

**WAR-WINNER:  
A RE-APPRAISAL OF THE M4 “SHERMAN” TANK IN WORLD  
WAR II**

by

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I dedicate this work to the veterans, both civilian and military, of the M4 tank. May your experience and sacrifice in the Second World War serve as an example to future generations in the preservation of liberty.

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## ABSTRACT

The M4 tank was one of the principal armored vehicles used by the United States during World War II. The U.S. also supplied the M4 in large numbers to its allies; it became the most important Allied tank of the war. In spite of this widespread use, historians, veterans, and post-war commentators frequently denigrate the M4 as a weapon and claim that it was a mistake to employ it against the Axis powers. The critics' argument is that the M4 was cheaply designed for easy mass production as part of the American strategy to overwhelm the Axis powers through the quantity rather than the quality of its weapons. These critics point to the technical inferiority of the M4 to late-war German heavy tanks as proof of this claim and argue that by employing the M4 the Americans wasted thousands of lives and delayed the end of the war.

This argument is flawed and does not portray an accurate story of the M4 in World War II. Interior Army disputes over the role of tanks in battle and the resulting doctrine developed to defeat the German army were the primary determinants of the M4's design; ease of production was not the overriding factor. The record of the M4 in combat from 1942 to 1945 was exemplary when it was used as it was intended. Additionally, the 1944 modifications to the M4 demonstrated the soundness of its overall design. The M4 struggled (but still occasionally succeeded) in duels with the heavier German tanks, a task it was not designed for. Considering its overall war record, the M4 was an invaluable resource for the Allied powers and must be considered a successful tank.

## TABLE OF CONTENTS

INTRODUCTION.....	1
CHAPTER I: ARMOR DEVELOPMENT IN THE INTERWAR PERIOD: A PRECURSOR TO THE M4 "SHERMAN".....	8
CHAPTER II: THE DESIGN AND DEVELOPMENT OF THE M4.....	35
CHAPTER III: THE M4 IN COMBAT, 1942-1943.....	66
CHAPTER IV: THE M4 IN COMBAT, 1944-1945.....	90
CONCLUSION.....	125
BIBLIOGRAPHY.....	130
APPENDICES: .....	142
APPENDIX A: ANNOTATED ORGANIZATION OF THE WAR DEPARTMENT.....	143
APPENDIX B: KEY GERMAN & AMERICAN TANK DEVELOPMENT AND PRODUCTION, 1940-1945.....	145
APPENDIX C: AMERICAN MEDIUM TANKS, 1940-1945.....	146
APPENDIX D: BASIC ARMY STRUCTURE.....	149
APPENDIX E: SIMPLIFIED U.S. ARMORED DIVISION ORGANIZATION, 1944.....	150
APPENDIX F: SELECTED ARMOR AND GUN COMPARISON.....	152

## **INTRODUCTION**

World War II was a mechanized war in which motorized vehicles were decisive to the outcome of the conflict. All major and minor powers utilized these machines extensively; anything that could be, was equipped with an internal combustion engine for the purpose of increased mobility. In the air and on land, the new machines revolutionized warfare, and one of the principal icons was the tank. The tank--with its firepower, armor, and off-road capabilities--proved to be one of the decisive weapons of the war. Every major land battle of the war included tanks, frequently as the key weapon in offensive and defensive operations. For the United States and its allies, the primary tank of World War II was the Medium Tank M4, commonly called the M4 or "Sherman." It operated in every theater of the war and participated in every major battle in which the United States fought. The other major Allied powers--including Great Britain, France, China, and the Soviet Union--also used the M4 extensively in combat. From its introduction in 1942, this tank played an essential role in the battles and campaigns the Allies planned and conducted. Despite its widespread use and significant role, historians, veterans, and commentators have decried the use of the M4 ever since 1944; for them, the M4 was a failure as a tank and a weapon. However, the critics' argument is flawed; first, it is based on a false premise, and secondly, the criticism is myopic regarding the M4's performance. Contrary to the criticism, the M4 was an excellent tank that was fully capable of performing the role it was designed for, and moreover, its capabilities made it a vital asset in every theater where it fought. The M4 had limitations to be sure, but a full analysis of its history and record show that its merits significantly outweighed its deficiencies.

Critics of the M4 make a flawed comparison with late-war German tanks and misrepresent the design history of the M4. Without a doubt, the M4 was technically inferior in some aspects to the late-war German heavy tanks, the *Panzerkampfwagen V* “Panther” and the *Panzerkampfwagen VI* “Tiger” and “King Tiger” tanks. These *panzers* had more powerful guns and thicker armor than the M4; in a duel, the M4 was at a distinct disadvantage. To critics, the inadequacies of the M4 resulted in unnecessarily high losses in both tanks and crews for the Allies. Historians such as Stephen Ambrose and Max Hastings have argued (implicitly and explicitly) that the M4 caused excessive and unnecessary casualties.<sup>1</sup> Veterans such Omar Bradley and Belton Cooper have made similar accusations; Cooper referred to the M4 as a “deathtrap” in the title of his book.<sup>2</sup> This extremely negative image of the M4 persists even in popular culture; one program on the History Channel labeled the M4 an “engineering disaster.”<sup>3</sup> From 1944 until now, scholars, soldiers, and laymen have questioned why the United States, with all of its industrial prowess and ability, was unable to produce a tank superior to those of the Germans. Moreover, why did the United States continue to use such an “inferior” tank without developing a replacement? The aforementioned critics have asserted that the

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<sup>1</sup> Stephen Ambrose. *Citizen Soldiers: The U.S. Army from the Normandy Beaches to the Bulge to the Surrender of Germany, June 7, 1944-May 7, 1945* (New York: Simon & Schuster, 1997), 63; Max Hastings, *Overlord: D-Day and the Battle for Normandy* (New York: Simon and Schuster, 1984), 190.

<sup>2</sup> Omar N. Bradley, *A Soldier’s Story* (New York: Henry Holt and Company, 1951), 41; Benton Y. Cooper, *Death Traps: The Survival of an American Armored Division in World War II* (Novato, CA: Presidio Press, 1998, 2000).

<sup>3</sup> History Channel, “Modern Marvels S10E49 Engineering Disasters 12,” YouTube Web site, MPEG, [http://www.youtube.com/watch?v=WM-w6Bnk\\_bI&list=WLF195F8E78D1C6DBD](http://www.youtube.com/watch?v=WM-w6Bnk_bI&list=WLF195F8E78D1C6DBD) (accessed January 30, 2013).

United States sought to win the war by overwhelming its enemies through sheer numbers rather than skill; they offer the M4 as evidence of this interpretation. Moreover, critics point to the M4 as an example of the failure of the U.S. Army to prepare adequately for war, which resulted in “poor” performance in the Mediterranean and European theaters--an ironic view when one considers that the Allies won. Likewise, critics argued that the British and Soviets did not use the M4 because it was an excellent tank; they used the M4 because it was available and their own tank production was inadequate to meet their needs. Subsequently, the sole value of the M4 was that it was easily manufactured in large numbers and therefore “won” by overwhelming its opponents, regardless of its quality as a weapon. However, this argument does not hold up to historical scrutiny, especially when one examines the origin of the M4 and its combat record.

The M4 was the product of the limited experience of the U.S. Army in the interwar years (1920-1939) with tanks and the resulting internal debates over the role of the tank. Prior to the German invasion of Poland, which featured tanks prominently, American army officers debated the role of tanks in future battles without ever reaching a consensus. The Infantry branch favored using tanks to support foot soldiers and therefore pushed designs that focused on heavy armor and armament. The Cavalry, on the other hand, wanted light and fast tanks for quick strikes and raiding behind enemy lines. The interwar years were lean budgetary times for the Army, and it could not accommodate both branches’ wishes. Limited funding for research and development hampered the Army’s ability to experiment with tank tactics and designs. Consequently, the Army had little experience designing and building tanks; the small number of tanks produced was wholly inadequate to practice and develop tactics that could be developed into a doctrine.

By mid-1940, the successful German attacks on Poland and France stunned both American civilian and military observers alike; the role of the tank figured prominently in the minds of American leaders. The U.S. Army sought to create a tank doctrine and force that could first counter the German *panzers* and secondly defeat Germany using similar methods to blitzkrieg, which emphasized the use of tanks to strike deeply into the enemy's rear areas to maximize confusion and disruption. As a result, it developed Tank Destroyers (self-propelled, anti-tank guns) for the first mission and the M4 for the second mission. Americans, particularly Army Ground Forces commander Lt. General Leslie McNair, did not believe that tanks should be wasted in solely breaking through an enemy's front lines or in dueling other tanks. McNair believed that tanks should be used after a breakthrough had been achieved to attack headquarters and supply depots dozens of miles behind enemy lines. He also believed that tanks were useful to support the infantry. As the chief architect of the doctrine, organization, and training of the Army in wartime, McNair's views dominated the development of weapons and their use in combat; his vision was a compromise between the opposing views that emerged during the interwar debate. In conclusion, McNair's interpretation of this debate and his understanding of German blitzkrieg primarily determined the design of the M4.

The M4's design incorporated all of the features that McNair and the Army believed were necessary for the tank to perform the battlefield mission they had designed for it. Additionally, its manufacture took place against the desperate background of 1941, when the Germans seemed to be on the verge of total victory. The Americans desperately needed new tanks to help the British and to build up their own forces, which was more imperative after the United States entered the war following the Japanese attack on Pearl

Harbor in December 1941. Previously in September 1941, U.S. President Franklin D. Roosevelt had ordered American factories to produce thousands of new tanks per month and tens of thousands per year, a goal clearly beyond American ability at the time. The American army possessed some tanks, but all of these models were obsolete by 1941. The first attempt to produce a new tank was based on expediency and resulted in the M3 medium tank, an unbalanced design that merged existing, obsolete models with a new weapon, a 75mm gun. None of the users were satisfied with the M3, but it served as the father of the M4, which used the same gun. Moreover, the Army used or modified the engine, suspension systems, and other features from the M3 in the M4's design. The chief characteristics of the M4 were its mechanical reliability, easy maintenance, and dual-purpose 75mm gun, capable of firing both high explosive and armor piercing shells. Because American industry was in the process of building production facilities, the Army did not specify that the design of the M4 must accommodate existing production practices or be easy to produce. As soon as the new tank plants were ready, U.S. industry built whatever the Army had ordered as quickly as the factories could manage. The efficiency of the American tank industry generated the large numbers of M4s, not the nature of the design.

In late 1942 and 1943, the American, British, and Soviet armies were pleased with the M4's performance and saw little need for a replacement. The British first used the M4 at the Battle of Second El Alamein. The M4 demonstrated its quickness and effective firepower and also showed that it was capable of defeating any Italian and German tanks with ease, with a one exception, the "Tiger" heavy tank. In the Pacific, the U.S. Marine Corps used the M4 first during the assault on Tarawa (November 1943) and then in its

subsequent campaigns. The M4's ability to destroy Japanese bunkers and support American troops endeared it to the Marines and the Army Forces in the Pacific. The American tank also earned the respect of its adversaries, including German General Erwin Rommel in Africa, who praised it. The period between 1942 and 1943 was the highpoint of the M4's career and when General Jacob Devers, chief of the Armored Force, even described it as the best tank in the world.<sup>4</sup>

The record of the M4 in 1944-45 was more complex, with both achievements and difficulties. Prior to D-Day (June 6, 1944), the Americans upgraded the M4 with a variety of modifications to improve its armor protection, mobility, and firepower, but only the British incorporated an anti-tank gun that could defeat the largest *panzers*. The Americans continued to hold to the doctrine that the M4 should avoid tank-on-tank engagements. As in the previous campaigns, the M4 performed extremely well in all the missions it was designed for: fast-moving attacks against unarmored or lightly armored troops and infantry support. In the Pacific, the marines and soldiers continued to use their M4s with great success and requested that more be shipped to them as soon as possible. Likewise, Soviet soldiers successfully used their M4s for similar missions but also developed effective methods for combating the *panzers*. The Soviet accounts, although very sparse, also demonstrated great appreciation and even affection for their M4 tanks. In northwest Europe after D-Day, the Americans and the British had similar success with their M4s. Only in battles against the heaviest German tanks did the Allies find the M4

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<sup>4</sup> Erwin Rommel, *The Rommel Papers*, ed. B. H. Liddell Hart (New York: Harcourt, Brace, 1953), 19; G. MacLeod Ross, *The Business of Tanks, 1933 to 1945* (Ilfracombe, UK: Arthur H. Stockwell Ltd., 1976), 245.

lacking, but once again, this mission was outside its design parameters. Even so, the Americans developed tactics to defeat the *panzers* that gave the M4s a chance of victory that belied subsequent critics' claims; a duel was not an automatic German victory. Moreover, tank battles were not the M4's most common mission in France, the Low Countries, and Germany during the last year of the war. The Allies mostly used the M4 to support infantry and to seize objectives behind German lines, the tasks the Americans had designed the M4 for and in which it excelled.

By the war's end, the M4 had proved a valuable asset in the Allies' arsenal, and it is not an exaggeration to say that they could not have won the war without it. The critics' assertion that the M4 was solely the product of a desire for mass production is not accurate; it was not cheaply made for mass consumption. The story of the M4 in combat with the larger German tanks that is the focus of its detractors is important, but that is not the whole story nor as one-sided as often portrayed. The majority of the record of the M4 is one of success and achievement. From both the Allied and Axis points of view, the M4 was a great tank, albeit not the technical stand-out of the war. In this respect, historians and laymen alike should recognize the M4 tank for what it was--a war-winner."

## **CHAPTER I**

### **ARMOR DEVELOPMENT IN THE INTERWAR PERIOD: A PRECURSOR TO THE M4 “SHERMAN”**

Tanks were the dominant land weapon of the Second World War, but their origins stem from the First World War and the interwar period (1920-1939). Although tanks had been used briefly in World War I, the technology was not advanced enough for their full potential to be realized at that time. More importantly, the doctrine on how to employ tanks, called armored or mechanized warfare, was still in its experimental stages. The various armor doctrines of World War II were the result of theories and experiments conducted in the interwar period. For the U. S. Army, the interwar period was a time of shortage and frustration. Poor funding and scant public interest made the Army’s mission of preparing for the next war almost impossible. However, the causes of the Army’s problems were not all external, especially where tank development was concerned. The notable tank historian George Hofmann commented that a doctrinal development gap as much as a production gap hampered the Army’s tank program even as late as 1941 along with a “prewar political and economic ambivalence towards military affairs.”<sup>1</sup> At the highest level, Army leadership was deeply conservative and generally held an unfavorable view towards new technology and new doctrines in the 1920s and 1930s. Believing that future wars would be fought in essentially the same manner as the past, Army officers struggled to make sense of how to use tanks and therefore what kind of tanks to build. The German invasion of Poland in 1939 demonstrated the capabilities of massed tank attack and consequently revealed the inadequacies of American ideas on

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<sup>1</sup> George F. Hofmann, “The Tactical and Strategic Use of Attaché Intelligence: The Spanish Civil War and the U.S. Army’s Misguided Quest for a Modern Tank Doctrine,” *Journal of Military History* 39 (January 1998): 101-33.

tanks and their use. Forced to respond quickly, Army leaders had to pull together the many divergent theories on the use of tanks that heretofore had failed to be resolved. Although inadequate and frequently misguided, American tank development in the interwar period was a major influence on the design and deployment of the M4 “Sherman” tank in World War II.

In World War I, the U.S Army used tanks in combat for the first time and gained useful, albeit limited, experience. Upon entering the war Americans recognized the value of the tank and established an independent tank corps in January 1918, with a school for training crewmen during the war. Notable persons assigned to the tank corps included young officers such as George S. Patton, Jr., and Dwight D. Eisenhower. The Army leadership envisioned using tanks to assist advancing infantry as a mobile, fire-support weapon that would break the deadlock of trench warfare that dominated battlefields on the Western Front during World War I. Invulnerable to bullets and able to traverse the broken, shell-pocked ground, tanks overcame the many obstacles that had kept infantrymen from successfully attacking across the “no-man’s land” that characterized the battlefields in France. Tanks could also attack machine-gun emplacements successfully and cross the trenches; barbed wire had no effect on tanks. After eliminating enemy strong points, tanks could continue to advance and to exploit the opening (breach) in the defense without having to stop and rest. They could cross successive lines of trenches or attack enemy positions from the rear, while the foot-soldiers attacked the front, which was the preferred method. Theoretically, a successful attack would rupture an enemy’s lines and force neighboring units to retreat or be systematically destroyed in a similar fashion. Before the armistice, the Americans had several successful engagements

using tanks, including the Meuse-Argonne Offensive (September-November 1918), but these experiences were always with limited numbers of French and British manufactured tanks. No American-designed or -built tanks arrived during the war. At the conclusion of hostilities, tank corps officers advocated the continuance of an independent tank corps that could develop its own doctrine and technology. Like the promoters of the airplane (another new, wartime technology) and the air corps, tank officers perceived that the established, more conservative branches (the Infantry, the Cavalry, and the Artillery) would interfere with and hamper the development of these new weapons unless they had some independence.<sup>2</sup>

Following the conclusion of World War I, Army leaders took the first steps to officially define the role of tanks and their permanent place in the organization. Under the direction of the Chief of Staff and the Secretary of War, a committee of high-ranking officers was convened to analyze the “lessons” of the war and to make recommendations on the future structure of the Army, including tanks. Known as the Superior Board, this group was led by the former American Expeditionary Force (AEF) commander General John Jay Pershing, whose soaring reputation after the victory ensured that its findings would be widely accepted. In its report to the War Department and Congress, the board found no compelling reason for the continuance of an independent tank corps, because tanks had demonstrated their value only as supplements to the Infantry. An effective weapon to be sure, the tank had limited applications in the opinion of the board. In his

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<sup>2</sup> Kenneth Macksey, *Tank Warfare: A History of Tanks in Battle* (New York: Stein and Day Publishers, 1972), 65-66; William O. Odom, *After the Trenches: The Transformation of U.S. Army Doctrine, 1918-1939* (College Station: Texas A&M University Press, 1999), 54-57.

excellent work on the American army during the interwar years, historian David Johnson noted how the Superior Board did not evaluate the tank in terms of what it might become, but rather, how it had performed during the war. According to Johnson, board members took the short-sighted view that tank technology was stagnant and that nothing new could be expected in the future. Therefore, no need existed for a separate tank corps in the Army after the war to experiment and further develop tanks or their application in warfare.<sup>3</sup>

The wartime commander of the tank corps, General Samuel D. Rockenbach, supported the effort for independence from the other branches, but his remarks to Congress and War Department officials inadvertently worked against convincing leaders to create a separate branch for tanks. Appearing before a Congressional panel regarding the postwar restructuring of the Army, he testified that the role of the tank was to punch holes in an enemy's lines to clear the way for the Infantry. Having accomplished this, faster and more maneuverable tanks could then raid into the enemy's rear areas. Rockenbach's argument was a prophetic concept that would be central to the intended role of the M4 in World War II. However, the emphasis of his remarks was on the role of the tank in supporting the Infantry, which reinforced the arguments against an independent tank corps in the minds of Congressmen and Army officials.<sup>4</sup>

Naturally, the opinion of tanks held by the victorious AEF commander, General Pershing, was the most influential with Congress, War Department officials, and Army

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<sup>3</sup> David E. Johnson, *Fast Tanks and Heavy Bombers: Innovation in the U.S. Army, 1917-1945*, Cornell Studies in Security Affairs, ed. Robert J. Art, Robert Jervis, and Stephen M. Walt (Ithaca, NY: Cornell University Press, 1998), 38.

<sup>4</sup> Johnson, *Fast Tanks and Heavy Bombers*, 38-39.

leaders. In Pershing's view, tanks existed to aid the Infantry in battle and should therefore be placed under the Chief of Infantry. Tanks should be tested and developed in accordance with the Infantry mission, according to Pershing. Dr. Robert S. Cameron credited Pershing's opinion with assigning tanks exclusively to assisting infantry in the trench-breaching role, and therefore tanks should be under the control of the Infantry branch; an independent tank corps might otherwise pursue models of tanks and battlefield missions that jeopardized their usefulness to the Infantry.<sup>5</sup> For Congress, the opinions of Pershing and the Superior Board certainly outweighed those of Rockenbach and other tank officers, like Patton and Eisenhower, who also supported an independent tank corps.<sup>6</sup>

After the war, Congress intended to reduce and restrict the size of the Army in keeping with American peacetime tradition and the public's post-war sentiment. Certainly, the establishment of a new branch for tanks did not fit with this approach. Concurrently, Congress had already decided to establish an independent branch for aircraft. Legislators viewed this act as sufficient, albeit necessary, acquiescence to the Army's wishes regarding expansion. To Congress, tanks worked with and directly aided infantry; therefore, tanks belonged to the Infantry; the National Defense Act of 1920 codified this decision. As such, it provided the fundamental basis and conception for how American armor development proceeded in the interwar period. The Infantry branch would design, test, and evaluate tanks during the interwar years on the basis of how well the vehicles could aid the foot soldier. The tank was to be nothing more than a mobile

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<sup>5</sup> Robert S. Cameron, "Armor Combat Development 1917-1945," *Armor* 106 (September-October 1997): 14.

<sup>6</sup> Macksey, *Tank Warfare*, 73-74.

gun platform, supporting the Infantry and would not be utilized in any other capacity, such as exploitation or long-range attack. By relegating the tank to a support role rather than exploring other alternative missions for it, the act created conditions that ultimately stifled and deterred the creative development of and experimentation with tanks and their doctrine.<sup>7</sup>

Tanks in World War I had serious technical and mechanical issues that limited their overall usefulness in battle, so Army planners had to consider these aspects in their discussions on the use of tanks. Officers who advocated using tanks independently, operating miles deep inside enemy territory, had to speak of the possibilities of future tanks and assume a progression of technological and mechanical development. The decision to place tanks as a support to the Infantry was understandable, although inherently shortsighted; it reflected the limitations of tank capabilities at the time vis-a-vis technology and Army structure. Like most motorized vehicles of the period, tanks in World War I and the immediate post-war period were notorious for being mechanically unreliable. In most engagements, engine breakdowns and mobility impairments such as broken tracks accounted for as much as half of a unit's losses in a day. Although repairs were usually made in a day or two, the initial shock and momentum of the attack had been lost, enabling the Germans to recover and redeploy. Regardless of the gains made in terms of territory captured, the ability to maintain the offensive was weakened by the excessive maintenance demands inherent in World War I tanks. After operating for several miles, tanks needed vital mechanical servicing to prevent severe breakdowns.

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<sup>7</sup> Cameron, "Armor Combat Development," 14; Russell F. Weigley, *The American Way of War: A History of United States Military Strategy and Policy* (Bloomington: Indiana University Press, 1977), 216-17.

Any attack had to be halted while repairs and maintenance work occurred. When the attack was renewed, the tanks would have to battle through the new German defenses all over again. Of course, battles such as these occurred after units had reached the battlefield, which was also a struggle. These tanks had a small radius of action, less than fifty miles, before refueling was necessary. Refueling was a time-consuming and labor-intensive process that soldiers carried out by hand, using five-gallon cans and a funnel. To move longer distances, trains transported tanks on flatbeds to the nearest point where the attack was planned. Because of all these factors, Army officers believed that tanks, while useful, could only be employed in thoroughly pre-planned circumstances. The idea that tanks, independently, might penetrate deeply into enemy territory and rapidly change the direction of an attack was more theoretical than based on historical fact. During World War II, American tank designers strove to remedy these shortcomings, and mechanical reliability was one of the key features in the design of the M4. Reliable was not a term used to describe World War I tanks. However, technical limitations were not the only factor that influenced the Army's thinking on tanks.<sup>8</sup>

Military and civilian leaders did not view the tank as gaining victory in war but just as adjuncts to the real source of triumph, the foot soldier. The primary conclusion of the Superior Board was that manpower—specifically large numbers of riflemen--had won the Great War. The National Defense Act placed this belief at the center of its

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<sup>8</sup> Kenneth Macksey, *Tank Versus Tank: The Illustrated Story of Armored Battlefield Conflict in the Twentieth Century* (London: Grub Street, n.d.; New York: Barnes & Noble Books, 1999), 29; Dale E. Wilson, "World War I: The Birth of American Armor," in *Camp Colt to Desert Storm: The History of U.S. Armored Forces*, ed. George F. Hofmann and Donn A. Starry (Lexington: University Press of Kentucky, 1999), 24-27.

restructuring of the Army. Naturally, the Infantry branch was the primary benefactor of such an outlook. Presumably in the future, as in the past, the rifleman would be the bedrock of defense, not technology like tanks and their promises of future capabilities. In practice during the 1920s and 1930s, the Infantry chose personnel over machines in its decisions over how to allocate its limited funds; each branch of the Army requested and spent its own funds as it saw fit at that time. Hofmann notes that in 1932, the Army, at the request of the Infantry, requested \$2.4 million for limited service tests and procurement of a new semi-automatic rifle (the M1 Garand), a new anti-aircraft gun, and new tanks. The War Department approved only \$1 million, and the money was spent on the new rifle, the Infantry's highest priority.<sup>9</sup> Decisions such as these were typical in the interwar period and reflect the subordinate role of tanks in the Infantry's priorities.<sup>10</sup>

The Infantry branch was naturally inclined towards traditional elements and its primary component, the rifleman. With a slightly romantic notion, the Infantry repeatedly stressed the supremacy of the rifleman over all other battlefield weapons. The presiding view was that infantry, the so-called "Queen of Battle," had always been the decisive and crucial factor on the battlefield and would certainly remain so in the future. The Infantry chiefs considered ideas and opinions that challenged this belief as subversive and dangerous. Johnson records one particular example when Dwight D. Eisenhower, then a captain, published an article in the *Infantry Journal* in 1920. Eisenhower theorized about the possibilities of future tank technology and implied, either intentionally or

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<sup>9</sup> Timothy K. Nenninger, "Organizational Milestones in the Development of American Armor, 1920-40," in *Camp Colt to Desert Storm*, ed. Hofmann and Starry, 43-44.

<sup>10</sup> Odom, *After the Trenches*, 51.

unintentionally, that tanks might have a separate role from the Infantry in future operations. To his surprise, his article constituted a form of doctrinal heresy, and the Chief of Infantry advised him to discontinue such statements. According to Johnson, Eisenhower recalled that the Chief of Infantry even hinted at the possibility of a court-martial.<sup>11</sup> For the remainder of the twenties and into the early thirties, the Chiefs of Infantry sought to maintain both their domination over tank development and the paramount role of the Infantry in battle. Hofmann remarks that the unimaginative views of Infantry leaders were the most serious impediment to the development of an American tank force. By 1930, significant automotive improvements resolved many of the limitations of World War I tanks, but the Infantry leaders ignored the implications of these developments and how the capabilities of tanks had changed. The Infantry was determined to keep tanks in a secondary role to the rifleman and prohibited any experimentation that might alter this view or suggest a different mission. During the 1920s and 1930s, the Infantry's bias for its own service icon, the rifleman, was the guiding factor in tank development rather than a desire to comprehend and integrate new technology on the battlefield.<sup>12</sup>

Within the framework of the Infantry's views, Army engineers and mechanics improved the automotive and technical components of tanks in the interwar period. The Infantry chiefs examined and refined tank doctrine in order to better accomplish the mission of supporting the rifleman. The capabilities and reliability of automotive

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<sup>11</sup> Johnson, *Fast Tanks and Heavy Bombers*, 75.

