Spring 2013

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The Wrong Track: Errors in American Tank Development
in World War II

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A thesis submitted to the Graduate Faculty of
JAMES MADISON UNIVERSITY
In
Partial Fulfillment of the Requirements
for the degree of
Master of Arts

Department of History

May 2013
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Abstract

American main battle tanks in the European Theater of World War II were technologically inferior to their German counterparts. Crews in the M4 Sherman tank thus suffered extreme casualties in the fight to liberate mainland Europe from Nazi Germany. This thesis contends that the U.S. Army had another tank available by the fall of 1944 that could have saved the lives of many American soldiers and might have also ended the war sooner than May 1945. The existing historiography fails to consider much of the records from the U.S. Army’s Ordnance Department about the development of this more advanced tank: the M26 Pershing. These records provide evidence that many senior officers in the Army actively prevented the Pershing tank from reaching the battlefield in time for it to make a difference in the overall war effort. The tools of war often directly impact the progress of a given conflict. A similar instance of neglect occurred following the 2003 Allied Invasion of Iraq. Inadequately armored Humvees resulted in high American casualties—a problem that was foreseen as early as 1994. Greater attention to improving battlefield equipment will save lives and reduce the duration of armed conflict between belligerents.
Introduction and Historiography

World War II gave birth to modern combined arms warfare, and the new advent of massive maneuver tactics created a fast-paced and wide-ranging conflict. This high speed warfare created an extremely rapid arms race, and there is a striking difference between the weaponry used at the starting years of the war in 1939-40 and what showed up on the battlefields and in the skies at the end in 1945. The technological increase during this period is particularly surprising since the war lasted just barely six years. No area of weaponry advanced faster during World War II than did armored fighting vehicles (AFVs). The belligerent nations began racing to put out a tank superior to those of the enemy, creating a back and forth struggle. The Germans in particular are especially well known for their accomplishments in tank design, but this is not true for the Americans, who suffered horrible losses in armored forces because of their inferior tank designs. The United States did not make the correct decision in producing tanks in quantity rather than quality in World War II, and it both cost many lives and a delay in the end of the European Campaign.

The M4 Sherman would become the US Army’s main battle tank in World War II and debuted on the deserts of North Africa in 1942. By 1944, the Sherman was already an old tank and lagged significantly in important qualities for that later period of the war. The speed of the arms and technology race during World War II made weapons like the battle tank age within about a year. While some in the Ordnance Department advocated building a heavy tank for the next upgrade, others in Armored Forces merely wanted a bigger gun on the Sherman. Others still in Army Ground Forces (AGF) felt the Sherman was simply okay as it was. Army officials of various positions thus made little effort
to replace the M4. Not only did the boots on the ground suffer the consequences of this upper echelon decision, but the men doing the fighting were made less capable of fulfilling their assigned objectives. In short, stagnation led to more deaths and a longer war.

Throughout all of this mess, a better alternative was available in the form of the M26 Pershing. Developed throughout the years 1942 to the end of 1943, the Pershing improved on the Sherman in nearly every way: it had a more powerful main cannon; it had more armor that was also better constructed; it had a better suspension system and wider tracks, allowing superior mobility, particularly in difficult terrain such as mud; it had a better interior design that prevented the fire problem present in the Sherman. However, decisions to produce this tank were either avoided or actively prevented, delaying the arrival of this new vehicle on European battlefields to just a couple months before the war’s end in May 1945. Both early and late in its development stages, the M26 Pershing met various roadblocks in its path to European battlegrounds—and these roadblocks were nearly all imposed by unwilling senior Army leaders. The object of this research is to assess who exactly was responsible for the decisions in regards to the selection of tank designs and also to find the motives for those decisions.

The underlying argument presented is based primarily on official U.S. Army Ordnance Department records available from the National Archives in College Park, Maryland.

At the outset of World War II in Europe, tanks almost immediately became the key to success on the battlefield. The European nations who would become the main players in World War II had been preparing this new aspect of
warfare for years. Due to isolationism and the Great Depression, America had all but ignored this new weapon in the years leading up to 1940. The speedy fall of France, whose army was generally considered to be the best and most modernized in Europe at the time, was finally the red flag that sent US Army officials in search of a modern tank in the event of the war eventually involving America. This search would essentially have to start from scratch.

Lt. Gen. Leslie McNair\(^1\), head of the Army Ground Forces (AGF) for much of the war, outlined two criteria for a new weapon: battleworthiness and battle need. Battleworthiness required that the weapon be sustainable with relative ease so that it could be used when the soldier needed.\(^2\) This concept was pretty straightforward. The controversy regarding the Sherman would result from the debate on battle need. Steven Zaloga, perhaps the leading historian of armored warfare on World War II’s Western Front, astutely notes the difference between battle need when discussing weapon advances to tanks versus something like small arms weaponry; small arms become obsolete at a rather slow rate—a bullet will always penetrate the flesh. But with tanks, it is machine versus machine; new armor protection can arrive quickly and make certain cannons useless, and vice versa.\(^3\)

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\(^1\) Lt. General Leslie McNair held various positions in the United States Army throughout the 1930s and during the war, ranging from teaching university level military courses to commanding artillery units. McNair started leading the AGF in March 1942. As such, he mostly organized and equipped the various Army units and oversaw their training in the large picture. While personally observing the results of his work in the field in France, McNair was a killed by his own Army Air Forces in July 1944. Many planes in an Allied bombing raid intending to smash open the German lines for a ground offensive dropped their payloads far too early. As a result, McNair would be the highest ranking American to die in World War II. (Steven Zaloga, \textit{Operation Cobra 1944: Breakout from Normandy}. Osprey Publishing: New York, 2001, 41. Cooper, 58.) For more information on McNair, see Christopher Gabel’s \textit{Seek, Strike, and Destroy: U.S. Army Tank Destroyer Doctrine in World War II} (Fort Leavenworth, KS: Combat Studies Institute, 1985).


\(^3\) Ibid. 48.
The inability of the U.S. Army senior command to assess this problem and quickly find a solution is quite surprising. The German high command had no such difficulty in the evaluation of their tank models. During the invasion of Russia in 1941, the Wehrmacht received a shock when facing the Soviet T-34 main battle tank. The T-34 gave the Germans a lot of problems in the initial year of the war on the Eastern Front. The Soviets built it cheaply, but it had a strong design concept that allowed the tank to have a great balance of firepower, mobility, and protection with its sloping armor design. Most German weapons of 1941-42 could do little against this tank except at close ranges. German response to this problem was quite unlike the usual U.S. Army reaction: swift and thorough.

General Heinz Guderian, one of Germany’s original high-level tank commanders of tremendous talent, wrote in his memoirs about how in November 1941, “a group of designers, industrialists, and officers of the Army Ordnance Office” visited his army to study firsthand the combat experiences when fighting the T-34 to consider “what measures should be taken to help us regain technical supremacy over the Russians.”\(^4\) Hitler certainly had a specific fondness of tanks, but this demonstrates a more systematic approach to technological applications within the German military. Several results came out of this meeting. For starters, the Panzer IV—the mainstay of the German armored units and the most produced German tank of the war—was continuously upgraded throughout the war. The Panzer IV initially had a short-barreled and low velocity 75mm cannon. With the T-34 all but impervious to this weapon, long-barreled high velocity 75 cannons replaced the main gun.

More importantly, the German Ordnance engineers constructed what many historians consider the best tank design of the war with the sole purpose in mind that it would be able to outclass and defeat the T-34. This tank, the Panzer V, would be designated the “Panther” and become a menace to Allied tanks until the war’s end.

Consider another instance in 1944. A German Major named Karl-Wilhelm Krause devised a plan to mount a four-barreled anti-aircraft gun on a tank chassis. His superiors carried the idea up the chain of command until it was a standardized anti-aircraft vehicle within the same year. Although final production numbers of this vehicle (dubbed the Flakpanzer IV “Wirbelwind”) were considerably low due to decreasing resources towards the final year of the war, it proves the willingness of the German command at all levels to embrace practical adaptation to combat situations. Such an invention was particularly helpful for the year 1944 because the Luftwaffe had lost control of the skies to the Allied air forces. As a result, the Panzer units were constantly under air assault. To move about the battlefield safely, they needed to wait for the darkness of night or risk the consequences. The Wirbelwind was thus a particularly handy escort tool to preserve the mobility of the Panzer divisions. Lastly, a four-barreled machine-cannon would certainly be useful in various ground combat scenarios as well.

Such innovation and application in terms of weapons advancement was all but impossible in the U.S. Army. In all actuality, the American ordnance officials were indeed developing more tanks. But the difference between what the Germans and Americans did in this regard is prioritizing and expediting

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new tank models. Again, “battle need” was improperly understood. The U.S. Army did not see a problem that the Germans had superior tanks because AGF doctrine stated tank versus tank combat as rare and not the intention of tanks in battle to begin with. Admittedly, the M4 Sherman was a solid tank for the year 1942. But when combat experience proved this tank’s growing inadequacies and glaring weaknesses, the necessary improvements never came. One single year was a long time in tank years given the rapidly evolving technology of World War II.

The debate around the Sherman, however, does not exactly lie in its technical weaknesses; it would be difficult to find anyone who argues that the Sherman was better than its adversaries in a one on one match in 1944. Rather, the debate revolves around whether or not using its high numbers was more effective than a smaller number of better, more able tanks. Although only two authors explicitly name their positions as “war winner” or “death trap” when describing the end result of the M4 Sherman, historians still fall into one of these two categories.

Belton Cooper’s book *Death Traps: The Survival of an American Armored Division in World War II* is built around this question. Given the title of the book, he is the main proponent arguing that the Sherman’s long lasting combat years were a mistake. Cooper was not the first author to take this position, but his memoirs are the most important exclusive examination of this debate. Most authors only tackle this issue as it relates to their overall, separate historical investigation. Cooper, however, writes with a certain agenda, and that is to prove the problem that the Sherman became as a combat tank in 1944. He has a particularly unique and advantageous perspective on the subject because he
served as a junior officer in the Maintenance Battalion of the 3rd Armored Division during the war. This gave him direct firsthand experience with the aftermath of the M4 Sherman in combat. One of his main duties consisted of creating and delivering combat loss reports to the various command headquarters of the division. Such a responsibility meant Cooper was the recipient an enormous amount of information on how the tanks performed in combat and the thoughts of the crews that served in the tanks themselves. Cooper writes, “The 3rd Armored Division entered combat in Normandy with 232 M4 Sherman tanks. During the European Campaign, the Division had some 648 Shermans completely destroyed in combat and we had another 700 knocked out, repaired, and put back into operation. This was a loss rate of 580 percent.” This fact is staggering to fathom, and it remains difficult to understand how any Division could even exist under such circumstances. The subtitle of Cooper’s book is fitting when it mentions it is the story of the survival of an American Armored Division.

