysis, however, commanders of combined arms forces must have at their immediate disposal all of the types of forces necessary to quickly react to the changing tactical situation.

Infantry Requirements in Combined Arms

The foregoing analyses of the battlefield and of combined arms suggest a broad range of infantry tactical missions on the increasingly complex modern battlefield. In general terms, the U.S. Army requires infantry:

-whose primary tasks involve close cooperation with tanks;
-that can go to ground to defend fortified areas and strongpoints;
-that can attack fortified positions and create initial penetrations for exploiting forces;
-that can follow and support heavy forces which are pursuing or exploiting;
-that can conduct military operations in urban terrain;
-that can operate in difficult, restrictive terrain like heavy forests, mountains, jungle, or swamps that are not suitable for heavy forces; and
-that can conduct special operations.

To satisfy this very broad range of tactical

requirements, the U.S. Army has a wide variety of infantry units in its force structure: ranger, light, standard, airborne, air assault, motorized (high tech), mechanized (M113), and armored (BIFV). While the commonality is the infantryman, each type unit is organized, equipped, and trained to perform infantry missions under different conditions. All infantry subunits can perform core infantry collective tasks such as employing crew served weapons, patrolling, and so on, based on their common individual and collective requirements. Because each different type of infantry is organized, equipped, and trained to address some particular battlefield requirement, each has unique capabilities and limitations that dictate how it can best be employed. Since World War I, no generic infantry has been able to accomplish well all of the increasingly varied infantry functions. The French in World War I, for example, found it necessary to develop specially trained infanterie d'accompagnement to fight in support of tanks.[4]

"Three Kinds of Infantry"[5]

In his article "Three Kinds of Infantry," Colonel Huba Wass de Czege cites the need for three general kinds of infantry in the U.S. Army today, excluding special operating forces such as rangers. They are:

1. Infantry whose primary tasks require high strategic, operational, and tactical mobility most often by Army or Air

Force aircraft and who can fight on rugged and restrictive terrain. He calls this light infantry and notes that there are many variants including airborne, air assault, and so on.

2. Infantry whose primary tasks involve holding ground, defending positions, or attacking fortified positions. He calls this regular infantry.

3. Infantry whose primary tasks include close support of tanks. He calls this armored infantry.

Light Infantry. Infantry in this general category is lightly equipped. Its strength lies in infantrymen, highly trained for small unit, independent operations. Light infantry is not designed to hold ground; it is, therefore, primarily a offensively oriented force.[6] The fact that light infantry forces are designed for rapid air transportability and for combat in rugged terrain means that they will most often not fight in close cooperation with tanks. They rely predominantly on man-portable weapons and receive their fire support from light, air-delivered, vehicular mounted weapons and airpower. Properly employed they obtain protection from the rugged terrain, their ability to move quickly on the battlefield by foot or air, their ability to operate at night, and their small signature. They can operate successfully against other light infantry especially in rugged terrain, such as jungle or mountains. These forces can employ a variety of tactics against heavy enemy forces to tie down superior forces, deny enemy use of road nets through restrictive terrain, and operate against

enemy lines of communications. Light infantry can seize and deny chokepoints, thus slowing the tempo of the enemy's attack. It can fight in cities but is not equipped to create or to defend urban strongpoints, unless significantly reinforces with specialized equipment, tools, and materials.

Regular Infantry. Regular infantry is also infantry intensive, but it is more heavily equipped than light infantry. It employs available transportation to move soldiers and equipment to battle but fights on the ground. It accomplishes the lion's share of the traditional infantry missions of holding ground. It also attacks dismounted to penetrate prepared enemy defenses so that heavy mobile forces can break through and exploit or pursue. It can then follow and support the more mobile heavy forces. Regular infantry is trained to fight defensively or offensively in urban terrain. It requires a full range of supporting arms, especially tanks whose primary role becomes infantry support. As the infantry in World War II and Korea required the support of tanks, so will the regular infantry envisioned here. These tanks should carry a full array of ammunition types, including HEP, smoke, and anti-personnel rounds.

Armored Infantry. Armored infantry focuses on the advance of the main battle tank.

Desired Characteristics of Armored Infantry

First and foremost, armored infantry must have a tough, capable dismounted infantry component. On-the-ground infantry skills must be highly developed, in part because there are fewer infantrymen in armored infantry units than in others standard infantry units. Unfortunately, infantry skills tend to atrophy in mechanized infantry units. Training often orients on mounted skills and maintenance. Mechanized soldiers can easily grow too comfortable with "riding around on the battlefield." They can quickly become reluctant to leave the perceived safety and comfort of the "mother ship," especially at night, in inclement weather, or in rough, physically demanding terrain.[7] This is not a new phenomenon. Colonel E.M.Lloyd wrote of the ancient Persians:

> Cyrus taught his mountaineers to look upon it as discreditable for any man who had a horse to go on foot. In the open plains of Mesopotamia he had found that he must have cavalry to reap the fruits of victory; but infantry never reaches a high standard were foot service is despised.[8]

Armored infantry could suffer from these tendencies to an even greater extent. The perception that it can and should fight mounted, the pressure to move rapidly with advancing tanks, and the natural reluctance to separate vehicle and infantry all potentially contribute to an disinclination to dismount. Leadership must be high quality

and training of dismounted elements must be demanding.

Second, because armored infantry must accompany the main battle tank into battle, it must be equipped with armored vehicles that can closely match the protection and cross country mobility of tanks. Shortcomings in armored infantry mobility or protection may cause tanks to either slow and delay their operations or to separate from the infantry; thus, the infantry fails to effectively complement the tank force. Truck mounted infantry accompanying tank forces in World War II lacked both of these vital capabilities, as does the M113 armored personnel carrier used in mechanized infantry battalions in the U.S. and other armies today.

Because armored infantry vehicles may often have to stop to dismount their infantry, ideally they should be faster than tanks. A major strength of the German Marder and the Soviet BMP is their speed relative to the tanks they support; they can quickly close on accompanying tanks after stopping to discharge or recover their infantrymen.