<sup>12</sup> George F. Hofmann, "Army Doctrine and the Christie Tank: Failing to Exploit the Operational Level of War," in *Camp Colt to Desert Storm: The History of U.S. Armored Forces*, ed. Hofmann and Starry, 103.

components continued to improve significantly after World War I. The durability of power trains, fuel efficiency, and cross-country mobility had substantially improved. By the late twenties, tanks had the ability to operate for greater periods without extensive maintenance. Some Infantry officers began to question how these improvements might be utilized. Tanks, in their supportive role, could maneuver quickly against enemy strong-points and machine-gun nests; therefore, faster tanks became preferable to slower models. Infantry officers began to favor increased mobility across the ground and the newer, more reliable engines made this possible. citation needed (at least to infantry officers questioning how tank improvements could be utilized)

In order to achieve greater mobility, the overall weight of a tank had to be restricted to certain limits. The days of ponderous, lumbering heavy tanks was over as far as the Americans seemed to be concerned. Armor was reduced to make tanks lighter and therefore faster. The preference for mobility at the expense of armor protection remained a common theme throughout the interwar period and influenced the development of the M4. Besides off-road mobility, the structural load limit of most bridges in the United States was a factor that Infantry officers had to consider in designing a tank. Rivers became obstacles that would hold up an offensive if the tanks were too heavy to cross the bridges. As would be the case in World War II, the weight of a tank was one of the most important limiting factors in its design. Citation needed to American ideas that tanks had to be lighter

The Army's procedure for developing new weapons was for the user, the Infantry, to specify the criteria and submit the request to the Army Ordnance Department, which actually developed the blueprints. Frequently, the Ordnance designers were unable to

meet all of the stipulated design criteria regarding firepower, protection, and mobility and were forced to trade off certain requested features in order to balance what the user wanted with what was technically possible. Usually, the Infantry officers rejected these proposed compromises, and the design process started over again. The effect of this approach was that designed models were directly tied to the user's requests. The positive aspect of this approach was that unwanted equipment was not forced upon the user. Unfortunately, suggestions from the Ordnance Department on tank development had to be agreeable to the Infantry in order to be included in the next prototype. This practice tended to discourage experimentation and limited development to tweaking components that the Infantry believed were valuable. Once the United States entered the war, the Americans found it very difficult to change this mindset, and therefore American tank development was never on the cutting edge of technology and always seemed to be responding to what the Germans had developed first.<sup>13</sup>

Limited Congressional funding for the Army was also an important constraint on the development and experimentation of tanks. In the view of Congress, surplus World War I tanks were still plentiful. Robert Cameron noted that the surplus wartime tanks created an illusion of armored strength that influenced Congress to limit funding further development of tanks and discouraged funding any production of new models.<sup>14</sup> Furthermore, Congress was quick to question the need for more funding for tanks when

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<sup>13</sup> Constance MacLaughlin Green, Harry C. Thomson, and Peter C. Roots, *The Technical Services: The Ordnance Department: Planning Munitions for War*, United States Army in World War II series (Washington, DC: U.S. Government Printing Office, 1955; Reprint, Center of Military History, United States Army, 1990), 257-58.

<sup>14</sup> Cameron, "Armor Combat Development, 1917-1945," 14.

the Army itself viewed them as a lower priority. The onset of the Great Depression only strengthened this argument. Johnson makes the key observation that the Army would most likely have used any additional funding to support increasing manpower. Although his view is speculative, this opinion seems to be correct considering the Army's track record and, more importantly, stated views on the supremacy of the foot soldier over other weapons, particularly tanks. Considering what the Army did with the funds that it had, the idea that any additional funding would have benefited the tank program seems unlikely.<sup>15</sup>

In spite of internal bias and Army doctrine, many officials, both inside and outside the Army, became more aware of the potential and feasibility of motorization in warfare. Following a visit to Great Britain in 1927, Secretary of War Dwight Davis ordered the creation of an experimental mechanized force, commonly called the EMF. The purpose of the EMF was to study the effect of mechanization on all branches of the Army. In July of 1928, the Army brought together groups of soldiers from the Infantry, Cavalry, Artillery, Engineers, and Quartermasters at Camp Meade, Maryland. These groups were allocated all forms of motorized equipment and organized as a single unit. As such, truck-mounted infantry and artillery, tanks, and the cavalry's armored cars conducted a variety of tests. General Staff officers explored and analyzed the problems of using motorized equipment for long-distance road marches as well as supply and offensive operations. Naturally, the EMF experienced significant challenges and problems. Obsolete wartime equipment frequently broke down, and few spare parts were

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<sup>15</sup> Johnson, *Fast Tanks and Heavy Bombers*, 229; Weigley, *The American Way of War*, 217-18.

on hand to make repairs. The lack of cross-country mobility in vehicles other than tanks limited the ability of the exercises to demonstrate the potential of mechanization. By October of that year, the Army disbanded the EMF. However, the experiment had not been a waste. As Hofmann notes, the findings from the trials with the EMF provided useful practical and technical information on the operation of motorized forces. Rather than discrediting tanks and motorized forces, the EMF produced enough positive results that the Army's interest was stimulated to pursue future development. More importantly, the door for exploring the potential of the tank outside of a supportive role had been opened.<sup>16</sup>

When he assumed the duties of Chief of Staff of the Army in November 1930, General Douglas MacArthur sought to transform the American army's understanding and use of mechanized weapons, particularly tanks. In one of the most significant decisions regarding armor development, MacArthur ordered all branches to mechanize as much as possible. Furthermore, types of equipment were not to be limited to one branch. Hofmann explains that MacArthur believed that the different components of the Army should decide for themselves what equipment they needed in order to perform their battlefield mission; in short, missions should determine how the Army was equipped and organized, not vice versa.<sup>17</sup> The primary result of this order was that branches other than the Infantry could now experiment with tanks. The Cavalry was the primary benefactor of MacArthur's order. Previously, the National Defense Act and Army regulations limited the Cavalry to developing and equipping armored cars. Moreover, the protestations of the

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<sup>16</sup> Nenninger, "Organizational Milestones," 40.

<sup>17</sup> Ibid., 46.

Infantry, jealous of its prerogative with tanks, had previously prevented any Cavalry experimentation with tracked vehicles. MacArthur could overrule the Chief of the Infantry, but he could not simply override a Congressional mandate. In order to circumvent the provision that tanks belonged only to the Infantry, MacArthur and cavalry officers officially referred to their vehicles as “Combat Cars.”<sup>18</sup>

For the Cavalry, the combat car offered tremendous potential for carrying out that branch’s traditional missions: reconnaissance, screening, counterattack, and exploitation/pursuit duties on the battlefield. To Cavalry officers, the screening mission was the least practical area for consideration. Quite simply, sufficient numbers of tanks would be difficult to procure in order to guard vital rear areas and to screen the main body of the army. However, the ability to react quickly and powerfully to an enemy threat--such as an attack or breakthrough--was an attractive feature of the tank; the counterattack mission was one of the most vital roles cavalry played in an army. Considering the Cavalry’s other missions, Cavalry officers were extremely interested in the tank’s cross-country mobility. With the ability to go off-road, tanks could reconnoiter in any direction and were less vulnerable to enemy forces. With their additional firepower, tanks could conduct a “reconnaissance in force,” overcoming weaker enemy forces where possible. By moving swiftly and striking from unexpected locations, tanks could also severely disrupt and hamper an enemy’s movements. Likewise, a tank’s speed and increased firepower would be extremely useful in disrupting rear areas during the exploitation of a successful breakthrough of the enemy’s lines. While pursuing a retreating enemy, tanks, like horses, could easily outrun and isolate enemy troops on foot.

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<sup>18</sup> Hofmann, “Army Doctrine and the Christie Tank,” 117.

Thus delayed, these units could then be defeated by advancing infantrymen after they had caught up. In these ways, many Cavalry officers viewed tanks as a way to augment the existing cavalry force's capabilities<sup>19</sup>

With the inclusion of the Cavalry in the design process, American tank development began to diverge along two different development paths. Infantry tanks sought to improve the tank's armor protection and firepower while maintaining mobility. Infantry officers, on the other hand, wanted tanks that were able to withstand hits from heavy machine guns and the emerging anti-tank rifle, which fired a large-caliber bullet at high velocity. Progressively, the Infantry requested additional machine guns be added in order to suppress (force to take cover) an enemy's anti-tank weapons and troops. Small cannon were added following observations of tanks in the Spanish Civil War. Mechanical reliability was still crucial, but speed was less vital than protection now. Reminiscent of the World War I mentality, the Infantry believed that the tank really only needed to maintain the pace of advancing riflemen with occasional bursts of speed. The Infantry was also more concerned with the tank's cross-country mobility and suspension system, believing that a smoother, more stable ride would produce less strain and wear on components and thereby enable longer equipment life. A result of this viewpoint was the Vertical Volute suspension system, which proved very successful in the M4 during

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<sup>19</sup> Johnson, *Fast Tanks and Heavy Bombers*, 128-29; Odom, *After the Trenches*, 144.

World War II. By the late thirties, the Infantry designs had evolved into a category called medium tanks.<sup>20</sup>

The Cavalry had different criteria for tanks that reflected its own doctrine. Speed rather than firepower was paramount to the Cavalry mission. Accordingly, the combat cars had thinner armor than the Infantry models and less firepower, usually half the number of machine guns. Combat cars averaged a weight approximately one-half to three-fourths of an infantry tank. With less weight, the combat cars were generally smaller and significantly faster. A tank might have a crew of four, while a combat car had a crew of two or three. By the early 1940s, Army officials reclassified combat cars as light tanks and, as such, continued in this Cavalry role during World War II.<sup>21</sup>

Although developed as a result of rivalry, tanks and the combat cars ended up with similar components. The Ordnance Department did so primarily for economic reasons but also for standardization. Both used the same style of suspension and track, and they also had similar controls and layout. During the thirties, funding was still scarce for research and development. The substantial government outlays of Roosevelt's New Deal did not extend to the ground army as generously as they did to the Navy and the Army Air Corps. However, the sharing of resources and technology forced Infantry and Cavalry officers to interact on the issue of tanks. At least, one branch evaluated and discussed technical proposals put forth by another branch. However, the institutional bias remained strong, and disagreements frequently occurred along branch lines. Citation

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<sup>20</sup> George Forty, *United States Tanks of World War II* (Dorset, UK: Blandford Press, 1983), 78; Odom, *After the Trenches*, 103-5.

<sup>21</sup> Steven J. Zaloga, *M3 and M5 Stuart Light Tank, 1940-1945*, New Vanguard Series 33 (Oxford: Osprey Publishing, 2000), 3-5.

needed to the similarity of components, lack of New Deal funding, and interaction between Infantry & Cavalry

Although MacArthur's act had opened up the developmental field, the order did not produce any unified opinions and even tended to work against an established doctrine. Hofmann argued that the traditionalist views held by the combatant branches, the Artillery, the Cavalry, and most importantly the Infantry, stifled the development of a cohesive doctrine for fighting the next war and that MacArthur's policy intensified the inter-army discord on such matters.<sup>22</sup> Rather than seeking unity in war-fighting doctrine, the Infantry and Cavalry each viewed the order as a way to force the other branches to adopt its views. Severe infighting resulted over even basic concepts such as which branch had the primary role in the attack and the defense and what was the most important battlefield weapon. Even as late as 1940, these disagreements continued to prevent the adoption of any unified ideas on how to use tanks in the next war. Subsequently, when the war began in Europe, the American army had two distinct models of tanks in development (but very few in service) and no meaningful number of personnel trained in how to use them.<sup>23</sup>

Sending shock waves throughout the armies of the world, the German invasion of Poland in September of 1939 demonstrated the new methods of warfare possible in the mechanized age. As German troops poured across the Polish borders, military and political observers realized that mechanized warfare had come of age. German aircraft

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<sup>22</sup> George F. Hofmann, "Combatant Arms vs. Combined Arms: The U.S. Army's Quest for Deep Offensive Operations and an Operational Level of Warfare," *Armor* 106 (January-February 1997): 12.

<sup>23</sup> Hofmann, "Army Doctrine and the Christie Tank," 130-31.

and tanks were employed in a manner that completely befuddled their opponent. Dubbed “blitzkrieg” by American and British journalists, the German way of war utilized precision bombing, mass tank attacks, and above all, speed. In many instances, strong German armored units were attacking Polish rear areas before the front-line units realized that an attack was occurring. As reinforcements tried to deploy, they found that roads were blocked by *panzers* (tanks) and bridges had been knocked out by *Stuka* dive bombers. Paralysis was the result for the Polish Army. In most instances, Polish units that had been encircled either surrendered or were wiped out. Units that could retreat did so hastily but rarely had a chance to establish a new defensive line before the Germans were upon them. The concept of a front line held little real meaning as German armored units effectively knifed through the defenses and plunged deep into the Polish interior. Unlike the First World War, this war was about maneuver, not position; speed was essential. The pattern of German operations was repeated in the Low Countries and France in the spring of 1940. The soldiers on foot simply could not keep pace with the soldiers on tracks and wheels; the power of flesh had been eclipsed by the power of machine in battle.<sup>24</sup>

The German method of employing tanks seemed revolutionary to most observers, but actually, it was the fulfillment of the ideas of some pre-war British military theorists, who were decisively in a minority. In Great Britain and France, armor doctrine stipulated that tanks were to be dispersed among front-line units for either attack or defense, as they had been in World War I. British army officers J. F. C. Fuller and B. H. Liddell Hart disagreed contentiously with this idea, often publicly. Since the 1920s, these officers,

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<sup>24</sup> Robert M. Citino, *Armored Forces: History and Sourcebook* (Westport, CT: Greenwood Press, 1994), 68-69.

who chose to resign their commissions in the army rather than be silenced, advocated that tanks should be concentrated for one powerful punch at a decisive point. Quickly overpowering their opposition, the tanks would then attack into rear areas. However the attack would not be against local rear areas like front-line units. Instead, the tanks would strike out for the divisional, corps, and army headquarters and supply depots. Fuller explained in a post-war work,

[The Tank] was to employ mobility as a psychological weapon: not to kill but to move; not to move to kill but to move to terrify, to bewilder, to perplex, to cause consternation, doubt and confusion in the rear of the enemy, which rumour [sic.] would magnify until panic became monstrous. In short, its aim was to paralyze not only the enemy's command but also his government.<sup>25</sup>

Instead of an advance of four or five thousand yards a day, the tanks would push on for ten or twenty miles. Fuller and Liddell Hart envisioned tank armies in which all components were motorized; such armies would revolutionize warfare by overwhelming and outmatching any adversary who remained stationary in trenches.<sup>26</sup>

A German officer, Heinz Guderian, took these ideas and created the *Panzerwaffe* (Armored Force), consisting of large armored units. Tanks alone could not support a deep penetration into enemy lines; other armored units (such as self-propelled artillery and protected carriers for riflemen) were required to accompany and act in concert with the tanks. Where the British, French, and Americans envisioned an attack by twenty or thirty tanks, Guderian's *Panzerwaffe* struck with two or three hundred tanks plus their fully motorized support. This support consisted of infantry riding in trucks, on motorcycles, or

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<sup>25</sup> J. F. C. Fuller, *The Conduct of War, 1789-1961* (New York: Da Capo Press, 1992), 256-57.

<sup>26</sup> B. H Liddell Hart, *History of the Second World War* (Old Saybrook, CT: Konecky & Konecky, 1970), 66, 705-7.

in special armored carriers. Artillery, anti-aircraft, and anti-tank guns were towed by trucks or self-propelled. The Americans had not developed anything that combined these elements as effectively as the Germans had. Ironically during the 1930s, Guderian overcame resistance from tradition-bound army leaders who made all the same arguments regarding tanks that occurred in the American army. Following the surrender of Poland, American army officers quickly realized how inadequate their own armored forces and capabilities really were.<sup>27</sup>

The Army's acknowledgment of the inferiority of American tank doctrine coincided with the realization of the technical inadequacies of American tanks. When the war began in 1939, Congress allocated more funding, albeit limited, for the procurement of tanks. Unfortunately, the Army was unsure of what to produce, tanks or combat cars. This question called attention to the Army's core problem; it still did not really know how to employ tanks in battle. How to train and deploy a large armored force similar to the *panzer* divisions was also a puzzle. Under pressure from the President and Congress, the Army decided to produce both of the most modern designs. In October 1939, the Army ordered 329 of the Cavalry's M2A4 combat cars or light tanks. The Army planned to place the heavier, Infantry version, designated Medium Tank M2, into large-scale production in 1940 after the requisite factories had been built; however, this design was cancelled before significant production began and replaced by the M2A1. As the Army began to acquire a sufficient number of tanks in order to form true tank units, the

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<sup>27</sup> Heinz Guderian, *Panzer Leader*, The Great Commanders series, trans. Constantine Fitzgibbon (Pennington, NJ: Collectors Reprints, 1997), 24-26; Green, Thomson, and Roots, *Planning Munitions for War*, 250-51.

question over the best way to employ them in battle became more poignant, and a resolution was imperative.<sup>28</sup>

Although tanks were crucial to the German success in 1939, many American army officers were reluctant to accept that tanks were now the premier land weapon. The tank's central role was undeniable in the Nazis' swift victory over Poland. However, in the fall and winter of 1939, the American army found itself in a paradox. Both the Cavalry and Infantry advocated their tank concepts, yet neither branch wanted to be fully responsible for tanks. Tanks were in the ascendancy with political leaders, and the branch chiefs feared that their service icons, the rifleman and the horse, would be eclipsed by this mechanical marvel. It seemed likely that tanks would soon dominate whichever branch got "ownership" of them. So while branch chiefs advocated their ideas on tank employment, both continued to stress the dominance of their own branch's principle element. The Infantry believed in the supremacy of the rifleman; the Cavalry had difficulty giving up its romantic notions of the horse. The Cavalry was especially concerned that its horses would be replaced by tanks and armored cars, because their practical roles were so similar--transportation and mobile action. Some officers saw the tank as a potential replacement for the horse and fiercely resisted. Although George Patton was already recognized as a leading figure in the evolving American tank forces by 1941, he wrote a colleague and friend, "In spite of my gasoline affiliations, I am convinced that the day of the horse is far from over and that under many circumstances

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<sup>28</sup> Peter Chamberlain and Chris Ellis, *British and American Tanks of World War II: The Complete Illustrated History of British, American, and Commonwealth Tanks, 1933-1945* (London: Cassell & Co., 2000), 86.

horse cavalry and horse-drawn artillery are more important than ever.”<sup>29</sup> General John Herr, Chief of Cavalry, continued to stress the superiority of the horse and opposed efforts to transform Cavalry units into fully mechanized units, including several protests to the Chief of Staff, General George C. Marshall.<sup>30</sup>

With the fall of France, the need for drastic reorganization of the Army’s tank forces was imperative. Accordingly, General Marshall ordered the creation of the Armored Force as a separate combat branch in June 1940 (see Appendix A: “Annotated Organization of the War Department, June, 1941”). Technically equal to the other branches, the Armored Force was responsible for the deployment and use of tanks and their supporting elements, including infantry riding in protected carriers (half-tracks) and self-propelled artillery. Predictably, this decision displeased the branch chiefs of the Infantry, Cavalry, and Artillery. Fearing the loss of skilled personnel, these chiefs also feared a loss of resources. In order to placate these officers, General Marshall had stipulated that the Armored Force was for experimental purposes at present. As such, the Armored Force was neither superior nor equal to the traditional Infantry and Cavalry; it was merely an adjunct and separate from the two, who did not have direct control over it. Johnson noted that the Armored Force, while radical for the Americans, did not resolve the fundamental issue of tanks but only mollified the dispute. The Army’s lack of unity on the purpose of tanks directly influenced the design of the M4.<sup>31</sup>

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<sup>29</sup> Martin Blumenson, *The Patton Papers, 1940-1945* (Boston: Da Capo Press, 1974), 38.

<sup>30</sup> Johnson, *Fast Tanks and Heavy Bombers*, 140.

<sup>31</sup> Ibid., 144.

The Armored Force was influenced indirectly and unofficially by the interwar dispute over tanks. Both Infantry and Cavalry officers remained adamant in their views and argued the point with zeal, motivated too often by loyalty to their branch. As in the 1930s, the debate was a partly a bureaucratic turf battle for resources and prestige in the Army. More importantly, both branches were convinced that their view offered the most likely chance for success in future wars and was therefore the only real choice.<sup>32</sup> Because neither branch was willing to acquiesce in its pre-war views, the Armored Force became a compromise of sorts. Neither branch controlled it, so neither branch could dictate to the other how tanks would be used on the battlefield. The Armored Force developed and tested new models of tanks. It trained crews and standardized the basic combat methods (tactics) for tanks, such as formations and firing and driving procedures. However, the larger question of when, where, and how to use tanks remained unresolved. Should tanks purely support the Infantry, or should they be utilized as the Cavalry envisioned, exploiting openings and striking deep into the enemy's interior? Until this fundamental question was answered, the Army could not design a suitable vehicle, to say nothing of mass-producing one. Partly to resolve the impasse, the War Department was reorganized in 1942, and the Armored Force was placed on a more equal footing with the other branches (see Appendix A). In this capacity, the Armored Force had the principal voice in the development of tank doctrine within in the Army, although disagreements persisted. In short order, the Armored Force developed a solution meant to satisfy both

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<sup>32</sup> Kent Roberts Greenfield, Robert R. Palmer, and Bell I. Wiley, *The Army Ground Forces: The Organization of Ground Combat Troops*, United States Army in World War II series (Washington, DC: U.S. Government Printing Office, 1947; reprint, Center of Military History, United States Army, 1987), 62.

branches: medium tanks would be designed and produced that were capable of performing both the Infantry mission and the Cavalry mission. The M4 was a product of this decision.<sup>33</sup>

Into the dispute over the role of tanks, General Lesley McNair, chief of the Army Ground Forces, emerged as the principal individual who shaped American tank doctrine. Between 1939 and 1940, McNair served as the commandant of the Command and General Staff School at Fort Leavenworth, which was the principal Army agency for dealing with theoretical military problems such as the German blitzkrieg. In 1940, General Marshall tasked McNair with developing the General Headquarters, which was responsible for all training, organization, and mobilization. The General Headquarters evolved into the Army Ground Forces. The headquarters was also responsible for the implementation of doctrine as developed by both of the branches. As the superior headquarters over all combat forces, the Army Ground Forces, led by McNair, influenced the development of Army doctrine. For example, the Infantry branch developed new methods and tactics on how foot soldiers fought; the Army Ground Forces was responsible for ensuring that doctrine was taught at training camps and utilized in combat. However, McNair, as commanding general of all branches in the Army Ground Forces, could and did intervene in the development of doctrine. Doctrine needed to be coordinated between branches, and McNair worked hard to ensure such coordination happened. In regard to the role of tanks in the fighting tanks, McNair almost single-

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<sup>33</sup> Stephen J. Zaloga, *US Armored Units in the North African and Italian Campaigns, 1942-45*, Battle Orders series 21 (Oxford: Osprey Publishing, 2006), 10-13, 18.

handedly developed an innovative approach that appeared in 1941 to have merit but was ultimately wrong-headed.<sup>34</sup>

In early 1940, McNair and his staff set to work on how to counter the German offensives, specifically the *panzer* thrusts. With the fall of France, the demand for a solution became an outcry, as it was apparent to most officers that it was only a matter of time before the United States entered the war. The German method of attack was to mass their tanks at crucial points and, with a combination of speed and firepower, to drive deeply into enemy territory, cutting off front-line combat units. For McNair, the crucial question was how to stop the German *panzer* offensives. Based on his experience as an artilleryman, McNair believed in the power of anti-tank guns against tanks and was convinced of their ability to stop an attack. Furthermore, he studied the battles of the Spanish Civil War and the intelligence reports from Poland and France. George Hofmann describes how, as late as 1939, many military observers and theorists were arguing that tanks were obsolete because of the increasing efficiency of anti-tank guns.<sup>35</sup> McNair analyzed the Army's own ordnance reports on the effectiveness of anti-tank guns and the testimony of participants in Army maneuvers regarding tank defense. McNair's solution was to create a new branch, the Tank Destroyers Command, whose specific purpose was to counter the German *panzer* thrusts; Army planners were never seriously concerned about defeating Japanese or Italian tanks, since neither nation utilized blitzkrieg tactics or had developed impressive tanks. Wherever the Germans attacked, McNair proposed to

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<sup>34</sup> Christopher R. Gabel, *Seek, Strike, and Destroy: U.S. Army Tank Destroyer Doctrine in World War II*, Leavenworth Papers series 12 (Fort Leavenworth, KS: Combat Studies Institute, U.S. Army Command and General Staff College, 1985), 9-11.

<sup>35</sup> Hofmann, "The Tactical and Strategic Use of Attaché Intelligence," 128.

rush anti-tank guns to the area and set up ambushes for the *panzers*. He realized that one of the keys of the *panzer* attacks was that the Germans avoided strong points and simply bypassed roadblocks and defensive positions. McNair argued that if anti-tank guns were mobile enough and had been kept far enough back from the front line in reserve, they could be deployed in such a manner as to force the Germans to fight.<sup>36</sup>

A chief stipulation of McNair's proposed tank doctrine was that tanks should not and would not fight other tanks. According to Hofmann, McNair viewed tank-on-tank battles as wasteful and expensive; tanks were better suited to the exploitation and pursuit mission.<sup>37</sup> Tanks were complex, highly sophisticated machines that required many weeks to build at significant cost. Tank crews required even more time to train and cultivate into functional units. McNair saw little point in having months of labor blasted to scrap metal in a matter of minutes. He was not alone in this view; the Armored Forces commander, General Adna Chaffee, agreed that tanks should not be used in an assault role or to duel with other tanks. Patton also agreed: "I can conceive of nothing more futile than to send expensive tanks against a prepared position."<sup>38</sup> McNair's solution sought to address the crucial problem of the war in 1939 and 1940, but unfortunately it proved inflexible when battle conditions changed. While McNair's ideas were inventive, the basic problem of defeating large-scale German *panzer* offensives was already obsolete by the time the United States entered active fighting. After the Anglo-American invasion of North Africa

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<sup>36</sup> Charles M. Baily, *Faint Praise: American Tank and Tank Destroyers during World War II* (Hamden, CT: Archon Books, 1983), 20-21.

<sup>37</sup> Ibid., 131.

<sup>38</sup> Blumenson, *The Patton Papers*, 33.

in November 1943, the Allies were usually on the offensive and the Germans were the defenders for the remainder of the war.

The groundwork of armor doctrine already existed by the winter of 1940 when officers began to develop the design that became America's main tank during the war years. This proposed vehicle became the M4. The division and the disputes over the tank's role were evident in its design. As the design work proceeded, the Infantry and the Cavalry, now represented by the armor branch, continued to cling to many of their pre-war ideas and sought to have these incorporated into the model. The doctrine created by General McNair stipulated a specific role for this new tank that in turn imposed a criterion upon its design. As a result, the primary factor in the design of the M4 was its proposed function within American armor doctrine. The interwar dispute over the role of tanks in battle certainly influenced this doctrine, so when the M4 went to war, the legacy of the interwar period went with it.

## CHAPTER II

### THE DESIGN AND DEVELOPMENT OF THE M4

The catalyst for the creation of the M4 was the German invasion of Poland and France. Germany's rapid success in conquering Poland in 1939 and victory over French and British armies in 1940 forced all armies to reconsider how they used tanks in battle. The U.S. Army's response was a compromise solution to the interwar debate about the role of tanks that sought to satisfy both Cavalry and Infantry views but also to build a force capable of coping with the German *Panzerwaffe* (armored force). Accordingly, the Army reorganized itself, creating tank units in the process. The Army also needed new models of tanks. American army leaders quickly realized that the best U.S. tanks were so technically inferior as to be useless on the battlefields of 1940 and 1941. American tank designers evaluated existing tank characteristics--such as guns, armor, and mobility--to find the right combination of traits that would allow the tank to perform its role in prospective Army operations. A key stipulation of the new doctrine was that U.S. tanks would not duel enemy tanks and therefore did not need to be built to do so. Overriding everything, the success of German armies in 1940 and 1941 created a sense of urgency for the Americans; they perceived that further delays in reorganization and production would ultimately be harmful. Whatever the problems were, American leaders needed solutions quickly; this attitude was the backdrop for the creation of the M4. As such, the M4's design and production were the result of the atmosphere and the particular requirements of the U.S. Army in 1940-41.

In his definitive history of the M4, historian R. P. Hunnicutt accurately described the situation for the Americans in July 1940, noting that the U.S. Army possessed only

eighteen modern tanks.<sup>1</sup> These tanks, designated M2A1, carried a 37mm cannon and were the most advanced American tanks at the time; many of the features of the M2A1 were utilized in the M4. According to Hunnicutt, the fall of France in the spring of 1940 motivated the Americans to rebuild their armed forces with a particular emphasis on tank warfare. He argued that the Americans believed they needed to reorganize the Army and develop equipment that was second-to-none in order to cope with the German blitzkrieg. As a result, American Army planners realized that the M2A1 would be obsolete before reaching the battlefield and that a tank mounting a 75mm canon (similar to the latest German model) was required. Without such a tank, the Americans and their allies would not be successful against the German *panzers*.<sup>2</sup> As well as the dispute over the role of tanks in battle, the inadequacy of American tank designs compared to the Germans and the need to develop satisfactory tanks quickly overwhelmingly influenced the design of the M4, and its origins can only be understood in that context.

When the M4 was conceived in 1941, Germany already had a significant technical and experiential lead over the United States and Great Britain. The best German tanks, the *Panzerkampfwagen (Pzkw.) III* and *Pzkw. IV*, were designed in 1935 and employed since 1939; German soldiers knew how to use these tanks well. Not only did German soldiers have more practical experience operating tanks by 1941 but German industry also had more practical knowledge in the design and manufacture of tanks (see Appendix B). In comparison, the best American tank, the M2A1, was already obsolete

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<sup>1</sup> R. P. Hunnicutt, *Sherman: A History of the American Medium Tank* (Novato, CA: Presidio Press, 1976), 44.