Cooper argues that the blame for these horrendous casualties lies in a decision made months before the invasion. He refers to the choice made by the U.S. Army at Tidworth Downs in England (and particularly places the blame on General George Patton as having the most influence on those who had authority to decide). According to Cooper, the U.S. Army held a demonstration for senior commanders at a place called Tidworth Downs in January 1944. With General Dwight Eisenhower in attendance with other high level officers, this demonstration was a venue for the various Ordnance development teams to present their weaponry. This ranged from small arms to artillery and to the

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6 Cooper, xii.
tank—all the ground weapons. Cooper claims that, following presentation of
the various Sherman tanks, the officers viewed a film about the Pershing tank
since none had yet been sent to England.7

According to Cooper’s account of the demonstration, most officers were
elated to see the Pershing’s capabilities and enthusiastically endorsed the
tank’s production. Cooper also explains that the Pershing was ready to go and
that even factories in Detroit were awaiting the green light from Supreme
Headquarters, Allied Expeditionary Force (SHAEF). Following arguments chiefly
espoused by General George Patton, Cooper claims that SHAEF immediately
chose to focus on continuing production of the M4 Sherman in early 1944
instead of switching emphasis to the new M26 Pershing heavy tank. Cooper
points out that not only would this tank have been better armed and armored
than the Sherman, but would have been more mobile and reliable than the
Sherman as well. Essentially the Pershing would be superior to the Sherman in
every aspect and could combat German tanks in a nearly equal manner.8

This story only represents a small portion of Cooper’s narrative—as the
bulk of his book details his personal war experience—but it is a major source
contention in the field. Cooper blames the higher ups in the Army, mostly
Patton among them, who stuck to old Armored Force Doctrine stating that
tanks were not meant to fight other tanks, so it would be unnecessary to
produce a tank like the M26. According to Cooper, Patton felt that the M4 was
capable of high mobility in the operational sense and could also be
manufactured cheaper than the M26.9 Disregarding the validity of Patton’s

7 Cooper, 24-27.
8 Ibid. 21-29.
9 Ibid. 29-30.
logic for the moment, many historians have a problem with Cooper’s account. There are no records at all of the Tidworth Downs demonstration. As such, there is also no record of the arguments about this decision by Patton, other officers, or how Patton’s position affected SHAEF’s final decision. Cooper does concede the absence of these records in his memoirs: “When I visited Tidworth Downs fifty years later, the post historian told me that no records of the demonstration exist other than to note that it took place.”

But then Cooper goes on to explain in some detail the events of the demonstration and the discussion surrounding it—yet he does not mention how he knows the specifics of the event or even say that he attended the demonstration.

This is a very curious situation for the historian approaching this subject. Cooper states that Eisenhower and “some of the division commanders and staff officers” were in attendance. Given his position within the division as a liaison from the Ordnance Maintenance unit to the division’s Combat Commands, it is possible he would have been among those invited—despite his lower officer rank. But, even assuming that Cooper was indeed at this event, it is odd that no other memoirs make mention of this either. Of course, not every officer writes his story, so perhaps they are simply silent on the subject. Additionally, some of the key players in attendance died in the months surrounding the war’s conclusion, so this could also prevent further documentation of the demonstration. Also, if the Tidworth Downs post itself has no records of it, perhaps the officers were told not to make mention of it.

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10 Cooper, 24.
11 Ibid.
12 General Maurice Rose, commander of the 3rd Armored Division, lost his life in the waning weeks of combat in Germany, March 1945. General Patton died in December 1945, and had no comment on Tidworth Downs in his brief memoirs. Yet, there is no word of the demonstration in the many works by and about Gen. Eisenhower.
due to the sensitive nature of displaying new and future weapon designs.

One way or the other, this presents a major limitation to using a large part of Cooper’s argument as a source. Certain caution when approaching his arguments must then be kept in mind. Still, Cooper held an especially informative vantage point from which to observe the combat effectiveness of the various American tanks during the war. No other memoir or work on American tank combat in World War II Europe can match *Death Traps*’ scope and personal authority on the subject. Additionally, his firsthand relations to one of just two large American armored divisions are easily verifiable through official records and histories of the 3rd Armored Division. Although his book is certainly a primary source, Cooper writes with the purpose of an historian.

About ten years following the publication of *Death Traps*, the accomplished armor historian Steven Zaloga released a comprehensive study of the Sherman and its performance in World War II. Zaloga centers his research on disputing the notion of the Sherman as a “death trap” and then providing a commentary on the question regarding the Sherman’s “war winner” status. Zaloga finds the death trap idea to be an overdramatic label. He dismisses the idea altogether because every tank has vulnerabilities no matter how strong its design. Zaloga attributes the death trap idea to “shoddy sensationalism” of popular media. While stopping just short of full acceptance of the war winner label, Zaloga claims the answer must be “more nuanced...The Sherman was ultimately a better weapon than heavier German tanks like the Panther since it could be fielded in adequate numbers to carry out its many and varied missions and was technically adequate to do its job.”

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13 Zaloga, 327-330.
versus-one superiority of most German tanks, that the overall mission of the armor within the U.S. Army was fulfilled by the Sherman, making the Sherman a war winner in its own way. Zaloga closes his argument stating, “The Sherman was not the best tank of World War II, but it was good enough.”

As far as other historians who weigh in on the subject are concerned, there are several other significant contributors to the subject that agree with either the overall conclusions of Cooper or Zaloga, yet they only treat the debate rather briefly. American military historians Williamson Murray and Allan Millett both agree with Cooper’s overall assessment in their book *A War to Be Won: Fighting in the Second World War*. They mention that the “real scandal in US equipment was the decision of senior armored officers, including Patton, to stay with the M-4 Sherman instead of the new M-26 Pershing. . . which was ready to go into full production in early 1944.” Millet and Murray cite the discussion of Tidworth Downs in Cooper’s memoirs, but do not elaborate or really even question the account in *Death Traps*. For historians as accomplished as these two, it is surprising they do not justify their interpretation any further than to take Cooper’s word for it.

British historian Max Hastings, however, does go further on the subject. Hastings certainly does not deny many of the points argued about the Sherman’s advantages, but he still asserts that “Allied planners, and especially the U.S. War Department, made a fundamental error in 1943. They recognized the weakness of American tank guns and protective armor against those of the enemy. But they concluded that the Allies’ quantitative advantage was so great

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14 Zaloga, 330.
that the qualitative issue did not matter\(^\text{16}\). . . Yet, to the very end of the war, it was remarkable how much damage well-handled enemy tanks inflicted upon the Allied juggernaut.” He then goes on to relate an instance in which 17 Shermans and over 20 other vehicles were destroyed by one troop (typically 2-4) of German King Tiger tanks.\(^\text{17}\)

Hastings also brings a rare and overlooked source to this debate. A privately published memoir by British tank specialist Colonel George Macleod Ross provides interesting insights into the Allied perspective on armored warfare. Ross spent much of the war as Technical liaison officer to the U.S. Army’s Ordnance Department, so he witnessed the story from both Western perspectives. Ross wrote how “None of our authorities seemed to understand as the Germans did the need in war for sustained improvement of weapons.”\(^\text{18}\)

This is an astute observation, as the German panzer units progressed from being armed with machine guns and small 37mm cannons to particularly high-velocity 75mm and 88mm cannons within 5 years. Meanwhile, the Sherman and other Allied tanks retained the same armament from 1942-1944.

Col. Ross also suggested after the war that the best model for constructing a tank would be to pick the best and most practical weapon, and then design all the other features of the tank after that. In other words, the tank’s main gun should be the priority over any other consideration. Although this is an excellent idea in hindsight, it is highly unlikely that such an argument would have won over any advocates during the war’s key years of weapons development. The high command was too stubborn in its opinion of


\(^{17}\) Ibid. 377.

armored warfare—tanks were never meant to fight other tanks. Even still, Ross was not the only British officer to come to this realization, but by the time famed General Bernard Montgomery grasped this it was too late. In December 1944, Montgomery finally issued this recommendation for tank production: The weight of a tank is not to exceed 45 tons. Having selected the best possible gun as a primary weapon, and designed an engine with sufficient horsepower to give the required speed, then armour should be fitted: up to the maximum weight allowed.19

There is at least one aspect of this debate that both sides agree on: American officials chose the M4 Sherman because it was easy to produce in high numbers, and that the effect of this was Allies’ ability to overrun enemy forces and win the war. This is also the most cited reason that the high command chose the Sherman, sticking to its idea of armored warfare as a tool of pursuit. The U.S. Army and American auto companies produced around 50,000 Shermans by the end of the war. Historian Dennis Showalter argues that the U.S. Army needed tanks in volume and really had no other choice, claiming the numbers of Pershing tanks could not be significant before war’s end. “To speak of the failure of U.S. tank policy in World War II is nevertheless a crass overstatement, even if failure is defined in the narrow terms of tank versus tank,” and Showalter adds that the M4 was manufactured on a scale and pace that no other power could match.20 Only parts of these claims reflect reality. Although they fought the same enemy force, the Soviet Union produced even more tanks than the United States—most of which also had better armament. Additionally, Showalter only briefly covers the story and does not

19 Reynolds, 33.
support his claim that Pershing tanks could not arrive in time to make a significant contribution to the war effort.

Showalter’s interpretation of the M4 Sherman also echoes another aspect of Steven Zaloga’s position. The Sherman certainly proved itself as an achievement of industry and mass production. He writes, “Warfare in the industrial age requires a careful balance of mass and quality. A single perfect tank cannot offer the same combat power as ten adequate but imperfect tanks.” He continues to add that although the crews would prefer to be in a more powerful tank, no commander would trade the many Shermans for only a few of any superior tank model. Stephen Ambrose concurs with this position in his book *Citizen Soldiers*, “Quantity over quality and size was General Marshall’s deliberate choice. . . For all their shortcomings, the Shermans were a triumph of American mass-production techniques.” But could the Pershing also have been a similar and even more effective triumph of American mass-production techniques?

There are clearly settled facts considering the histories of the Sherman and Pershing tanks. The Sherman tank ended up being by far the most used battle tank among the Western Allies; the Pershing did not arrive until the war in Europe was virtually over. While the Sherman was ever present in Allied armies, Nazi Germany was a broken and defeated nation. As such, the Sherman was a war winner. Yet, as demonstrated in Cooper’s account of the 3rd Armored Division, Sherman tanks suffered unthinkable losses on the Western Front. At a loss rate of 580 percent, crewmen inside the Sherman

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stood no chance of escaping sustained combat tours unscathed. While it may seem a dramatic label, quite unavoidably, the Sherman was also a death trap. With the Sherman quite aptly filling both sides of the debate, the argument of “war winner” or “death trap” is asking the wrong question.