While tank-like protection is desired, it is seldom achieved in infantry vehicles for many reasons. Armored infantry vehicles are often designed as a compromise between requirements for a heavily armored infantry vehicle that can survive the same hit as a tank and requirements for a light, agile vehicle that can fill a wide variety of battlefield roles for cavalry as well as infantry. Besides the obvious

economic and financial reasons for settling on less than optimal protection for infantry vehicles, there were practical reasons for lighter armor. Armored personnel carriers had to be amphibious and, in the U.S. Army after World War II, had to be air transportable. Tactically, carriers were not thought of as fighting vehicles, with the notable exception of the Germans. In their 1941 instructions for motorized infantry the Germans state

> The possession of armored personnel carriers enables motorized infantry units to overcome weak opposition without dismounting. They can follow up tank attacks on the field of battle without dismounting. Motorized infantry is characterized by the ability to alternate rapidly between fighting from carriers and fighting on foot...Owing to the lack of sufficient armor, motorized infantry cannot fight from their trucks.[9]

The key word in this quotation is "sufficient," as the German half tracks were not as robust as tanks, either. They were capable of protecting mounted troops from the effects of most infantry weapons and depended on speed, agility, and suppressive fire to avoid heavier fire. When the tank-infantry force came under heavy fire, it was to maneuver around it, if possible, or to dismount infantry to eliminate the threat, supported by the fires of the tanks and half tracks and usually under the cover of smoke.

As General Adan of the IDF has observed, the quest for perfect protection is an endless and frustrating endeavor.

> From the outset of the historic competition between the production of armored vehicles and the

> development of armor-penetrating weapons, those working on the latter had the upper hand. Whenever a heavier tank appeared on the battlefield, its advantage was short lived. A new armor-piercing shell or antiarmor missile would soon be developed that could penetrate the new tank. It was not by strengthening the vehicle's passive penetration withstanding capacity that this problem could be overcome but by increasing survivability by means of improved battlefield tactics. Like the tank, the armored personnel carrier seeks to enhance its survivability by means of high mobility and increased firepower. Its high mobility and agility enable it to move more quickly out of fire-blanketed areas. Its high rate of firepower enables it to suppress sources of fire and prevent them from endangering it.[10]

Armored Infantry Tasks

What are the actual tasks that armored infantry must perform in supporting tanks? Armored infantry focuses on matching its infantry capabilities to complement tank limitations. As tank formations have primarily an offensive orientation, armored infantry must also be so oriented. Even in the defense it accompanies tanks in the fluid aspects of defensive combat, such as the counterattack. Armored infantry supports tanks by overcoming those battlefield hazards that restrict armor operations.

A primary mission for armored infantry is to sustain the forward movement of tanks through difficult or obstructed terrain. This includes removing obstacles, lifting mines, and clearing emergency paths through minefields. These typical combat engineer tasks are vital. Engineers cannot be everywhere, especially considering the fact that in the U.S.

Army they are not equipped with vehicles that can maintain the pace of the M1 Abrams and M2 Bradley team. The French infanterie d'accompagnement of World War I was trained to "act as assault pioneers" as well as "to provide close-in protection, to clean up with rifle and grenade, small nests of enemy resistance..."[11] In World War II the Germans charged their armored infantry with preparing "the ground for the employment of tanks by clearing a way through country difficult or impossible for tanks."[12]

In forests and urban areas where tanks are particularly vulnerable, infantry protects tanks through all-around observation, suppressive fires, and dismounted operations to clear chokepoints and root out enemy infantry. Not only do tanks have blind spots and close-in dead zones, but in narrow streets and close woods they often cannot freely traverse their turrets, making them susceptible to infantry attacks if not protected by friendly infantry. Armored infantry also uses dismounted soldiers and its amphibious capabilities to make assault river crossings, establish bridgeheads, and provide far shore supporting fires for crossing tanks, as the German infantry did at Sedan in 1940. Interestingly, the German Marder is the only modern armored infantry fighting vehicle that is not amphibious.[13]

Armored infantry also combats enemy forces which complement enemy tank formations, thereby reducing the synergistic combined arms effects for the enemy. This

includes suppressing and destroying enemy anti-tank fires. Most armored infantry vehicles and infantry elements are equipped with weapons designed to be effective primarily against enemy infantry, their vehicles and equipment. Armored infantry mops up pockets of resistance, consolidates gains of the armored force, and exploits and pursues with tanks.

Some modern armored infantry vehicles, like the BMP, Marder, and Bradley, are equipped with firing ports, permitting mounted infantry to deliver fires while under armor. These fires are primarily burst-on-target, limited range, small arms suppressive fires. C.N. Donnelly, a noted Soviet expert, has remarked that in recent studies the Soviets have found that their firing port weapons are extremely inaccurate and can be used to suppress only the weakest of defenses.[14] While this capability does allow armored infantry so equipped to maintain pace with tanks more readily, less than optimal protection and the questionable value of the firing port weapons makes fighting mounted a risky alternative.

Many modern IFV's have automatic cannons that are not only deadly against lightly armored vehicles but are also effective against the growing anti-tank helicopter threat. After the tank main gun, the "next greatest threat [to tanks] is from the air, from fixed and rotary wing aircraft alike."[15] The automatic cannon may be a natural for

engaging slow moving aircraft but surface to air cannon fire requires substantial ammunition.

IFV's equipped with anti-tank weapons, such as ATGM's, can supplement tanks in destroying enemy armor. Long range ATGM's give the IFV the capability to effectively overwatch tanks. This capability may be best exploited in desert terrain where the virtually unlimited line-of-sight can give ATGMs a definite advantage over tanks.

Lastly, infantry can protect tanks in assembly areas and at halts by dismounted patrols, observation posts, and listening posts.

Anticipating eventual reductions in the crew size of future main battle tanks, Richard Simpkin argues for an additional list of "in-house infantry" chores in support of tanks. The mundane, but important, services he mentions include minor repairs (such as reattaching thrown track), tank crew recovery, tank crew rotation, and vehicle recovery.[16] These tasks seem more appropriate for a closely following combat service support element from the combat trains.