<sup>2</sup> Ibid., 46.

due to its inadequate armor, firepower, and mobility. The British had significant experience in designing tanks during the 1930s, but much of that effort had been wrong-headed. The British produced a plethora of different models, such as the A10, A13, Covenanter, and Crusader, but all lacked firepower, armor protection, and mechanical reliability compared to the latest German models. British tanks were at a serious disadvantage against the German *panzers* in the first years of the war.<sup>3</sup> As such, the environment in which the M4 was conceived was one of urgency and extreme necessity. The British desperately needed tanks to replace the equipment destroyed or lost in the evacuation of France during the summer of 1940 and in the deserts of North Africa in 1941. Their own industry had proved incapable of meeting the wartime demand. Even before entering the war in December 1941, the Americans realized the necessity of creating an army that used tanks in a central role. Large numbers of tanks were required, but a new design was necessary before any new American tanks could be built. The new tank design was governed according to how the Americans envisioned using tanks in battle, but unfortunately, the Americans had not resolved its long-standing dispute about the role of tanks.<sup>4</sup>

As discussed in Chapter I, the interwar disagreement between the Cavalry and the Infantry was fundamental to American ideas about tanks and their capabilities; as such, the disagreement directly influenced the design of the M4. Although the Germans had demonstrated using tanks as the preeminent offensive weapon in Poland and France, the

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<sup>3</sup> Tim Moreman, *Desert Rats: British 8<sup>th</sup> Army in North Africa 1941-43*, Battle Orders series 28, ed. Duncan Anderson (Oxford: Osprey Publishing, 2007), 45; Ross, *The Business of Tanks, 1933 to 1945*, 129.

<sup>4</sup> Citino, *Armored Forces*, 88-90.

Infantry argued that tanks should be used only in a supportive role to assist foot soldiers (infantry). Accordingly, tanks should be designed as heavy, armored, mobile gun platforms providing firepower wherever it was needed.<sup>5</sup> A key aspect of this view was that tanks did not need to be any faster than a walking soldier (approximately three miles per hour), although occasional bursts of speed would be necessary. The Cavalry argued the issue in a manner keeping with its traditional mission: tanks should be used for scouting, for protecting the army's flanks, and for deep raids into enemy territory. As such, tanks should be fast moving and well armed and have a long range; therefore, they also needed to be lightweight. The Cavalry also argued that tanks should exploit breaches in the enemy's front line and strike deeply into enemy territory. Having done so, tanks would then attack enemy supply columns, communication points, and headquarters. Tanks would also seize important geographic objectives and hold them until the infantry could arrive. Based on this vision of the tank's mission, the Cavalry stressed that the new tanks primarily needed to be mobile and fast in order to quickly disengage from enemy forces and to strike their targets before a response could be developed. Given the technical limitations of the day, both views could not seemingly prevail; American tanks would either be heavy and slow or light and fast. By late 1940, improvements in the tank's automotive components blurred this distinction so that a new tank could have heavy armor (two to three inches) and also reasonably fast (25 mph or greater). Even so, the pre-war Infantry and Cavalry differences over the employment of tanks remained.<sup>6</sup>

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<sup>5</sup> George F. Hofmann, "The Demise of the U.S. Tank Corps and Medium Tank Development Program," *Military Affairs* 37 (February 1973): 25.

<sup>6</sup> Baily, *Faint Praise*, 3-5.; Hunnicutt, *Sherman*, 40, 47.

With the concurrence of General Leslie McNair, chief of the Army Ground Forces, the newly created Armored Force developed a compromise solution; tanks would be used for both missions and not limited to just one. As discussed in Chapter I, originally it was thought that the United States would create tank units to support the infantry and separate units to exploit breakthroughs into the enemy's rear. The Armored Force would create and organize the necessary units with the advice of the Infantry and Cavalry; it could chose to ignore that advice as well. Neither branch had dominance over tanks and could no longer dictate or interfere with tank design or production. The real crux of the solution was the centralization of tank issues into one body, the Armored Force, and the stipulation that different units of tanks, not different models of tanks, would carry out the different battlefield functions.

For the exploitation mission, the Army created armored divisions to attack into the enemy's rear areas. The armored division consisted of two light-tank regiments, one medium-tank regiment, and support units of infantry, artillery, and supply, all carried on trucks or armored vehicles.<sup>7</sup> Based on reports from the British in Africa and after several field tests and exercises, the Armored Force realized that light tanks were of limited value due to their lack of armor protection and insufficient firepower. Although useful for reconnaissance and screening duties, light tanks were no longer able to carry out the primary missions of the armored division; medium tanks therefore became the primary type for most missions in the division. Reflecting this change, the Armored Force modified the division in March 1942. These divisions consisted of two tank regiments

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<sup>7</sup> John B. Wilson, "Organizing the First Armored Divisions: The Meeting at a Schoolhouse in Louisiana in 1940 Dragged the Infantry and Cavalry Branches into the Age of Combined Arms," *Armor* 108 (July-August 1999): 43.

with 63 light tanks and 116 medium tanks each. The division was further modified in 1943 and re-equipped with 74 light tanks and 159 mediums.<sup>8</sup>

McNair also advocated the creation of separate, General Headquarters (GHQ) tank battalions to support the infantry. These tank formations were not a permanent part of the infantry division, which was the principal unit of all World War II armies and the smallest self-sustaining field formation (about 15,000 men). Instead, the corps or army commander would control the GHQ tank battalions (54 tanks each) and could allocate them as support in whatever manner he deemed best. This approach seemed to placate both positions on the use of tanks but had serious ramifications on tank design and deployment in the coming war.<sup>9</sup>

All tanks are engineering compromises and reflect what the designers seek to emphasize based on the doctrine governing the use of tanks. The three key features of a tank are its protection (armor), mobility, and firepower. From an engineering standpoint, weight is the real limiting factor in the design, because the heavier a tank becomes, the harder it is to move. Any engine has a finite amount of motive power it can generate, and the weight of the object will determine how easily (speed) it can be moved. Tank designers favor one feature over another based on the doctrine and the capabilities of the engine to be used. Therefore, an increase in armor plating, such as its thickness (better protection), meant fewer weapons and a slower speed. If the designer desires a large gun or large numbers of small guns, then armor plating must be reduced so that the engine

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<sup>8</sup> Zaloga, *US Armored Units*, 23-24, 36.

<sup>9</sup> Christopher Gabel, “World War II Armor Operations in Europe,” in *Camp Colt to Desert Storm*, ed. Hofmann and Starry, 145.

can handle the weight. If speed is the feature most desired, then armor and weapons must be limited. Moreover, designers must factor in other features that also contribute to weight, such as a turret, its traversing gear, radios, and fuel (which depends on the desired operational range). In determining the compromise between all the desired technical features, the crucial deciding factor is the power limit of the engine. The relatively weak engines (less than 300 horsepower) of the 1930s and early 1940s meant that tanks could not be thickly armored, fast, and heavily armed. The Soviet, German, British, and to a lesser degree, American armies all experimented with light tanks (twenty tons or less) and medium tanks (twenty to forty tons) in order to determine which characteristics were the most desirable. The light tanks emphasized speed over armor, whereas the mediums emphasized armor over speed. Both types had comparable weapons, usually a 20mm or 37mm gun plus several machine guns. Only the Soviets developed heavy tanks (forty tons or more) in the 1930s with the requisite powerful engine; the Germans quickly followed suit after the invasion of the USSR in July 1941. Heavy tanks focused on heavy armor, impervious to everything but large anti-tank guns and powerful weapons; speed and mobility were sacrificed, and mechanical failures in the engines were common due to overstressing. For example, the famous German *Pzkw.* VI, the “Tiger,” had thick, heavy armor and a powerful gun (88mm), but its range was limited to less than one hundred miles. Its speed was significantly slower than its contemporaries, and its off-road mobility was restricted due to its tendency to sink into soft ground such as mud or snow.<sup>10</sup> The Americans had little interest in heavy tanks: the lack of mobility was contrary to the Cavalry vision, and the excessive fuel and

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<sup>10</sup> Macksey, *Tank Versus Tank*, 122.

maintenance requirements were unappealing to the Infantry. More importantly, the Americans did not have an engine that could power a heavy tank. Consequently, American tank design focused exclusively on the light tanks favored by the Cavalry and the medium tanks favored by the Infantry.<sup>11</sup>

Tank guns reflected the user's doctrine more than any other aspect of the design. Until late 1940, the available technology required that different guns were used to accomplish different tasks. An infantry support tank would be armed quite differently than one designed to combat other tanks. A gun highly effective against soldiers was less effective against other tanks and vice versa; guns were not dual-purpose. Combining the main gun with several machine guns enabled tanks to engage multiple targets effectively, but the added weight required other design compromises.

An anti-tank gun was significantly different from guns required for other purposes. Anti-tank guns fired relatively small (37mm to 50mm in diameter) armor-piercing (AP) rounds at high velocity. Occasionally called solid shot, AP rounds were solid pieces of highly dense metals, such as steel or tungsten. The correct combination of the round's mass and its velocity (kinetic energy) was the key to penetrating armor plating. If the projectile lacked sufficient mass or velocity, the armor plating deflected it either by absorbing or deflecting the impact (ricochet). Although larger guns were eventually developed, the 37mm and 50mm guns were the only ones available to the American, British, and German armies until 1942. Projectiles of this size were easier to propel to the necessary velocities, and tank crewmen could easily handle the physical size

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<sup>11</sup> Chamberlain and Ellis, *British and American Tanks*, 155-56; Green, Thomson, and Roots, *Planning Munitions for War*, 278.

of the complete round (projectile plus propellant) in the confines of a tank interior.<sup>12</sup> In addition to the amount of propellant, the length of the barrel also affected the velocity of the projectile. A longer barrel provided greater muzzle velocity and accuracy than a shorter barrel due to the larger number of rotations (due to the rifling effect) the projectile experienced as it traveled down the barrel. Gun designers could increase the barrel length to achieve greater velocity, but only to a certain point. After that point, the rifling effect became negligible, and the gun became physically unbalanced and dangerous. To balance the gun, a larger and heavier turret was required, which increased the overall size and weight of the tank. Moreover, extremely long barrels had other potential drawbacks, such as limiting the ability to rotate the turret in cramped conditions like city streets or forests. Designers had to factor in such issues in determining the barrel's length and tried to achieve some type of compromise between desirability and practicality.<sup>13</sup>

For use against troops, fortifications, and non-armored vehicles, only guns firing larger shells (75mm or higher) filled with high explosive (HE) were effective. An HE shell has an explosive charge inside the projectile (hence the term "shell") that bursts upon impact. The explosive power was in direct relation to the size of the charge, so bigger shells meant better results; 37mm and 50mm guns could fire HE shells, but the explosion was of dubious usefulness. Larger projectiles require greater amounts of propellant because of their mass; the increase in propellant creates another requirement. Because the explosive force of the propellant is greater, thicker, stronger barrels are

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<sup>12</sup> Kenneth Macksey and John H. Batchelor, *Tank: A History of the Armoured Fighting Vehicle* (New York: Ballantine Books, 1971), 126.

<sup>13</sup> Green, Thomson, and Roots, *Planning Munitions for War*, 326-28.

required to prevent the barrel from exploding (bursting). Complex and more difficult to manufacture, thicker barrels are also heavier, which makes them harder to move; a larger tank is once again required. Compared to the AP guns, a shorter barrel length was used to reduce weight and to ease production. Until 1942, no army in the world mounted guns larger than 75mm because of the limits on automotive power and the limited usefulness of such weapons.<sup>14</sup>

Prior to 1941, the technology did not exist to create a single gun that could fire both AP and HE projectiles with equally satisfactory performance. For example, the British 2 pounder and the German 37mm gun AP shells had excellent armor penetrative capability; but the HE shell fired by both was small, and its explosive power was limited to a small radius that was unlikely to injury or kill anyone who was not at the point of impact. The German short-barreled 75mm gun fired an excellent HE shell that was very effective against unarmored targets. However, the gun had a short barrel and low muzzle velocity that rendered the AP inaccurate and ineffective at normal combat ranges. For tank designers prior to 1941, guns could either fire effective AP or HE projectiles, but not both. As such, guns really had only one purpose on the battlefield—either to attack tanks with armor-piercing shells or to attack military personnel and fortifications with HE shells. In 1941, a problem developed as opposing tanks began to mount heavier, thicker armor; previously HE rounds could destroy a tank if the resulting explosion was large enough, but only AP rounds now had a real chance of doing so. The German *Panzerwaffee* sought to resolve the problem by equipping units with both the *Pzkw.* IV (25 tons) armed with the short-barreled 75mm gun for attacking troops and soft (non-

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<sup>14</sup> Macksey, *Tank Versus Tank*, 54-56.

armored) enemy targets and with the *Pzkw.* III (20 tons) with its long-barreled 50mm gun, designed to duel other tanks.<sup>15</sup> *Panzer* units equipped in this way were able to deal with a variety of targets they encountered. For the Americans, the solution to the problem fit neatly into McNair's proposed doctrine for U.S. tanks and tank destroyers. Since tank destroyers were to fight tanks, they would mount the high-velocity AP guns. These tanks would carry guns better suited for their prospective targets, non-armored enemy troops and equipment. Because the M4 would not be used in an anti-tank role, the 75mm short-barreled gun was the preferred weapon. These decisions led to one of the greatest sources of criticism of the M4, because it hampered the M4's ability to combat other tanks successfully.<sup>16</sup>

The concept of tank destroyers as advocated by General McNair was highly influential in American tank development. Outwardly, tank destroyers (TDs) resembled normal tanks. The TDs used tracks, were armored for protection, and had a turret-mounted gun. However, its purpose was very different. The tank destroyer was an anti-tank gun that had been made mobile; tracks were better than wheels, because they were able to move off road in conditions such as mud or snow. The TDs were lightly armored on the sides to protect the gun crews from machine-gun fire and artillery-shell fragments, but they lacked roofs on the turret to reduce costs and to lighten the vehicle so that it moved faster. The main armament was a high-powered, anti-tank gun that had excellent AP capabilities, but the HE shell it fired was distinctly inferior to the M4's 75mm shell.

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<sup>15</sup> Bryan Perret, *Panzerkampfwagen IV Medium Tank, 1936-1945*, New Vanguard series 28 (Oxford: Osprey Publishing, 1999), 4-5.

<sup>16</sup> Hunnicutt, *Sherman*, 117; Steven J. Zaloga, *Sherman Medium Tank, 1942-1945*, New Vanguard series 3 (Oxford: Osprey Publishing, 1993), 6.

The Americans designed and built TDs for the sole purpose of destroying tanks, whereas tanks were capable of a variety of missions. According to McNair, the tank destroyers were the solution to the German blitzkrieg, which he defined as the Army's most pressing problem in 1940. As stated in Chapter I, McNair believed that American tanks should not be used to stop German *panzers*; the TDs would do that job.<sup>17</sup> In theory, wherever German tanks penetrated the front lines, the tank destroyers would rush to the spot *en masse* and ambush the attackers. The massed German *panzers'* attack would be stopped by a hail of AP rounds from the highly mobile TDs, firing from concealed positions. As McNair envisioned it, the blitzkrieg would be stopped and the defenders would be able to redeploy before being destroyed by the German forces that attempted to follow the *panzers*.<sup>18</sup>

Since tank destroyers cost less than tanks in both resources and money, they were attractive to the Army. The emphasis on firepower and speed required a reduction in the amount of armor that was carried on the TDs. With the reduction in weight, the TDs required less powerful engines and less robust suspension systems than tanks. These characteristics of the TD fit well with McNair's other view: tanks, expensive and sophisticated, should not duel other tanks. By seeking battle with German tanks, American tanks risked destruction at the hands of the one adversary to whom they were most vulnerable. In McNair's opinion, the money, resources, and effort used to produce tanks were wasted when they were quickly destroyed in battles that should be avoided.

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<sup>17</sup> Greenfield, Palmer, and Wiley, *The Organization of Ground Combat Troops*, 73-74.

<sup>18</sup> Baily, *Faint Praise*, 20-21.

On the other hand, TDs were designed to destroy enemy tanks and had better chances of doing so. If destroyed, TDs did not represent as significant a loss of investment when compared to a tank.<sup>19</sup>

Not everyone agreed with McNair, and some believed that his views handicapped American tanks unnecessarily; a belief that later proved correct when the M4 was forced to duel German tanks. General Jacob Devers, who replaced Chaffee as Armored Force commander in August of 1941, disagreed with both Chaffee and McNair. Devers argued that the best defense against a tank was another, more powerful tank and that TDs were a poor substitute. Although he did not advocate abandoning the TDs, Devers wanted American tanks to be fully capable of dealing with any armored opponent they encountered.<sup>20</sup>

McNair bears the most responsibility for the development of American tanks and their use during World War II. Often labeled “the principal architect of the U.S. army,” McNair’s misconceptions regarding tank warfare influenced tank design throughout the course of the war.<sup>21</sup> As the chief of the Army Ground Forces, McNair’s views and ideas on tanks had the weight of “unofficial” orders in a practical sense; only General Marshall, Chief of Staff of the Army, outranked McNair. To be fair, McNair encouraged discussion and debate regarding tank design and was willing to modify some of his views as the war progressed. Even so, McNair’s pre- and early war influence on the development of the M4 reverberated throughout the course of the war. Although McNair died accidentally in

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<sup>19</sup> Ibid., 9.

<sup>20</sup> Green, Thomson, and Roots, *Planning Munitions for War*, 280.

<sup>21</sup> Hastings, *Overlord*, 192.

July 1944, the war ended before his replacement could seriously change the course that he had set.<sup>22</sup> From the initial designs to later modifications, the M4 reflected McNair's views on tanks. The absence of an effective anti-tank gun on the M4 has been a major source of criticism ever since 1944. However, the official doctrine from 1940 was that American tanks were to avoid combat with enemy tanks whenever possible. The problem was not in the design but in the doctrine.

The Armored Force seemingly resolved the pre-war dispute over the role of tanks in battle by 1942. As previously discussed, armored divisions, consisting of 390 tanks, were to pursue the exploitation mission advocated by the Cavalry. Concurrently, the Armored Force created and trained separate tank battalions (formations of 54 medium or light tanks) to operate with the Infantry. As a matter of policy and practicality, the Army did not develop different tanks for the different roles. In 1940, the United States was unable to produce tanks in meaningful numbers due to the lack of existing facilities. Dispersing resources along two separate lines of development and production would have reduced the total numbers produced. During the war, the British attempted to develop distinct tanks for the Cavalry and Infantry missions but were unable to produce adequate numbers of each or to cope with the increased logistical problems satisfactorily; different machines required different replacement parts and mechanics with different training to maintain them. British General G. MacLeod Ross, liaison to the United States for tank development, noted bitterly in his memoirs the wasted time, effort, and resources of this

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<sup>22</sup> Greenfield, Palmer, and Wiley, *The Organization of Ground Combat Troops*, 84.

approach.<sup>23</sup> In contrast, U.S. Army ordnance officers sought to develop a single medium tank capable of functioning satisfactorily both in the armored division and in the separate tank battles. They did so by excluding features not essential to the specified missions of Infantry support and exploitation of a breakthrough. Ordnance designers excluded a high-powered anti-tank cannon and heavy armor plating that were useful only in tank-on-tank engagements.

Adding to the impetus for a new tank design, the light tanks proved inadequate in 1941 during the fighting in North Africa. As previously stated, McNair and other Army planners had initially envisioned in 1940 that armored divisions would be composed of mostly light tanks and limited numbers of medium tanks; the separate tank battalions would use mostly medium tanks and a few light tanks for scouting duties. However, British reports coming from North Africa in late 1941 amply demonstrated that light tanks were increasingly vulnerable on the battlefield and were becoming obsolete because of the improvements in anti-tank guns, specifically the German 50mm gun. Likewise, Major George Jarrett, U.S. Army, argued in 1941 that Allied forces were at a serious disadvantage against German tanks following a fact-finding mission to Africa. His findings revealed that current British and American anti-tank guns were increasingly ineffective against German armor. Based on experience and tests in North Africa, Jarrett reported that the improvements to the German *Pzkw.* III and *Pzkw.* IV had made them invulnerable to the American 37mm and the British 2 pounder anti-tank guns, which were the standard armament of each country's light tanks. Furthermore, the armor on Allied tanks was extremely vulnerable to the German 50mm anti-tank shell and the 75mm high

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<sup>23</sup> Ross, *The Business of Tanks*, 187-89.

explosive shell.<sup>24</sup> Light tanks were simply outclassed and obsolete in the North African desert; a new medium tank was required to combat the Germans.

Although design work began on a model that eventually became the M4, the Americans and British could not wait and required a new tank sooner that could temporarily meet the need in Africa in 1941. Taking the quickest route to produce a new model, the Americans upgraded their existing medium tank, the M2A1. Originally armed with a 37mm gun and several machine guns, the M2A1 was essentially a light tank. Army Ordnance engineers created the Medium Tank, M3, a hybrid that shared most of the same design features as the M2A1 but incorporated heavier armor and a 75mm gun in addition to its existing weapons. The 75mm gun was the key item that the British strongly advocated in a new tank; notably, the British demand for this gun came from the hope in its superior ability to defeat German tanks. Although not intended by the Americans for this purpose, the 75mm gun proved capable of penetrating the armor of the *Pzkw.* III and *Pzkw.* IV beyond the effective range of the Germans' guns.<sup>25</sup> Even so, the M3 was a stop-gap measure based upon the urgency of the contemporary situation's requirements, particularly in North Africa. Moreover, the lack of British and American satisfaction with the M3 was the direct cause for the production of the M4.<sup>26</sup>

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<sup>24</sup> Lida Mayo, *The Technical Services: The Ordnance Department: On Beachhead and Battlefront*, United States Army in World War II series (Washington, DC: U.S. Government Printing Office, 1968; Washington, DC: U.S. Army Center of Military History, 1991), 27.

<sup>25</sup> Hunnicutt, *Sherman*, 92; Ross, *The Business of Tanks*, 172-73.

<sup>26</sup> Macksey, *Tank Warfare*, 173-74.

The physical appearance of the M3 demonstrated the fact that it was an interim design. The M3 strongly resembled an M2A1 with a 75mm gun seemingly grafted onto its right side. Army Ordnance engineers simply incorporated the gun and its housing, a sponson, into the original design. This feature reflected the urgent desire to match the German *panzers'* armament, particularly the 75mm-armed *Pzkw.* IV. The M3's 75mm gun was not housed in a turret above the hull; the gun was placed inside the hull, facing forward and had limited traverse to the right side of the vehicle only. To engage targets on the left side, the M3 had to turn in that direction. This was a distinct disadvantage in combat, and the M3 had other problems as well.<sup>27</sup>

American Brigadier General Paul M. Robinett commanded the 13<sup>th</sup> Armored Regiment of the 1<sup>st</sup> Armored Division that was equipped with the M3 during the North African campaign of 1942. In his autobiography, Robinett wrote,

Our M-3 medium tanks were no match for the German Mark IV; and our M-3 light tanks were obsolete . . .

There were many bad features that damned our tanks. The German tanks had greater mobility on soft or sandy terrain. Our M-3 medium tanks were higher than German tanks and thus presented a better target. The 75-mm gun of the M-3 was side-mounted and lower than the German tank gun giving the advantage to the German. The lack of all-round traverse made the medium tank extremely vulnerable in a running fight and in a withdrawal. The armor piercing ammunition of the German 75-mm gun penetrated from 4.1 to 5.9 inches of steel plate at 1,000 yards, normal impact; while the best American ammunition would penetrate 3.5 inches only. The American 37-mm gun was completely outclassed by all German guns in Africa. The enemy's smokeless powder, muzzle brakes, and all-around vision slits in tank turrets favored fire control and made it extremely difficult for

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<sup>27</sup> Hunnicutt, *Sherman*, 47.

our tankers to find targets. American instruments, such as field glasses and tank sights, were also inferior to those of the enemy. American tactical doctrine and training were, therefore, out of line with reality.<sup>28</sup>

Noteworthy, Robinett's criticism of the M3 pertains to its performance in battle against German tanks, which was the function of the Tank Destroyers. As stipulated in the official doctrine, American tanks were supposed to avoid combat with German tanks if at all possible. In hindsight, Robinett's conclusion is on the mark: American tactical doctrine was "out of line with reality," because American M3s were battling German tanks both out of unavoidable necessity and due to their misuse by American commanders. For example, American generals ordered U.S. tanks, not TDs, to counter-attack German *panzers* during the battle for Kasserine Pass (February 19-25, 1943); most of the American tanks were destroyed in the battle.<sup>29</sup> In spite of McNair's and others' views on tank employment, U.S. tanks were fighting tanks on a regular basis in North Africa in 1942 and 1943; unfortunately, American army leaders and engineers looked only to solve the technical shortcomings of the M3 instead of also re-evaluating how tanks were actually used in battle. The M3 had serious technical shortcomings, but the real problem was the idea that U.S. tanks could avoid German tanks during a battle and that TDs would intervene as needed. Army leaders failed to connect the change in battle conditions with how tanks were being constructed. Thus, designers of the M4 attempted

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<sup>28</sup> Paul McDonald Robinett, *Armor Command: The Personal Story of a Commander of the 13<sup>th</sup> Armored Regiment, of C.C.B., 1<sup>st</sup> Armored Division, and of the Armored School during World War II* (Washington, DC: McGregor & Werner, 1958), 107.

<sup>29</sup> David Rolf, *The Bloody Road to Tunis: Destruction of the Axis Forces in North Africa, November 1942-May 1943* (Mechanicsburg, PA: Stackpole Books, 2001), 127-28, 133.

to correct the technical deficiencies of the M3 but did not reexamine whether the proposed features meet the needs of current and future combat. Although Ordnance engineers compared and stressed armor thickness and gun size between American and German tanks, Army leaders continued to insist that U.S. medium tanks not be built for the purpose of shooting it out with the German *panzers*.<sup>30</sup>

The final ingredient influencing the design and production of the M4 was the massive increase in the size of the American armed forces and the subsequent need for large numbers of tanks. During a pre-war conference in September of 1941, President Roosevelt ordered the production of 2,800 tanks per month or 33,600 per year; after the attack on Pearl Harbor, this number changed to 45,000 for 1942 and 75,000 by 1943.<sup>31</sup> The President, who seemed to generate these numbers out of thin air, inflated these production goals wildly without consulting with civilian or military planners as to what current or projected production might be. Even so, Roosevelt's high production target compelled Army leaders to produce as many as they could; orders from the commander-in-chief could not simply be disregarded. In accordance with pre-war plans, American industry played a key part in carrying out wartime military expansion. Civilian and military planners looked to the industries that were already experienced in the production of heavy vehicles and in working with large amounts of heavy steel: the locomotive and

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<sup>30</sup> Bailey, *Faint Praise*, 52, 81, 84-85; George F. Howe, *The Mediterranean Theater of Operations: Northwest Africa: Seizing the Initiative in the West*, United States Army in World War II series (Washington, DC: U.S. Government Printing Office, 1957; reprint, Washington, DC: Center of Military History, 1993), 672-73.

<sup>31</sup> Harry C. Thomson and Lida Mayo, *The Technical Services: The Ordnance Department: Procurement and Supply*, United States Army in World War II series, (Washington, DC: U.S. Government Printing Office, 1960; reprint, Center of Military History, United States Army, 1991), 232-34.

boiler manufacturers. The Army planners saw the automobile industry as the key workforce because of its tremendous success in utilizing the assembly line in producing automobiles. Unfortunately, none of the civilian engineers had any experience or conception of how to build a tank; many had never even seen one. The Army officer in charge of the Detroit Ordnance district remarked in 1944,

All [industry leaders and engineers] engaged to make something that they had never seen. They were frustrated and exasperated by late drawings and changes of design, shortages of everything they needed, late deliveries [of vital components and materials] and engineering bugs, yet we never heard a bitter word from them. For such men I have, as a soldier and a citizen, the highest respect.<sup>32</sup>

In spite of the steep learning curve, American industry started producing tanks as soon as it was able to do so. The production goals had been set, and all participants, civilian and military, were motivated to achieve their very best. They only needed to the tools and resources to do so.

To meet the tank production goals set forth by the President, American industry needed factories in which to produce the tanks. Months were required to re-equip existing facilities with the proper machine tools, to say nothing of developing an efficient workforce. Building new facilities took even longer than expected, which was illustrated by the new Detroit Tank Arsenal, which was constructed from June 1940 to April 1941; ten months elapsed before the first tank rolled out of that factory.<sup>33</sup> When a facility was ready, tank production had to start immediately and proceed quickly in order to meet both the production goals and to supply forces, both American and Allied, that were already in combat. The ability of the assembly line to mass-produce was due to repetitive

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<sup>32</sup> Forty, *United States Tanks of World War II*, 16-17.