What must be determined instead is whether the M26 Pershing tank could possibly have arrived on the battlefield in time to make a substantial difference in the war’s overall progress. The Pershing participated in combat operations in the European Theater only during the final two and half months of the war—and then only in very limited numbers. If this timetable was inevitable, then the debate is unnecessary and the Allies were simply stuck to make do with the Sherman, as they eventually did. Doctrinal debates within the various organizations within the U.S. Army about the use of armor certainly delayed the development of the Pershing, but by how much? If the Pershing could have arrived in European combat units by the summer or fall of 1944, they would have made a world of difference. Historians have not yet fully used the documents and testimonies available to approach the controversy from this angle.

To determine the answers to this line of inquiry regarding the American tank controversy of World War II, this particular research will be based most heavily on the documents and notes left by the Technical Division of the U.S. Army Ordnance Department. Headed by General Gladeon Barnes, this division oversaw the development of most ground weapons, including tanks and artillery in particular—essentially specializing in anything that involved explosive ammunition. The Technical Division left behind hundreds of documents relating to the Pershing tank’s development, much of which has been studied
thoroughly. But what appears to be almost entirely absent from the discussion is an untitled history log of the tank series that eventually became the M26 Pershing. This document is quite long and is muddled with many mundane details about tank technology, but it also includes a great deal of detail regarding the controversy between several Army organizations and their leading officers during the tank’s development stages.

Debate about which tanks would most effectively win World War II in Europe did not begin with historians, but were actually quite fierce within the Army departments during the 1940s. The history log of the Pershing’s development sheds light on what the Technical Division reasoned was realistic and necessary in terms of advancing the Army’s armored units. This log reveals that Ordnance, and General Barnes in particular, repeatedly requested that the Pershing tank receive greater priority in future arms distribution and that the tank be standardized to be placed in the field. These requests, more often than not, were ignored or simply denied. Barnes explained the urgency in combat need regarding tank improvements and often warned explicitly regarding the timetable of the Pershing’s completion. Barnes indicated when orders for the M26 were necessary for the arrival of the tank on the battlefield by roughly the middle of 1944, but this caution remained unrecognized during the crucial moments of decision.

To understand the eventual reasoning behind why so many high level officers blocked the M26 Pershing’s progress, the U.S. Army’s theories and adopted doctrine for the tank’s use on the battlefield must be addressed. Chapter One will briefly discuss the evolution of American tank strategy from before the start of World War II and also the creation of a separate Tank
Destroyer Force. Doctrine stated that tanks should not fight enemy tanks, so the Army established a separate troop for eliminating enemy armor. The existence of this force had direct impacts of the designs of future American tanks. Chapter Two will discuss an overview of the Sherman’s combat record throughout the war, with particular interest in the Army’s attempt to invade Germany itself in November 1944. This chapter will also contain the reactions to the Sherman tank reported by various American newspapers. The press got wind of the controversy during the latter years of the war, resulting in several articles and even a political cartoon about the debated weaknesses of the American tank.

Chapter Three includes the overlooked history log of the M26 development at the Technical Division of the Ordnance Department and the many attempts to prevent this tank from reaching the battlefront. The end of this chapter also includes reports on the eventual combat success of the M26 during a trial mission in March through May 1945. The Pershing received high acclaim from those that used this weapons system in battle.

Whereas Belton Cooper places the principal blame for this situation on an undocumented demonstration at Tidworth Downs, England in 1944, the evidence from Ordnance’s Technical Division reveals how the problem began much earlier in the war. These documents also indicate whether the Pershing really could have been completed, produced, and battle ready in time to make a difference in the war. While Steven Zaloga and other historians focus more on grading the Sherman’s final performance in the war and defend the Sherman’s strategic level fighting qualities, questions regarding the Army’s tank development status must go deeper. The benefits of the U.S. Army having
fought with a better tank on the Western Front, such as the M26, are speculative. Whether the war would have ended sooner is a debatable issue of alternate history somewhat beyond the scope of this thesis, but certainly many more American tank crews would have avoided a fiery death in the pursuit of stopping Adolf Hitler’s terrible regime.
Chapter One: America’s Pre-War Tank Policy and Early War Development

The progress of tank development in America before World War II partially explains why the M26 was not produced in time to have an effect on the war. Prior to 1939, the U.S. Army was officially not supposed to have any light tanks, so the Army’s cavalry units developed their own light tanks under the designation of ‘combat car’ as a disguise.¹ In fact, the budget allotted for annual research and development for tanks was only $85,000 in the summer of 1939.² Such low priority status prevented quick advancement in production and technology, and also intelligence gathering on the status of tank research and production in foreign armies. The most recent war experience in Europe in 1918 also taught generals that attrition still dominated warfare. This meant the standard practice of capturing and holding ground with infantry, wearing down enemy forces in the process. This mindset did not entirely eliminate innovative ideas in American tank development, however, and a young American tank designer named J. Walter Christie came up with a very novel concept during the interwar years. In the early 1930’s, he devised a new system in hull and suspension design, mainly consisting of a new torsion bar system that supported the bogey wheels that the tracks rolled over.³

Basically, Christie’s new system would allow tanks to benefit from similar effects that modern automobiles get from all-wheel drive functionality. The axis (torsion bar) on each set of bogey wheels would act independent of each other. With independent movement of the bogey wheels, the tank’s tracks could avoid

³ Ibid.
loss of traction and speed. In the case of the Christie system, if the tank hit a large rock or log, each wheel would react to this bump one at a time until the tank passed over it. This allowed a tank using the Christie suspension to pass over rough terrain with limited hindrance to momentum and provide for a smoother ride overall. Tanks are built for navigating rough terrain, but their heavy weight can often severely hinder a tank’s capability on off-road travel if its weight is not distributed correctly across the tracks. With the more dynamic bogey wheel design, weight disbursement was more effective with Christie’s innovation. The structure would be far superior to the eventual helicoil system that would be used in the M4 Sherman, as rough terrain—especially mud—was always a particular problem with the Sherman. The Christie system also had the added advantage in that the tracks could be removed for travel on highways, allowing the tank to travel up to 60 mph—an astounding feat for tanks of the era.\(^4\) Most main battle tanks during the war had a top speed of around 20-25 mph.

But the Army looked down upon Christie’s invention. Given the isolationist thought of the 1930s, this is somewhat understandable. Yet, the Christie design would actually have been a perfect fit for the Army’s evolving doctrine for armored and mechanized warfare. The Army had set forth guidelines for future development of land warfare in the Armored Force Doctrine. This doctrine called chiefly for mobility, allowing field officers to have the ability to plan wide-ranging moves across the battlefield before the enemy could react. The purposes of the armored divisions in such a maneuver were to penetrate deeply into enemy lines, perform many tasks with the goal of causing

\(^4\) Cooper, 22.
as much trouble as possible in enemy territory, and in essence, to protect the main assault by infantry further behind. Once armored units created havoc behind the lines, the defenses facing attacking infantry would pose much less of a threat. Additionally, Armored Force Doctrine described that tanks were not meant to engage enemy tanks on the battlefield, and that this would only occur on rare occasions. Therefore, few at the time saw it as necessary to design a main battle tank with the capabilities to destroy enemy tanks and to protect itself against enemy antitank (AT) weaponry. The officers in charge of approving new tank designs thus outlined mobility as the main requirement for tank models. High explosive power of the main gun (which meant the ability to destroy fixed positions and structures rather than knock out enemy AFVs) was then the secondary criteria outline by the Army as essential to tank design.

The Christie system provided excellent mobility, and it is puzzling that even this system was not adopted by the U.S. Army prior to World War II—especially since one of its own officers came up with the idea. The Soviet Union, on the other hand, would appreciate Christie’s work and adopted his plans in the design of most all their main battle tanks. The Soviet model T-34, which historians often regard as the world’s best tank in history as far as effectiveness on the battlefield and influence on a war’s final outcome are concerned, would also use the Christie suspension. The T-34’s suspension and wide tracks gave it excellent weight disbursement which gave it an important advantage over its German counterparts when handling the intense mud and snow of the Eastern Front. Steven Zaloga, perhaps the most prominent American tank historian,

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5 Cooper, 29.
6 Ibid.
7 John L. Pimlott, ed., The World at Arms: The Reader’s Digest Illustrated History of World War II (New
does however point out that the Christie design was not the only key to success. British tank designers used the Christie suspension as well on their Cruiser, Crusader, Covenanter, and Cromwell series tanks, and Zaloga states that “[n]one of these matched the T-34, which suggests that features other than the Christie suspension determined the T-34’s success.” Zaloga is mostly correct, but he still understates the advantages of the T-34 in terms of mobility—which was the main concern for American officers of armor. But what made that tank particularly devastating in comparison to the British models with the Christie design was that it also had a powerful gun and suitable armor protection.

The T-34 succeeded on the battlefield for three main reasons. First, it had an adequate cannon capable of taking on its adversaries on at least equal grounds. By the time the war entered its final years, the Russians upgraded its cannon to coincide with the increasing amount of armor the Germans added to their late war tanks. Second, the T-34 not only had relatively thick armor, but was particularly effective because its sloping armor plates added to the probability of deflecting an incoming shell. This way, even a gun that proved itself capable of penetrating the amount of armor the T-34 carried may not cause any internal damage. Lastly, the tank had wide tracks that allowed it to maneuver without much trouble through muddy terrain and thick layers of snow—something most Panzers and the Sherman were incapable of doing. By June of 1944, the Sherman lacked all three of these qualities. Its cannon was effective in 1942, but was obsolete two years later unless its crew could manage to fire it at extremely close ranges; the armor was very thin and only slightly

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York: Reader’s Digest, 1989), 123.

sloped in the front on the Sherman; it had a rather high silhouette which made
the tank easy for enemy gunners to spot; its tracks were very narrow, which
created poor weight distribution, and it easily bogged down in mud and snow.

In the years prior to World War II, American officers took the first steps
in setting up their tank crews for disaster. The Soviet’s T-34 series adopted the
designs the U.S. Army rejected and led that tank and their armored units to
considerable success. Having skipped out on using some of the most effective
tank designs, such as the one proposed by Christie, the U.S. Army shifted into
observation mode. During the early years of 1939-1942, the Army slowly
formulated its ideas for armored warfare. The First World War had
demonstrated the horse no longer carried any real combat value. At the same
time, the tank’s role on the battlefield during that conflict had somewhat
fulfilled the role formerly tasked to cavalry units. These two factors had led the
Army’s Cavalry officers to assume command over the tank’s introduction as a
standard part of the Army.

The cavalry saw the tank as a way to avoid extinction, but infantry
commanders felt the tank would be best used as an infantry support weapon.
Classic interservice rivalry ensued, and so the Army created a separate
organization to be in control of tanks. Thus, the Armored Force came to into
existence. While still settling on a fixed doctrine for tanks in Armored Force,
Nazi Germany subdued France with an extremely effective use of its panzers.
While coordination between armor, infantry, and air units was absolutely
essential to the Wehrmacht’s victory in France, the lessons to be learned
focused on how Germany had used its armor. Since the panzers were

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Zaloga, 13.
organized as divisions with supporting regiments built into the division itself, the Armored Force assumed this was the best method of armor deployment. Robert Cameron, in the Army’s official history of its armor, wrote, “American analysis attributed the defeat of French mechanized units to their use of outmoded tactics and reluctance to create tank divisions until too late.”