Relative Merits of the M113

To accomplish these armored infantry tasks the U.S. Army has depended for the last two decades on mechanized infantry

equipped with the M113 armored personnel carrier. The M113 has long been recognized as a substandard vehicle for infantry whose primary role involves supporting tanks. As mentioned above, it lacks the degree of protection necessary to fight on the same terrain as tanks; it is vulnerable to most weapons employed by Soviet motor rifle troops, as well as to the proliferation of tank and anti-tank systems expected in Soviet formations. It lacks the mobility necessary to keep pace with the U.S. Army's new main battle tank, the M1 Abrams. The M113 also lacks the firepower to destroy the BMP and other Soviet infantry carriers. Lastly, the M113 offers no protection to the gunner and limited opportunity for the squad being transported to orient on the battlefield before dismounting.

Despite the shortcomings, the M113 offers many advantages to infantry which does not have to fight in close support of tanks. First, the M113 does provide some degree of protected mobility to soldiers being transported. It provides protection from shrapnel, small arms, and limited reduction of the harmful effects of chemical and nuclear hazards. Second, the M113 is relatively cheap, mechanically reliable, adaptable to a wide array of uses, and plentiful. It represents a ready source of transportation for the regular infantry described above - infantry that fights on the ground but requires transportation and the ability to haul the volume of munitions, materials, and equipment needed to effectively build and defend fortified positions or to

attack fortified enemy positions.

Relative Merits of the M2 BIFV

With the introduction of the M2 BIFV, the U.S. Army has a much more capable vehicle for armored infantry. The M2 is not just an infantry carrier, like the M113, but a fighting vehicle system, as its capabilities below reflect.

Maneuver. The Bradley has the speed and cross country mobility to stay with the M1 Abrams. It carries a squad of nine men who can fight from the vehicle, two men in the turret and six using vision blocks and firing ports to deliver small arms fire. These six men can dismount and perform minor independent infantry tasks or become part of a larger dismounted platoon force. Three men remain with each vehicle to drive and man the turret. The Bradley is amphibious after some preparation.

Firepower. The Bradley is a potent firepower system. Besides the man portable weapons that the dismounted element employs, it has four on-board weapons systems: a two-tube TOW ATGM system, a 25mm stabilized automatic cannon, a 7.62mm coaxial machine gun, and the firing port weapons mentioned above. The TOW, cannon, and machine gun are mounted in a two-man turret with a sophisticated fire control system including thermal imaging capability which can passively "see" at night and through obscurants.

Protection. The Bradley is fitted with space laminated armor that provides protection against automatic weapons up to 14.5mm and against airbursts from 155mm artillery. It has been tested against a Soviet RPG 7 type weapon without catastrophic destruction.[17] While it does not have the ability to withstand the same direct hit as the tank its supports, it relies on its speed and agility and on the suppressive and standoff capabilities afforded by its firepower to secure increased protection. As Clifford Bradley of the U.S. Army Tank Automotive Command has written,

> From a technical standpoint, any significant increase in the armor weight of the M2 would have an adverse effect on the vehicle's automotive performance and RAM [reliability, availability, and maintainability] characteristics, and these degradations could reach unacceptable limits long before any appreciable or meaningful increase in protection could be obtained against a high intensity battlefield threat.[18]

In addition to its less than desired protection, the Bradley equipped infantry has other notable limitations.

A full strength Bradley infantry squad can normally dismount only six infantrymen. A platoon can therefore aggregate only about twenty men as a dismounted element. However, U.S. Army units with the highest priority are seldom at full authorized strength; deployable strengths run lower, especially in wartime.

The major weapons systems on the Bradley (TOW, 25mm

cannon, and machine gun) cannot be dismounted and employed on the ground as part of a positional defense.

Squad and platoon leaders are faced with the decision of remaining with the vehicle or going with the dismounted element when the tactical situation requires dismounted operations.

Bradley Employment Considerations

These characteristics of Bradley infantry indicate that it is not suited for those infantry tasks that require holding ground or conducting manpower intensive activities. Bradley infantry is not optimally organized or equipped for positional defenses, strongpoints, or dismounted operations to attack fortified enemy positions. It is organized and equipped to cooperate with tanks and to conduct mobile operations.

As the Bradley is being fielded, there has been significant discussion among doctrine writers about how the Bradley equipped infantry should be employed. The principal concerns center on when and where the infantry should dismount, which leaders dismount, and what is the proper role of the IFV once the squad dismounts. These concerns are not too different from those of the Soviets and the Germans over the last twenty years as they considered how best to employ their infantry fighting vehicles. The solutions in great

measure depend on the situation. This trite but true reply does not satisfy the need to address how IFV equipped infantry should be trained and employed to optimize its capabilities as part of the combined arms team. Several factors established earlier in this study provide guidance for addressing these questions.

1.) Armored infantry focuses on the advance of the main battle tank.

2.) Tanks depend upon the complementary capabilities of infantry and benefit from the supplementary effects.

3.) In general, complementary aspects of combined arms are more vital than supplementary functions as they cannot be replicated by the other arms.

When one examines those systems which constitute the Bradley equipped infantry, only the dismounted infantry capability is truly complementary. The ATGM fires supplement the tank-killing capability of the tank force being supported. The coaxial machine gun matches a tank capability and is also supplemental. The 25mm cannon can destroy non-tank vehicles within the range of the tank's main gun and in that regard it is a supplemental system also. However, as tanks become increasingly limited in the variety and amount of ammunition for other than tank engagements the 25mm cannon may be pushed toward becoming a complementary system. It is certainly the more cost effective means of attacking non-tank targets within range. If the 25mm cannon can demonstrate its

effectiveness against rotary winged aircraft it will become a recognized complementary component of the Bradley system supporting tank forces, especially if tactical air defense systems remain equipped with vehicles unable to maintain the pace of the M1/M2 team. The Bradley itself could be considered complementary to the tank because of its water crossing capability.

As tanks require infantry and as the dismounted infantry is the true complement to tanks, the operations of the dismounted forces should be a paramount concern to the Bradley force commander.