<sup>33</sup> Ibid., 20.

manufacture of the same item over and over again. Once the process began, the assembly line could not be altered easily. Modifications to the original design were possible but interrupted the production cycle. Replacing the design with a different model would require stopping the manufacturing process and retooling the entire assembly line before production could start again; this process might take weeks or months depending on the required changes. The urgency of the situation in 1942 limited the practical possibilities of modifying tank designs; the outcome of the war was being decided in months, as shown in Poland and France. In the spring of 1942, it was not clear that Britain and the Soviet Union would withstand the German onslaught; they desperately needed to replenish their forces and replace their equipment losses, particularly tanks. Under these conditions, ease and speed of production were vital factors influencing the design of the M4.

Although future critics of the M4 -- such as Max Hastings, Stephen Ambrose, and Omar Bradley -- faulted the inclusion of production ease as a criterion in the design of the M4, speed of production was vital to America's war effort in 1941, 1942, and 1943. The United States, Britain, and the Soviet Union needed tanks in large numbers as quickly as possible if there was to be any chance of defeating Germany; the M4 met that need. The time needed to research and experiment with unproven tank designs that might be superior to any future German designs was before 1939 in London and before 1941 in Moscow and Washington; by 1942, that time was lost and gone. The Allies had to make do with what they had available in the early war years, and remarkably, the M4 proved more than capable of performing its designated role.

To summarize, seven key factors dictated the design of the new tank, officially called the Medium Tank, M4. These factors were concurrent in influence and consideration during the 1941-42 development phase of the M4. As discussed, they were

- 1) the desire to emulate the German *panzer* forces and tactics as demonstrated in Poland, France, and the Soviet Union;
- 2) the compromise to the Infantry's wish for support tanks and the Cavalry's belief in exploitative tanks;
- 3) the desire to mount a 75mm gun;
- 4) the requirement to avoid anti-tank operations (the job of the tank destroyers);
- 5) the necessity of replacing the M3 Medium Tank as soon as possible due to its inherent, unsatisfactory qualities;
- 6) the ability to mass produce the tanks to achieve the President's specified production goals and the war-time needs of the Allied militaries;
- 7) the urgent need to equip the rapidly expanding American tank forces and thereby speed the defeat of Germany.

The M4 met all of these demands in 1942 and 1943. As will be shown in the next chapter, it even exceeded these original requirements and expectations.

To save development and production time, Army tank designers used numerous components that were already proven and available for manufacture. The fuel system, steering mechanisms, gun sights, tracks, and transmission of the M4 had been used

satisfactorily and upgraded from the M2A1 and the M3.<sup>34</sup> A key example was the M4's suspension system, the Vertical Volute system, first used on the M2A1. Consisting of two large, vertically mounted springs shaped like truncated cones, the system was attached to two roadwheels to form a complete unit. Compressing the springs absorbed shocks and bumps from the ground; the result was a relatively smooth and stable ride. Three complete units (six roadwheels total) were mounted on each side of the tank, which supported the weight and held the track in place. Each unit could be removed and replaced individually without specialized facilities. This feature was particularly useful in the field, where tools were limited and time was short.<sup>35</sup>

As already stated, the primary weapon for the M4 was the 75mm gun. Used initially in the M3 medium tank, this gun met all of the Army's requirements in 1941 and 1942. With respect to the role envisioned by the Infantry and Cavalry, this gun was superb because of its extremely effective high-explosive shell. As planned, the 75mm gun was ideal for attacking everything that lacked armor protection (trucks, foot soldiers, bunkers, etc.). Even so, tank crews found that the gun's AP shell was also easily capable of dealing with most other medium tanks fielded by Germany and Italy in 1942, except for the German heavy tank, the *Pzkw. VI "Tiger."* As will be discussed in Chapter V, the poor performance of the 75mm AP shell against the late-war German tanks was the source of most of the criticism of the M4. However, in 1942, most Army commanders did not consider this a liability because of the stated mission of the M4 and the doctrine requiring the M4 to avoid tank-versus-tank combat. To supplement the 75mm gun, the

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<sup>34</sup> Hunnicutt, *Sherman*, 119–20.

<sup>35</sup> Ibid., 135, 241.

M4 carried two .30 caliber machine guns (one mounted in the turret and one in the hull facing forward) and an external .50 caliber machine gun for anti-aircraft defense. Firing incendiary, armor piercing bullets, this heavy machine gun devastated unprotected ground targets and further enhanced the M4's firepower.<sup>36</sup>

The superstructure (body) of the M4 was the vital component that connected everything else and protected the crew and engine. Excluding the suspension system and the tracks, the body of the M4 consisted of two visible parts, the turret and the main hull. The turret housed the 75mm gun and was mounted centrally on top of the hull; it was capable of rotating 360 degrees, unlike the design of the M3. For the hull, Army designers developed two different manufacturing approaches that defined the first two models, the M4 and the M4A1. The first approach (M4) utilized flat pieces of armored steel cut into the necessary shapes that were welded together during the assembly process. The result was the box-like appearance of the M4 except that the front was sloped about 47 degrees from the vertical; the other sides were vertical. In the second production approach (M4A1), two separate halves, a top section and a bottom section, formed the hull. The top section was cast from a single mold; welded pieces of steel formed the bottom half, similar to the construction of the M4. The top section had few flat, vertical surfaces or corners; the result had a curved appearance that was more effective at deflecting enemy shots and resisted penetration. The process of casting the enormous top hull section was both difficult and time-consuming; moreover, few facilities were capable of pouring and handling such large molds. The Army decided to produce both the M4 and the M4A1 simultaneously in order to achieve the maximum

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<sup>36</sup> Zaloga, *Sherman Medium Tank*, 5-6.

monthly production. Between February 1942 and May 1945, American industry produced 49,234 M4 series tanks of which 9,707 were cast hull M4A1s; all other types had welded hulls.<sup>37</sup>

As a critical component, the engine of the M4 had to be capable of moving the tank quickly and reliably. Prior to 1941, the U.S. Army lacked an engine with sufficient horsepower (HP) to dependably propel a thirty- to forty-ton tank, because in the pre-war years there were no tanks in this weight range. Tanks such as the M4 required engines generating at least 300 HP (500 HP ideally); engines with lower horsepower could move a tank but only slowly and were prone to breakdowns due to the stress. The American civilian market had a vast knowledge of engines, but no models met the unique features that a combat vehicle required. A tank engine has to be able to operate consistently in diverse climates, such as in the desert, the artic, and the tropics. Army tank engines also needed to be able to run for long periods of time without extensive maintenance. Army mechanics needed to be able to perform routine maintenance easily, and parts needed to be quick and simple to remove and replace in the field. Field maintenance occurred outdoors in all weather, often without all the resources available in a formal shop. Mechanics had to perform these chores quickly, because every tank that was out of combat weakened the tank unit's ability to fight. It is one thing for a tractor or bulldozer to be inoperable for a few days due to maintenance needs; tanks needed to be back in service in a matter of hours. When Army leaders asked for the first thirty-ton tank (the M3) in the winter 1940, designers had to find a suitable engine to propel it. Engines

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<sup>37</sup> Citino, *Armored Forces*, 88; Hunnicutt, *Sherman*, 118, 141, 525.

capable of the required performance were in very short supply in 1941, but the Army found the solution in engines used by aircraft.<sup>38</sup>

In early 1941, U.S. Army tank designers discovered that engines were already available in the aircraft industry that met most of the necessary requirements. The American aircraft industry had a lot of experience in designing and building engines that already had a proven track record. Due to the nature of flying, aircraft engines needed to perform consistently and exceptionally well for extended periods of time. Just like tank engines, aircraft engines needed plenty of power, and maintenance needed to be easy to perform. Equally important, the engines were available in large numbers quickly, because factories were already making them. When full-scale production of the M3 began in April of 1941, sufficient numbers of these engines were available. The first engines installed in the M3, the Continental R-975, were radial engines similar to those used on passenger airlines. Generating 350 HP, the R-975 met all of the required specifications. However, these engines were not completely satisfactory. Resembling a doughnut, the vertical layout of radial engines required that the engine compartment to be tall, which increased the overall height of the tank and made it easier to see, and therefore a bigger target.<sup>39</sup> More importantly, the extensive aircraft production program also needed the radial engines, and Army planners determined that the tank program would not receive enough engines; by the summer of 1941, the Army pursued alternatives to radials as a result.<sup>40</sup> Contractors such as Chrysler, Ford, and General Motors sought to develop a better tank

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<sup>38</sup> Green, Thomson, and Roots, *Planning Munitions for War*, 287-90.

<sup>39</sup> Macksey and Batchelor, *Tank*, 110-11.

<sup>40</sup> Green, Thomson, and Roots, *Planning Munitions for War*, 291.

engine, but that took time. By the summer of 1943, American industry had successfully developed engines specifically for tanks; however, tank production was not delayed. Most M3s built in 1941-42 utilized radial engines, as did the M4 and the M4A1 when production began in the spring of 1942. As newer models of engines became available, the Army incorporated them into the production of M4s and used them as the basis for distinguishing between the M4A2, -A3, -A4, and -A6 (see Appendix C.)<sup>41</sup>

Besides differing hulls and engines, the Army used both diesel and gasoline for the M4 tanks, which created a further distinction between the models. The M4 and M4A1 had radial engines that ran on gasoline. The M4A3 and M4A4 also used gasoline but had automobile engines designed and manufactured by Ford and Chrysler respectively. These engines were the type the Army preferred but, as previously mentioned, were unavailable until July of 1943. The M4A2 and M4A6 used diesel-fueled engines; the A2's engine was a conventional tractor engine, while the A6's engine was a modified radial produced in small numbers (75 built). The U.S. Army only used the M4, the M4A1, M4A3, and M4A4 models in combat. The M4A3's Ford GAA V-8 gasoline engine was preferred by the Army and veterans who liked its power (500 HP), reliability, and easy maintenance.<sup>42</sup> As part of the Lend-Lease program, American industry developed the M4A2 for the British and Soviet armies, who preferred diesel fuel for tanks primarily due to habit. The Soviets and British used diesel exclusively during the interwar years when gasoline tank

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<sup>41</sup> Chamberlain and Ellis, *British and American Tanks of World War II*, 110, 115; Forty, *United States Tanks of World War II*, 98.

<sup>42</sup> Chamberlain and Ellis, *British and American Tanks of World War II*, 116; Hunnicutt, *Sherman*, 153; Zaloga, *Sherman Medium Tank*, 9.

engines did not exist.<sup>43</sup> Consequently, their supply systems were already structured to provide diesel to their tank forces. The U.S. Marine Corps preferred it as well, because diesel was readily available from the U.S. Navy; small boats and landing craft ran on diesel.<sup>44</sup> Also, production of all types (except the M4A2) was reserved for the Army, so the Marines had to accept the diesel model anyway.<sup>45</sup>

The choice of fuel for the M4 was the cause of a major disagreement over its design and a subsequent source of criticism. Prior to 1942, diesel fuel was the preferred type of fuel because of its superior efficiency in the high-powered engines used by tractors, trucks, and heavy construction equipment. Diesel engines were capable of generating greater horsepower than gasoline engines and seemed ideal for tanks. The best medium tanks from other nations, such as the German *Pzkw.* IV and the Soviet T-34, used diesel engines. However, the Armored Force determined that the use of diesel engines in tanks would create an unacceptable burden on overseas maintenance and supply services. The majority of the Army's vehicles ran on gasoline, and duplicative supply networks would be necessary if all the tanks ran on diesel. In February 1942, Brehon Somerville, who commanded the Army Service Forces (non-combat portions of the Army), wrote that the use of diesel engines in tanks "will greatly complicate the fuel supply problem . . . the maximum production of diesel fuel required will interfere to some extent with production of aviation gasoline, toluene for explosives, and butadiene for

<sup>43</sup> Macksey and Batchelor, *Tank*, 111.

<sup>44</sup> Zaloga, *Sherman Medium Tank*, 9.

<sup>45</sup> Stephen J. Zaloga, *US Marine Corps Tanks of World War II*, New Vanguard series 186 (Oxford: Osprey Publishing, 2012), 14.

synthetic rubber.”<sup>46</sup> The commander of the Armored Force, General Jacob Devers, concurred, stating, “In view of our past experience [during training exercises], and the present world situation as to the [limited] supply of Diesel fuel, the Armored Force does not desire any type of . . . diesel engines for use in Light or Medium Tanks.”<sup>47</sup> Both Somerville and Devers were concerned that the high demand for diesel might lead to inadequate supplies for the tanks in addition to complicating the overseas supply system. In opposition to this view, Major General Gladeon M. Barnes, the chief of the Research and Development Services (Ordnance Department), wrote a strongly worded response and stated,

Reliable information available to the Ordnance Department does not indicate any difficulty in obtaining diesel fuel in any theaters of operation where gasoline may be obtained, and diesel fuel has a number of obvious advantages over gasoline. In fact, the Ordnance Department considers the diesel engine the proper ultimate engine for tanks and believes that every effort should be made to expedite the development of adequate diesel engines for all tanks.<sup>48</sup>

However in the same letter, Barnes proceeded to categorically enumerate all the different vehicles using diesel fuel and stating that Britain and the Soviet Union required large amounts of fuel as well. He sought to demonstrate that the Allied supply networks were already transporting both fuel types but did not specify if they were adequate in meeting demand. Moreover, Barnes’ argument did not address the increased load that forthcoming American overseas deployments would cause on the existing supply network, especially

<sup>46</sup> Gen. Brehon Somervell to Gen. George Marshall, memorandum, February 28, 1942 as quoted in Green, Thomson, and Roots, *Planning Munitions for War*, 297-98.

<sup>47</sup> Gen. Jacob Devers to Gen. Brehon Somervell, April 28, 1942 as quoted in ibid., 297.

<sup>48</sup> Gen. Gladeon Barnes to Gen. Brehon Somervell, May 12, 1942 as quoted in ibid., 297-98.

in fuel shipments, and that was the crucial point in Sommervell and Devers' position. In May 1942, large numbers of American forces were not overseas yet; what information could the Ordnance Department possess that could be considered reliable enough to indicate future requirements and the ability to meet them? Barnes' superiors rejected his argument on these grounds and because the user (the Armored Force) and the supplier (Army Service Forces) both opposed him. The matter would have ended and probably been forgotten except that later a major criticism of the M4 was its propensity to catch on fire quickly when damaged. Critics blamed the choice of gasoline rather than diesel as the cause of the fires; this view was incorrect as will be shown in Chapter III.<sup>49</sup>

A variety of factors influenced the design of the M4, many of which seem reasonable regarding the circumstances of 1941 and 1942. Post-war critics proclaim that the M4 was a simplistic design that emphasized ease of production over combat requirements. For example, historian Stephen Ambrose claimed that American army leaders pursued a quantity-over-quality approach that valued large numbers of tanks over a smaller number of well-built tanks.<sup>50</sup> His interpretation misrepresents the army leaders' desires for the tank. The need for mass production was a factor in the M4's design, but this was not a detriment; it was a vital necessity in 1941 considering the pathetic state of America's tank forces and the course of the war to that point. Post-war critics seem to suggest that the United States should have designed a tank in 1942 that was technically capable of overcoming the best German models of 1944; the implication is that a process of continuing research and development should have been in place. In actuality, such a

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<sup>49</sup> Ross, *The Business of Tanks*, 95; Zaloga, *Sherman Medium Tank*, 15.

<sup>50</sup> Ambrose, *Citizen Soldiers*, 63.

process did exist, but this argument misses the larger point, regardless of how valid the point might be. Army engineers designed tanks in accordance with Army doctrine in 1941, and that doctrine had not changed by 1944. The technical merits of the M4 were well established as long as it was used according to Army doctrine. Within that framework, the M4 performed exceedingly well. When the soldiers utilized the M4 outside of that role, its performance was poor, specifically in tank-on-tank engagements. The American army had designed the M4 with a particular mission in mind; combat revealed how well it handled that mission, regardless of whether that mission was correct.

## **CHAPTER III**

### **THE M4 IN COMBAT, 1942-1943**

The ultimate test of any weapon is how it performs in combat, and the M4 was no exception. Until the fall of 1942, everything pertaining to the M4 was essentially academic. As shown in previous chapters, U.S. army ordnance engineers designed the tank based on theories developed from the observation of other models, field exercises, and extrapolation from the combat experience of the Allies; the Americans had no practical experience with tanks in combat yet. U.S. light tanks first fought early in 1942 in the Philippines, but the Army drew no meaningful lessons from the limited part they played. The tanks used by the American and Filipino armies against the Japanese were already obsolete, as the United States had not produced any of the new American tanks, the M3 and M4, yet. A result of Lend-Lease, the M4's baptism of fire occurred first in North Africa (October 1942) in the hands of America's ally, the British. The Americans followed suit, employing M4s during the invasion and liberation of North Africa (November 1942 to May 1943). The Allies considered the M4 an overwhelming success, and it became the principal tank of the Anglo-American forces in the Mediterranean Theater. In the Pacific, the U.S. Marine Corps employed the M4, enthusiastically and successfully, during its seizure of the island of Tarawa in November of 1943. Moreover, the Soviet Union, another Lend-Lease recipient, accepted numerous shipments of M4s to supplement its own tank forces after the summer of 1943. The Allied powers greatly appreciated the M4's armor, firepower, and reliability; however, the ordnance department and some users expressed the need for some upgrades in these areas. None of

these concerns resulted in a recall or rejection of the M4 by its users up to the beginning of 1944.

The M4, built to meet the American army's requirements, also sufficiently met the needs of its other users. The British, Soviets, and French had their own ideas on how to use tanks that varied in their agreement with the American doctrine that tanks should be used to exploit breakthroughs and to support the Infantry, but they disagreed with the American army's view that tanks should not have an anti-tank mission. The U.S. Marine Corps did not fully share the American army's vision of armored warfare either; the Marines agreed that tanks should support Infantry, but the Marines saw the exploitation mission as impractical in their theater. In the American army, General Leslie McNair, chief of the Army Ground Forces, and the Armored Force shaped the design of the M4 to fulfill the particular requirements of the American army in response to the success of the German *panzers* in 1940 and 1941, as discussed in the previous chapter. Except for Britain, the allies of the United States and the U.S. Marines had no influence on the design of M4, and the American army accepted or ignored British advice as it saw fit. Nevertheless from 1942 to 1943, all Allied forces employed M4s as part of their existing military framework and doctrines and were pleased with its performance. In terms of firepower, armor protection, and mechanical reliability, the M4 was an effective and vital weapon in the Allied arsenal in that period. Even when thrust into situations that it was not explicitly designed for, the M4 performed well and demonstrated its overall soundness as a tank during 1942 and 1943.

The various users of the M4 incorporated the tank into their overall army structure, which reflected both their views on tanks and how the armies of the Allied

nations functioned. All armies organize themselves in the manner most suitable to their war-fighting methods and ideas. They likewise allocate equipment according to the established organization. The basic framework of all armies during World War II was essentially the same (see Appendix D). Although generally similar, specific differences reflected each army's unique ideas and doctrines.

In the American army, the most basic tank unit consisted of five M4s led by a junior officer. Called a platoon, army commanders rarely broke this unit up in combat. Three platoons plus a headquarters element with its own two tanks formed a tank company consisting of seventeen tanks led by a captain. Like platoons, American commanders rarely dispersed companies; as such, they were frequently the most common size of unit assigned to support infantry units such as battalions and regiments. Even so, companies were not independent nor self-sufficient units; they lacked basic administrative and supply services. To meet those needs, the Army organized companies into a tank battalion that consisted of three M4 companies, a light tank company consisting of seventeen lightly armed and armored tanks (under twenty tons) and service/supply elements in the American army. Possessing 54 M4 tanks, the tank battalion was the largest all-tank formation in the Army that endured for the entire war. As discussed in Chapter II, the U.S. Army deployed regiments consisting of 116 medium tanks as the tank component of its armored divisions in 1942 and 1943. However, Army leaders deemed these formations too unwieldy in battle based on the experiences of 1943

and therefore reorganized all the armored divisions in 1944 (except two already deployed to Europe as will be discussed in Chapter IV).<sup>1</sup>

Other Allied armies had comparable organizations for their tanks. Similar to the American battalion, the principal British tank formations were the armored regiment and the royal tank regiment; the first regiment conducted the exploitation mission following a breakthrough of enemy lines, and the second regiment supported the Infantry in its missions. Both consisted of approximately 44 tanks, although this fluctuated somewhat during 1943. Noticeably smaller, Soviet tank battalions consisted of approximately 31 tanks, but these battalions rarely operated outside of a brigade, which grouped two tank battalions with a truck-mounted infantry battalion. By contrast, the Germans organized their tanks into battalions of roughly 54 medium tanks, a mix of *Pzkw.* III and IV. With the exception of the Americans, the various armies rarely maintained their tank units at full strength due losses and slow-arriving replacements; the Soviets and Germans especially tended to operate with below-strength tank units, so actual strength must be determined on a per unit basis at any given time.<sup>2</sup>

As discussed in Chapters I and II, General McNair organized American medium tanks (M4s) into two distinct formations, the separate tank battalions and the larger armored divisions, to resolve the interarmy dispute over the role of tanks in battle. Separate tank battalions, originally called GHQ tank battalions, fulfilled the Infantry

<sup>1</sup> Zaloga, *US Armored Units*, 24, 26.

<sup>2</sup> Moreman, *Desert Rats*, 19-20; George Nafziger, *The German Order of Battle: Panzers and Artillery* (Mechanicsburg, PA: Stackpole Books, 1999), 24-25; Steven J. Zaloga and Leland S. Ness, *Red Army Handbook, 1939-1945* (Stroud, UK: Sutton Publishing Limited, 1998), 78-81.

Branch's desire for tank support in battle. The armored division's mission was the fulfillment of the Cavalry's pre-war vision of tanks: exploitation into the enemy's interior to wreak havoc on headquarters, supply, and communication targets. The Army ordnance engineers designed the M4 to meet both of these needs. In battle from 1942 to 1945, American tank strength in battle was a combination of the armored divisions and the GHQ tank battalions attached to the infantry divisions. As such, any German, Italian, or Japanese force fighting an American force of division strength or larger was almost certain to have to fight at least one battalion of tanks as well.<sup>3</sup>

Exclusively using the M4 tank, the American separate tank battalions provided vital support to American infantry divisions in World War II. Upon arrival in the various overseas theaters, the theater commander allocated these battalions to a field army, such as the Seventh Army that operated in Sicily and Italy in 1943. The Army commander attached the separate tank battalions to the various corps under his command. The various corps commanders then temporarily attached the tank battalions to their subordinate divisions depending on the existing situation. Occasionally, an Army or Corps commander grouped some of these battalions together on a temporary basis into an Armored Group, although this rarely occurred; the infantry divisions were dependent on the tank battalions, and rarely were any battalions available to form a group. Army and corps commanders could detach and re-attach the separate tank battalions from divisions and corps, as they deemed necessary. This method provided great flexibility to American

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<sup>3</sup> Marvin Jensen, *Strike Swiftly! : The 70th Tank Battalion: From North Africa to Normandy to Germany* (Novato, CA: Presidio Press, 1997), 6; Harry Yeide, *The Infantry's Armor: The U.S. Army's Separate Tank Battalions in World War II* (Mechanicsburg, PA: Stackpole Books, 2010), Amazon Kindle e-book.

generals and enabled U.S. commanders to augment the combat power of the Infantry divisions when it was needed most. McNair did not limit this approach to tanks alone but also organized tank destroyers (TDs), anti-aircraft battalions, engineers, and artillery in a similar fashion. A typical American infantry division fighting in Europe had three permanent Infantry regiments, four permanent Artillery batteries (three “light” battalions of 105mm guns and one “medium” battalion of 155mm guns) plus a separate tank battalion, a TD battalion, and an anti-aircraft battalion to supplement its firepower. In Europe, infantry divisions tended to have the same tank battalion attached on an unofficial, semi-permanent basis; the practical result was improved familiarity and coordination between infantry and armor. Moreover, an Army or Corps commander assigned more tank companies or battalions to a division if its current mission required additional tank support. As a general rule, a tank destroyer battalion (36 TDs) was attached as well to provide protection against enemy tanks.<sup>4</sup>

Combining tank, infantry, and artillery elements, the larger armored division was the most powerful army unit for land combat in every army in World War II, and the M4 was the key component in the American army. The division was composed of subordinate tank, infantry, artillery, and engineer units that the Army had created and trained together prior to deployment. Commanded by a general, the division was capable of performing most missions, particularly seizing and holding ground in advance of the slower moving infantry divisions. In the American, German, and British armored divisions, tanks, infantry, and artillery units could be rearranged to perform specific

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<sup>4</sup> Robert S. Cameron, *Mobility, Shock, and Firepower: The Emergence of the U.S. Army's Armor Branch, 1917-1945* (Washington DC: Center of Military History, 2008), 486; Greenfield, Palmer, and Wiley, *The Army Ground Forces*, 72.

missions. For example, a particular mission might require two battalions of tanks, a battalion of infantry, and a battery of self-propelled artillery. The Americans called these temporary groupings Combat Commands, whereas the Germans titled them *Kampfgruppen*. Both formations were very flexible in their composition, as the armored division commander shuffled units around to meet particular needs. More organized but less flexible, the Soviets and British tended to group the same division elements--tank, infantry, artillery, and engineer--together into a brigade on a semi-permanent basis; even so, the brigade served the same purpose of grouping tanks, infantry, and artillery. In all cases, the headquarters of each Combat Command, *Kampfgruppen*, or brigade existed on a permanent basis in the division; the experienced command personnel remained the same, while the subordinate units rotated around inside the division. The British, Soviet, and German armies employed armored divisions to break through a defense and then drive deeply into an enemy's interior to destroy vital targets. In the American army, Army and Corps commanders were supposed to hold an armored division in reserve until the Infantry divisions had created a gap in the enemy's front lines; the armored division then quickly exploited this opening and raced into the enemy's rear areas. In actual combat in 1943, this scenario rarely occurred, as American generals found that the armored divisions' firepower was necessary to achieve the breakthrough and to maintain the front line.<sup>5</sup>

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<sup>5</sup> Pier Paolo Battistelli, *Panzer Divisions: The Eastern Front, 1941-43*, Osprey Battle Orders series 35, ed. Duncan Anderson (Oxford: Osprey Publishing, 2008), 7, 76-77; George Forty, *British Army Handbook, 1939-1945* (Stroud, UK: Sutton Publishing Limited, 1998), 150-52; Zaloga, *US Armored Units in the North African and Italian Campaigns*, 52-53; Zaloga and Ness, *Red Army Handbook*, 78, 81-82.

The success of the M4 in combat was significantly dependent on the officers who commanded it in battle. Armor officers and soldiers in the divisions and the separate tank battalions needed to be creative, pro-active, flexible, and bold in their decisions. Frequently, the mobile nature of tank warfare required tank commanders to act decisively in situations for which little time was available for preparation. On short notice, tank units often provided additional support to a stalled attack or repulsed an enemy's attack. Coordinating with different combat elements was a required skill for every armor officer, more so than Artillery and Infantry officers who might not directly work with a unit from another combat branch. The Germans considered *panzer* divisions to be elite formations; personnel had to apply to join the *panzer* units, and tank commanders therefore tended to be veterans with proven combat records of success. In combat, the *panzers* often received the best replacements and a priority on supplies such as fuel and spare parts.<sup>6</sup> Interestingly, the American, British, and Soviet armies did not hold similar views on the status of their tank forces. Personnel were assigned as needed, although volunteering was permitted; the Allies did not require any special aptitude or skills to serve in tanks. As such, the combat efficiency of the Allied tank officers and men tended to be lower than the Germans. The rationale for why the Allies pursued this policy in light of the requirements of tank combat is a question that historians have yet to fully answer.<sup>7</sup>

As already stated, the M4 was a vital asset in Allied armies besides the United States during World War II. In fact, the need to meet the orders from Allies such as Great Britain, the Soviet Union, France, and China influenced the production of the M4. Taken

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<sup>6</sup> Citino, *Armored Forces*, 52-53.