With armored divisions formed, Armored Force determined the battlefield use of the tank. Armored Force doctrine established a hybrid of the ideas earlier proposed by infantry and cavalry commanders. Tanks would use their mobility in a cavalry-like manner to pursue the enemy and by exploiting breaks in the frontlines. These armored divisions would then quickly attack the weaker rear-echelon units before they could recover and withdraw. The Armored Force Field Manual, dated 7 March 1942 defined the role of tanks as “the conduct of highly mobile ground warfare, primarily offensive in character, by self-sustaining units of great power and mobility, composed of specially equipped troops of the required arms and services.” The idea of “self-sustaining” units justified the creation of large armored divisions, such as the 3rd Armored Division, which Belton Cooper would join. Further, the manual states how “offensive operations of armored units, acting either alone or as part of a combined force, are characterized by rapid thrusts into vital parts of the hostile rear followed by immediate exploitation to complete enemy demoralization.” This part of Armored Force doctrine, however, created two messes that would plague the future of American tank warfare in Europe.

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12 Ibid. 5-7.
The first mess was somewhat minor. The idea of “rapid thrusts” meant that the tank divisions would be moving too quickly to support infantry divisions. The fighting in France had proven the necessity of having some armor supporting infantry in combined arms fashion, but fulfilling this task would prevent the armored divisions from performing their own assignments. Armored Force thus created the independent tank battalions. These battalions of roughly 60-70 tanks, most of which would be M4 Shermans, received attachment assignments to whichever infantry division had a need for them. The second mess resulted in the entire controversy surrounding American tanks in the Second World War: the idea that tanks would not confront enemy tanks in combat. Because Armored Force doctrine stated how armor was to make “rapid thrusts” into the rear areas of the front, tanks needed speed and mobility and would simply not find enemy tanks in the rear. Therefore, as logic gathers, tanks versus tank combat would be a rare situation in theater.

As a result, Ordnance designed tanks with the priority of keeping the weight as low as possible and focusing on a multipurpose main gun. Because these tanks were meant to fill the divisions for the Armored Force doctrine as well as the independent tank battalions in the infantry support role, the main gun “also performed the role of artillery when required.” To fulfill all these diverse roles, Ordnance all but had to choose a “hull-mounted 75-mm. gun capable of firing smoke, shrapnel, and high explosive rounds” as well as white phosphorous ammunition.

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14 Cameron, 283.
Because the main battle tanks like the Sherman were not meant to confront enemy tanks as per Armored Force doctrine, another means necessary of dispatching enemy armor required organization. General Leslie McNair decided to create a series of combat vehicles very similar to tanks that would form the Tank Destroyer battalions. These units would function just like the independent tank battalions—they would be attached to whichever division had the need for anti-tank capabilities. Towed anti-tank guns were previously relied upon to fight off enemy armor. So McNair opted to install these guns on lightly armored tracked vehicles to increase their mobility. Essentially, they would act as fire brigades, rushing to any sector of the front that was threatened by enemy tanks. For all intents and purposes, these tank destroyers would be just like the Sherman, only faster and with less armor protection. The main gun was only a slight improvement—a 76mm cannon that at least specialized in armor-piercing rounds rather than functioning as a universal cannon fit for all roles. Aside from the confusion in terms of strategic level doctrine about tank destroyer use, the tank destroyers were more vulnerable to enemy fire than the Sherman. Talented crews could utilize the speed of the M18 Hellcat, for example, to great effect, but unless the tank destroyers fired the first shots in a duel with enemy tanks, they stood a small chance of survival due to such little armor protection.

McNair’s Tank Destroyers

Historian Harry Yeide called the Tank Destroyer force “one of the most successful ‘failures’ in American military history.”15 Although tank destroyers

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15 Harry Yeide, The Tank Killers: A History of America’s World War II Tank Destroyer Force (Haverton,
would often accomplish their individual missions, the Tank Destroyer Force as a whole was largely ineffective, poorly structured, and was hardly able to achieve the goals of its overall purpose. Nonetheless, the idea of the tank destroyer would greatly affect the eventual fate of the M26 Pershing.

General Leslie McNair did not get discouraged when hearing of the poor performance of AT guns employed in the defense against Panzers by France in 1940. Optimistically, he compared the stationary AT gun and a tank to shore guns and a warship. Shore guns are small and harder to hit than a ship, and thus will almost always win in a fight. McNair believed the same story would hold true for AT guns. The only disadvantage of the AT gun is that is hardly mobile. To get rid of this problem, the War Department created the Tank Destroyer Force; an organization whose main job would be quick response to sectors under enemy armor attack and knocking out enemy tanks on the battlefield. Initially, the 3-inch (76.2mm) AT gun was installed on the M3 Halftrack as the first tank destroyer. Although tremendously successful in war games, it would only provide an insignificant boost to American AT capability when employed overseas.\(^6\)

From appearance, the tank destroyer would later look nearly identical to a regular combat tank. The difference was that the tank destroyer would have far less armor protection and the turret would have an open roof, unlike a tank’s turret. Since the tank destroyer was supposed to rush to areas threatened by enemy armor, speed was its principle need. The most used tank destroyer during WWII was the M10 Wolverine. Built on a modified chassis of the M4 Sherman, it mounted the 3-inch gun, about one inch of armor, and had

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\(^{16}\) Yeide, 3-6.
a maximum speed of less than 30 mph. Its speed increase over the Sherman was hardly noticeable, which made the Wolverine’s purpose quite questionable from many perspectives. Still, the M10 likely saw the most use in the European Theater of all the tank destroyers.\textsuperscript{17}

The tank destroyer that received the most praise from commanders was the M18 Hellcat. The M18 had all the essential characteristics that the Army outlined for a tank destroyer. Although armed with the 76mm cannon (slightly less powerful than the 3-inch gun), it still packed a punch equal to or better than the Sherman. Additionally, the Hellcat had a rather low silhouette, employed a very effective modification of the Christie suspension that increased its mobility, and could reach a top speed of around 50 mph. Its top speed capability made the Hellcat close to the fastest armored vehicle of World War II.\textsuperscript{18} The Army deployed in force both the M10 and M18 in time for the Normandy operation.

The most important tank destroyer, the M36 Jackson, had a fate similar to that of the M26 Pershing main battle tank. The M36 existed for the sole purpose of putting the 90mm cannon on the battlefield to more effectively destroy enemy tanks. Because the M36 was a tank destroyer and not a tank, the using forces could not employ the “not meant to fight enemy tanks” argument as was used to fight the M26. Instead, senior officers claimed how the 76mm cannon on the M10 and M18 was already good enough, so an even better cannon was unnecessary (see chapter three for more detail on this debate). Still, the ingenuity of the soldiers in the field found ways to make the

\textsuperscript{17} Gander, 210-211.
\textsuperscript{18} Gander, 214-215. The best American tank destroyer of the war, the M36 Jackson, would not arrive till shortly after the invasion. This tank destroyer’s fate was heavily linked to that of the M26 Pershing, and will be discussed at length later.
best of their situation. Although it achieved sporadic success, the Tank Destroyer Force did not reach its expectations, and no Tank Destroyer Force has existed since November 1946.
Chapter Two: The Sherman on the Battlefield

Since it was not the main battle tank’s responsibility to be capable of fighting enemy tanks, the M4 Sherman received a low velocity 75mm main gun at its first conception. This cannon was chosen because it fired a very effective high-explosive (HE) shell, which made it perfect for destroying bunkers, machinegun nests, and other fixed defenses. The armor-piercing (AP) capability of the cannon was of little importance because, in theory, the tank would rarely need it.

The Sherman first debuted in North Africa in 1942, and to much acclaim. Maj. General Gladeon Barnes, the Chief of the Technical Division of Ordnance Department, accompanied the Sherman to the North African Theater to assess its performance so that he knew which direction to take for the Department’s future tanks. His report included that the ranking officers of the British Eighth Army, “as well as members of the British tank crews, are convinced that the American M4 medium tank (General Sherman) is the best tank on the battlefield. It was this tank that defeated the Germans at El Alamein.”1 General Jacob Devers, commander of the Armored Force, also agreed that the Sherman was “the best tank on the battlefield.”2

While this very well may have been the case in 1942, this does not mean that the Sherman would never be surpassed. In fact, when an army meets a superior foe, its impulse is to adapt. General Barnes was most aware of this fact, and recommended that the “further perfection of the M-4 tank, the best on

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1 Official Notes and Papers, Barnes’ Mission to North Africa and England, Dec 1942-Jan 1943, pg. 1, RG 156, Box A 778, National Archives and Records Administration II (NARA II), College Park, MD.
2 General Jacob L. Devers Report on Problems in Armored Units in the ETO, Conclusions, RG 156, Box A 778, NARA II, College Park, MD.
any front today, should be aggressively continued.”3 Barnes realized that the enemy would soon develop a tank capable of beating the Sherman, and thus pushed for any and all upgrades to the M4. He was not satisfied and complacent that his Army possessed the best tank of the day. Unfortunately, not many other influential decision makers shared the same intuition as General Barnes.

In the same report about the North African campaign, Barnes stated that a new series of tanks under the designation T20 will be “more in advance of the M-4 than the latter was ahead of the M-3.”4 The M4 Sherman borrowed the chassis and hull design from its predecessor, the M3 Grant/Lee, but the M4 was a vastly superior tank. The M3 had the same 75mm cannon as the M4, yet it was not in the turret but fixed to the front corner of the tank’s hull—meaning it had very little traverse. The Grant still had a turret, but it was a small turret with a 37mm gun. While it was decent tank for the war’s earlier years, it had a very awkward design. The strange placement of the tank’s weapons made it largely ineffective in highly mobile armored combat. The M4 thus made huge strides over the M3. When Barnes says the T20 would take an even bigger step over the M4 than that one did with the M3, this is a significant claim.

Further, Barnes recommended that the T20 series “should be pushed to completion, given rigorous service tests, and made ready for future production.”5 Barnes’ recommendation received little notice, however, and the higher authorities like General McNair would hardly give the T20 series much notice. As far as General Devers was concerned, although the Sherman was the

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4 Ibid.
5 Ibid.
best tank, to “achieve success all combat units must be able to repel tanks and low flying aircraft with their own weapons.” General Devers saw the same needed improvements that Barnes saw, but also further critiqued the Tank Destroyer Force.