When and where the infantry should dismount depend on two general factors: where the tanks need the support and where the Bradley can safely deliver them in light of the enemy threat. Certainly the tactical situation and the desired tempo of operations will affect the decision. Infantry will dismount to observe, provide security, patrol, breech and emplace obstacles, fire and maneuver on enemy positions, and mop up and consolidate overrun defenses. Of these, the mission that is most challanging is the assault of enemy defenses. The Soviet solution appears to be to dismount as close to the forward edge of the enemy defenses as the enemy situation permits. As the concluding article in the Soviet Military Herald series of letters on BMP tactics, General Colonel Viktor A. Merimskiy, then Deputy Chief of Combat Training of the Soviet Ground Forces, wrote

that while the dismount point depends heavily on the factors of METT-T,

> in all circumstances the commander must strive, first, to make the line of attack and the line of dismounting as close as possible to the forward edge of the enemy's defenses. Second, he must take the necessary steps to protect the dismounted riflemen from machine gun fire and the BMPs from being hit by short-range antitank systems. Third and finally, he must provide for the maximum use of the firepower of the BMPs and provide an opportunity to conduct effective fire with automatic weapons of the motorized riflemen in order to destroy the enemy's forces and firing system.[19]

C.N. Donnelly summed up the remarks of Merimskiy and others on the BMP debate as follows. Although Merimskiy would not be pinned down to a normal distance, the contributors to the BMP debate generally agreed that it was unwise for infantry in BMPs to approach closer to the enemy defenses and their own preparatory artillery barrage than 300 meters. Normally dismounting will occur between 300-400 meters but never more than 1000 meters. Infantry should always dismount as close behind the tanks as possible and should assault with the tanks, suppressing enemy infantry and antitank systems with small arms fire. At no time should the riflemen fall more than 200 meters behind the tanks as their small arms fire will then be ineffective. Attacking sections of infantry will insure that there are gaps in their attack formations so that BMPs trailing 300-400 meters behind can support by fire through these gaps. The attack must be synchronized so that artillery is not lifted prematurely leaving tanks and infantry at the mercy of relatively

unsuppressed defenses. Lastly, as a general rule, the Soviets will avoid using BMPs in the first echelon of an assault on a prepared defense when any suitable alternative exists.[20]

The German solution seems to expect that armored infantry will attack mounted, mixed in close formation with tanks. Infantry will dismount to solve tactical dilemmas but will mount the vehicles again quickly to sustain the tempo of the attack. In the defense armored infantrymen fight dismounted from prepared positions.[21]

Which leaders dismount again depends on the situation and the mission of the vehicle system after the infantry are on the ground. The problem is aggravated by the reality that all systems (dismounted squad, TOW, and cannon) cannot usually be optimally employed on the same terrain. The dismounted force does best in close terrain and the vehicle and supported tanks do best in terrain affording long range fires. Tentative solutions within the U.S. Army indicate a recognition of the importance of associating selected primary leaders (platoon leader and some squad leaders) with the dismounted element while other leaders (platoon sergeant and the rest of the squad leaders) habitually remain with the vehicles. Insuring that some battle oriented leaders who have been in the turret up until the time of dismounting (and are therefore well oriented on the battle), accompany the dismounted element is a driving consideration.

Simpkin points out three general possibilities for the Bradley vehicle once the infantry dismounts:

1.) it can be handled conservatively to retain at all cost the capability to pick up the squad once the dismounted mission is complete.

2.) it can be separated from the infantry and sent on independent missions, capitalizing on its own tank like qualities; or

3.) it can be employed to support by fire the infantry in the conduct of the dismounted mission.[22]

The conservative option ignores the capabilities of the Bradley and wastes potential combat power. While this method certainly offers the safest means of retaining the protected mobility of the infantry, it reduces this complex fighting system to the same tactical status of the M113 - a carrier only.

The option of sending unladen Bradley IFVs on independent missions or to move them with tanks on an axis independent of the dismounted element is similar to the method preferred by the Germans in defensive battles. This option offers the potential advantage of putting both the dismounted and vehicle systems on terrain where each of their separate capabilities can be maximized. There are significant disadvantages. As previously shown, tanks will

often require close infantry support. IFVs acting as tanks, it would seem, need similar support. Independent fire and maneuver missions, out of the immediate effective range of dismounted infantry, leave the IFV force subject to the hazards of enemy obstacles and infantry and leave the dismounted element without the potential fire support of its vehicles. The infantry's much needed protected mobility is at greater risk. Despite its more varied firepower, speed, and agility, its limited armor protection makes it more vulnerable to these hazards than tanks. The Bradley IFV was not intended to operate as a tank.[23]

The option of keeping the Bradley in support of the dismounted element is the method preferred by the Soviets. General Merimskiy stated the "greatest result in an attack can be achieved when the BMPs support the riflemen and tanks with their fire."[24] That, of course, seems to be the best option when the terrain and tactical situation permit it: tanks are closely supported by infantry and the combined tank infantry force is supported by the IFV's suppressive and destructive firepower. As Simpkin wrote,

> In offensive forward movements at all levels, both in the attack and within the framework of an aggressive defense, <u>armored</u> infantry maintains the mobility of tanks; the IFV supports both the tank and its squad and maintains the mobility of both.[25]

While the conduct of independent operations by unladen Bradley IFVs is not optimal, occasions may occur when a Bradley-equipped infantry force is required to operate

without tanks. While IFVs cannot be handled as boldly as tanks, especially when loaded with infantrymen, an armored infantry pure force can conduct limited independent operations. During the Soviet BMP debate, there was substantial agreement that BMP forces were suitable for certain missions where speed and agility were a decided advantage. In considering such missions as reconnaissance, forward detachment, or deep raids in enemy rear areas, the Soviets presume there are no substantial defenses to penetrate.[26]

Bradley-equipped infantry could certainly be employed in similar fashion if the situation dictated. The break-up of the tank-armored infantry combined arms team, however, potentially reduces the overall effectiveness of the combined arms force. A situation in which such a mission could be effective is in the execution of the exploitation by the armored force. Tank-heavy forces could be used to block or defeat counterattacking enemy armor while armored infantry attacked to capture and destroy soft rear area installations against which tank fire is less effective. The IFV may well be a better exploitation vehicle than the tank, but armored infantry depends on tanks for protection from other tanks in most tactical situations.