<sup>7</sup> Jensen, *Strike Swiftly!*, 10.

from the U.S. Army's own stock, the United States shipped the first M4s overseas to supply the British. Overseas shipments were not the leftovers of U.S. production; rather, American industry built M4s to meet Allied orders while simultaneously trying to fulfill the orders of its own military. The sharing of the M4 is a reflection of Allied interdependency and cooperation during the war years; whereas the other Allied powers provided manpower to fight the Germans, the Americans provided large amounts of material aid to help equip those armies. The Soviet Union received over 4,000 M4s during the war, enough to equip 24 American armored divisions or 75 separate tank battalions.<sup>8</sup> Free French and Polish forces eventually received sufficient M4s to equip three armored divisions and three independent tank brigades respectively (the Poles enlarged one brigade to a full division in 1944).<sup>9</sup> The French tended to structure their tank units along the American model, whereas the Polish followed British practice. Regarding China, historians have yet to significantly examine the activities of the Chinese Provisional Tank Group, mostly due to limited information; however, enough M4s were available to the Chinese to form at least two battalions. The largest Allied user of the M4 was Great Britain; from late 1942 onward, the M4 constituted roughly half of British tank strength.<sup>10</sup>

The British army needed the M4 because of its tank doctrine and the inability of its own industry to produce satisfactory tanks during most of the war. Similar to the Americans, the British army entered World War II divided over the best use of tanks in

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<sup>8</sup> Zaloga, *Sherman Medium Tank*, 41.

<sup>9</sup> Ibid., 40.

<sup>10</sup> Hunnicutt, *Sherman*, 152, 183.

battle. The dispute was for the most part along the same lines as the U.S. debate. Should tanks be used in the exploitation role after a breakthrough in the enemy's lines, or should tanks be merged with the Infantry as a supportive weapon platform? Foreshadowing the approach adopted by the American army, the British decided to pursue both lines of development for tanks but went further than the Americans by designing and fielding different models for units. For the exploitation mission, the British created "cruiser tanks" organized into the aforementioned armored regiments; the design of these tanks increased mobility by carrying lighter guns and less armor protection. For the support role, the "infantry tanks" emphasized heavy armor, more firepower, and less speed; their units were called tank regiments. Although the British were innovative in their ideas and designs, their tanks suffered critical flaws that combat revealed.<sup>11</sup>

During Operation CRUSADER (November 18 to December 7, 1941) in the eastern half of Libya, the British 30<sup>th</sup> Corps lost 430 tanks out of an initial 500 to enemy anti-tank fire or mechanical breakdown. CRUSADER was a victory for the British in that the German and Italian forces were compelled to retire westward into Libya; however, the cause of the retreat was a lack of supplies, not the superiority of British arms.<sup>12</sup> On January 21, 1942, the German *Afrika Korps* in Libya under General Erwin Rommel launched an offensive towards Egypt and destroyed 50% of the tanks in three British

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<sup>11</sup> Gerhard L. Weinberg, *A World at Arms: A Global History of World War II* (Cambridge, UK: Cambridge University Press, 1994), 539.

<sup>12</sup> B. H. Liddell Hart, *History of the Second World War* (Old Saybrook, CT: Konecky & Konecky, 1970), 189.

armored regiments during the first encounter.<sup>13</sup> All German anti-tank weapons easily destroyed the cruiser tanks because of their thin armor, which was only good for stopping rifle and machine-gun fire. Although better protected, the infantry tanks were also easy targets because of their slow speed; in consequence, novice tank crews tended to panic when hearing the sounds of multiple armor piercing (AP) shots striking their tank. Moreover, all British tanks suffered from inadequate and inferior engines that required excessive maintenance. Prone to overheating and mechanical breakdowns, the British engines were the bane of tank crews in 1940 and 1941. Regarding armor protection, the German *Pzkw.* III and IV and the German 37mm, 50mm, and 88mm anti-tank guns easily defeated all British tanks with the exception of the infantry tank model dubbed the “Matilda” by the British. Although well armored, the “Matilda” suffered engine trouble, and its 2 pounder anti-tank gun (lacking a high explosive shell) did not have sufficient firepower for engagements against ground soldiers and the increasingly more heavily armored German tanks. In 1942, the British enthusiastically welcomed the M4—dubbed the “Sherman” for ease in identification--partly out of disgust for their own models but also out of desperation. As a badly needed replacement, the “Sherman” did not disappoint the British in its debut.<sup>14</sup>

In the summer of 1942, the British desperately needed to replenish their forces in North Africa; the British were in retreat, but the M4 was part of the solution that turned the tide against the Germans. In Libya and Egypt, the drain on British tank forces was

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<sup>13</sup> Ibid., 267.

<sup>14</sup> Chamberlain and Ellis, *British and American Tanks of World War II*, 10, 30-38, 56, 68; Moreman, *Desert Rats*, 45-47.

enormous, and British tank production proved inadequate for wartime. It simply could not produce enough tanks to replace lost ones and to build new units simultaneously. Under the brilliant direction of General Rommel, the German Africa Corps (DAK) with its Italian allies outmaneuvered the British 8<sup>th</sup> Army in a series of fast moving tank battles. By the summer of 1942, Rommel had forced the British out of Libya and into Egypt; the front lines were only 66 miles from Alexandria and the Suez Canal, which was of vital strategic importance to the British. During July, the British 8<sup>th</sup> Army repulsed the German and Italian assault during the first Battle of El Alamein in a costly battle; both sides spent several weeks in August recuperating and preparing for the next battle. The British needed to continue to defend the canal and sought to expel the Axis forces from Egypt.<sup>15</sup>

A key weapon in the success of the first Battle of El Alamein was the new American M3 medium tank. In the late spring, the British had received a large number of American M3 and M3A1 medium tanks, which they called “Grants” and “Lees” to reflect minor technical differences between the two models. The British were both pleased and impressed, despite the fact that the placement of the 75mm gun in the hull limited the ability of the M3 to engage targets quickly (as discussed in Chapter II). Even so, the British considered the M3 superior to all existing British models in Africa at the time; its heavier armor, mobility, and the 75mm gun gave the M3 a better chance against the German *Pzkw.* III and IV. The Germans were also impressed; General Rommel wrote to his wife,

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<sup>15</sup> Citino, *Armored Forces*, 82-83; Macksey, *Tank Warfare*, 186, 194.

Looking back on the first day's fighting [first El Alamein], it was clear that our plan . . . had not succeeded. The advance to the coast had also failed . . . The principal cause was our underestimate of the strength of the British armored divisions. The advent of the new American tank had torn great holes in our ranks. Our entire force now stood in heavy and destructive combat with a superior enemy.<sup>16</sup>

The British were particularly pleased with the engine's reliability and the power of the 75mm gun; this gun was the first one available to the British that could fire both an effective AP shot and a high explosive (HE) shell. Even so, the M3 was not wholly satisfactory but was used because of its availability and superiority to most British models. Like the Americans, the British wanted the M4 as their new tank.<sup>17</sup>

The M4 entered combat for the first time with British forces in October of 1942 during the successful second Battle of El Alamein. Ironically, a foreign power that had had no say in the design process or development of the doctrine that had created it, was the first combat user of the tank that was specifically tailored to meet the requirements of American armor doctrine. After the summer battles, the British 8th Army badly needed new tanks to replace its losses and to enable it to defeat the Axis forces in Africa. British Prime Minister Winston Churchill recorded the following dialogue between himself and President Roosevelt in his wartime memoirs, ““What can we do to help [in North Africa]?” said Roosevelt. I replied at once, ‘Give us as many Sherman tanks as you can spare, and ship them to the Middle East as quickly as possible.””<sup>18</sup> Churchill’s words

<sup>16</sup> Rommel, *The Rommel Papers*.

<sup>17</sup> Chamberlain and Ellis, *British and American Tanks of World War II*, 112; Moreman, *Desert Rats*, 114, 130.

<sup>18</sup> Winston S. Churchill, *The Hinge of Fate*, vol. 4 of *The Second World War* (Boston: Houghton Mifflin Company, 1978), 344.

accurately reflect the British need for the M4 in 1942. When the British received the M4, they issued it immediately to their tank units as replacements for lost equipment. Usually, an army will spend several weeks and maybe months transitioning to a new piece of equipment. In this case, the only training was an orientation period for crews to learn how the M4 functioned; neither review nor revision of doctrine and tactics occurred. The British first used the M4 to supplement and then replace its own models and then the M3 in the various units. Conceptually, the British employed the M4 as a cruiser tank in the armored regiments of the 8<sup>th</sup> Army, but they also used the M4 in the Infantry tank role too. When the second Battle of El Alamein (October 1942) occurred, the British used the M4's firepower, armor protection, and mechanical reliability to defeat the German forces and break through the Axis lines, forcing the *Afrika Korps* to retreat from Egypt and eventually Libya as well.<sup>19</sup>

The British singled out several key features of the M4 as being exceptionally praiseworthy. At second El Alamein, the British deployed 270 M4A1s as part of its 1,029 tanks. Called the "Sherman II" (Sherman I being the first M4 model), this tank utilized the Continental R-975 radial engine that operated efficiently for extended periods of time with little maintenance, which contrasted favorably with British models.<sup>20</sup> The 75mm gun was able to penetrate the armor of the *Pzkw.* III and IV successfully, and the M4's 75mm HE shell was particularly effective against infantry and anti-tank guns. The British greatly appreciated the internal layout of the tank, which enabled crewmen to work

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<sup>19</sup> Alun Chalfont, *Montgomery of Alamein* (New York: Atheneum, 1976), 152; Rommel, *The Rommel Papers*.

<sup>20</sup> Patrick Delaforce, *Taming the Panzers: Monty's Tank Battalions, 3 RTR at War* (Thrupp, UK: Sutton Publishing, 2000), 106.

together more smoothly. In short, the British were thoroughly impressed with the M4. American General Paul Robinett, who participated and used M4s during the Tunisian campaign in the spring of 1943, recorded in his memoirs, “[British Major General Charles F.] Keightly had a low opinion of British tanks and said most emphatically, ‘I want General Sherman tanks! Diesel-driven jobs, too!’ He eventually received them but not before certain of his troops went into battle with British tanks and with bad results.”<sup>21</sup> From the British point of view, the M4 was the tank they had been waiting for, and it gave them a distinct advantage over the Germans in 1942 and 1943.<sup>22</sup>

The capabilities of the M4 as demonstrated at El Alamein and the subsequent battles in North Africa impressed the Germans as well. Like the British, they appreciated the M4’s mobility and reliability. Moreover, German *panzer* crews respected the firepower and armor protection of the M4, and its appearance on the battlefield caused them great concern. The Germans believed that only the upgraded *Pzkw.* IV was a match for the M4; the Germans upgraded the *Pzkw.* IV’s short-barreled 75mm gun with a long-barreled anti-tank gun creating the *Pzkw.* IV, *auf* F2. All other models of German and Italian tanks were obsolete compared to the M4. At the time and after the war, many tank experts agreed with this assessment. Rommel paid the M4 the supreme compliment in a letter to his wife: “Their new tank, the General Sherman, which came into action for the first time during this battle [second El Alamein], showed itself to be far superior to any of

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<sup>21</sup> Robinett, *Armor Command*, 116.

<sup>22</sup> Moreman, *Desert Rats*, 48; Ross, *The Business of Tanks*, 229, 245.

ours.”<sup>23</sup> The Germans who faced the M4, like its users, respected and admired its performance in the African theater.<sup>24</sup>

Like the British, the Americans’ first experience with the M4 in combat occurred in North Africa in 1942 and 1943. The first American units equipped with M4 tanks arrived during Operation TORCH in November 1942 when the Allies invaded French Morocco and Algeria. The Americans used the M4 alongside the M3 for most of the African campaign. With a clear contrast between the two tanks in battle, the M4 was definitely superior with its turret-mounted 75mm gun. At the beginning of the North African campaign, M4-equipped units participated in minor engagements with French forces and a few German units during December and January; no large-scale tank engagements of battalion strength or greater occurred until weeks after the Americans entered Tunisia. The Battle of Kasserine Pass (February 19-25, 1943) was the real debut of American M4 units in combat; it was an American disaster.<sup>25</sup>

The M4’s performance at Kasserine Pass reflected American inexperience and poor combat leadership rather than a shortcoming in the tank’s technical features. The American II Corps commander, General Lloyd Fredendall, ordered the tanks of the 1<sup>st</sup> Armored Division to counterattack the German *panzer* assault at Kasserine Pass. The commander of the 1<sup>st</sup> Armored Division and its subordinate units, which included

<sup>23</sup> Rommel, *The Rommel Papers*.

<sup>24</sup> Hart, *History of the Second World War*, 298; Mayo, *On Beachhead and Battlefront*, 28-29.

<sup>25</sup> Charles M. Baily, *Faint Praise: American Tank and Tank Destroyers during World War II* (Hamden, CT: Archon Books, 1983), 32, 52; Liddell Hart, *History of the Second World War*, 403-5.

General Robinett, objected to this mission on the grounds that it was unsuitable for their tanks. Robinett and his comrades were correct; the anti-tank mission was a job for the Tank Destroyers. However, Fredendall insisted that American tanks seek out and destroy the German tanks in violation of American tank doctrine. The result was a tank duel between concealed German *panzers* and anti-tank guns against the M3s and M4s of two American tank battalions that were subsequently destroyed. In spite of American actions, the Germans halted their attack and pulled out of Kasserine Pass; German supplies were low, and threats from other sectors of the front required their redeployment. The Americans were quick to admit the tactical mistakes they had made during the battle, such as sending the tanks of the 1<sup>st</sup> Armored Division into a valley against camouflaged tanks and against anti-tank guns hidden in the surrounding hills. The Americans had not conducted any reconnaissance of the area and had also left the flanks of the American tank units undefended; a vulnerable spot the Germans exploited to maximum effect. The U.S. Army used the battle as a learning tool to season its inexperienced troops. Merits and deficits of the M4 were not part of the review process for tank forces following the battle. In fact, the Americans continued to view the M4 favorably because it performed mechanically well, and Army leaders viewed Kasserine as a failure of American leadership and tactics, not equipment.<sup>26</sup>

The M4's positive reputation continued to grow during the remainder of the Tunisian campaign and during the invasions of Sicily and Italy late in 1943. Both the British and Americans used their M4s in similar missions. Both armies employed M4s in

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<sup>26</sup> James Dunivan, "Kasserine Pass and the Necessity of Training," *Armor* 110 (September-October 2001): 14-16; Gabel, "World War II Armor Operations in Europe," in *Camp Colt to Desert Storm*, ed. Hofmann and Starry, 151-52.

support of infantry in those missions where the 75mm gun and its HE shell were highly effective at destroying enemy bunkers, exposed troops, and unarmored vehicles. The M4's armor adequately protected it against all German and Italian anti-tank weapons, except for the limited numbers of 75mm and 88mm anti-tank guns; this exception became more significant as the Germans eventually phased out all anti-tank guns of smaller calibers by June 1944. Even hits that penetrated did not necessarily destroy the tank, a testimony to its rugged design. A German *panzer* officer in Italy reported, "One enemy Sherman tank was hit three times, turned back, and . . . [moved off] about 1200 meters."<sup>27</sup> Regarding the M4's mobility and speed, neither British nor American forces encountered opportunities to break through and exploit into the enemy's rear areas as envisioned during 1940 and 1941. Even so, certain operations demonstrated the speed and mobility of the M4, such as General Patton's quick seizure of Palermo on the northwest coast of Sicily in July 1943. Moreover, the M4's ability to quickly redeploy during battles in North Africa, Sicily, and Italy was testimony to its sound automotive design. Allied mechanics greatly appreciated the reliability and easy maintenance of the M4's engine, suspension system, and tracks.<sup>28</sup> In all of its design categories (firepower, mobility, and protection), the M4 was a success in 1943. Contrary to postwar claims, overall Americans and British forces were very satisfied and pleased with the

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<sup>27</sup> Oberleutnant Schaft, 6. Kompanie, to Panzer-Regiment 26, after-action report, December 14-16, 1943, as quoted and translated in Thomas L. Jentz, *Panzertruppen: The Complete Guide to the Creation and Employment of Germany's Tank Force, 1943-1945* (Atglen, PA: Schiffer Publishing, 1996), 142.

<sup>28</sup> Robert R. Palmer, Bell I. Wiley, and William R. Keast, *The Army Ground Forces: The Procurement and Training of Ground Combat Troops*, United States Army in World War II series (Washington, DC: U.S. Government Printing Office, 1948; Reprint, Center of Military History, United States Army, 1991), 285.

performance of the M4.<sup>29</sup> British generals declared to the Americans that the M4 was better than all German contemporary tanks.<sup>30</sup> American General Jacob Devers, chief of the Armored Force, declared the M4 was the best tank on the battlefield.<sup>31</sup> Even the Germans agreed in their own reports; excluding the *Pzkw. VI* “Tiger” (a heavy tank of approximately sixty tons), German officers often described the M4 as “superior” to their own models, the *Pzkw. III* and *Pzkw. IV*.<sup>32</sup> With few exceptions, combatants in the Mediterranean believed that the M4 was an excellent tank throughout 1943.<sup>33</sup>

In other theaters of operation, the users of the M4 reached similarly positive conclusions on its abilities. The U.S. Marine Corps first used M4s in combat during the seizure of Tarawa atoll in 1943. The Marines considered the M4 crucial to the success of that operation, and the commanding general, Holland Smith, recommended that M4s be used in all future amphibious assaults.<sup>34</sup> The Marine Corps used the M4 exclusively in the Infantry support role during the battles for the Pacific islands with very good results. Marines pioneered several effective methods of coordinating infantry movements and actions with M4s to destroy Japanese targets during battles. M4 units focused exclusively

<sup>29</sup> James Wellard, *General George S. Patton, Jr.: Man under Mars* (New York: Dodd, Mead & Company, 1946), 75.

<sup>30</sup> Baily, *Faint Praise*, 53.

<sup>31</sup> Ross, *The Business of Tanks*, 245.

<sup>32</sup> *Panzer-Regiment 8, 15.Panzer Division*, war diary, November 2, 1942 in Jentz, *Panzertruppen*, 10.

<sup>33</sup> John North, “Lessons of the North African Campaign,” *Military Affairs* 8 (Autumn 1944): 164.

<sup>34</sup> Hunnicutt, *Sherman*, 188.

on the support mission due to the lack of any threat from Japanese tanks; Japanese tanks were rarely part of these battles, and their technical inferiority posed no challenge to the M4.<sup>35</sup> As more Marine commanders observed how well the M4 crossed beaches, moved in jungles, resisted Japanese shots, and provided vital firepower to Marines in both defense and on the attack, they demanded more and more M4s and wanted nothing else. The successful Marine employment of the M4 in the Pacific created greater enthusiasm for it; this belief in the M4 and the Marines' methods of using it even impressed Army observers.<sup>36</sup>

The Soviet Union was another important operator of the M4 during 1943, and its reports on the tank were favorable, although the quantity of records available to scholars is limited. Due to the politics of the Cold War, initial Soviet post-war history downplayed the contributions of Lend-Lease American equipment in the Soviet Union's victory over Germany.<sup>37</sup> Even so, sources became more readily available after the collapse of the Soviet Union in 1991 and the opening of Soviet archives on the war. Other sources emerged as well on Soviet wartime experiences that include accounts of the large numbers of M4s used by the Soviets. As a veteran, Dmitriy Loza's memoirs as a Soviet M4 tank commander provide valuable insight into both its use and the Soviets' attitude about it. Already tank veterans, Loza and the men of his unit received their first M4s in

<sup>35</sup> Zaloga, *US Marine Corps Tanks of World War II*, 18.

<sup>36</sup> Henry I. Shaw, Jr., and Douglas T. Kane, *Isolation of Rabaul*, History of U.S. Marine Corps Operations in World War II series (Washington, DC: U.S. Government Printing Office, 1963), 436.

<sup>37</sup> Dmitriy Loza, *Commanding the Red Army's Sherman Tanks: The World War II Memoirs of Hero of the Soviet Union Dmitriy Loza*, trans. and ed. James F. Gebhardt (Lincoln: University of Nebraska Press, 1996), xiii.

the summer of 1943 and trained with them until November of that year. They highly prized the M4 or “*Emcha*” as they called it; his writing expresses the pride they felt in their M4s and their faith in what they could do, when used properly.<sup>38</sup> However, he noted that the M4’s mobility suffered on the icy roads of the northeastern Ukraine where they were stationed. Loza wrote, “In these complex icy road conditions, the well-dressed tracks [in contrast to the less refined tracks of the Soviet T-34 tank] of the Sherman became its principal deficiency. It was as though the tanks were on skis.”<sup>39</sup> Loza noted that American manufacturers worked hard to get the Soviets the necessary parts to prevent such slipping, and the arrival of kits that modified the tanks’ tracks resolved the problem several weeks later. Most of Loza’s memoirs discussed his experiences in 1944 and 1945 and will be further discussed in the next chapter. Although the record is far from complete, existing reports (such as Loza’s) imply that the Soviet tank crews both appreciated and liked the M4.<sup>40</sup>

Although the users were satisfied, experience in the Mediterranean campaigns revealed flaws in the M4 that required correction. Allied reports on the M4 tended to exaggerate its positive aspects and minimize its shortcomings, but officers acknowledged several key flaws that needed correction. These flaws were a limitation on the M4’s mobility in soft terrain, a propensity to catch fire, and the main gun’s growing inadequacy in penetrating German armor. Operators of the M4 observed that the tank seemed to sink too much into wet, muddy ground, which impaired its mobility. Although rarely a

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<sup>38</sup> Ibid., 11-12.

<sup>39</sup> Ibid., 6.

<sup>40</sup> Ibid., 7-8; Zaloga, *Sherman Medium Tank*, 40.

problem in the arid climate of North Africa or in the central Mediterranean, officers were concerned that this characteristic might become an issue when the M4 was used in muddier environments like northern France. Another shortcoming was the M4's propensity to catch fire when hit by enemy AP shells. The M4 earned the disparaging moniker, the "Ronson," which was a brand of cigarette lighter that was advertised as "a light every time."<sup>41</sup> One or two German shells penetrating an M4 could start an inferno that completely gutted the interior of the tank and made it irreparable; the heat was so intense that the armor softened and lost most of its effectiveness.<sup>42</sup> Initially, soldiers and crewmen attributed the fires to the use of gasoline rather than diesel as fuel; a view that continues to persist.<sup>43</sup> However, Army ordnance inspection determined that three factors caused the fires. First, the Germans tended to shoot at a tank until it caught fire and they saw smoke. Second, the tank crewmen were stacking ammunition inside the turret for quick reloading; ammunition should have been stored only in the armored lockers in the floor and in the sides of the M4 and M4A1.<sup>44</sup> Lastly and most importantly, the Germans used a special AP shell that was filled with an explosive; British and American shells were solid pieces of metal. When this German shell penetrated the armor, it exploded, causing severe damage and setting anything flammable alight. The Americans modified

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<sup>41</sup> Hastings, *Overlord*, 191.

<sup>42</sup> Cooper, *Death Traps*, 67.

<sup>43</sup> Moreman, *Desert Rats*, 48.

<sup>44</sup> Hunnicutt, *Sherman*, 142, Ross, *The Business of Tanks*, 246.

captured German 75mm AP shells and achieved similar results when used against German *panzers*.<sup>45</sup>

In regard to firepower, American army ordnance engineers began to explore an upgrade to the 75mm gun. Although the users considered the 75mm gun adequate in Africa and Sicily, Army tank and ordnance officers believed that the 75mm gun would be less effective in 1944 as the Germans increased the armor protection of the *Pzkw.* IV; Army leaders recognized the *Pzkw.* VI “Tiger” heavy tank as beyond the ability of the M4 to handle, but anti-tank warfare was strictly the problem of the TDs. No one officially questioned the Army doctrine on tanks (they were still not to fight other tanks) and TDs; however, the Army’s acknowledgment of the limitations of the M4’s anti-tank firepower and the push to improve was an indirect challenge to the doctrine’s validity. Although the M4 was supposed to avoid tank duels, some Army leaders argued that this idea might be not be practical. The Army implemented solutions to all of these problems in the first months of 1944, which will be discussed in more detail in the next chapter.<sup>46</sup>

As previously stated, the various users of the M4 concluded that the tank was more than just satisfactory in 1943; the M4 was exceptional. Designed for the mission of exploitation and Infantry support, the Americans and their allies used the M4 in a variety of situations, including the anti-tank role for which it was not explicitly designed. The successful use of the M4 in all these roles in 1942 and 1943 validated the overall design of the tank but created a confidence that was misplaced. As a tank in 1943, the M4 was an engineering success; its combat record demonstrates that conclusion. The Germans

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<sup>45</sup> Hunnicutt, *Sherman*, 89.

<sup>46</sup> Ibid., 204-6.

themselves acknowledged the merits of the M4. Even so, the Americans designed the M4 to fulfill a role defined by American tank doctrine that specified limits on what the M4 could do. Although successful in 1942 and 1943 during tank-on-tank engagements, the Army engineers had not designed the M4 to duel enemy tanks; Army leaders also should have expected that its ability to do so would diminish as newer German models appeared on battlefields. The very success of the M4 in 1943 seemed to blind Allied armies to its limitations, and they paid a steep price in lives in 1944 and 1945 for ignoring the design restrictions. The M4's late-war shortcomings notwithstanding, its story is not complete without the inclusion of its very successful record in Africa, Sicily, Italy, the Soviet Union, and the Pacific; in 1943, it was, as General Jacob Devers expressed, one of the best tanks on the battlefield.

## CHAPTER IV

### THE M4 IN COMBAT, 1944-45

The Allies entered 1944 confident in the M4 and its combat abilities based upon their experiences in previous campaigns. In the African, Sicilian, Italian, Russian, and Pacific operations, the M4 met and frequently surpassed the expectations of its designers. Whatever the task, American, British, and Soviet soldiers used the M4 with success. At the end of 1943, the various users desired to upgrade some components of the M4; even so, they were sufficiently pleased with its performance that no demand had emerged for a replacement. The basic design of the M4 seemed sound to its users. With modifications to the gun, armor, and tracks, the Allies expected the M4 to be as successful on the battlefields of 1944-45 as it had been in 1942-43. In most aspects, this expectation proved true; the mobility, reliability, and firepower of the M4 were crucial to Allied victory over Germany and Japan. When used in roles it was designed for, the M4 performed exceptionally well. Even so, the M4's record was not completely positive in 1944-45. The M4 proved woefully inadequate in anti-tank operations against German tanks; a mission for which the M4 had not been originally designed. After June 1944 (D-Day), British and American M4s encountered increasing numbers of heavier German tanks that were superior in both armor and firepower; the German *Pzkw. V* "Panther" and the *Pzkw. VI* "Tiger" had definite advantages over the M4 in tank-on-tank battles. Some critics claimed that it took five M4s to defeat one German tank. Contemporary and post-war critics of the M4 focused on this aspect of its service alone to frame their opinion of the tank, which is unfair. Tank-on-tank combat was infrequent in Western Europe and practically non-existent in the Pacific theater. When it did occur, the crews of Allied M4s

defeated the larger German tanks on numerous occasions. The complete record of the M4 for 1944-45 shows failures, which were not always attributable to design of the tank, but also successes that could not have been accomplished without the key features of the M4. In the final analysis, the assets of the M4 continued to be vital to the ultimate Allied victory in 1945, a testimony that proved the quality of the original design.