Devers was not very impressed with the tank destroyer idea in general, and his opinion was vindicated following his examination of armored units. “The tank destroyer concept is not practical on the battlefield,” wrote Devers. “Offensively the weapon to beat a tank is another tank. Sooner or later the issue between ground forces is settled in an armored battle—tank against tank.” This analysis completely contradicted the U.S. Army’s tank doctrine at the time. According to McNair and AGF, tank versus tank combat was rare, but Devers tried to explain that from experience it was quite commonplace. Devers added, “The concept of tank destroyer groups and brigades attempting to overcome equal numbers of hostile tanks is faulty unless the tank destroyers are actually better tanks than those of the enemy.” This last comment hits exactly the reason why the tank destroyer concept mostly failed. Sure, the tank destroyers succeeded at times because they had decent cannons and the soldiers could often apply the tactics necessary to score some wins, but ultimately the tank destroyers were limited and did not make sense in the grand strategic view. The fact that they were built and appeared just like tanks made them weak because they would essentially be engaging tank versus tank combat, just with severely weaker armor. Weak armor caused limited

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6 General Jacob L. Devers Report on Problems in Armored Units in the ETO, Conclusions, RG 156, Box A 778, NARA II, College Park, MD.
7 Ibid.
opportunity for the tank destroyers; they could only succeed in very favorable conditions.

The report that Devers submitted, which was based on recent experience, lined up perfectly with what the British reported as well: inevitably, tanks will fight other tanks in combat. In a U.S.-British Joint Committee meeting on armored units in March 1942, the British concluded “that tank vs. tank fighting must be expected in modern warfare. For this reason adequate armour and adequate armament, as well as a good turn of speed, is essential.” The British had the idea that the Allies needed a cruiser tank to withstand and fight enemy tanks, and an assault tank was needed for the close support role. But even with the assault and close support role (which was the main goal of the Sherman tank), the British felt it necessary to sacrifice mobility for enough armor. The Americans certainly did not sacrifice anything for more armor on the Sherman, and this would manifest itself as a big problem in the future, particularly in November 1944.

In this meeting, the Americans responded with their own view:

“Armoured Divisions will not normally be employed in fighting enemy tank formations. The latter will be dealt with either by self-propelled guns or tank destroyers.” In other words, they repeated their own pre-war doctrine, and rejected the idea of strengthening both the armor and armament of tanks. The meeting concludes that it “is clear that these two widely divergent views of the employment of armoured forces cannot be brought together until further war experience has proved one or the other of the theories to be correct.”

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8 Findings and Final Minutes of the Joint British Tank Mission and the U.S. Tank Committee, pg. 1, RG 156, Box A 781, NARA II, College Park, MD.
9 Ibid. 2.
British already used experience as the basis of their theory, but the Americans did not. The stubbornness of the U.S. representatives in rejecting the British view proved disastrous. Additionally, the combat reports from other fronts, particularly from Russia, had been ignored as well. If the experience of the war’s tank combat before March 1942 was not yet enough, then certainly the reports of Devers and Barnes from January 1943 added plenty of data to the discussion. But again, their reports and findings were ignored, just like the British and other foreign war experience. Even if the theory was still rejected, why would they also reject a tank better than the Sherman (like any of the T20 series), which experts viewed was the best of the time?

While the Sherman was applauded on the battlefields of Africa in 1942-1943, it would receive less than flattering nick-names after fighting in Italy and France. Most Allied soldiers would refer to the Sherman as the “Ronson burner,” named after a cigarette lighter company. The slogan of the Ronson was “Lights first time, every time”—very dark humor from the tankers, but they clearly did not feel safe in their Sherman.\(^{(10)}\) On a similar note, the Germans referred to the tank as the “Tommy Cooker.”\(^{(11)}\) A report on 6 June 1945 found that about 60-90 percent of Sherman tanks were destroyed by fire, and it was not until the latter models with the 76mm gun that even remotely fixed this issue.\(^{(12)}\) The Sherman had outlived its time, and the Americans needed to constantly upgrade their tanks just as their enemies had been doing since the beginning. The Sherman was surely no longer the “best tank on the battlefield.”


\(^{(12)}\) J.M. Roamer, Observations on Problems in Armored Units, 6 June, 1945, pg. 1-2, RG 156, Box A 778, NARA II, College Park, MD.
When the Normandy invasion commenced, the Sherman still supplied the bulk of both the American and British armored forces. The rough terrain of the Normandy bocage made the task of knocking out Sherman tanks quite easy for the German defenders. It was easy in this type of battlefield to hide anti-tank weapons (especially of the handheld variety) and close range shots that hit nearly always proved deadly for the Sherman. Combat attrition rates in American armored units were expected to equal the results of the Italian theater, but the Normandy battles would double the expected rate. From June through August 1944, the British and American armies would lose over 1,600 tanks—most of them Shermans.

Following Operation Cobra, which succeeded as the breakout from the Normandy stalemate, the Sherman would face a more significant problem. The terrain throughout the rest of northern France and the Low Countries near the German border brought on very different combat scenarios. While enemy tanks and anti-tank guns had been the main pest to Allied armor in the Normandy campaign, the mud would become the biggest problem in the latter months of 1944. The autumn of 1944 would be the wettest on record in northwest Europe. In this autumn rain, the U.S. Army began an offensive against the German Siegfried Line, the defenses built to keep the Allies from crossing the borders of Germany itself. The German defenses in this area consisted mostly of a multilayered system of pillboxes that were full of machine guns, anti-tank guns, and artillery positions. Few German Panzers were stationed to defend the

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14 Ibid. 168.
15 Ibid. 201.
Siegfried Line (perhaps also because most were being secretly built up behind the lines for the coming Ardennes offensive in December).

The objective of this campaign was not just to get Allied troops on German soil, but to also destroy as many German units as possible on the West side of the Rhine River.\(^16\) This meant busting through the German border and eliminating German units before they could fall back across the river. The Rhine is the largest river in Germany. Militarily speaking, this river is a natural fortress and line of defense. Allowing German units to escape to the East side of the river would cause as immediate delay in the successful campaign march on Berlin. Thus, speed and mobility were essential to the progress of the November offensive.

The U.S. First and Ninth Armies were chosen to lead the offensive. The day before the assault, the Ninth Army made some foreboding reports on the coming operation: “The action of our armored elements will be severely canalized due to natural terrain obstacles, to enemy-made tank obstacles, and to weather conditions...It is felt that every means conceivable must be fully utilized to assist armored units to overcome these obstacles and retain their all-essential mobility.”\(^17\) When a Sherman tank lost its mobility advantage and had to fight the weather and terrain effects, it stood little chance for success.

Although Allied planners knew nothing of Hitler’s plans for 16 December 1944 (exactly one month after the start of this new operation), the November Offensive was particularly important to the Germans. Hitler had begun to gather armored forces slightly further to the South very carefully. What became

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\(^{17}\) Ibid. 106.
of this secret force would result in the largest battle in the history of the United States Army—and is now commonly referred to as the Battle of the Bulge. Defeating German forces west of the Rhine was high stakes enough, but this hidden element (not hidden to the Germans) made this coming offensive of paramount importance. Should the November Offensive succeed, Hitler’s gathering forces near the Ardennes would be effectively outflanked. Belton Cooper contends that such an event would have prevented the Battle of the Bulge from happening. With the marshaling areas overrun and cut off, this is a more than likely interpretation. The German units were prepared to prevent his from happening, and the performance of the Sherman tank went to their benefit.

As part of the U.S. First Army, Cooper’s 3rd Armored Division played a significant role in the attack. On 16 November 1944, the 3rd Armored began a major push to penetrate the Siegfried Line. The Division’s official history notes how on that November day “it was doughboy weather, mean and muddy...The men waited impassively, but they knew very well what the attack would mean. They knew all about the way of a Sherman in soft ground.” These tank crews did not have to wait long for the results. Of the opening day of the offensive, Cooper writes, “The soft ground would mire the tank so deeply that it would stick...All the stuck tanks became sitting ducks for the murderous German antitank fire. The Germans continued to fire until they set them on fire.” The casualty rates were enormous: Cooper claims a loss of 48 out of 64 tanks medium tanks within just twenty-six minutes. Such heavy losses were not

18 Cooper, 339.
20 Cooper, 161.
limited to the 3<sup>rd</sup> Armored’s sector during the November campaign. One of the independent tank battalion’s attached to the 104<sup>th</sup> Infantry Division reported losing 35 tanks within one week—this loss accounted for 61 percent of the battalion’s total losses in the entire European campaign.\(^{21}\)

Many of these Shermans received hits from just a lone Panther or Panzer IV tank. One of the 3<sup>rd</sup> Armored’s platoons lost three of its five Shermans to one Panther before finally eliminating this German tank.\(^{22}\) This was typical of the Sherman’s combat experience in the Normandy campaign as well, and not much had really changed once the war moved away from bocage terrain.

Historian Harry Yeide described some of the action as follows:

> The high-velocity German guns knocked out the Shermans from ranges starting at three thousand yards. Shells from 75mm and 76 mm Sherman guns bounced harmlessly off the panzers’ front armor...The panzers also had wider tracks than the Shermans and were better able to maneuver in the deep mud.\(^{23}\)

The prevailing theory of American pre-war doctrine had done its damage. General McNair and others in AGF did not want any heavy tanks because of theirs supposed lack of mobility and speed due to all the added weight. When the goal of armor was quickness and pursuit ability, these officers continued to support the Sherman. Cooper explains why this was a grave error in judgment:

> This assumption was incorrect. The key to a tank’s off-road mobility lies in its ground bearing pressure: how the weight of the tank is distributed over the ground. Because the Panther had wider tracks than the Sherman, it actually had a lower ground bearing pressure and could go places where the Sherman could not. More importantly, the narrow track on the Sherman could not negotiate muddy terrain and snow.\(^{24}\)

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\(^{21}\) Yeide, 124.
\(^{23}\) Yeide, <i>The Longest Battle</i>, 148.
\(^{24}\) Cooper, 338.
Narrow tracks and a weak main gun created a vastly inferior weapons system in the Sherman. But while the November offensive more fully exposed the Sherman's inadequacies, it also revealed what could have been.

During the campaign, a number of new tank destroyers arrived at the front. Designated the M36 Jackson, this new armored fighting vehicle carried a 90mm main gun. Like the German's famed 88mm cannon, this 90mm was converted from anti-aircraft use to be fitted in turrets. Although the weapon's caliber was slightly larger than the German 88, it still did not match the muzzle velocity. Nonetheless, the 90mm was close enough to the 88's capabilities that it allowed American armor to finally stand up to panzers on roughly even ground. In an action on 17 November, some Shermans in the 2nd Armored Division were falling back from an attack of German Panther tanks. Fortunately, this 2nd Armored unit's company commander brought help at just the right time—in the form of an M36 Jackson platoon. Several shots from these Jacksons scared off the Panthers almost immediately. Correspondent Jack Bell wrote that American tank crews “won because of sheer numbers...given enough Shermans and firm footing, that they can outslug [panzers]. ‘But just the same,’ said Sgt. Louis Weir, a Sherman commander, ‘I want a tank with a 90mm gun.’”