There is another position, proposed by some at the U.S. Army Infantry School, which envisions Bradley-pure forces fighting positional defenses thus freeing tank forces to

maneuver.[27] While feasible under certain METT-T conditions, in most cases this solution seems to represent a sub-optimal use of force capabilities. A case can be made for Bradley-pure defenses, for example, in desert environments where line-of-sight factors favor ATGMs. A pure Bradley-equipped force could be employed effectively in a positional defense to block or fix an attacking enemy force, permitting a tank-heavy force to maneuver to attack the enemy flank or rear. Similar tactics were used by Rommel as he lured enemy tank formations into attacking his anti-tank defenses. With favorable terrain and superior range, he fixed and destroyed enemy armor while his own armor outflanked the enemy to counterattack into softer, more vulnerable rear area forces and threatened lines of communications.

However, the relatively closed terrain of Central Europe denies ATGMs a range advantage most of the time, reducing the effectiveness of a Bradley-pure defense. In Europe a more effective and efficient solution seems to involve the cooperation of regular infantry, armored infantry, and tanks. The regular infantry, transported to its defensive positions by M113s, can establish a strong positional defense (anvil), supported by some tanks and its organic ATGMs, ITVs. The bulk of the armor and armored infantry, more suited for the fluid battle, can become the hammer, counterattacking to the flank or rear of the enemy.

Summary

No analysis can consider every tactical variant. The factors discussed here indicate that Bradley-equipped infantry is the best equipped infantry in the U.S. Army to perform as armored infantry - to focus on the advance of the main battle tank. In so doing it must focus on its complementary capabilities, the dismounted infantry and the 25mm cannon. Its other capabilities are supplementary and, while important, they can be replicated in kind by tanks.

Armored infantry moves and fights in close support of tank forces. How close depends on METT-T; in most cases the actions of the dismounted infantry must affect the same portion of the battlefield upon which the tanks are operating.

The great temptation to view the Bradley IFV, with its turret, firepower, mobility, and protection, as a light tank must be avoided. The primary purpose of the vehicle is to move infantry with tanks under armor. Although Bradley-equipped forces may take on limited independent missions, they can do so only when the general situation greatly reduces the need to fight as a close, mutually supporting combined arms force.

The optimal role for unladen IFVs is to support by fire the dismounted elements and the tanks they complement.

Unless the U.S. Army reorients its infantry doctrine, the Bradley infantry will suffer the same role confusion and frustration that is symptomatic of the mechanized infantry in M113s. It will be employed in roles and given missions for which it is ill-equipped, organized or trained.

ENDNOTES - CHAPTER 4

1. Types of Divisions-Post War Army - General Board Report #17 , Headquarters, Headquarters, U.S. Forces, European Theater, 1945.

2. von Senger und Etterlin, Tanks of the World 1983, pp. 729-738.

3. Types of Divisions-Post War Army - General Board Report #17, p. 8.

4. Ogorkiewicz, p. 386.

5. Colonel Huba Wass de Czege, "Three Kinds of Infantry," p. 1.

6. General William R. Richardson, Kermit Roosevelt Lecture. Lecture delivered to the Royal College of Defence Studies, 23 May 1984. In this speech General Richardson discussed the orientation and employment of the U.S. Army's new light infantry units.

7. The degradation of infantry skills in mechanized infantry has been noted often in recent military literature, such as Richard Simpkin's Mechanized Infantry and John English's Perspective on Infantry. Perhaps more significantly, it was noted by BG Edwin Burba, Deputy Commandant of the U.S. Army Infantry School, in an unpublished paper entitled "M2 Doctrinal Concepts." See page 26.

8. Colonel E.M. Lloyd, A Review of the History of Infantry (London: Longmans, Green and Co., 1908), p. 1.

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14. C.N. Donnelly, "Tactical Problems Facing the Soviet Army," International Defense Review, (9:78) p. 1407.

15. Richard Simpkin, Mechanized Infantry, p. 43.

16. Ibid, pp. 43-57.

17. LTG Fred K. Mahaffey, "Bradley Fighting Vehicle Systems (BFVS) - Information Memorandum," Washington, D.C.: Department of the Army, Office of the Chief of Staff for Plans and Operations, 7 Mar 1983.

18. Clifford D. Bradley, "The Future IFV," Infantry, Jul-Aug 1981, p. 27.

19. General Colonel Viktor A. Merimskiy, "The BMP in Combat," in The Soviet Art of War. Ed. Harriet F. Scott and William F. Scott. (Boulder, CO: Westview Press, 1982), p. 285.

20. Donnelly, p. 1407.

21. The German view of armored infantry tactics are described in articles by Simpkin, Walter, and Klaffus. The report from the TRADOC liasion with the German General Army Office entitled "Concept and Operating Principles of the German Armored Combat Troops" is also helpful.

22. Richard Simpkin, "When the Squad Dismounts," Infantry, (Nov-Dec 83) 15.

23. Mahaffey, p. 3.

24. Merimskiy, p. 285.

25. Simpkin, "When the Squad Dismounts," p. 17.

26. Donnelly, p. 1407.

27. BG Edwin Burba, Deputy Commandant of the U.S. Army Infantry School, which has responsibility for developing tactical doctrine for Bradley infantry, has written a "think piece" entitled "M2 Doctrinal Concepts." This unpublished document presents his thoughts on Bradley tactics and is illustrated with a number of situational examples. Some of these examples show Bradley infantry fighting relatively independently, not in close cooperation with tank forces.

CHAPTER 5

CONCLUSIONS

This study has focused on determining an optimal role and orientation for Bradley equipped infantry in the U.S. Army today and in the next decade. It is not an attempt to prescribe in detail the tactics used by Bradley infantry, to bemoan its shortcomings, or to recommend a redesign for future IFVs. Rather, given the Bradley IFV, how should infantry equipped with it maximize its potential contribution on the modern battlefield?

As the U.S. Army fields the Bradley IFV it must reflect on the many changes that this and other modernization efforts will have on the way the army fights. This study suggests, in light of the expected threat, terrain, other battlefield conditions, and the lessons of modern military history, that several prudent actions should be considered by the U.S. Army in order to maximize its combat capabilities. These can be summarized under the paradigm of doctrine, weapons, and soldiers used earlier.