As mentioned in Chapter III, the Americans and the British recognized some M4 features needed modifications and improvements based on the experiences of 1943. Although the Allies were pleased overall, they anticipated that the nature of the 1944 battlefields in northwest Europe would require some upgrades to its capabilities. Accordingly the Allies sought to improve three key areas of the M4's design: mobility, armor, and firepower. All of the modifications improved the capabilities of the M4, but the record of the tank in 1944-45 was not limited to just the new models. The Americans were unable to modify existing M4s or to produce new, improved M4s in sufficient numbers prior to the D-Day invasion. Most of the M4s used were therefore the same models as the ones used throughout 1942-43. Consequently, critical evaluations of the M4 based on events during June and July 1944 are derived from models that the Army already recognized as in need of improvement.<sup>1</sup>

In regard to mobility, the American army and industry engineers sought to improve the M4's ability to move over soft ground, such as mud or snow. The key problem was the tendency of the M4 to sink too deeply in soft terrain due to its high

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<sup>1</sup> Baily, *Faint Praise*, 120-21; Mayo, *On Beachhead and Battlefront*, 101; Steven J. Zaloga, *US Armored Divisions: The European Theater of Operations, 1944-45*, Battle Orders series 3 (Oxford: Osprey Publishing, 2004), 26.

ground pressure. Ground pressure is a measurement of how much force the weight of a vehicle exerts on the ground. Measured in pounds per square inch (psi), ground pressure was a vital factor in any tank's off-road capability. The use of tracks rather than wheels dispersed a tank's weight over a larger area thereby reducing the overall ground pressure; in contrast, wheels focus a vehicle's weight into smaller areas and cause it to sink in soft terrain more readily, because the weight is concentrated at four fixed points. To improve the M4's mobility, Army ordnance engineers decreased the ground pressure from 15 psi to 11 psi by incorporating new, wider tracks—24 inches instead of 16 inches—that increased surface area. They also created removable extensions (called grousers) that crewmen attached to sides of the track as necessary. The grousers, referred to as “duckbills” due to their appearance, added even more width to the track and further lowered the ground pressure to 10 psi.<sup>2</sup>

To support the new, wider track, Army ordnance engineers successfully modified the existing suspension system, the Vertical Volute system. The cause of the high ground pressure in the original models of the M4 was the narrow width of the track used with the Vertical Volute suspension. As more weight was added to the tank, the overall ground pressure increased, which limited the mobility of the M4 even further. To utilize a wider track, engineers turned the vertical springs sideways so that they lay horizontally and would disperse the weight better. Along with other minor modifications, engineers called the new suspension system the Horizontal Volute suspension system (HVSS). Capable of supporting the new track and increased weight, the HVSS also provided a more stable

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<sup>2</sup> Hunnicutt, *Sherman*, 241-44.

ride off-road and was more durable due to less wear on the springs. To designate the changes, the Army added the suffix of “HVSS” to a tank’s model number; for example, the Army identified a modified or newly constructed M4A3 with the horizontal suspension system as an “M4A3 HVSS.” The upgraded suspension and track restored mobility to the M4 in most soft terrain. The HVSS proved very satisfactory and became the users’ much preferred type of suspension system for the M4. In testimony to the design, the Army only discontinued using HVSS when it could not satisfactorily handle weights greater than forty tons, such as those found in the M4’s replacement (the M26) and other post-war tanks. For the 33-ton M4, the HVSS was completely adequate and performed well.<sup>3</sup>

To improve the M4’s battlefield survivability, Army ordnance engineers successfully rectified several vulnerable aspects of the M4’s design and improved the overall armor protection. Combat experiences in 1943 showed that many M4s were lost to similar causes. Losses came when enemy fire penetrated the armor and hit the M4’s ammunition lockers, detonating the stored ammunition and exploding the tank. Even if the ammunition was not hit, penetrating shots frequently started fires that completely destroyed the tank. Ordnance engineers also determined that the shape of the hull front did not deflect rounds as well as it could. Army ordnance engineers devised solutions to

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<sup>3</sup> Green, Thomson, and Roots, *Planning Munitions for War*, 303-4; Zaloga, *Sherman Medium Tank*, 19.

these problems by modifying existing M4s and integrating a design change in the production of new M4s in 1944 and 1945.<sup>4</sup>

Regarding the M4's 75mm ammunition, the engineers sought to decrease its vulnerability by providing better protection against enemy fire. In the M4s built prior to 1944, shells for the 75mm gun were stored in bins in the turret floor but also in lockers located internally on the sides of the hull above the tracks. An impact from an AP shell on the side of an M4 could hit one of the storage bins with catastrophic results. To resolve this problem, Army ordnance engineers relocated all the ammunition stowage to lockers beneath the turret and eliminated the side storage lockers; the engineers also increased the overall thickness of the front and side armor. All M4s produced after January 1944 incorporated these design changes. For existing M4s, Army mechanics welded patches of 1 to 1.5 inches of additional armor plate over the outside of the two right-side lockers and the one left-side locker. In spite of the patches and thicker armor, the AP shots from the German 75mm and 88mm anti-tank guns still penetrated at most combat ranges. The additional armor was more effective against lighter weight and man-portable anti-tank weapons, and shots were less likely to hit ammunition in the redesigned M4s.<sup>5</sup>

Fires caused by penetrating AP shots were a serious problem for the M4, but the Army developed a successful solution in 1944. The Army ordnance engineers determined the cause of the fires was often the stacking of ammunition outside of their protected bins

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<sup>4</sup> Hunnicutt, *Sherman*, 204-5.

<sup>5</sup> Ibid., 222.

as well as the explosive charge contained within the German AP rounds. The propellant used in the American ammunition was the source of the fire, not the fuel (gasoline) as some critics have stated. A penetrating AP shot ruptured the casing of the ammunition, and then the explosive charge started a fire. To help reduce the chance of a fire starting, engineers redesigned all new M4s so that the ammunition locker walls were filled with a water-and-fire-retardant chemical mixture. If the locker wall was ruptured, it filled the container with approximately 35 gallons of liquid. The Army referred to this as “wet stowage,” and it was very successful in reducing the outbreak of fires. An Army study in 1945 reported that only 10-15% of M4s with “wet stowage” burned, whereas 60-80% of the earlier models had burned.<sup>6</sup> Newly constructed M4s incorporated this feature, and a few M4A1s and M4A3s were modified. An M4 with “wet stowage” was identified with the suffix “W” after its model number, such as “M4A3 W.”<sup>7</sup>

Another key modification was a re-design of the hull front of the M4 to improve its deflection performance and crew survivability. New M4s had thicker and stronger steel on the hull front that resisted enemy fire better. Engineers simplified the front by removing any curves or protuberances that weakened the armor; they relocated items such as light fixtures and removed features such as viewing ports. The result of the redesign was a featureless (except for the front machine gun port), sloped armor plate that resisted enemy fire better than the old shape. Moreover, the driver and co-driver hatches were enlarged to make it easier for these crewmen to exit quickly; combat experience

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<sup>6</sup> Zaloga, *Sherman Medium Tank*, 16.

<sup>7</sup> Hunnicutt, *Sherman*, 260-61; Ross, *The Business of Tanks*, 246.

revealed that these crewmen had had difficulty quickly exiting through the original hatches in an emergency. The Army's modifications to the M4 improved its survivability in battle and enabled the tank to remain effective for the rest of the war.<sup>8</sup>

The most controversial modification to the M4 was the effort to upgrade the main gun's anti-tank capability. Based on observations, the British and the Americans determined that the 75mm gun was becoming less effective against the increased armor the Germans had added to the *Pzkw. IV*. Although not part of its mission, combat with German tanks occurred more frequently as the Allies increasingly used their M4s to attack the German positions, which responded with their *panzers*. Although this had occurred since North Africa in late 1942 and early 1943, the Army Ground Forces, led by General Leslie McNair, still believed that Tank Destroyers (self-propelled anti-tank guns) should be primarily used against other tanks and that the M4 should refrain from combat with other tanks. However, McNair recognized that the nature of combat in Europe was requiring the M4 to defeat German tanks, and he was therefore agreeable to upgrading its armament. The key obstacle in December 1943 and January 1944 was the objection of the Army field commanders. A majority of them favored keeping the powerful, high explosive shell used by the M4's 75mm gun. Containing 1.47 pounds of high explosive, the round was very effective against everything except tanks. This position made sense in 1943, when American tank units were mostly used against German infantry and bunkers and when tank combat was the exception and not the norm. The new gun, a 76mm high velocity canon, had a superior AP round but a distinctly inferior HE shell that contained

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<sup>8</sup> Chamberlain and Ellis, *British and American Tanks of World War II*, 117; Hunnicutt, *Sherman*, 272.

only .86 pounds of high explosive. Anticipating the majority of combat would remain the same after the invasion of France, Army tank commanders did not want to lose the 75mm gun. The Army decided on a compromise that stipulated only a partial replacement of 75mm-armed M4s. By July 1944, approximately two hundred 76mm-armed M4s (identified by the suffix “(76)”) were in Europe, although more were on the way. As American commanders encountered heavier German tanks with greater frequency in France, they demanded more and more 76mm-armed M4s. As will be discussed later, the ordnance engineers had high expectations for the 76mm gun, but it proved a disappointment against the German “Panther” and “Tiger” tanks.<sup>9</sup>

In addition to a new gun, the Army also developed new ammunition for use against enemy tanks. A new AP shell fired from the 76mm gun was terms Hyper-Velocity Armor Piercing (HVAP), a somewhat deceptive name. The key to the new round was its ultra dense core composed of tungsten-carbide. The core was significantly smaller in diameter than the barrel; in contrast, a normal shell is the same diameter as the interior of a barrel. To enable it to fit tightly in the barrel, the core was encased in an aluminum sheath. When fired, the gun propelled the smaller projectile to higher velocities, because it weighed less than full-size 76mm AP rounds. Normal American AP shells travelled at 2,600 feet per second (fps), whereas the new HVAP travelled at close to 3,400 fps. Because of its greater speed to the target, the HVAP round had more kinetic energy to penetrate the target, and its denser structure allowed it to push through the

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<sup>9</sup> Green, Thomson, and Roots, *Planning Munitions for War*, 326-27; Hunnicutt, *Sherman*, 206, 212-13; Steven J. Zaloga, *M4 (76mm) Sherman Medium Tank, 1943-1965*, New Vanguard series 73 (Oxford: Osprey Publishing, 2003), 7-8, 11.

armor plating more easily; the aluminum sheath either fell away after firing or disintegrated on impact with the target.<sup>10</sup> These new rounds were more effective than the older ones, but few were shipped to Europe before D-Day. The scarcity of tungsten carbide and the relative lack of demand prior to July 1944 worked against large amounts of the new ammunition being sent overseas. As the M4 confronted more heavily armed tanks, tank commanders in France demanded the HVAP round, like the 76mm gun, with urgency.<sup>11</sup>

Like the Americans, the British also developed a new anti-tank gun, the 17 pounder, for their M4 and achieved tremendous success using it against the German *panzers*. The 17 pounder anti-tank gun was originally developed during the North African campaign to replace the obsolete and ineffective 2 pounder and 6 pounder anti-tank guns. The name indicating the weight of the projectile, the 17 pounder fired a large, high-velocity AP round that was capable of penetrating the armor of all German tanks at 1,000 yards or further. Like the 76mm gun, the British developed a new HVAP round that further improved the British gun's armor-piercing capability. The most serious drawback of the 17 pounder was its lack of an HE shell; the gun only fired AP shells. For the Americans, this deficiency disqualified the 17 pounder for use in American tank units; in January 1944, the British offered to supply two hundred 17 pounders plus ammunition within three months. However, American army leaders and field

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<sup>10</sup> Hunnicutt, *Sherman*, 207.

<sup>11</sup> Green, Thomson, and Roots, *Planning Munitions for War*, 237, 372; Macksey and Batchelor, *Tank*, 126; Zaloga, *M4 (76mm) Sherman*, 18-19.

commanders declined the offer, believing that the new 76mm gun was adequate and better suited for their purposes. To integrate the new gun into their forces, the British modified their existing tank units to include one 17 pounder M4, called a “Firefly,” for every three 75mm-armed M4s. The British reasoned that this would give their tank units sufficient HE firepower and anti-tank capability to handle any challenges encountered after D-Day. The 17 pounder proved a great success against the German *panzers*, and after the development of an effective HE round in 1945, it was a decisive asset to the M4 in tank combat.<sup>12</sup>

In preparation for the D-Day, the Americans and British developed one of the most innovative modifications to the M4 that enabled it to float and propel itself through the water to the beach. The purpose of the invention was to provide immediate tank support to infantrymen who stormed ashore a hostile beach during an initial assault wave. Previously, tanks arrived ashore via large, vulnerable landing craft that had to wait until the beach was relatively secure before approaching. To make the M4 float and swim, engineers waterproofed the M4 to prevent foundering by completely sealing all openings in the hull except for crew hatches. Next, they attached a canvas panel lined with inflatable rubber tubes to the sides of the hull; the height of the panels—approximately three feet above the water--prevented water from overflowing the top of the tank. The canvas panels and rubber tubes also formed a floatation screen that made the tank buoyant enough to float. To provide mobility in the water, engineers attached propellers—called a Duplex Drive--to the rear of the tank; the Allies referred to tanks so equipped as

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<sup>12</sup> Hunnicutt, *Sherman*, 303; Ross, *The Business of Tanks*, 286-88.

DD-tanks. The tank driver could engage or disengage the Duplex Drive as needed and operated it just like driving the tank. One key problem was that if water penetrated the canvas screen through shell holes or if waves came over the top, the tank lost its buoyancy and sank rapidly, imperiling the crew. The British and the Americans first used DD-tanks on D-Day (June 6, 1944) by launching them from landing craft several thousand yards from the French beaches in Normandy. In the British sector, several DD tanks made it ashore with the first troops and were very helpful in destroying German bunkers and gun positions. In the American sector, the use of DD tanks was almost a total failure; the rough seas caused almost the entire lot to founder, and German anti-tank guns quickly put out of action the few tanks that made it ashore. After D-Day, the Allies considered the concept of DD tanks only partially successful, because the tanks were too vulnerable and too many were lost that day. Even so, the Americans also used DD tanks in the August invasion of southern France, and later both the Americans and British utilized them to cross the Rhine River into Germany in 1945. Although not completely successful, the DD concept was one of the most unusual modifications to the M4 in the war and reflects well on the versatility of the tank design.<sup>13</sup>

To improve the M4's ability to support the infantry, the Army and the Marine Corps successfully replaced the 75mm gun with a 105mm gun and a flamethrower respectively. The 105mm gun was a large howitzer that had the ability to destroy buildings with a single shot; its shell contained almost double the amount of high

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<sup>13</sup> George A. Harrison, *The European Theater of Operations: Cross-Channel Attack*, United States Army in World War II series (Washington, DC: Center of Military History, 1951; reprint, Minnetonka, MN: National Historical Society, 1994), 192; Hunnicutt, *Sherman*, 422-25; Mayo, *On Beachhead and Battlefront*, 229, 240.

explosive compared to the 75mm shell.<sup>14</sup> Whereas, artillery cannons fired from miles away and their aim had to be corrected by radio, the 105mm-equipped M4s were able to see their targets and shoot directly at them with great effectiveness. These tanks, identified by the suffix (105), also shelled targets from a distance (like artillery) when necessary. This modification pleased the Army, which issued one M4(105) to every tank company (seventeen regular M4s) and three to every battalion headquarters. Accordingly, a tank battalion had six M4(105)s for its use, providing considerable additional firepower considering that a normal artillery battery was twelve 105mm guns.<sup>15</sup> Throughout the 1944-45 period, Army commanders in Europe and the Pacific persistently requested more M4(105)s, an indication of their satisfaction with this model. Likewise, the installation of a flamethrower was equally successful. At the request of the U.S. Marine Corps, a flamethrower replaced either the main gun or one of the internal machine guns. Previously, the Marines used man-portable flamethrowers very effectively against Japanese bunkers, but the men carrying them were very vulnerable to enemy fire. By placing the weapon inside a tank for protection, the Marines removed the chief shortcoming of the weapon and used it even more effectively.<sup>16</sup> For example, the Marines used the flamethrower tanks during the invasion of Guam to clear Japanese defenders from caves at Asan Point on July 22, 1944. Previously, Marines had to eliminate such heavily fortified positions at great risk and usually with high casualties; the flamethrower tanks, impervious to Japanese rifle and

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<sup>14</sup> Hunnicutt, *Sherman*, 562, 568.

<sup>15</sup> Zaloga, *US Armored Divisions*, 25-27.

<sup>16</sup> Baily, *Faint Praise*, 328.

machine-gun fire, burned the defenders out with little risk to the Marines. Both the 105mm gun and the flamethrower were invaluable in supporting infantry and marines in 1944, and their use in the M4 is an important part of the tank's history.<sup>17</sup>

One of the most successful modifications to the M4 was the M4A3E2, a heavily armored assault tank invulnerable to most German weapons except at close range. In March 1944, the Army Ground Forces suggested that the armor on 254 M4A3s be significantly increased to create heavily armored tanks capable of leading assaults against strong enemy positions. Although European commanders approved, the Ordnance Department objected to this modification and claimed that the automotive and suspension components were not designed to handle the increased weight. However, the engineers carried out the modifications as directed and created the M4A3E2 or "Jumbo" as it was commonly known. The "Jumbo" had an extra 1.5 inches of armor on the front and sides of the hull, raising the total to four inches and three inches respectively. The turret walls' armor was six inches thick. The increased protection raised the M4's weight to 42 tons, whereas the original M4A3 weighed just under 34 tons.<sup>18</sup> As a result, the "Jumbo" was significantly less mobile; it was slower, and its overall ground pressure of 14 psi was higher, despite permanent track extensions. Even so, the Jumbo's armor was highly resistant to all German anti-tank weapons except at close range (less than 200 yards). American soldiers in Europe praised its armor protection highly and demanded more of the "Jumbo." However, the Army produced no more than the original 254 M4A3E2

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<sup>17</sup> Zaloga, *US Marine Corps Tanks of World War II*, 18-20.

<sup>18</sup> Hunnicutt, *Sherman*, 289-90.

tanks. The Ordnance Department argued successfully that resources should be devoted to the creation of a new tank, not further modifications to the M4; in spite of the users' wishes, the Army deployed no more "Jumbos" to Europe.<sup>19</sup>

The final key modifications made to M4s prior to D-Day were attempts to provide the tank with the capability to assist Army combat engineers on the battlefield. They performed a variety of different missions during a battle, including bridge-building, construction and demolition of fortifications, and the laying and removal of landmines. The Army combat engineers frequently required the use of earthmovers (bulldozers) in their tasks, but these vehicles and their operators were vulnerable to enemy fire. The solution was to attach a dozer blade to the front of an M4 along with the necessary mechanisms to raise, lower, and change the blade angle. The crew of the M4 was able to jettison the entire device if need be and reattach it again after combat. These "Dozer Tanks" proved extremely useful throughout the northwest European campaign; Army leaders were so pleased that there never were enough to meet demand.<sup>20</sup>

Another modification was the attachment of devices to M4s to assist with the detection and removal of landmines. The Army engineers experimented with a variety of devices, but the principal types employed were "mine exploder discs" and the so-called "flail" tanks. Attached to the front of an M4, the "mine exploder discs" were pairs of four discs—resembling wheels—that ploughed the ground in front of the tank and detonated any mines on contact. Over eight feet in diameter, the discs were large enough to withstand

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<sup>19</sup> Baily, *Faint Praise*, 120-21.

<sup>20</sup> Hunnicutt, *Sherman*, 432-33.

the detonation of a mine and, if destroyed, were easily replaced. The main problem with the discs was their weight, which strained the front suspension, required early replacement of components, and decreased the tank's speed. An M4 using the discs moved at just three miles per hour, which made it quite vulnerable to enemy fire. Also for mine-clearing operations, the British developed a device that whipped the ground in front of an M4 with several heavy chains by attaching them to a revolving drum. The chains detonated any mines buried in the ground on contact. The drum was attached to an M4 by two arms that raised and lowered it as needed. When in operation, the drum rapidly revolved and "flailed" the ground with the chains as the "flail tank" moved forward. Any mines struck by the chains detonated without damaging the tank, and there was minimal damage to the drum and chains. Like the mine exploder discs, the whole mechanism strained the front suspension system and required that the tank move slowly over the battlefield, making it vulnerable to enemy fire. As such, the devices were not completely satisfactory, but they were successful in clearing pathways through minefields, so the Americans and the British used them until the end of the war. Although the mine clearing devices were tried with other tanks, the M4 proved to be best suited for their use due to its automotive capabilities and its adaptability to new devices. All of these modifications demonstrated the ability of the M4 to accommodate such devices and reflect positively on its overall design.<sup>21</sup>

Prior to the invasion of France, the American army decided to reorganize the structure of the armored divisions, which in turn affected how the M4 was deployed in

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<sup>21</sup> Chamberlain, and Ellis, *British and American Tanks*, 133-34; Hunnicutt, *Sherman*, 456, 461; Macksey and Batchelor, *Tank*, 140.

combat. The Army was satisfied with the organization of the tank battalion and used it as a basis for re-structuring the armored division. Inside the division, the Army eliminated the two armored regiments and the one infantry regiment by splitting them into three battalions each respectively. The Army excluded the 2<sup>nd</sup> Armored Division and 3<sup>rd</sup> Armored Division from this reorganization, because they were already in Europe and their commanders opposed the change. The 1<sup>st</sup> Armored Division fighting in Italy delayed making the change until mid-1944, because it was not practical to do so while it was on the front line. The Army designated the new armored division organization as the “light” armored division, compared with the older “heavy” division (see Appendix E.) In the new structure, the Army decreased the number of M4 tanks assigned to the division from 232 to 168. Although the overall firepower was reduced, the Army found that combat operations were more effective, because the subordinate battalions were easier to control and to form into combat commands. As part of the reorganization, the Army created a third, reserve combat command headquarters (CCR) to supplement the existing combat commands A (CCA) and B (CCB).<sup>22</sup> So when the M4 went into battle as part of an armored division, the tanks were dispersed among the subordinate CCA, CCB, or CCR along with the division’s infantry, artillery, engineers, and reconnaissance troops. For example, the 6<sup>th</sup> Armored Division attacked the city of Mulhausen, Germany, on April 4, 1945, and organized itself as follows: CCA was composed of the 15<sup>th</sup> and 68<sup>th</sup> tank battalions, the 9<sup>th</sup> Armored Infantry Battalion, the 212<sup>th</sup> and 274<sup>th</sup> armored field artillery battalions, one tank destroyer company, and one armored engineer company;

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<sup>22</sup> Zaloga, *US Armored Divisions*, 21.

CCB had the 44<sup>th</sup> and 50<sup>th</sup> armored infantry battalions, the 69<sup>th</sup> Tank Battalion, the 128<sup>th</sup> and 231<sup>st</sup> armored field artillery battalions, one tank destroyer company, and one armored engineer company; and CCR contained the rest of the division's personnel, the remaining attached tank destroyers, and the anti-aircraft battalion.<sup>23</sup> The combat commands were tailored for a particular assignment and therefore were either predominantly tanks or infantry, although not exclusively. By 1944, the Army recognized the necessity of tanks and infantry working closely together, and who supported whom was dependent on the situation. With the new division organization, the Army showed that it had resolved the interwar question on the role of tanks on the battlefield. In 1944 and 1945, the Army did not view tanks as either independent of or subservient to the other branches. Rather, tanks were now an equal partner in all combat missions, and the M4 was the tank of choice in that partnership.<sup>24</sup>

In 1944 and 1945, the role of the M4 in the Pacific theater remained essentially unchanged from 1943. The Marines modified their tank battalions to include four companies with fourteen M4s each; the Army retained the three M4 companies plus one light tank company in its tank battalions. Aside from the addition of the dozer tanks, flamethrower tanks, and the various mine-clearing devices, the soldiers and marines used the 75mm-armed M4 for the same purpose of supporting attacks on Japanese defensive positions. As in 1943, the M4 was very successful in this role; the 75mm gun was particularly effective at destroying bunkers and blasting away jungle vegetation to reveal

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<sup>23</sup> Ibid., 70.

<sup>24</sup> Gabel, "World War II Armor Operations in Europe," in *Camp Colt to Desert Storm*, ed. Hofmann and Starry, 147, 153-55, 163.

hidden Japanese positions. As mentioned in Chapter III, the Marines pioneered a variety of methods to improve the coordination between foot soldiers and tanks. The most successful idea involved welding a steel box on the rear of an M4 and placing a field telephone inside. The telephone's wires passed through a small hole in the hull and tied in to the tank's intercom system. A Marine simply picked up the phone and began communicating with the crew inside, pointing out obstacles and potential targets. During combat, tank crewmen kept their hatches shut to prevent the enemy from tossing grenades or firing into the interior. Prior to the addition of a phone to communicate with the outside, the tank commander opened the hatch on the turret and stood up, exposing himself to enemy fire. The method developed by the Marines resolved this danger and permitted quick and accurate communication between the marines and tanks.<sup>25</sup>

With the addition of a defensive adaptation, the M4 provided highly valuable and effective service in the Pacific theater. The main Japanese anti-tank weapon was a 37mm gun that was ineffective against the M4, but the magnetic anti-tank mine was a greater threat. In the close confines of the jungle, Japanese soldiers dashed up to the tanks and affixed the mine to the sides and engine compartment, usually losing their lives in the process. The resulting explosion of the mine disabled the tank. To defend against this tactic, marines attached wooden boards to the sides of the M4 and also used concrete as an extra layer of armor; the magnetism in the mines was thereby rendered ineffective.<sup>26</sup>

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<sup>25</sup> Robert M. Neiman and Kenneth W. Estes, *Tanks on the Beach: A Marine Tanker in the Pacific War* (College Station: Texas A&M University Press, 2003), 69; Zaloga, *US Marine Corps Tanks of World War II*, 26, 34-5.

<sup>26</sup> Neiman and Estes, *Tanks on the Beach*, 94.

Robert Neiman, a Marine tank veteran, described a typical tank action on Okinawa (June 1945) in his memoirs. He wrote,

We would send out anywhere from a platoon to a company of tanks as much as eight hundred yards beyond our [front] lines. Infantry fire teams would follow the tanks and protect them from close assaults by concealed Japanese. A section or platoon, depending on the size of the element we sent out, would go far forward and draw fire, if necessary. Then they and the rest of the platoon or company would fire 75-mm high-explosive rounds at every possible cave or emplacement on the Japanese-held ridgeline. . . Any Japanese antitank gun that opened up got immediate attention . . . and was quickly smothered with fire . . . That done, the infantry would then come forward and move past the tanks . . . Then we would send the tanks up to join them and repeat the procedure.<sup>27</sup>

The M4's firepower, mobility, and armor protection were vital to the success of these operations, especially when coupled with effective teamwork with the foot soldiers.

Although the M4 was a prized asset for the American combat forces, it was a nemesis for the Japanese in the Pacific. During the same battle for Okinawa, Japanese General Mitsuru Ushijima wrote in a battle lesson to his soldiers, "the enemy's power lies in his tanks. It has become obvious that our general battle against the American forces is a battle against their . . . M4 tanks."<sup>28</sup> Such comments reflected both a respect for and the danger the American M4s posed to the Japanese army. The combat record of the M4 in the Pacific is an appropriate part of the history of the tank and should be included in any evaluation of its wartime performance. The M4 was the tank of choice in the Pacific for the Marines and the Army.<sup>29</sup>

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<sup>27</sup> Ibid., 147.

<sup>28</sup> Mitsuru Ushijima to Thirty-Second Army, letter, June 1945, as quoted in Hunnicutt, *Sherman*, 329.

<sup>29</sup> Joseph H. Alexander, "Marine Corps Armor Operations in World War II," in

Like the marines and soldiers in the Pacific, the Soviet operators of the M4 were as pleased with their tanks in 1944-45 as they had been in 1943. As mentioned in the previous chapter, information is limited on the Soviet experience, but the impression from what is available is positive. The Soviets used their M4s in every tank-related mission: assaulting German positions, supporting infantry, defense, and exploiting a breakthrough. Like the British and Americans, the primary Soviet complaint about the M4 was their limited mobility in soft terrain due to the narrowness of the original track. The Soviets received large numbers of M4A2s, enough to equip several Soviet tank brigades consisting of 65 tanks each.<sup>30</sup> Initially armed with the 75mm gun, the Soviets received many M4A2 (76mm) tanks and used them effectively, even against the heavier German tanks such as the “Tiger.” Soviet commentary on Anglo-American equipment tended to be very candid; regarding several M3 tanks they received, Soviet crews referred them by a nickname that translated as a “grave for seven brothers.”<sup>31</sup> Therefore, Soviet comments on the M4 may be taken as sincere, albeit subjective, and not couched in diplomatic language. As previously mentioned, the Soviets recognized the shortcomings of the M4 but still greatly valued its overall utility.<sup>32</sup>

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*Camp Colt to Desert Storm*, ed. Hofmann and Starry, 186, 200-01.

<sup>30</sup> Zaloga and Ness, *Red Army Handbook*, 178.

<sup>31</sup> Ibid., 172.

<sup>32</sup> David M. Glantz and Jonathan House, *When Titans Clashed: How the Red Army Stopped Hitler* (Lawrence: University Press of Kansas, 1995), 151, 281; Hunnicutt, *Sherman*, 326.