Sgt. Weir and his unit would have to wait another three months for this desired tank. The November offensive would end in a miserable failure, despite a courageous attitude on the part of the tankers. American units on the Western Front would not reach the Rhine until March 1945—ironically at the

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same time the M26 Pershing made its combat debut. The Sherman’s maneuverability weakness in tough terrain was on display throughout the November campaign, as well as its obsolete armament. The 3rd Armored Division would be nearly depleted following the offensive, just as the Battle of the Bulge loomed on the horizon.

**Reaction in the Press**

The growing inadequacies of the Sherman were common knowledge among tankers and high ranking Army commanders at the end of 1943. The experiences of tankers in the Sherman in Sicily and Italy during the last half of the year began to showcase the results of the Sherman when taking on the new German tanks. Germany constantly upgraded their existing tank models and produced new ones as well. In the early days of 1944 the press even began to take notice of this problem and its effect on the soldiers’ morale. In a cable from General George C. Marshall to Lt. General Jacob Devers (head of Armored Force), Marshall expressed his worry on allowing the press to publish an article on such matters. The article, by *New York Times* correspondent Cyrus Sulzberger, had this to say about American tanks:

Weakest portion of armor on German Tiger tanks equals strongest armor plating on Sherman. Either German Mark 4 or Mark 6 outguns Sherman. New German antitank gun has at least double muzzle velocity of best American weapon. There isn’t a single American gun in this theater which can equal the range of the German 170 by thousands of yards. In other words our tanks and guns must close with the enemy before they are able to deal a blow. Even if we are numerically superior that does not equalize the situation. . . Just yesterday night writer sat up in tent with 2 tank Colonels gloomily discussing their particular mission . . . There will be plenty of flamers. Germans have been able to make this sector regular trap and we haven’t got guns to stand up
against them. But we have got to get in action. As our General says "a tank doesn't make very good mantelpiece." Gen. George Marshall was shocked that such an article even reached Washington for publication consideration, and questioned if the theater really wished it published. Devers replied that it happened out of “sheer stupidity” and that “drastic action” was being taken to prevent such articles in the future. This cable is evidence that the tank problem was well known over at least six months prior to the Normandy invasion. The article was, in the end, not allowed to be printed.

This was far from the only instance that the press wrote on the poor performance and weaknesses of American armored units. The Washington Post printed an article entitled “Death of a Myth.” The title of this article brings me first to ask what myth is referred to. Reporting to Gen. Marshall, Gen. Devers spoke that “[t]he consensus of opinion is that our tanks are as good as, if not better than, any tanks in use in the desert by either the British or the Germans.” While this may have been the case in 1942, when this report was sent to Gen. Marshall, this was far from the case two years later, as the US Army was still using the same tanks. Gen. Omar Bradley also found this peculiar in his memoirs, “When I asked about our equipment, I learned that our gasoline-driven Shermans had already established a bad reputation among U.S. troops at the front . . . In their first engagement, the American tankers learned that tank for tank their General Grants and Shermans were no match for the more heavily armored and better-gunned German panzers. Two years later in

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27 Ibid.
the Battle of the Bulge this disparity had not yet been corrected.”

By 1945, this myth had reached this Washington Post article. In it, the author cites U.S. troops complaining that the German tanks are far superior and that it takes three Shermans to take out one Tiger. The author goes on to say that “It is scandalous that this lag should have been allowed. This country prides itself on its incomparable industrial and engineering genius. Yet it has fallen behind both our Russian ally and our Nazi enemy in arming the ground forces with their basic weapon.” The article goes on to request an investigation to find those responsible for the lag in armor. It is striking to see how direct the press could be in accusing the Army of a failure to equip its soldiers with what they needed to win. Even though Generals Marshall and Devers could suppress this story from publication in early 1944 (Sulzberger’s article), it came to the public eye in several articles published by the Washington Post and the New York Times by early 1945.

General Patton attempted to publicly cover up for the “tank scandal.” Less than a week after the Post’s “Myth” article, Patton wrote a letter to a fellow general in support of our tanks. The War Department then publicly released this letter and the Post continued the debate. It appeared on 28 March 1945, stating, “Lieut. Gen. George S. Patton, Jr., has fired a high-velocity volley of words and figures at ‘certain misguided or perhaps mendacious individuals’ who criticize American tanks.” Patton was worried, as were Marshall and Devers, that this story would have an adverse impact on the morale of the soldiers and the American people on the Home Front. He was even confronted

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on the subject at a press conference in Luxembourg, and Patton defended our tanks as having knocked out twice as many as we have lost, and added “that all of our equipment, clothing, etc. was superior to anything the Allies or the Germans had.”

Patton’s outburst, however, conflicts with his true feelings. Capt. Cleves H. Howell, Jr. would later quote Patton chiding the Ordnance Department just after the Battle of the Bulge saying, “Ordnance takes too God Damn long seeking perfection at the expense of the fighting men, and you can tell that to anyone at Ordnance.”

Would Patton maybe even privately admit his volley of words and figures had a much higher velocity than that of the cannon on a Sherman tank? But it is difficult and unfair to put much, if any, blame on the Ordnance Department; a myriad of bureaucracies were not able to agree with each other on the remedy, and they did not often listen to the recommendations of the Ordnance Department to begin with.

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32 George S. Patton, Jr., *War As I Knew It* (New York: Houghton Mifflin, 1947), 263.
Patton argued that our tanks were far more mobile and required fewer supplies than the German Tigers and Panthers, and that “the purpose of the American tank is not to engage in a slugging match, but to attack from the rear.”

Patton would also contend that the German tanks would not have been able to make the quick moves to threatened areas near as quickly as his could during the previous campaigns. But how much weight can one really put in the advent of mobility, especially when the M26 was better suited to rough terrain?

Tankers themselves were not too convinced of Patton’s mobility logic. Sgt. Robert Early, who commanded the first tank to enter Cologne, was interviewed by the Post and said, “Our tanks are not worth a drop of water on a hot stove. We want tanks to fight with, not just to drive over the countryside.”

The historian and general alike are forced to consider whether the loss of so many crews’ lives in using the Sherman was worth its advantage in numbers. Tankers of the 2nd Armored Division, for example, eventually learned the most effective way to fight German Tigers and Panthers with Shermans, but their cost of doing so was rather high. One of the Division’s tank battalions lost 51 percent of its personnel killed or wounded, while 70 percent of its tanks were destroyed or “evacuated for fourth echelon repair” in just the two weeks between July 26 and August 12, 1944. This data shows that the 3rd Armored Division’s losses mentioned by Cooper were not mere isolated experiences.

Gen. Omar Bradley added that “our U.S. superiority in numbers enabled us to surround the enemy in battle and knock but his tanks from their flanks. But this willingness to expend Shermans offered little comfort to the crews who

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36 Mayo, 322.
were forced to expend themselves as well.” Less comforting still was the constant bickering between the Army’s various bureaucracies that determined weapons allocation. A viable or better alternative that could still fill the role of superior numbers while protecting the crews better than the Sherman was available: the M26 Pershing. While Allied soldiers fought Germans across Europe, those in the Army’s Ordnance Department fought other Army departments to get their new tanks placed in the field.

37 Bradley, 41.
Chapter 3: Ordnance Department and the T26

The next steps in tank technology and development that were to follow the Sherman and its debut in the North African theater became entangled and blocked by a myriad of bureaucracies. The U.S. Army’s Ordnance Department would get entangled with the head of the Army Ground Forces in a dispute over what was wanted and needed at the battlefront. While those at the Ordnance Department would recognize the need to improve combat vehicles before the changing battle requirements arrived, AGF would consider the weapons already in theater to be sufficient and blocked efforts to replace them.

Maj. General Gladeon Barnes, the Chief of the Technical Division of Ordnance Department, would be the main overseer of tank development for the entire war for the United States Army. Early in the war, he recognized the need to be constantly advancing tank technology. He knew the nature of tank warfare meant machine versus machine combat, which required rapid improvements and new models of tanks. Barnes worked strenuously at getting new equipment out to the fighting soldier at the front, and thus was especially dedicated to the T20 series. He would face hurdle after hurdle in his push to produce and standardize what would become the M26 Pershing main battle tank.

The Ordnance Department created the T20 series of tanks in the spring of 1942.¹ In a short history report on the T20 series, the Ordnance Department stated, “Realizing that the M4 medium tank developed in 1941 would, as time passed, be considered out of date, the development of a new series of tanks was

¹Tanks that are in the research and development phase get a “T” designation. Once they are standardized, they receive an “M” designation, and occasionally a new number as well. For example, the T26 would become the M26 once it was accepted and produced.
started. . .to provide tanks with greater fire power and thicker armor." This series had about six different models, and each was essentially the same tank with slight mechanical design adjustments. These adjustments consisted mostly of things such as changing the transmission, suspension, and/or the tracks; the chassis on all of these models remained, for all intents and purposes, almost exactly the same. The biggest difference that the T20 series had over the M4 Sherman (aside from the clear armor and weapon upgrades) was that the T20 had a much lower silhouette and was wider. This wide design helped displace the added weight from the extra armor and heavier cannon, allowing the T20 better maneuverability than the Sherman despite its larger size. The model T20 itself, however, had a relatively short lifespan, and focus shifted to the T23 (one of the other six models in the series) because the torquematic transmission it used worked better in this particular model.

The T20 series was at first intended to mount the 76mm cannon (also known as a 3 inch gun). The Ordnance Department believed that this would give a significant upgrade over the Sherman’s 75mm since its muzzle velocity was much higher despite the mere increase in caliber of one millimeter; it was also the same cannon that was mounted on the M10 Wolverine and M18 Hellcat tank destroyers. Since the British mostly relied on the Americans for tanks (especially with the success of the Grant and Sherman in Africa in comparison to the largely ineffective British Crusader and Valentine models), their army took great interest in the T20. The British Purchasing Commission got word of the new series and sent a representative named Colonel Bouchier to Detroit in early September 1942 to look at its progress; the British looked forward to

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2History of T20 Series, 1-2, RG 156, Box A 797, NARA II, College Park, MD.
standardizing this vehicle in their own armored units.³

The added pressure and positive interest of the British in standardizing the T20 so early on in its development still did not help the series get much of a priority level in the US Army. The T20 had AA3 priority level, which put it behind production of all other tanks. Barnes talked with representatives of Fisher Body Division (the company that would manufacture the T20’s electrical parts) on 16 September 1942 about beginning production of the T20. Fischer replied that the engineering work was moving along just fine, but the manufacturing was making no progress because of priority given to the M10 tank destroyer. Barnes questioned this, to which Fischer replied they “can start immediately providing the necessary priority is furnished.”⁴ The M10 had AA1 priority level, and this would cause the initial delay in beginning testing on pilot models of the T20 series.