Doctrine

For years the shortcomings of the M113 have left the

U.S. Army without infantry that could fight effectively in close mutual support of tanks. Mechanized infantry with inadequate protection for the task adopted a role and orientation for which it was better equipped. Its inability to support tanks closely caused many to doubt the requirement to do so. The mismatch between tank force requirements for close infantry support and the lack of capability of M113 equipped infantry to provide it, have contributed to the confusion about tank-infantry cooperation and the role of mechanized infantry.

The adoption of a maneuver-oriented AirLand Battle doctrine described in the 1982 publication of FM 100-5, Operations, and the introduction of the M1 Abrams and the complex M2 Bradley IFV demand a reexamination of infantry roles. As each mechanized infantry battalion is reorganized and reequipped with Bradley IFVs it must also be retrained and reoriented as armored infantry. The battalion can no longer tackle with the same degree of success the missions of positional defense and dismounted attack of a fortified position that it could as mechanized infantry. It lacks the dismounted infantry strength and the capability to dismount weapons into a fortified defense or strongpoint. The battalion can, however, accomplish the job of cooperating with tanks in the fluid defense, attack, counterattack, exploitation, and pursuit much more effectively than it could before. It has the increased protection, firepower, speed, and mobility to fight with and support the main battle tank

force.

The optimal role for Bradley infantry is as armored infantry in close support of tanks in offensive operations and in the mobile aspects of defensive combat. Working together, tanks, Bradley IFVs and dismounted infantry form a complementary combined arms team that must focus on the same engagement and not be piecemealed into separate engagements where the mutual supporting effects are lost.

M113-equipped infantry still has a role. As the analysis of the European battlefield has shown, much of Central Europe favors the use of dismounted infantry, supported by tanks and other weapons, in positional defenses. The substantial amount of urban, forested, and undulating terrain offers ample opportunities for employment of regular infantry which can go to ground to take advantage of natural and man-made cover and concealment, limited observation and field of fire, and the opportunities to reinforce terrain with mines and obstacles to slow and canalize Soviet mechanized formations. Employing heavy forces with M1s and M2s in open terrain and in depth behind these positional defenses and strongpoints offers the opportunity for fluid maneuver battles and counterattacks which optimize the attributes of heavy forces. The U.S. Army should consider, therefore, maintaining some M113 equipped <u>regular</u> (mechanized) infantry in Europe for many of the defensive roles for which it is now prepared. The U.S. Army should

field armored infantry (Bradley) battalions for the specific purpose of cooperating with main battle tank battalions.

In light of rapid reinforcement requirements and constrained air and sea lift, the U.S. Army might consider establishing a stockpile, or POMCUS sets, of M113s to provide protected transportation for other regular infantry which quickly deploy to Europe. Under the old pentomic division structure, transportation units of pooled APCs were assigned to infantry divisions to provide infantry (that fought dismounted) with the protected mobility to get to and around the battlefield.[1]

Some military critics who strongly favor maneuver warfare think that mobile fighting forces like tanks and Bradley infantry are all that is required. They question the survivability of dismounted regular infantry on the mid- and high-intensity battlefield in light of the certain Soviet use of massive amounts of artillery, the probable use of chemical munitions, and the possible use of battlefield nuclear weapons. Against this range of weapons of mass destruction dismounted infantry depends on passive and active means to increase its protection.

First and foremost, dismounted regular infantry must remain undetected. It relies on counter-reconnaissance efforts of covering forces, on its ability to camouflage, and on its general lack of thermal and other signatures given off

by vehicles and radios. Dismounted forces in the defense use wire communications to the fullest extent possible. They construct dummy positions and use lightly held combat outpost lines to deceive the enemy. Once the enemy has expended its massive fire preparation on the "wrong hill" it may be strained logistically and tactically to quickly repeat these preparatory fires on strongly held positions in depth.

Second, dismounted infantry relies on the earth for protection. It is the best protection against the immediate effects of nuclear weapons. In Europe dismounted infantry can also seek protection from the proliferation of small towns that dot the countryside every 2-3 kilometers. Regular infantry must be supplied with ample chemical protective gear and with portable decontamination equipment. It may not be able to be pulled from the line to decontaminate at a pre-prepared site. If M113s were available, they could move up from hide positions well to the rear, rendezvous with the dismounted force, and move it from contaminated areas to subsequent or alternative battle positions within the defense as the situation permitted.

Light infantry gains protection from rugged terrain in which it fights, from dispersal in small groups, and from its relatively high tactical mobility in rugged terrain.

Bradley-equipped infantry is not "better" than mechanized infantry. It is just better organized and

equipped for certain infantry roles. Mechanized infantry is "better" than armored infantry in many of the infantry requirements on the modern battlefield. Maintaining M113-transported infantry for positional defenses and other infantry intensive operations certainly seems a more viable solution than converting all mechanized infantry battalions in Europe to the Bradley and forcing them to take on tasks, dictated by the terrain, for which they are ill-equipped. The Germans maintain both armored (Marder) and Mechanized (M113) infantry battalions; the Soviets motor rifle troops consist of both "armored" (BMP) and "mechanized" (BTR) and make the distinction in the types of missions given each. The Soviets use BMP-equipped infantry as the infantry component of tank divisions; in motorized rifle divisions there are two BTR-equipped regiments and one BMP regiment matched with one tank regiment.

A U.S. heavy division with a mix of tank, armored infantry, and M113-equipped, regular infantry would certainly be more versatile than a division with only tanks and BIFVs. While current fielding plans for the M2 BIFVs focus on divisions in turn, the more economical and tactically effective approach may be to create BIFV battalions in each heavy division. BIFV fielding does not necessarily have to coincide with the fielding of the M1 Abrams tank in each division; armored infantry equipped with BIFVs can operate effectively with M60A3 tanks also.