Soviet tank crews were aware of the strength of the armor of the “Panther” and “Tiger,” but they employed their M4s against them anyway and frequently did so successfully. The Soviets developed specific tactics for using their tanks against the heavier German tanks that maximized the M4’s strengths and avoided its weaknesses. Dmitriy Loza’s memoirs recount many of the impressive methods his unit’s M4s used to defeat the *panzers*. Loza frequently noted that the Soviets conducted thorough reconnaissance of an area before sending their tanks into a situation where German tanks were expected; the tank commanders often performed this reconnaissance on foot. The commanders identified concealed routes and attempted to bypass the main German defenses whenever possible. Loza recalled that it took two M4s to defeat a “Tiger” or “Panther”; American critics claimed that five were necessary and that at least three would be lost in the process. Loza wrote, “The 85- to 100-mm frontal and turret armor of the enemy tanks made them practically invulnerable to the *Emcha*’s [M4’s] projectiles at those points. But they did burn and could be immobilized in place by our precision shooting.”<sup>33</sup> In a tactic he called “Hunting with Borzois,” Loza and his men followed a few simple steps to defeat the German tanks. He and his men first used this tactic successfully in the Korsun-Shevchenkovskiy region of Ukraine during January and February of 1944 and did so again in many different engagements. In the first step, Loza and his men’s M4s did not shoot at the German tanks until they were in effective range of the 76mm guns. The range varied depending on the type of German tank and the angle from which the M4s approached it; the sides and rear of the German tanks had the

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<sup>33</sup> Loza, *Commanding the Red Army’s Sherman Tanks*, 19.

thinnest armor and were the most vulnerable, particularly if the range was less than 500 yards. If unable to get close enough, the M4s backed off and tried a different approach route. Noticeably, the M4s did not try to outshoot the Germans in a head-on duel, even when closer than 200 yards. To assist the M4s in getting close enough, another portion of Loza's unit created a distraction to focus the Germans' attention away from the direction of the approaching tanks; they also tried to lure the German tanks to advance to a particular spot on the battlefield. When ready, two M4s attacked each German tank by first shooting off one of its tracks. When the *panzer* tried to move, the loss of the track caused it to spin in one direction. As the side of the German tank appeared, the M4s fired into its fuel tanks, located behind the turret. The fire, smoke, and impact compelled the German crew to evacuate the tank, and they were machine-gunned as they exited.<sup>34</sup> Loza's unit recorded great success with these tactics and used them for the remainder of the war with variations; the Soviet army high command designated his unit as an elite "Guards" formation in September 1944.<sup>35</sup>

Loza and his men believed that their personal survival and success in the war was due partly to the M4. The strong feelings that Loza and his men held for the M4s were demonstrated at the end of the war when his unit had to hand in their tanks. As part of the Lend-Lease agreement, the Soviets were to return the M4s to the United States. When the M4s were loaded on trains prior to moving to their port of departure, Loza recounted how several of his men openly wept at the separation from their beloved *Emchas*. Of course,

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<sup>34</sup> Ibid., 20-21.

<sup>35</sup> Ibid., xiv.

Loza's account is his own personal experience with the M4 and certainly not exhaustive of the full Soviet record. However, Loza's opinion and memories stand in stark contrast to the American veteran, Belton Cooper, who labeled the M4 a "deathtrap" and recounted with contempt his experiences with the tank.<sup>36</sup>

The brightest aspects of the M4's performance in 1944 Europe continued to be its mobility, reliability, and most importantly, its ability to support infantry effectively. In spite of the aforementioned limitations, the M4 continued to go places that German tanks could not and at speeds that they envied. In November 1944, German Armament Minister Albert Speer wrote,

On the Southwest Front, opinions are in favor of the Sherman tank and its cross-country ability. The Sherman tank climbs mountains that our Panzer crews consider impassable. This is accomplished by the especially powerful engine in the Sherman in comparison to its weight. Also, according to reports from the 26. Panzer Division, the terrain-crossing ability on level ground (in the Po valley) is completely superior to our Panthers. The Sherman tanks drive freely cross-country, while our Panthers must remain on trails and narrow roads and therefore are very restricted in their ability to fight.

All Panzer crews want to receive lighter Panthers, which are more maneuverable, possess increased ability to cross terrain, and guarantee the necessary combat power just with a superior gun.<sup>37</sup>

This comment is remarkable considering the derision that postwar critics hold for the M4 and their preference for the German *panzers*. Additionally, the M4 remained one of the

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<sup>36</sup> Ibid., 153-54.

<sup>37</sup> Albert Speer, report, November 1, 1944, as quoted in Jentz, *Panzertruppen*, 151.

most mechanically reliable tanks of the war, a trait that meant more M4s were available for battle.<sup>38</sup>

Moreover, the separate tank battalions continued to use the M4 with great success in supporting infantry troops. The M4's HE shells and machine guns were vital in clearing defending Germans out of bunkers, buildings, trenches, and other locations. This role was the main role of the M4 in Europe, not tank-against-tank combat. The amount and type of ammunition expended illustrated this point well: 60% of the shells carried in an M4 were HE, whereas only 30% were AP (the balance of the shells were smoke shells for marking targets). One summary of the M4's combat history in Europe showed that tanks and other armored vehicles were targets only 14% of the time; bunkers, buildings, troops, artillery, and anti-tank guns accounted for the remaining 86% of combat targets.<sup>39</sup> Therefore, for the vast majority of engagements, the M4 was very well prepared and performed admirably. In one example from September 1944, M4s from the 741<sup>st</sup> and 747<sup>th</sup> tank battalions assisted American soldiers of the 28<sup>th</sup> Infantry Division in an assault on the Germany fortifications on the Franco-Germany border. On September 19<sup>th</sup>, the M4s and infantry destroyed 29 enemy bunkers, plus an addition 22 bunkers over the next two days. Without the support of the M4s, the Infantry would not have been as successful

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<sup>38</sup> Ambrose, *Citizen Soldiers*, 64.

<sup>39</sup> Steven J. Zaloga, *Armored Thunderbolt: The U.S. Army Sherman in World War II* (Mechanicsburg, PA: Stackpole Books, 2008), 233.

in its mission. It is not an exaggeration to state that the Anglo-American infantry were dependent on the M4 for success.<sup>40</sup>

The first use of the M4 in France occurred on D-Day, and its performance there laid the foundation for its reputation for the rest of the northwest European campaign and postwar criticism. The Anglo-American campaign to defeat Germany lasted from June 1944 to May 1945 and was the setting of thousands of tank battles involving the M4. Critics of the M4 have focused primarily on this period to form their opinion and understandably so; the Americans and British used more M4s here than in any other theater or time of the war. The first M4s landed at Normandy on June 6, 1944. Operating as DD tanks, the M4s attempted to swim ashore with some success in the British zones and less success in the American zones. During all of the fighting in Normandy, the M4 was a vital part of Allied operations, but using it proved very difficult.<sup>41</sup>

In Normandy, the chief geographic feature of the area, the hedgerow, hampered American operations and their use of M4s in combat. The Norman hedgerow is an earthen wall that separates the local farm fields. A hedgerow varied from one to four feet thick and from three to eight feet high. Shrubbery and trees grew on top of the hedgerow, and the branches overlapped the farm lanes. The enclosed farm fields averaged between 200 and 400 yards in size, but with no regular shape. Visibility was very poor, and

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<sup>40</sup> Nathan N. Prefer, *Patton's Ghost Corps: Cracking the Siegfried Line* (Novato, CA: Presidio Press, 1998), 57; Yeide, *The Infantry's Armor*.

<sup>41</sup> Michael D. Doubler, *Closing with the Enemy: How GIs Fought the War in Europe, 1944-1945* (Lawrence: University Press of Kansas, 1994), 47, 66-67; Gabel, "World War II Armor Operations in Europe," in *Camp Colt to Desert Storm*, ed. Hofmann and Starry, 162-63.

German ambushes were frequent. The overall effect of the hedgerows was to turn the battlefield into hundreds of narrow, confined combat areas in which the defending Germans held the advantage; the hedgerows were poor terrain for tank operations.<sup>42</sup> Tanks could climb up and over the hedgerow but were exposed to enemy fire as they did so; alternative entrances into a field were the pre-existing gates or through holes made by explosives in the hedgerows. Both entrances forced the tanks to enter one at a time and be picked off by German anti-tank guns. The hedgerows were mostly in the American sector on the western side of Normandy; the British sector was more open and permitted greater movement but also allowed the long-range German anti-tank guns to shoot more effectively. For the Americans, the only significant advantage the M4 had over the German tanks was that its barrel length was short enough to rotate the turret in the farm lanes; the barrels on the *panzers*, on the other hand, were often too long for these cramped conditions. In mid-July, the Americans developed devices like the Culin hedgerow cutter—also known as the “Rhino”—that enabled tanks to plow through the hedgerow with no warning; then the tanks and infantry could quickly overwhelm the surprised Germans. Even so, the Germans had the advantage of defending territory and

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<sup>42</sup> Martin Blumenson, *The European Theater of Operations: Breakout and Pursuit*, United States Army in World War II series (Washington, DC: Center of Military History, 1961; reprint, Minnetonka, MN: National Historical Society, 1994), 11.

could therefore hide and wait for the Allied tanks to expose themselves; German anti-tank guns then took a fearsome toll on the attacking M4s.<sup>43</sup>

In June and July 1944, inexperienced American soldiers made critical mistakes using their M4s that increased American casualties. Carl Rambo, a veteran of the 70<sup>th</sup> Tank Battalion, recounted how a new platoon leader wanted to lead a charge of M4s through an opening in a hedgerow. As soon as the first M4 entered the opening in the hedgerow, German anti-tank fire immediately destroyed the tank. The platoon's second-in-command wanted to push on through, even though Rambo advised against it; the platoon lost three more M4s, and only Rambo's tank survived.<sup>44</sup> Such encounters were all too frequent, but instead of recognizing American inexperience with such terrain, critics blamed the M4 and its armor's failure to protect the tank. Furthermore, journalists and soldiers alike reported numerous accounts describing American AP shots bouncing off the front of German tanks; the M4's guns, both 75mm and 76mm, were poor tank killers as they described them. Such criticism missed the larger point that soldiers were using the M4 in a manner for which it was not designed, head-on duels with German heavy tanks. Moreover, one cannot help but make comparisons between Rambo's account and that of Lazo; would U.S. tank losses have been less severe if American tank commanders had used Soviet methods or something similar? The answer is probably not, because the hedgerow country of Normandy was too confined to permit the kind movement that Lazo

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<sup>43</sup> Gabel, "World War II Armor Operations in Europe," in *Camp Colt to Desert Storm*, ed. Hofmann and Starry, 161-162; Steven J. Zaloga, *Armored Thunderbolt: The U.S. Army Sherman in World War II* (Mechanicsburg, PA: Stackpole Books, 2008), 156-57.

<sup>44</sup> Jensen, *Strike Swiftly!*, 182-83.

described. However, it is clear that the Americans tended to blame the machine rather than their own tactics.<sup>45</sup>

The American experience in Normandy in the summer of 1944 set the pattern of dissatisfaction with the M4 and led to a search to understand the disparity between German *panzers* and the M4. During the fall of 1944, journalists and other commentators seemingly dropped the issue of tank inferiority as the Allied armies swept victoriously across France and Belgium to the German border. However, the German winter offensive known as the Battle of the Bulge (December 16, 1944 to January 25, 1945) turned the issue into something of a scandal. On January 5, 1945, Hanson Baldwin of the *New York Times* wrote in an article,

Why at this late stage in the war are American tanks inferior to the enemy's? That they are inferior the fighting in Normandy showed and the recent battles in the Ardennes [Battle of the Bulge] have again emphatically demonstrated. This has been denied, explained away and hushed up . . . It is high time that Congress got to the bottom of a situation that does no credit to the War Department. This does not mean that our tanks are bad. They are not; they are good. They are the best tanks in the world – next to the Germans.<sup>46</sup>

Baldwin was not unique in searching for answers. In July of 1944, Supreme Allied Commander Dwight D. Eisenhower remarked to American First Army commander Omar Bradley, “Ordnance told me this 76 [mm gun] would take care of anything the German

<sup>45</sup> Baily, *Faint Praise*, 106; Cooper, *Death Traps*, 19-21, 32; Roman Johann Jarymowycz, *Tank Tactics: From Normandy to Lorraine*, The Art of War series, ed. John A. English (Boulder, CO: Lynne Rienner Publishers, 2001), 97.

<sup>46</sup> Hanson W. Baldwin, “The German Blow – III: New German Tanks Prove Superior to Ours – Inquiry by Congress Urged,” *New York Times*, January 5, 1945.

had. Now I find you can't knock out a damn thing with it.”<sup>47</sup> In his memoirs, Bradley concurred that the lack of firepower in the M4 reflected poorly on its design and laid out the narrative that was to become the answer to Baldwin’s question. Bradley wrote, “Our tank superiority devolved primarily from a superiority in the number rather than the quality of tanks we sent into a battle.”<sup>48</sup> According to Bradley and many post-war historians, the sole value of the M4 was its ease of production that permitted large numbers of the tank to be manufactured. Although true, critics of the M4 distorted this fact into the *raison d'être* for the M4 and the cause of its inferiority to German heavy tanks.<sup>49</sup>

Comparing the M4 with the *Pzkw.* IV, the most numerous German medium tank produced, reveals many similarities but also distinct advantages for the M4. The M4 was more mechanically reliable than the *Pzkw.* IV and easier to service and maintain in the field. The M4’s ability to quickly aim its main gun provided a distinct advantage over the German tank. In terms of firepower, the *Pzkw.* IV’s long, 75mm anti-tank cannon was superior to the M4’s original 75mm gun in armor penetration at ranges exceeding 500 yards. Even so, the M4’s 75mm AP was capable of defeating the *panzer*’s armor, and its HE shell was superior to the German version in supporting infantry. By using the 76mm gun and the HVAP shell, the Americans nullified the *Pzkw.* IV’s previous range advantage over the M4 in duels. In armor protection, both tanks were relatively equal,

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<sup>47</sup> As quoted in Bradley, *A Soldier's Story*, 323.

<sup>48</sup> Ibid.

<sup>49</sup> Ambrose, *Citizen Soldiers*, 63; Hastings, *Overlord*, 192-93; Jarymowycz, *Tank Tactics*, 321.

especially after the Americans added the “wet stowage” for the ammunition in the M4.

The *Pzkw.* IV comprised 50% of German tank strength in western Europe in 1944 and 1945. The M4’s ability to regularly and easily defeat that *panzer* invalidates critics’ arguments that German tank units always had the advantage over the Allies.<sup>50</sup>

Without question, the M4 was inferior to the German *Pzkw.* V “Panther” and the *Pzkw.* VI “Tiger” in a tank-on-tank duel (see Appendix F). However, American encounters with these heavier German tanks were rare; the Germans only manufactured 1,354 *Pzkw.* VI during the entire war and then dispersed them across every theater.<sup>51</sup> The “Panther” was more numerous than the “Tiger” but still lagged behind the *Pzkw.* IV in availability; most encounters between an M4 and a German tank involved the *Pzkw.* IV. Even so, the M4 was and continues to be mostly compared to the bigger German tanks—“heavy” tanks in American wartime classification—although the M4 was a “medium” tank. The “Panther” weighed approximately 45 tons, and the “Tiger” weighed almost sixty tons. In this sense, comparisons between the M4 and these models are like comparing the fighting strength of a featherweight vs. a heavyweight boxer. The main guns on the “Panther” (a 75mm high-velocity cannon) and on the “Tiger” (88mm high-velocity cannon) were capable of penetrating the M4’s armor at a distance greater than

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<sup>50</sup> Baily, *Faint Praise*, 52, 112-13; Bryan Perret, *Panzerkampfwagen IV Medium Tank, 1936-1945*, New Vanguard series 28 (Oxford: Osprey Publishing Company, 1999), 42-43.

<sup>51</sup> Peter Chamberlain and Hilary Doyle, *Encyclopedia of German Tanks of World War Two* (London: Arms and Armour, 1999), 446.

2,000 yards.<sup>52</sup> The M4's 75mm could not penetrate the frontal armor of either tank, but it could penetrate the side and rear armor of the "Panther" at 500 yards. Against the "Tiger," the M4 needed to get within 300 yards for an effective side or rear shot. The 76mm gun was incapable of penetrating the frontal armor of either tank at ranges greater than one hundred yards, but the gun could penetrate the sides and rear at greater distances. The new HVAP ammunition increased the overall range at which a shot could penetrate German armor. Even so, the German tanks retained the edge in long-distance shooting through the end of the war. As previously mentioned, the British 17 pounder was the only Allied tank gun capable of penetrating the German tanks' frontal armor at one thousand yards. The M4 equipped with a 17 pounder was quite capable of destroying the German tanks on a regular basis; a fact that suggests that the M4 was merely lacking in anti-tank firepower—a specific design choice shown in Chapter II.<sup>53</sup>

In spite of its deficiencies, Anglo-American M4s did successfully take on German "Panther" and occasional "Tiger" tanks. A battle between the two was not an automatic victory for the Germans as has been implied by post-war critics. Because the M4 could not win in a head-on confrontation, the crews of the M4s developed tactics to handle the bigger German tanks. Similar to the methods described by Loza, Allied M4s maneuvered for shots to the sides and rear of the Germans' vehicles while other friendly troops distracted the German tanks. A key feature of the M4 in this type of fast-moving battle was the powered turret traverse that permitted quick and accurate aiming of the gun;

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<sup>52</sup> Zaloga, *Sherman Medium Tank*, 14.

<sup>53</sup> Hunnicutt, *Sherman*, 562, 564-65.

German tank turrets had to be rotated by a hand-crank into position, which was a slow process due to the size and weight of the turret. G. MacLeod Ross, British army tank liaison in the United States, recorded the following in his memoirs,

It was something of a coincidence when in July 1966 I met a Canadian who had fought at Caen [June to July 1944] with the Canadian 4<sup>th</sup> Armored Brigade. Asked about gunnery, he volunteered that a feature of the installation on the Shermans was the Oilgear traversing [mechanism], which gave hair-line laying [quick and precise aiming] of the gun. He added that its high speed in traversing from target to target was so much faster than the gear on the German ‘Tiger’ tank that it was possible to catch the enemy tank off line. I felt that this unsolicited testimony paid for the bloody-mindedness which . . . I had shown over traversing gears; even to the day when we refused to break for lunch until we got a written order from Ordnance for work to be done modifying the gear.<sup>54</sup>

The victorious American tank battles at Arracourt, France (September 19-29, 1944), likewise featured fast shooting and skillful flank shots against the Germans. On one of the rare occasions when the roles were reversed, the German LVIII *Panzer* Corps and the XLVII *Panzer* Corps attacked the American XII Corps as part of an attempt to repel the American Third Army under General George Patton as it approached the German border. A series of German attacks and American counter-attacks ensued, but when the Germans finally called off their offensive, 200 *panzers*, mostly “Panthers,” had been destroyed, abandoned, or severely damaged. The American 4<sup>th</sup> Armored Division, which bore the brunt of the attack, lost 41 M4s. Although TDs, artillery, and aircraft destroyed many German tanks, the M4s destroyed a great many too. For example, on the morning of the 19<sup>th</sup>, a company of seventeen M4s destroyed four “Panthers” out of a group eight; no M4s were lost. Later in the day, two companies of M4s destroyed nine “Panthers” with

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<sup>54</sup> Ross, *The Business of Tanks*, 247.

the loss of only three American tanks. Such achievements were not uncommon for veteran M4 crews who knew the strengths and weaknesses of their tanks.<sup>55</sup>

It is quite possible that many of the earlier failures of the M4 against German tanks were attributable to green troops who lacked sufficient combat experience with the M4. Further study is needed on the effectiveness of American tank training in preparing for combat in Europe, but many veterans described it as inadequate. One particular case briefly illustrates some of the Army's poor personnel management with tank units.

William S. Triplet was a professional Army officer before the war and recounts in his memoirs his experience when he was assigned to the 13<sup>th</sup> Armored Division shortly after its activation in 1943. Reporting to the commanding general, Triplet records the following conversation:

[General:] "Had no experience with armor I suppose."

[Triplet:] "Yes sir. Tank school, 1929-30; company commander, Second Tank Regiment, 1930-32; maintenance and test officer, F Company, Sixty-seventh Infantry (tanks) with thirteen experimental types plus the platoon of Christies [tanks], 1934-36; and tested the Bren gun carrier for the Infantry Board this spring."

[General:] "Hmmm, I think I'll put you in charge of the division [supply] trains."<sup>56</sup>

Considering the bulk of the 13<sup>th</sup> Armored Division was composed of draftees and brand new officers fresh from college, the question of why someone with Triplet's experience was assigned to a support role begs to be answered. After the division deployed to

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<sup>55</sup> Hugh M. Cole, *The European Theater of Operations: The Lorraine Campaign*, United States Army in World War II series (Washington, DC: Center of Military History, 1950; reprint, Minnetonka, MN: National Historical Society, 1994), 224-25.

<sup>56</sup> William S. Triplet, *A Colonel in the Armored Divisions: A Memoir, 1941-1945*, ed. Robert H. Ferrell (Columbia: University of Missouri Press, 2001), 17.

Europe, the division commander reassigned Triplet to lead one of the division's Combat Commands where he served quite successfully. Even so, such practices, if common, reflect poorly on the Army's personnel management and might explain the combat record of some units equipped with the M4—records of heavy losses until crews gained enough experience to use their M4s appropriately and avoid situations where it was vulnerable.<sup>57</sup>

Although American doctrine specified that tanks should avoid other tanks, the U.S. forces in Europe were unable to consistently do so in 1944-45. Two reasons caused this condition: first, German doctrine stipulated that enemy tanks were to be countered by *panzers*, and second, the Germans determined when and where to use their own tanks. As a result, the tank battles of the last year of the war were inevitable. The difficulties experienced in those engagements were not a reflection on the design of the M4 but on the shortcomings of American army doctrine. U.S. tank destroyers proved inadequate as the sole weapons for anti-tank missions, usually because they were not present when and where the German tanks appeared. By the time the TDs arrived, the fight was often over, and oftentimes the M4s had prevailed, but with losses. Although the Americans adapted quickly and began including TDs as part of any attacking force, they did not refrain from ordering M4s to engage the heavier German tanks. Allied commanders continued to pit them against the German tanks during the remainder of the war with high losses in both tanks and crews. As previously stated, this mission was beyond the design parameters of

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<sup>57</sup> Cooper, *Deathtraps*, 114; Doubler, *Closing with the Enemy*, 30, 277-78.

the M4, so one would expect it to perform badly. The fact that crews of the M4 were able to defeat the heavier German tanks on numerous occasions should reflect positively on the tank's design and the crews.<sup>58</sup>

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<sup>58</sup> Gabel, "World War II Armor Operations in Europe," in *Camp Colt to Desert Storm*, ed. Hofmann and Starry, 179.

## CONCLUSION

The M4 medium tank was a success based on its record from World War II. The designers of the M4 successfully, albeit imperfectly, balanced firepower, armor, and mobility in a model that was tremendously successful in the various war theaters. The M4 was not the best tank of World War II, but it was not the failure that its critics alleged either. The M4 was not a weapon forced upon unfortunate Allied soldiers; rather, its operators valued the tank's usefulness in every mission except one. The criteria by which the M4 should be judged is how well it performed according to its design requirements. Many contemporary observers and post-war critics, however, formulated their opinions of the M4 based upon a technical comparison with the German "Panther" and "Tiger" tanks; they compare armor thickness and the armor-piercing power of the main gun. However, these metrics are insufficient to evaluate a tank, because such comparisons only matter when the tanks are dueling each other. As shown, the Americans did not design the M4 as a tank-killer; their doctrine stipulated another weapon, the tank destroyer, for that mission. Therefore, the quality of the M4 should not be based on an evaluation of its performance in a role for which it was not designed; instead, a tank's quality should be judged by its full combat record, particularly in the missions it was meant to perform. Historians should examine and question the American army's doctrine on tanks and anti-tank operations, which certainly contained flaws. However, historians should differentiate between the issue of American armor doctrine and the issue of the M4's performance; failure to do so only obscures what actually took place. Additionally,

a failure to understand the mission for which the M4 was created will necessarily lead to a misunderstanding of the tank's performance in the war.

The Americans created the M4 because they needed a tank force that was capable of defeating the German army. In 1940, the United States possessed small numbers of tanks and therefore had to build a tank branch virtually from scratch. A sense of urgency pervaded everything the Army did in those years, especially after the attack on Pearl Harbor. However, the M4 was not designed haphazardly or carelessly, despite the press of time. The M4's design encapsulated the Army's prevalent views on the role of tanks in battle. The Army's overriding concern was not simply to build large numbers of tanks but to build the tank it wanted in large numbers. With the M4, they believed they had accomplished this. The characteristics of the M4 met all of the Army's requirements, which did not include an anti-tank mission. Although the M4 could fight other tanks, that was not the Army's intention in 1942-43.

The M4's combat record in 1942 and 1943 was a success according to both Allied and Axis commentators at the time. All of the users praised its performance in battle as did some opponents, such as Erwin Rommel. In Africa, American and British soldiers reported some problems with the M4, such as its seeming propensity for catching on fire. However, investigations by the U.S. Army Ordnance Department and the British revealed that this issue had nothing to do with the design of the tank. In the Mediterranean and the Pacific theaters, the M4 proved its worth in supporting ground troops with its quick, reliable movements around the battlefield. However, critics seem to overlook this positive aspect of the M4's record (half its service time in World War II).

The M4's combat experience against German tanks in Europe during 1944-45 shaped its long-term reputation and the evaluation of the M4, largely overshadowing its successes during 1942-43 and its achievements even in the later period. Comparing the M4 with the late-war German heavy tanks, critics point out its inferiority in armor and firepower, which put Allied crews at a disadvantage when they confronted the "Panther," "Tiger," and "King Tiger" tanks. In their opinion, the M4 was therefore a failure as a tank because of this inferiority. However, this aspect of the M4's story is only part of the full record. Elsewhere in 1944 and 1945, the M4's positive reputation from 1943 continued and even increased. Both Pacific and Soviet users highly valued their M4s and wanted more shipped to them. In France and the Low Countries in 1944, the M4 faced many challenges besides German tanks, such as hedgerows and frequently muddy ground. The Army successfully adapted the M4 to overcome these challenges, which reflects positively on the M4's design. In every mission where tanks could play a role, the Allied armies used their M4s effectively and successfully. Even when confronted by German tanks, the crews of the M4 developed methods to defeat them. The British developed a gun that easily penetrated German armor, the 17 pounder anti-tank cannon, and the Soviet operators of the M4 developed effective maneuvering tactics to defeat the same German tanks. For the critics of the M4, the question emerges, how was it possible to defeat the technically superior German tanks if the M4 was so inadequate to the task? Considering the complete record of the M4, the conclusion is that the M4 was not so

grossly inferior nor as poorly designed as critics argue; it seems grossly unfair to conclude that the M4 was an “engineering disaster.”<sup>1</sup>

It is a mistake to attribute the difficulties the M4 faced in fighting the heavy German tanks to a design flaw; the M4 was a different class of tank than these German models. The M4 was a 33-ton medium tank; the “Panther” and “Tiger” were 45- and 60-ton heavy tanks. Comparisons on such unequal terms will always yield unbalanced and false results. In contrast, the M4 fared exceedingly well against the German medium tank, the *Pzkw. IV*. Produced in greater numbers than any other *panzer*, the *Pzkw. IV* was the most common tank that faced the M4. Both tanks were comparable in many areas, but the addition of the 76mm gun enabled the M4 to defeat the *Pzkw. IV* at most combat ranges. The *Pzkw. IV* did not outclass the M4, so the argument that the M4 was inferior to all German tanks is invalid. Moreover, the success of the Allied crews in defeating the heavier German *panzers* reflects well on their abilities and on the design of the M4.

The M4 was a successful tank design, and its combat record from World War II supports this interpretation. Although it struggled in combat against the German heavy tanks, the majority of the M4’s story is praiseworthy. Whether fighting in the jungles of the Pacific, the deserts of Africa, or the snows of the Soviet Union, the M4 was an essential component in the Allied war machine. At the end of the war, journalists asked American General Jacob Devers for his assessment of the M4; he remarked, “It got the job done.”<sup>2</sup> The M4 was more than just adequate for the task; it was the right tank for

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<sup>1</sup> History Channel, “Modern Marvels S10E49 Engineering Disasters 12.”

<sup>2</sup> As quoted in Baily, *Faint Praise*, 33.

most jobs. The M4's shortcomings in limited situations should not detract from its otherwise excellent record. An accurate appraisal of the M4 is important if historians are to understand the nature of the fighting in World War II and the course and outcome of the war. For the allies, the M4 "Sherman" tank was indeed a war-winner.