The history log on the T20 series kept by Ordnance Department states that TAC (Technical Division) received a memo on 20 September 1943 that General Motors (also helping manufacture the T20) could not begin either because of the AA3 priority rating, and would only be able to begin work on the T20 in March 1943. The log notes that metals needed to build the T20 pilot models were so insignificant they would not threaten production of other tanks in any way. It states, “The total metal requirements for two pilot models is estimated between 50 and 55 tons. This matter is extremely urgent and requires immediate attention.”⁵ The log notes the request for higher priority level was not even received “by all proper officials” until 25 September, and then

³History Log T20 Series, pg. 3-4, RG 156, Box A 797, NARA II, College Park, MD.
⁴Ibid. 5.
⁵Ibid. 7.
had to await a reply. Three days later, on 28 September, a Colonel Ritchie, who had been monitoring the priority request, reported it was still not obtained. AA1 priority was not given until 1 October, but this still delayed the turret production an additional 10 days.⁶

The mess of bureaucracies had already become a problem, only months into development of the T20 series. It is striking that so much paperwork and official business had to be dealt with simply to procure two pilot models of a tank thought to be the near future of the U.S. Army during a war on a scale never before seen or experienced. The lack of enthusiasm from many senior officers to put better and better weapons onto the field of battle is shocking. A mere two pilot models would indeed have not made a dent in production times, as the TAC noted. This is made even more insignificant when factored into the more than 49,000 tanks produced by the United States during the war. The more practical decision-makers pressing for advancement had their hands tied by the knots of bureaucratic paperwork and unnecessary tiers of responsibility.

While waiting for a response, Technical Division completed a study on 1 October 1942 that concluded it might be practicable to mount the 90mm anti-aircraft gun in a turret that was designed for a 3 inch gun. The study concluded that it should be experimented with in the T20 series and also to replace the 3 inch gun on the M10 tank destroyer. Ordnance immediately recommended the diversion of two 90mm guns to test this theory.⁷ On 11 March 1943, following successful tests of this larger weapon in various tank turrets, General Barnes would instruct the Developing Branch to design all future medium tanks with the 90mm in the turret. Barnes hoped that General

⁶Ibid. 8.
⁷Ibid.
Jacob Devers, head of Armored Force, would go along with building 100 of these T23s with the 90mm guns after reviewing them a week later. Very early on in the development phase Barnes recognized the potential of having this weapon mounted in a tank, and had high hopes for the new design.

On 30 March 1943, Barnes talked to Army Service Forces (ASF) representatives to discuss ordering test groups for the T20, T22, and T23. ASF wanted to get 15 of each, to which Barnes replied they “may as well kill the project at this time” if they were only going to order that few. Barnes had stated earlier when trying to get the two pilot models that the two would be needed to test the practicability of the mounting the 90mm gun. The blunt reply about killing the project if only 15 each were ordered was his way of explaining that since the 90mm is a legitimate possibility (and one he highly recommended), they needed to take serious steps to get this new tank overseas as quickly as possible. Barnes explained that ordering such a small number would create a situation where it would take 10 months to produce, plus another 2 months for testing. Once that was complete and production was authorized, it was take another 10 months to get the tanks in significant quantities to be useful overseas. This was why Barnes had hoped about two weeks prior that Devers would be in concurrence with ordering 100 T23s with the 90mm. Barnes then explained to ASF that even 100 of each model (for a total of 300) would be the bare minimum consideration, and added, “If we are to consider production, we must begin this initial lot of 300 immediately so that we will not be behind other nations in our tank designs.”

Barnes was exactly right when he warned ASF about lagging behind

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8Ibid. 30.
other nations, and this is a rather early prediction of the consequences of delaying the research on the T20. This conversation took place 14 months prior to the Normandy invasion, by which point the United States Armored Force certainly was behind other nations in their tank designs. Tank historian Steven Zaloga wrote that “When Sherman tanks landed at Omaha Beach in Normandy in June 1944, they did not differ much from the Shermans used at El Alamein two years earlier. In the meantime, the Wehrmacht had introduced a whole new generation of tanks, including the formidable Panther, and antitank weapons. Why had the Sherman design stagnated for two years?”

Barnes and the Ordnance Department recognized this coming reality in the spring of 1942, and by March of the following year, Barnes had found out several solutions to Zaloga’s question.

Ordnance held a meeting at Erie, Pennsylvania, on 5 April 1943, with many in attendance (including General McNair) to demonstrate the differences between the M4 and the T23. The history log does not mention the reactions of all those in attendance, but five days later a Colonel Alden of the Timken-Detroit Axle Company called the Ordnance Department to express how he had enjoyed the tank demonstration, suggesting that they build 2,000-3,000 tanks and “get started at once.”

General Barnes would also note a phone call to General Brehon Somervell from TAC to ask what he thought of the demo. Somervell replied that “he is ready to go into production right away, that it was a wonderful demonstration, and an outstanding job.” It is quite obvious that at this point, Barnes was not the only one advocating for the T20 series, and

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9Zaloga, Armored Thunderbolt, 61.
10History Log T20 Series, 31-32, RG 156, Box A 797, NARA II, College Park, MD.
11Ibid. 31.
others had also recognized the urgency to begin production and finish the project. General Campbell would also call the Ordnance Department later, saying he was “very anxious to have the 90mm gun on account of firepower, but Gen. Devers does not concur.”

Barnes replied that he could still make an OCM request (an official order) for 200 T23 tanks to have the 76mm, and an additional 50 T23s to have the 90mm, 10 of the latter would have extra armor. The first demonstration of the T23 had gone just as well as Barnes had expected it would, and the model received very positive reactions from those in attendance. It appeared that Barnes would be vindicated after all, as more and more officers were siding with his argument. It was in this positive atmosphere that Barnes began to push even harder for standardization of the T20 series during the summer months of 1943.

On 5 May, the development model that would become the M26 Pershing was born. OCM 20342 indicated that the T23 tanks that would mount the 90mm in its turret would be designated the T25, and the T26 would be the same tank, but with additional armor plating protection. Testing and fitting the new gun in a turret continued, and on 22 and 24 July Barnes put it quite bluntly to other generals that if any T20 series tank were to hit the field by mid-1944 the order was needed right away. After four days, neither of these two warnings received any recorded response about the urgency for the M26. In a third recommendation in less than one week, Ordnance made another move to standardize the T20 series by drafting a document for AGF to discuss, but

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12 Ibid. 33 Also, General Devers would not disagree with mounting 90mm guns on tank units for long, but would instead push quite heavily for the weapon only a few months later.
13 Ibid. 39.
14 Ibid. 52.
15 Ibid. 53.
General Clay of ASF Headquarters would reply that he “desires no action be taken at this time relative to the standardization of these weapons.” Without any documented reason, the tank that could have made the difference on western European battlefields in 1944 uselessly remained stateside, idle on Ordnance testing grounds.

The Hope of British Interest and the M36 Jackson

Army Ground Forces, Army Service Forces, and the “using forces,” as the higher authorities called them, seemed quite apathetic in their reactions to the progress of the T26 and her sister tanks in the T20 series. General Barnes was not quite ready to give up just yet though. The thought of the Western Front opening up on a large scale in the coming year (1944) had Barnes and the Ordnance Department still racing for action any way they could. On 4 September 1943, British representatives General Gatehouse and Colonel Bouchier came to the Ordnance Department to discuss new tanks. Conversation centered at first around the T14 heavy tank’s progress. Like the T26, it was also nearing completion at the time, and was being considered for production. Barnes interjected saying that while he has “nothing against the T14, the T26 is considerably better, will be out in September or October and can be manufactured just as rapidly as the T14.” Upon hearing Barnes’ comments, General Gatehouse “remarked that in over 2½ years the British still have been unable to produce a satisfactory tank to meet their needs and he has come to the conclusion that, ‘We can do nothing; what can the Americans do?’ and asked if they can be given a definite order for a stop-gap tank such as the

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16Ibid. 57.
General Barnes noticed this new opportunity for the T26 during this meeting and jumped on it. In reply to the British plea, Barnes told them:

[T]he T26 has been thoroughly tested and when it comes out, it will be fool-proof, but we have no program on it, since no one has been interest[ed] in it. General Barnes suggested that the British put in an order for a thousand of the T26’s and perhaps it will suffice to wake our people up. The British agreed to this.18

While no documentation is known that proves the British took action on their agreement to order T26 tanks at that time, Barnes tried two weeks later to further the movement for the T26 by explaining how the alternatives were either unnecessary or not practical. A weapons board still wanted to put 90mm guns on 1,000 already made Sherman tanks, but General Barnes told them Ordnance would not agree to do this because of how unbalanced of a design it was to install that gun on a Sherman. Clearly the 90mm gun was still on some minds as a need for the Army, but Ordnance still appeared to be the only ones willing to put the cannon on an effective vehicle chassis to support the larger weapon. General Barnes played on this desire once more by suggesting to ASF to order 500 T25 and 500 T26 tanks—about the same order the British agreed upon with his suggestion at the beginning of the month.19

Aside from the help he got from the British and the desire of some to use the 90mm gun, the T71 (later the M36 Jackson) provided a huge opportunity to push for standardizing the T26. From its appearance, one could expect even General McNair to go along with the T71 project. Ordnance planned to upgrade the Tank Destroyer Force by mounting the 90mm in a new turret designed to fit right into the M10 Wolverine’s chassis. The M10 was the most common vehicle

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17 Ibid. 62-63.
18 Ibid. 63.
19 Ibid. 64.
in the tank destroyer units. It was basically a modified chassis of the Sherman with a different hull design, an open-top turret, and with a 76mm gun. Since no new chassis would be needed for construction of the T71, and turrets were already built to house a 90mm gun for the T20 series project, the T71 would require very little production time at all—it was being built upon an already proven and adopted model. McNair already approved of the M10, and he was the general that so heavily advocated the Tank Destroyer’s mission. If the 90mm gun was rejected on a main battle tank such as the T26 because fighting enemy tanks was the job of the Tank Destroyers, then certainly it would be agreed to install a better gun for a force whose principle role was anti-tank defense.

The T71 project would begin on 21 September 1942. As early as February 1943, Lt. Colonel Thomas Schaffer of the Tank Destroyer Branch would begin the resistance to the T71. He wrote the Ordnance Department that he and the Branch were okay with the project as long as it is understood it was only a development project, meaning the only goal was to gather information on the practicability of having a 90mm gun on the M10 chassis. Schaffer added that the “gun is not desired by the tank destroyers as a tank destroyer weapon since it is believed that the 3-inch gun has sufficient power.” Why some would not desire an even more effective weapon that Barnes claimed would give them “overwhelming striking power” is quite strange at best. Records indicate that a large number of senior officers throughout the Army’s various organizations simply did not want better cannons on their armored fighting

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20 History of the 90mm Gun Motor Carriage, T71, pg. 2, RG 156, Box A 728, NARA II, College Park, MD.
21 LTC Thomas Schaffer, Memorandum to Ordnance Committee, Technical Staff, 9 February 1943, RG 156, Box A 728, NARA II, College Park, MD.
22 History of the 90mm Gun Motor Carriage, T71, pg. 3, RG 156, Box A 728, NARA II, College Park, MD.
vehicles.