Weapons

The suggestion that the U.S. Army seriously consider building its ground tactical doctrine around a force consisting of tanks, armored infantry, and regular infantry is made in light of several important factors. First, M113-equipped infantry has a viable tactical role. Second, M113-equipped infantry will remain a substantial part of U.S. heavy force structure for many years to come. Third, M113s are cheap reliable and available. If retained, however, the M113-equipped forces require some minor modernization. Protection and automotive performance could be enhanced by adopting the M113A3 version.[2] Additionally, regular infantry needs a better BMP killing capability; the caliber .50 machine gun cannot do it and the DRAGON is often too slow and remains ineffective at night and in reduced visibility.

The history of twentieth century combined arms warfare clearly shows the need to fight as combined arms. While this study has concentrated on the cooperation of tanks and infantry, all arms must work in concert before the true synergistic effects of combined arms are realized. Commanders of combined arms forces must have at their immediate disposal all of the types of forces necessary to quickly react to the changing tactical situations.

A significant dilemma for the M1/M2 task force commander is the inability of many supporting arms and systems, key to

combined arms operations, to maintain the potential pace of the maneuver force. Mortars, command and control, service support, and dedicated anti-tank weapons (ITVs) in the M1 and M2 battalions are equipped with M113 type vehicles. Additionally, engineers, air defense, and artillery and air liaison parties all have M113 type vehicles. Just as the footmobile infantry in World War I outran its non-mobile artillery support, the M1/M2 task force will occasionally be faced with the dilemma of separating from its support arms or having to curtail the tempo of its operations. As the Bradley was designed to eventually accommodate a family of vehicles[3] perhaps it would be prudent to redirect production and fielding plans to provide vehicles with Bradley automotive and protective capabilities for the artillery FISTs and FSOs, air force liaison officers, battalion mortars, engineers, and air defenders who normally accompany and support the heavy task force. The required mobility and protection could also be attained by adopting the cheaper M113A3.

Until the dilemma is resolved, ad hoc solutions will undoubtedly be taken. FISTs equipped with digital message devices (TACFIRE communications devices) may have to ride in the Bradley company commander's vehicle. Stinger or Redeye air defense gunners may have to ride in Bradley platoon vehicles with the already cramped infantrymen. The Soviets include an SA-7 gunner in some BMP squads.[4]

Soldiers

As LTG Arthur S. Collins, Jr. stated in Common Sense Training,

> The infantryman must learn to execute more different missions than the soldiers of any other branch...The most varied and difficult training confronting the combat-arms commander is infantry training.[5]

LTG Collins wrote these words before the U.S. Army fielded the Bradley IFV. There may be no type unit in the U.S. Army, except armored cavalry, whose training requirements are as varied as the Bradley infantry. This infantry must not only train on a fairly wide array of individual and collective infantry tasks, but it must also conduct leader intensive gunnery training at every level from squad to battalion commander. It must train for highly mobile, fluid operations as part of the combined arms team, and it must train dismounted infantry elements.

Any training strategy must be the result of detailed analysis of the individual and collective tasks the unit must be able to execute. The resulting task list for armored infantry, like other units, may seem to be so extensive that the unit and soldiers could never be trained to standard. The task list, therefore, must be prioritized based on the most important roles and missions. Through innovative methods and multi-echeloned training the armored infantry can be trained to accomplish its complementary and supplementary

roles in combined arms operations.

Some of the factors that characterize armored infantry and make it different impact on leader, soldier and unit training.

Leader training. Leaders of Bradley infantry units must think like infantrymen and like tankers. They must think like infantrymen because employment of their dismounted elements is of paramount concern. They must think like tankers for three significant reasons:

(1) Their primary purpose is to focus on the the advancement of the tank force. They must know armor capabilities, limitations, and tactical methods and techniques as well as their own.

(2) Armored infantry leaders will habitually command tanks. Under current U.S. Army methods of task-organizing, Bradley battalions and companies will cross attach to form tank-infantry teams and task forces.

(3) The tempo of operations will be more like tank operations than traditional infantry operations. As Richard Simpkin noted, "A tanker halts between moves; an infantryman moves between locations."[6] In this regard perhaps armored infantry leaders will have to think more like tankers than other infantry leaders do.

The importance of the dismounted element argues for leaders solidly based in infantry tactics. The tempo of

operations and support of tanks argues for leaders who can think and operate at an armor pace. Leader development comes from experience and schooling. Perhaps armored infantry leaders should have the opportunity to attend the armor officer's advanced course or to attend some precommand course specifically oriented on armored infantry-tank operations.

The Germans train all the soldiers who make up their armored forces, including all mechanized infantry at the German Army Armor School at Munster. It is a mission of the school to develop, train and educate leaders, from vehicle commanders to battalion commanders, so that they can lead their armored combat troops using the principles of Beweglichkeit. This term describes a style of leadership in which subordinates are allowed a large degree of freedom to operate. It requires leader mental flexibility and a spirit of command adaptable to rapid changes in location, task organization, mission, and battle conditions.[7]

Perhaps the best leader training comes from the experience of training with leaders of the other arms. As battalions are not permanently of semi-permanently cross attached in peace time training, brigade and division commanders must insure that commanders of tank and armored infantry unit habitually train together.

Armored infantry leaders from squad to battalion are also vehicle commanders who ride in the turret and must be

fully capable of fighting the vehicle systems. While the Army solution appears to be to dedicate certain leaders to the vehicle team and others to the dismounted element, certain key leaders (platoon leader, company commander, etc.) must be fully qualified to fulfill both roles equally well. These leaders will be challenged to balance their personal training efforts between the mounted and dismounted leader tasks.

Collective training. Training as pure Bradley units makes little sense except at the lowest levels, squad and platoon. The organizational concepts for the current army structure call for single-weapon companies (an obvious contradiction in the case of Bradley infantry). Combined arms tactics, however, seem to dictate task organizing tanks and armored infantry at company team level in many instances. There will always be a conflict between the desire to mass tanks, for example, and the actual tactical necessity to mix tanks and armored infantry to realize the desired combined arms effects. While the optimal mix situationally depends on METT-T, tanks and armored infantry must at least fight the same engagement in mutual support for combined arms effects to occur. This will often be at company level.