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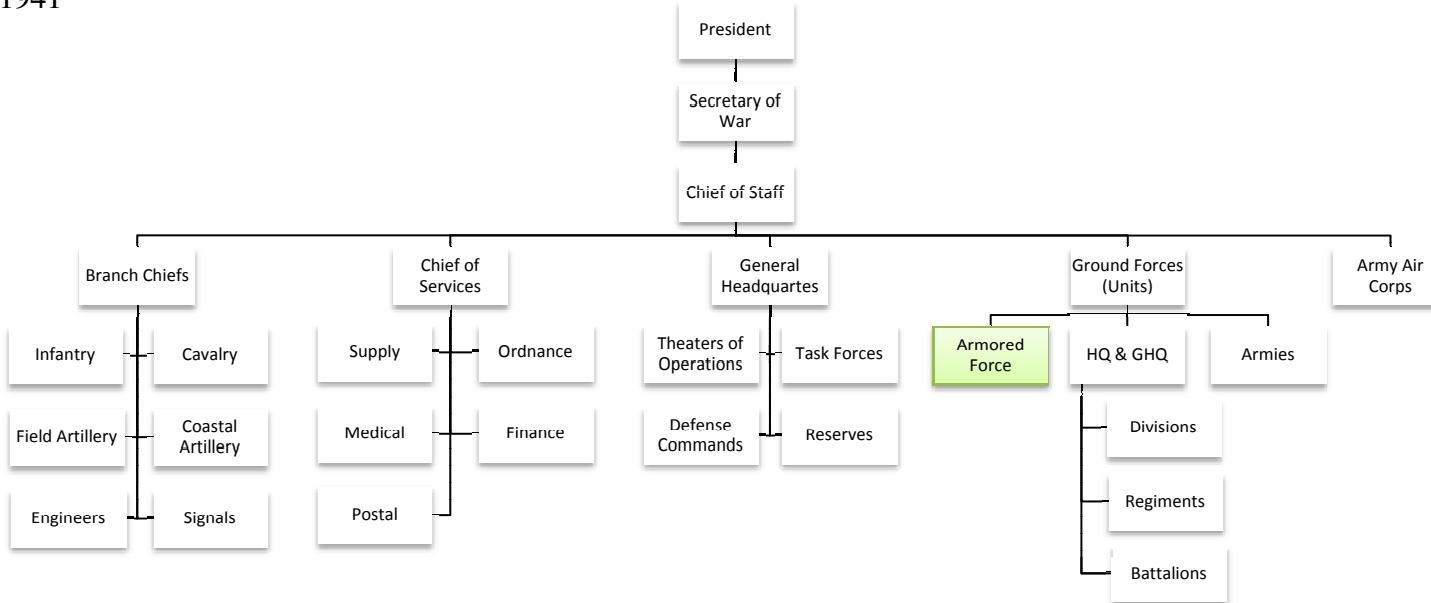
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## **APPENDICES**

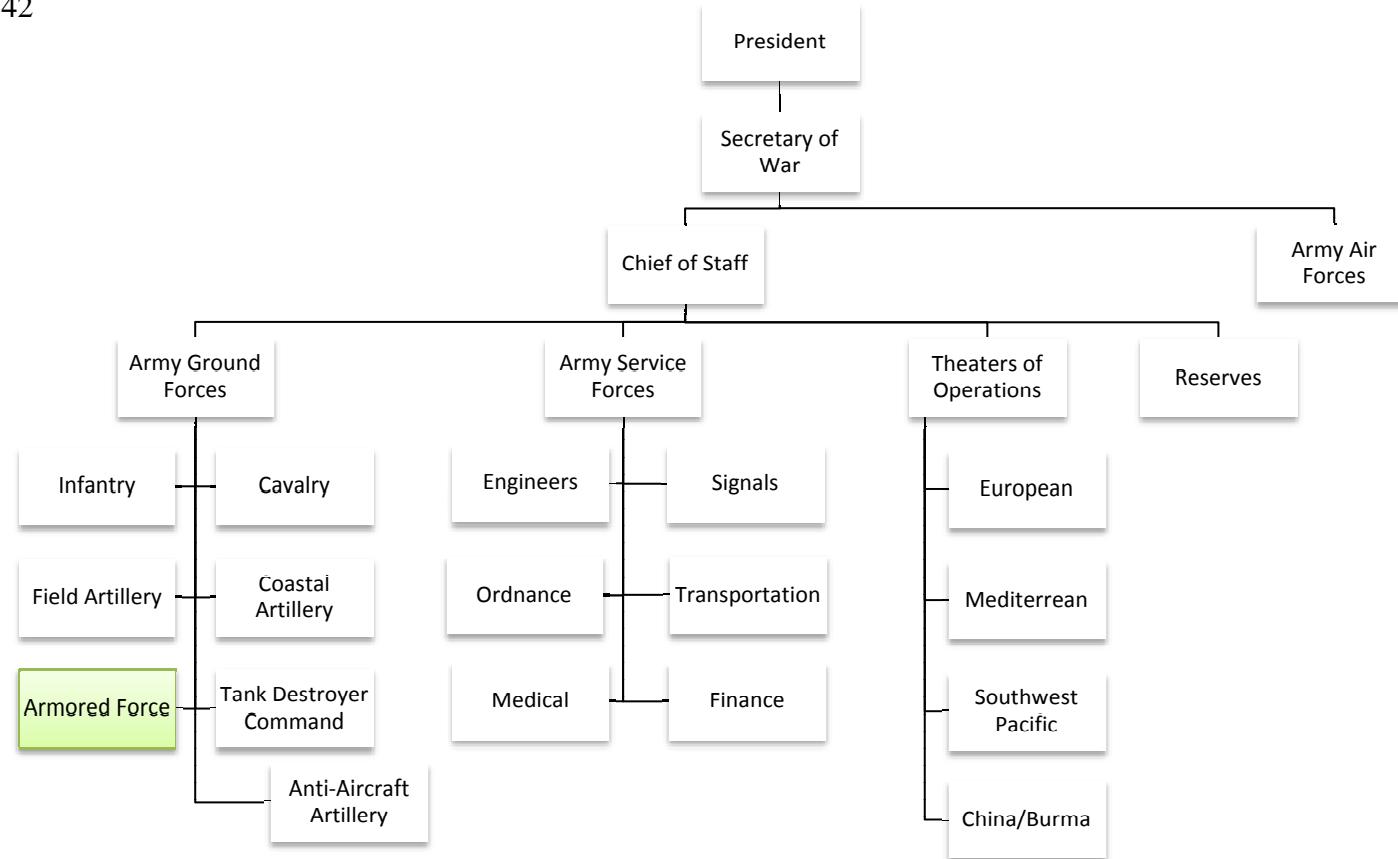
## APPENDIX A: ANNOTATED ORGANIZATION OF THE WAR DEPARTMENT

June, 1941



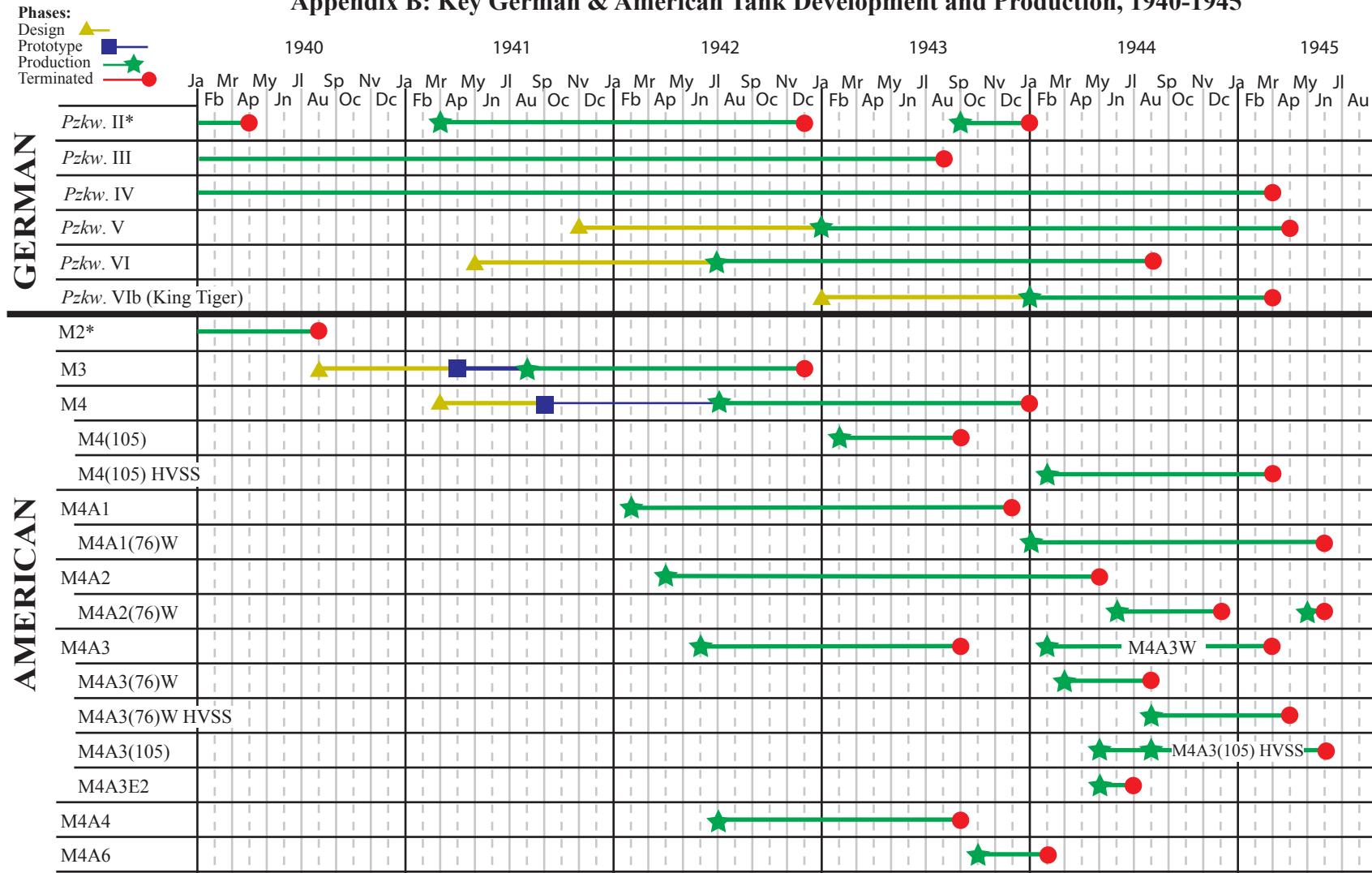
Greenfield, Palmer, and Wiley, *The Organization of Ground Combat Troops*, 14.

March, 1942



Greenfield, Palmer, and Wiley, *The Organization of Ground Combat Troops*, 152.

## **Appendix B: Key German & American Tank Development and Production, 1940-1945**



\* Initially classified as medium, but later re-classified as light tanks

Chamberlain and Doyle, *Encyclopedia of German Tanks of World War Two*; Chamberlain and Ellis, *British and American Tanks of World War II*.

### APPENDIX C: AMERICAN MEDIUM TANKS, 1940-1945

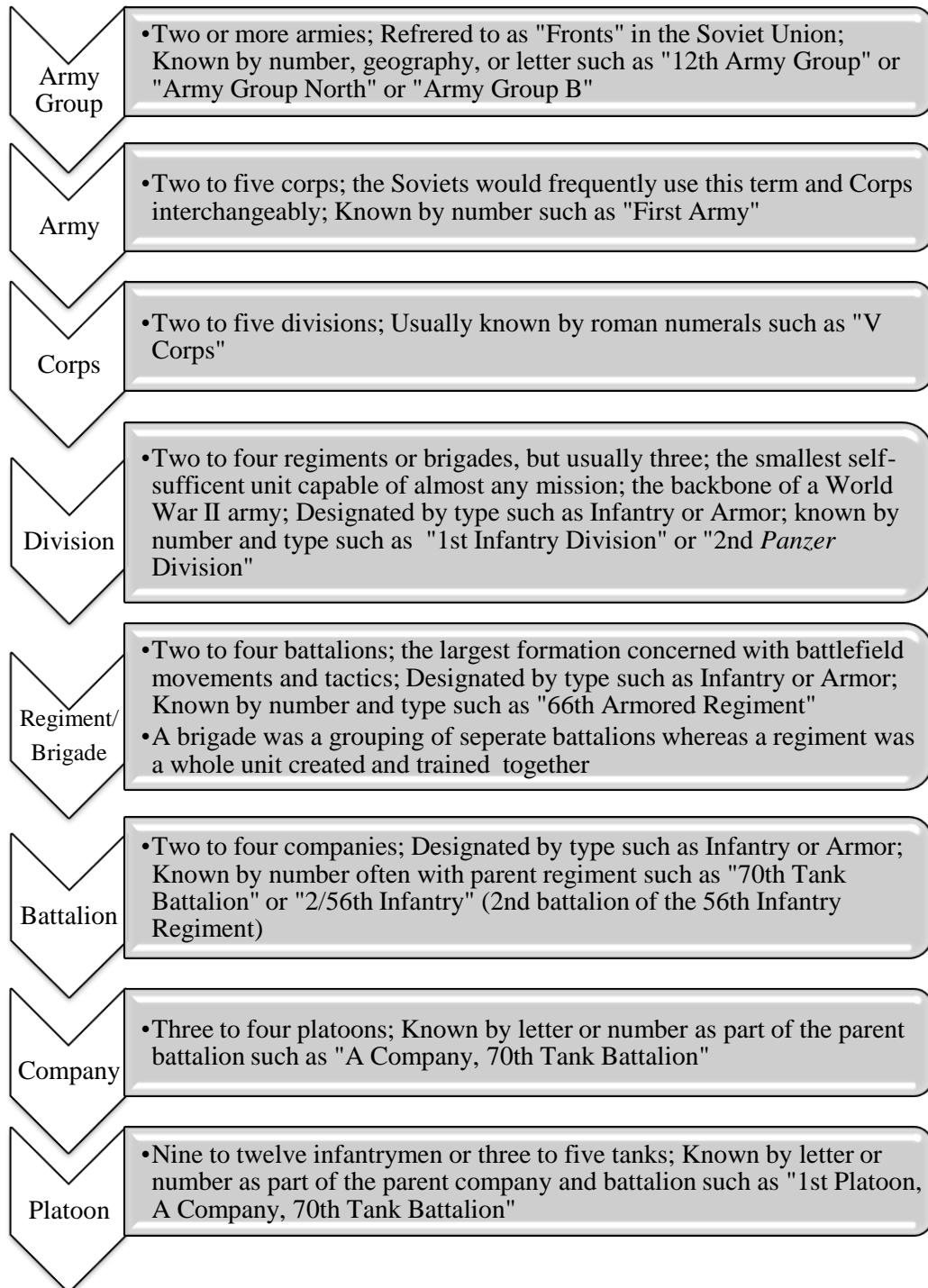
	<b>M2A1</b>	<b>M3</b>	<b>M4</b>
<b>Crew</b>	6	6	5
<b>Length (ft)</b>	17' 6"	18' 6"	19' 4"
<b>Height (ft)</b>	9' 3"	10' 3"	9'
<b>Width (ft)</b>	8' 6"	8' 11"	8' 7"
<b>Weight (Loaded) lb.</b>	47,040	60,000	66,900
<b>Suspension</b>	Vertical volute	Vertical volute	Vertical volute
<b>Armament</b> (amount) type of cannon, machine guns (MG)	(1) 37mm M6 (8) .30cal MG	(1) 75mm M2 or M3 (1) 37mm M5 or M6 (3-4) .30cal MG	(1) 75mm M3 (1) .50 cal MG (2) .30 cal MG
<b>Hull</b>	Riveted/ Welded	Riveted	Welded
<b>Armor Thickness</b>	32mm 9.5 mm	37mm max 12mm min	75mm turret 50mm hull
<b>Engine</b>	Wright Radial	Wright Continental Radial R-975	Wright Continental R-975 Radial
<b>Power (Horsepower)</b>	400 HP	340 HP	340 HP
<b>Max Road Speed</b>	26 mph	26 mph	24-29 mph
<b>Max Off Road Speed (approx)</b>	17.2 mph	16 mph	15-20 mph
<b>Road Radius</b>	130 miles	120 miles	100 - 150 miles
<b>Number Built</b>	94	4,924	6,748
<b>Variants/Modifications</b>	Type = Amount produced (105): 105mm Howitzer HVSS: Horizontal Volute Suspension System		M4(105) = 800 M4(105) HVSS = 841

	<b>M4A1</b>	<b>M4A2</b>	<b>M4A3</b>
<b>Crew</b>	5	5	5
<b>Length (ft)</b>	19' 4"	19' 4"	19' 4"
<b>Height (ft)</b>	9'	9'	9'
<b>Width (ft)</b>	8' 7"	8' 7"	8' 7"
<b>Weight (Loaded) lb.</b>	66,800	70,200	66,700
<b>Suspension</b>	Vertical volute	Vertical volute	Vertical volute
<b>Armament</b> (amount) type of cannon, machine guns (MG)	(1) 75mm M3 (1) .50 cal MG (2) .30 cal MG	(1) 75mm M3 (1) .50 cal MG (2) .30 cal MG	(1) 75mm M3 (1) .50 cal MG (2) .30 cal MG
<b>Hull</b>	Cast	Welded	Welded
<b>Armor Thickness</b>	75mm turret 50mm hull	75mm turret 50mm hull	75mm turret 50mm hull
<b>Engine</b>	Wright Continental R-975 Radial 340 HP	Twin General Motors 6-71 Diesel 375 HP	Ford GAA V-8 500 HP
<b>Power (Horsepower)</b>	24-29 mph	24-29 mph	24-29 mph
<b>Max Road Speed</b>	15-20 mph	15-20 mph	15-20 mph
<b>Max Off Road Speed (approx)</b>	100 - 150 miles	100 - 150 miles	100 - 150 miles
<b>Road Radius</b>	6,281	8,053	1,690
<b>Number Built</b>	M4A1(76)W = 3,426	M4A2(76)W = 2,915	M4A3W = 3,071
<b>Variants/Modifications</b>	Type = Amount produced (76): 76mm Gun W: wet-stowage (105): 105mm Howitzer HVSS: Horizontal Volute Suspension System		M4A3(76)W = 1,400 M4A3(76)W HVSS = 3,142 M4A3(105) = 500 M4A3(105) HVSS = 2,539 M4A3E2 "Jumbo" = 254

	<b>M4A4</b>	<b>M4A6</b>
<b>Crew</b>	5	5
<b>Length (ft)</b>	19' 10.5"	19' 10.5"
<b>Height (ft)</b>	9'	9'
<b>Width (ft)</b>	8' 7"	8' 7"
<b>Weight (Loaded) lb.</b>	69,700	70,000
<b>Suspension</b>	Vertical volute	Vertical volute
<b>Armament</b> (amount) type of cannon, machine guns (MG)	(1) 75mm M3 (1) .50 cal MG (2) .30 cal MG	(1) 75mm M3 (1) .50 cal MG (2) .30 cal MG
<b>Hull</b>	Welded	Cast (Rolled front); Welded
<b>Armor Thickness</b>	75mm turret 50mm hull	75mm turret 50mm hull
<b>Engine</b>	Chrysler WC Multibank	Catapillar RD-1820 Radial
<b>Power (Horsepower)</b>	370 HP	450 HP
<b>Max Road Speed</b>	25 mph	25 mph
<b>Max Off Road Speed (approx)</b>	15-20 mph	15-20 mph
<b>Road Radius</b>	100 - 150 miles	100 - 150 miles
<b>Number Built</b>	7,499	75
<b>Variants/Modifications</b>		

Chamberlain and Doyle, *Encyclopedia of German Tanks of World War Two*, 115-18; Hunnicutt, *Sherman*, 525, 538-51.

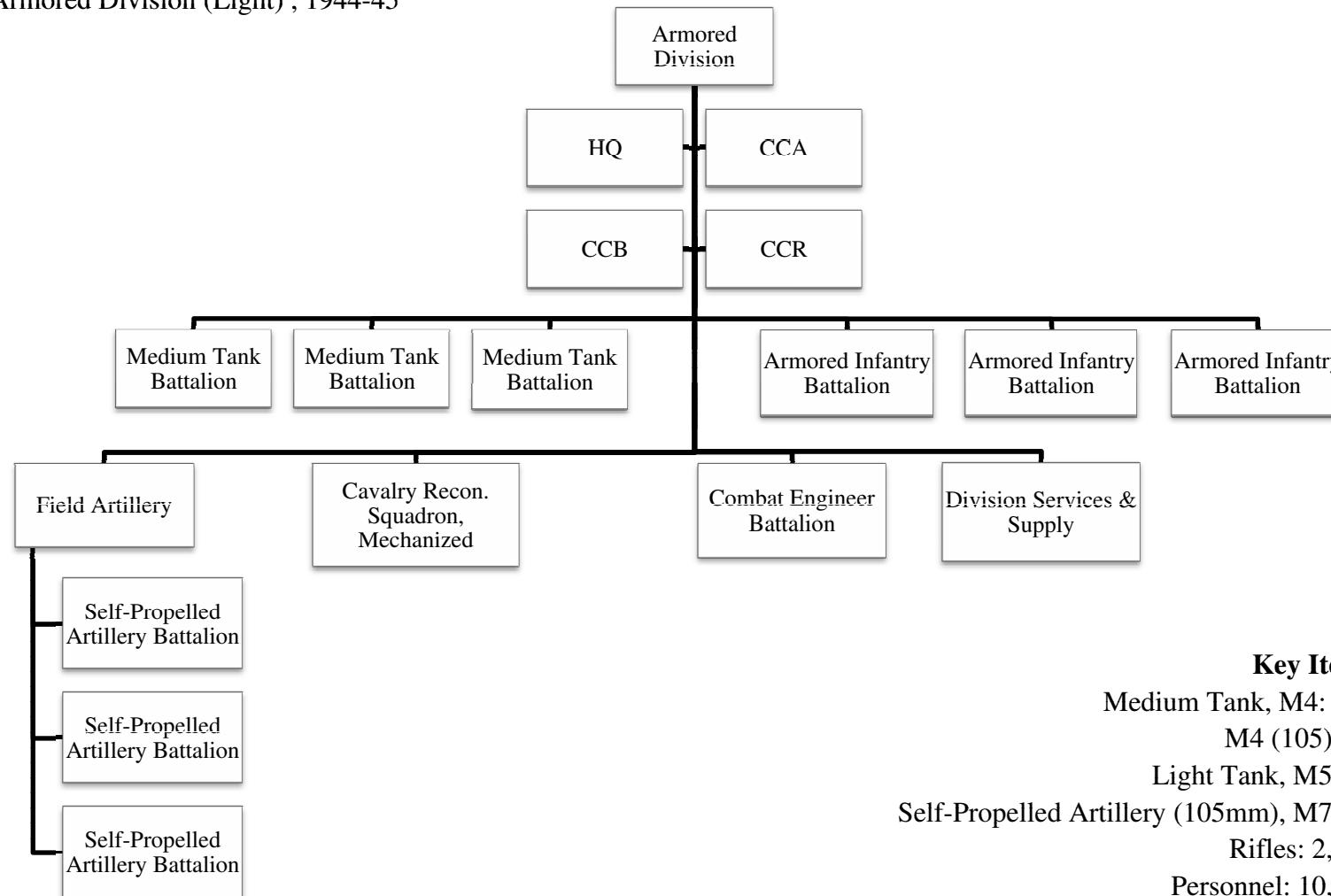
## APPENDIX D: BASIC ARMY STRUCTURE



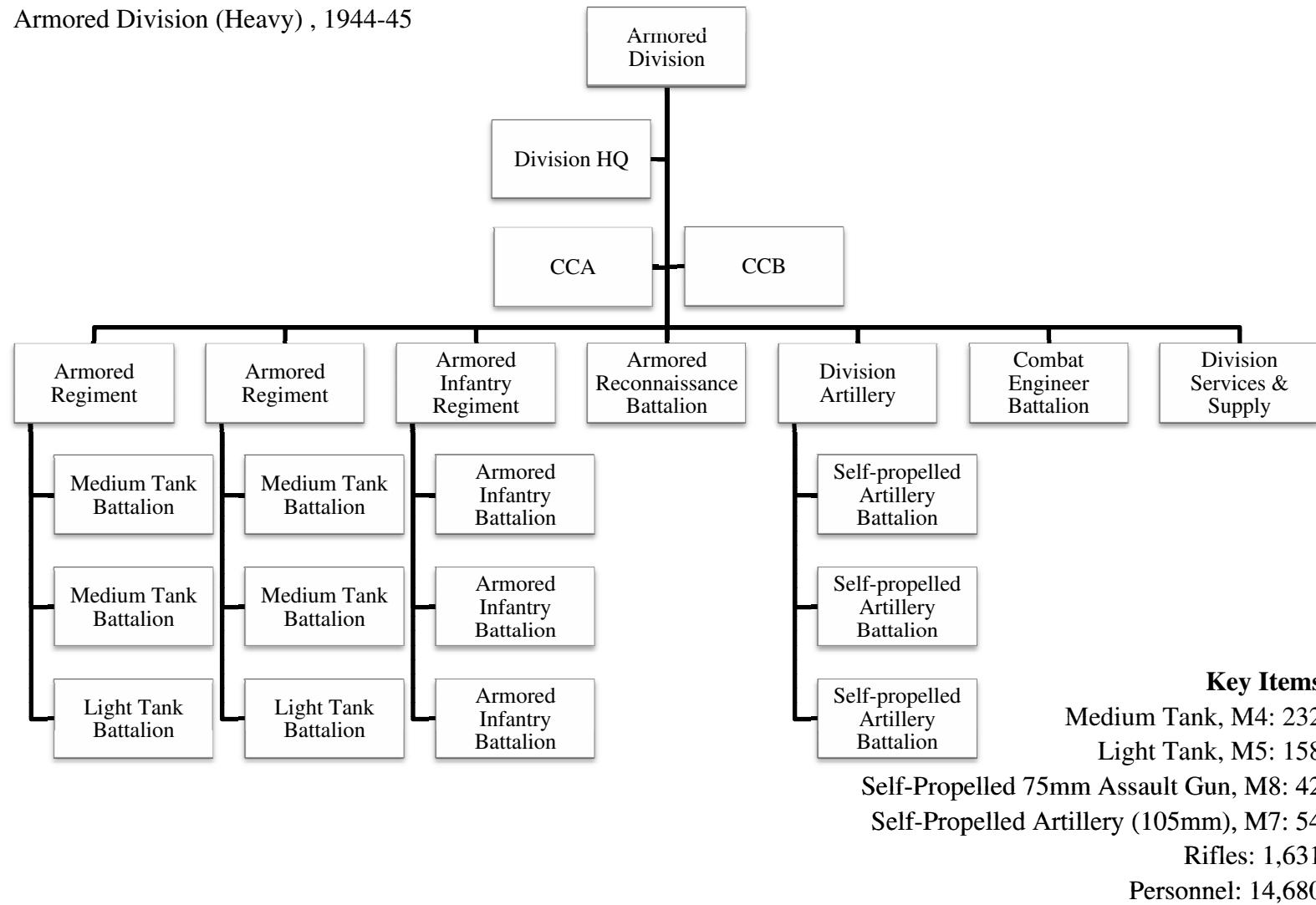
Forty, *British Army Handbook*; \_\_\_\_\_. *US Army Handbook, 1939-1945* (New York: Barnes and Noble, Inc., 1995); Zaloga and Ness, *Red Army Handbook*; War Department, *Handbook on German Military Forces* (1945; repr., Baton Rouge: Louisiana University Press, 1990)

## APPENDIX E: SIMPLIFIED U.S. ARMORED DIVISION ORGANIZATION, 1944

Armored Division (Light), 1944-45



Armored Division (Heavy) , 1944-45



Zaloga, *US Armored Divisions* , 18-19; \_\_\_\_\_, *US Armored Units in the North African and Italian Campaigns* , 23-24.

## Appendix F: Selected Armor and Gun Comparision

Armor thickness scale is 1:1; Greater slope of armor increases chance of deflecting shot

### German Pzkw. Mk IV Ausf. H

Hull frontal armor: 3.15" at 10°  
(most common version deployed  
after January, 1944)



### German Pzkw. Mk V "Panther"

Hull frontal armor: 3.15" at 55°



### German Pzkw. Mk VI "Tiger"

Hull frontal armor: 3.9" at 24°

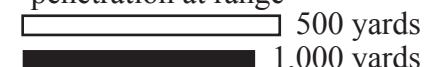


### M4A1

Gun: 75mm M3



Maximum inches of armor  
penetration at range



### M4A3(76)W HVSS

Gun: 76mm M1A1



with HVAP Shot



### Sherman Firefly (British)

Gun: 17 pounder



## Appendix F: Selected Armor and Gun Comparision

### M4A1

Hull frontal armor: 2" at 44°  
(mean between 37° and 53°)



### M4A3 (76) W HVSS

Hull frontal armor: 2.5" at 47°



### M4A3E2

Hull frontal armor: 4" at 47°



### German Pzkw. Mk IV Ausf. H

Gun: 75mm KwK40 L/48



Maximum inches of armor  
penetration at range

500 yards      1,000 yards

### German Pzkw. Mk V "Panther"

Gun: 75mm KwK42 L/70



### German Pzkw. Mk VI "Tiger"

Gun: 88mm KwK36 L/56



Chamberlain and Doyle, *Encyclopedia of German Tanks of World War Two*, 98, 122, 136, 245; Hunnicutt, *Sherman*, 540, 546, 548, 562, 564;