In keeping with its role, Bradley infantry will focus on training to cooperate with tanks, in offensive and fluid defense missions. In most cases, training for missions like establishing strongpoints, positional defenses, urban

warfare, and so on, will take a low priority. Bradley dismounted elements should train in assault tactics, rapid maneuver through smoke, woods and close terrain to attack enemy positions, patrolling, obstacle and mine clearing and emplacement and other tasks supporting the advance of tanks. Infantry must be able to dismount quickly, orient rapidly, and move out swiftly to accomplish its mission.

Individual training. Except for leaders, gunners, and drivers, armored infantrymen must be trained almost exclusively in dismounted skills. Armored infantrymen must be tough, versatile soldiers who are physically and psychologically prepared to dismount and to fight intensely demanding, rapid-paced battles on the ground. For these men mounted tasks, such as engaging targets with firing port weapons, are low priority, low return for training time endeavors.

By concentrating on a limited range of dismounted tasks and by giving dismounted training a high priority, armored infantry may avoid the degradation of infantry skills that plagued the mechanized infantry.[8] Vehicle maintenance tasks should fall to the driver and gunner under the supervision of those leaders whose primary orientation is the vehicle system.

Armored infantrymen must be trained to a high standard in combat engineer skills. As the combat engineer is an

engineer first and an infantryman second, the reverse is true of the armored infantryman; he must be a sapper-pioneer-combat engineer almost as a secondary specialty. He will often be required to breech obstacles and to open lanes through minefields so that tanks can advance. He must be trained in peacetime and equipped in combat for such tasks.

The small number of soldiers who fight dismounted from each squad compared to the variety of weapons available requires each man to be capable of employing them all. These soldiers must be qualified not only on an array of engineer munitions but on the squad assault weapon (SAW), grenade launcher, automatic rifle, DRAGON medium ATGM, and the M72 light anti-tank weapon (LAW).

Other Concerns

Two additional concerns must be addressed. First, because of its primary role of supporting tanks and because the Bradley IFV appears to be a tank-like vehicle, many argue that Armor Branch should have proponency for armored infantry instead of Infantry Branch. There are good reasons and examples which support either position. On one hand, the German Army seems to enjoy success with all armored forces under its Armor School. On the other hand, as the Israeli mechanized infantry was allowed to languish under its armor corps[9], so might armored infantry under the U.S. Armor

Branch. Even if the situation did not get out of hand, it is certainly predictable that armored infantry would focus on armor skills, like Bradley gunnery, at the expense of the dismounted infantry skills if the BIFV were assigned to Ft. Knox. In the final analysis, armored infantry must first be superb infantry; as a unit its dismounted skills must be of paramount concern. Other skills are important but supplementary.

Second, despite the low number of armored infantrymen available per unit to handle a broad spectrum of mounted and dismounted tasks, Army leaders seem convinced that "elite" unit status and priority on top-notch infantry leaders are the purview of infantry on the light end of the continuum. As General William R. Richardson, Commander, U.S. Army Training And Doctrine Command, has stated:

> All units in the light divisions will be fully structured and manned at 100% of authorized levels. Quality officers and noncommissioned officers will meet stringent selection and retention standards. Many leadership positions will require ranger training, while unit commanders will be the most experienced in the Army. Noncommissioned officers will be the most technically competent, physically fit trainers we can muster.[10]

In a manpower constrained force, the tendency to inequitably distribute talent toward special operating forces and light infantry, may be the greatest obstacle to the success of armored infantry and the regular infantry. This was certainly the case in the IDF.

Summary

This study suggests that the demands of the modern battlefield and of combined arms warfare require a variety of specially trained and equipped infantry. The U.S. Army today is moving to strengthen infantry at the heavy and light ends of the continuum, with the fielding of the Bradley IFV and the creation of light infantry organizations. In so doing it appears also to be concerned with adapting each to cover a wider range of infantry missions than each was equipped and organized to conduct. As discussed, armored infantry is not manned or equipped to take on the missions of position defense or the attack of fortified positions. The concerns about augmenting light infantry with tanks and other heavy support highlight the realization that it is not capable of covering much of the positional, infantry intensive tasks, either. What is needed is regular infantry, perhaps not too different from the M113-equipped infantry of today. Each type of infantry - armored, regular, and light - is capable of optimally accomplishing an important part of the U.S. Army's infantry missions. Each contributes to the combined arms warfighting capabilities. Each deserve command emphasis and a fair share of quality soldiers and leaders.

This study began and ends by quoting J.F.C. Fuller's criticism of the adaptive processes he had observed in most armies.

> In most armies we see weapons evolving on no rational plan. New arms are invented and introduced without a definite tactical reason, and without a definite relationship to structure, maintenance, and control. Old weapons are maintained; the old and new are mixed irrespective of their elemental values. Proportions are not logically arrived at, but are the outcome of ignorant opposition on the one side and enthusiastic aggressiveness on the other. The whole process is alchemical, is slow and costly and inefficient; ultimately trial and error wins through.[11]

This indictment does not have to be true of the U.S. Army today as it integrates the BIFV and strives to determine its impact on the triad of doctrine, weapons, and soldiers. This study is an attempt to analyze the critical factors vital to developing a rational plan for employment of U.S. heavy maneuver forces, especially Bradley-equipped armored infantry.

ENDNOTES - CHAPTER 5

1. Cushman, p. 20.

2. BG Claude B. Donovan, "Bradley Fighting Vehicle Systems," lecture delivered to the Advanced Military Studies Program, CGSC, 31 Jul 84.

3. Ibid.

4. United States Army Training and Doctrine Command, Bulletin 7, "The BMP: Capabilities and Limitations," Fort Monroe, VA, 30 Jun 77.

5. LTG Arthur S. Collins, Jr. Common Sense Training (San Rafael, CA: Presidio Press, 1978), p. 151.

6. Simpkin, Mechanized Infantry, p. 57.

7. United States Army, Training and Doctrine Command Liaison Office, German General Army Office, "Concept and Operating Principles of the German Armored Combat Troops," 1980.

8. Major R.P. Cousens, "Light Infantry - A Renaissance?" British Army Review (Nov 82) p. 29. Also see explanatory note #7, Chapter 4.

9. Adan, pp. 206-207.

10. Richardson, p. 22.

11. Fuller, The Foundations of the Science of War, p. 147.

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