In March 1943, the debate would heat up between Ordnance and AGF. Ordnance received word that AGF would not go along with installing the 90mm gun on the M10 chassis. Barnes replied that “we must try these things before they are needed and we know that this unit represents a great deal of firepower. At the moment it would be the only thing that we could provide that would take the [Tiger] tank and we feel that we must have the experimental work behind us (emphasis added).”\(^{23}\) If such experimental work were indeed put behind them in March 1943, then the advantages of the 90mm would have been proven earlier. Such data would have greatly helped Ordnance ease the resistance to the T26 as well. Perhaps successful T71 studies early on would have removed much of the hassle and resistance to the eventual Pershing tank. The T71 and the T20 series projects would thus be invariably linked; the fate of the former project would greatly determine the fate of the latter.

In the same discussion with AGF that March, Barnes would add that “if it were necessary to put 90mm guns on the [M10], and get them into the battlefield we could do it in a few months, but we cannot get any of the T20’s into the field for 8 or 10 months.” This particular estimate would place the M36 Jackson tank destroyer on the battlefield by late summer 1943, and the M26 Pershing several months before the scheduled Normandy invasion. Barnes’ comments are thus significant for two key reasons. The obvious point here is that the T71 could have been ready and achieving results very quickly due to its simple design and already standardized chassis and turret. Secondly, Barnes gives an update on the T20 progress. As of March 1943, Barnes expected the

\(^{23}\)Ibid. 4.
T20 series to be ready around the same time the following year at the latest. With the addition of the T71’s success had it been adopted at the time of Barnes’ recommendation, the T26 would have gotten the added boost it needed to be ready in the year 1944—certainly in time for the November 1944 offensive on the Siegfried Line in substantial numbers, if not also early enough to make an impact in the Normandy fighting and Cobra Breakout.

AGF, however, would then explain to General Barnes that they were to reduce all development projects that are not essential to winning the war and the pressure “is being brought to review the whole program.” Barnes seemed quite shocked and irritated at such a gesture, and retorted “that he watches these projects like a hawk, reviews them every month and if one should be canceled, he does it.” Judging by AGF’s reaction to weapons development, they must have almost entirely ignored half of the war—the Eastern Front. At almost the exact time that Ordnance and AGF were arguing over the 90mm tank projects, General Roland P. Shugg wrote a memorandum to General Joseph T. McNarney at the Pentagon regarding happenings on the Eastern Front:

Both sides in this war are increasing the percentage of armored and motorized troops. The danger of having too many foot troops in line is shown by what happened to the slow German infantry divisions around Woronesh . . . Reports indicate that guns and tanks in line are steadily becoming larger. The small gun—75mm and less—and the small tank have restricted uses. In battle they cannot stand against the larger guns and larger tanks. How far this increase will go is not yet known, but the end is not yet in sight. For battle, each side is attempting to have a larger number of big guns and big tanks than the other side. The race is definitely on.

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21Ibid. 4. 
22Roland P. Shugg, memorandum for Joseph T. McNarney, 29 March 1943, RG 156, Box A 778, NARA II, College Park, MD.
While the Russians and Germans were intensely racing to defeat each other with the newest weapons of war available, AGF was trying to “stop the incessant change” of tank development.\(^{26}\) It is unknown whether this decision was motivated by ignorance of realities of the new type of warfare introduced during World War II, a refusal to believe that this race existed if they had known, or if AGF and General McNair were simply too stubborn to change their idea of armored warfare.

Ordnance submitted the forms recommending the standardization of the T71 on 23 August 1943, but ASF and McNair would resist, delaying the process for close to a year. After questioning how changing the M10 tank destroyer to the T71 would affect resources, Ordnance replied “that if we can give Fisher\(^ {27}\) an order of 500 or 1,000 of the [T71] now they can use the materials they have for the 90mm turret with a very small loss. If we wait they will have used up the materials.” General McNair turned it down because he considered the tanks too heavy and he did not want any 90mm self-propelled mount.\(^ {28}\) McNair’s complaint about the weight looks to have merely been an excuse to hide his only real resistance to the project—that he did not want it. The weight issue did not exist; the T71 would weigh in at a mere 32 tons, actually less than the M10’s 33 tons.\(^ {29}\) Judging by the records of McNair’s responses to the T26 and T71, he clearly had little to no objection to the projects as far as the practicability of the two models was concerned. He plainly did not want the projects, thinking no improvement was necessary over the M4 and M10, and thus tried to stop their development. Perhaps the dominant thinking fell in the

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\(^ {26}\)History of the 90mm Gun Motor Carriage, T71, pg. 5, RG 156, Box A 728, NARA II, College Park, MD.

\(^ {27}\)Fisher Body Company, a Detroit based firm that produced many vehicles for military use during the war.

\(^ {28}\)History of the 90mm Gun Motor Carriage, T71, pg. 9, RG 156, Box A 728, NARA II, College Park, MD.

\(^ {29}\)Gander, 210-213.
same line of thought as the phrase, “If it’s not broken, don’t fix it.” The Sherman tank, however, was now easily broken by German Panzers. Meanwhile, it would be American tankers who suffered the brutal consequences on the frontlines.

The T71 was finally approved in June 1944, almost a full year after Ordnance recommended its standardization. The T71 was redesignated the M36 Jackson, and went on to great success on the battlefield. A combat report from the 702nd Tank Destroyer Battalion during ten days of action from 16 to 26 November 1944 described a very impressive tally of tank kills with two companies of the M36. They included 2 King Tigers, 12 Panthers, 9 Panzer IVs, 5 other vehicles, and several pillboxes and AT guns, while losing only 8 M36s. The two Tigers were knocked out from ranges of about 2000 and 3000 yards. Such distances were unheard of for the gun of a Sherman or M10, which required near point-blank combat for their guns to even achieve small chances of success. Another battle report had tankers telling the story that the 90mm left less smoke after firing which made hit results easier to see. Although tankers would also argue about the accuracy of the gun at extreme ranges of 4,000 yards, “all agree that it is a much better weapon than the 3-inch gun.” Had the weapon been available a year earlier, the success of the 90mm gun could have proved the necessity of the T20 series and the Pershing tank. The results of the M36 would have been the boost that General Barnes and Ordnance needed to convince McNair, AGF, and ASF of their urgent

30History of the 90mm Gun Motor Carriage, T71, 36, RG 156, Box A 728, NARA II, College Park, MD.
31Immediate Report No. 8 (Combat Observations), 11 December 1944, RG 156, Box A 773, NARA II, College Park, MD.
32Report on the 90mm Gun Motor Carriage, M36, Col. James Guion, 17 January 1945, RG 156, Box A 728, NARA II, College Park, MD.
recommendations. Sadly, both the M36 and M26 projects were delayed, preventing their use by the soldiers as well as the war's overall progress in general. If America and her allies had better tanks it would have meant having greater operational capacity in a mobile war such as World War II. This would also have translated into more opportunities to end the war earlier than May 1945, to say nothing of the potential lives saved in terms of Allied soldiers and European civilians waiting their liberation from Nazi control.

The Fate of the M26 Pershing

Still wishing to get the T20 series finished and in use, General Barnes wrote the commander of the 11th Armored Division: “I hope to get these new tanks standardized so that we can have them on the battlefield next summer, but have met considerable opposition. I know that these new tanks will be badly needed next summer if we are fighting then—especially the T26 with the 90mm gun and 4 inch armor.” A few days later, General McNair agreed that weapons and doctrine needed to be developed ahead of theater needs, but his other comments contradict this statement. For example, in a letter written to Ordnance, McNair stated “the 90mm project was getting to the point where we are asking for heavy tanks and encouraging the idea of tank versus tank battles rather than remembering that the tank was a maneuvering vehicle and that the anti-tank proposition is a function of the Field Artillery or the Tank Destroyers.” This opinion brings one to question McNair’s dedication to developing new weapons prior to theater needs. Either McNair lacked the information from the Eastern Front, or completely ignored it. Furthermore, he

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31 History Log T20, 65a, RG 156, Box A 797, NARA II, College Park, MD.
34 Ibid. 67.
also either ignored or forgot the reports from General Devers following the year 1942.

That same day, a General Evetts would tell Barnes that “the 90mm is a ‘must’ on the battlefield on the [European] Continent and we are going to be in a very bad way if it isn’t used. Barnes added they should not have to wait even another month for a decision.\textsuperscript{35} This certainly was an issue that should never require a month for a simple affirmative decision, let alone the many months it would eventually take for AGF to allow the T26 to go overseas. General A.C. Richardson cabled from London that “… it must be remember that the Sherman is over a year old and is nearing obsolescence. . .”\textsuperscript{36} Barnes also found out from General Dean of AGF that upon receiving a request for 500 of the new tanks immediately, “General McNair wrote the letter personally turning it down.”\textsuperscript{37} It is unclear how McNair and AGF could either ignore what so many other Generals saw coming or not notice it themselves. Either way, something considered a “must” was apparently not quite good enough to warrant notice or concern in the eyes of General McNair and the Army Ground Forces.

December 1943 saw the last chance for the Army to equip its units with the T26 in time for use in 1944. On 9 December, General Barnes wrote it “is believed that these new types of tanks will be urgently needed on the battlefield by the time they can be manufactured.”\textsuperscript{38} Since the Sherman was indeed praised by friend and foe alike upon its debut in North Africa, it is understandable that there would be some hesitance to replace that tank or even build a new one. But the fact that the Sherman would be about two years old

\textsuperscript{35}Ibid. 68.  
\textsuperscript{36}Ibid. 69.  
\textsuperscript{37}Ibid. 72.  
\textsuperscript{38}Ibid. 72a.
come the Normandy invasion, it also had to be realized that the technology gets outdated. Barnes’ comments in December 1943 reflect how it takes a considerable amount of time to manufacture new tanks, which adds even more time to the aging of the Sherman before something new reaches the frontlines. The events in the ETO by the time the Pershing tank could have been manufactured would prove Barnes correct: Just one year later, the Siegfried Line campaign as well as the Battle of the Bulge revealed the urgent need for new tanks, and that the Sherman had long outlived its battlefield significance.

Barnes suggested an order of 250 T26 tanks in December 1943. General Jacob Devers wanted this order as well, and told the War Department he had “an operational need” for them. In reality, an order was placed for 10 of the T26, but on 8 January 1944 ASF would actually increase the order to 260. Armored Force even admitted that the only fault they could find with the tanks was the width, which impacted the amount of tanks they could fit in the delivery space for transport overseas. It looked as though Ordnance had finally convinced the higher authorities to go ahead and give the T20 series a try. On 31 January, Ordnance also received word from General Eisenhower: “Requirement for T26 Tanks, as stated from Devers to [Gen. George C.] Marshall, is reaffirmed.”

This good reversal of fortune proved to be fleeting, however, as delays still continued in the finalization process. The War Department was still unclear on what they wanted as far as standardization was concerned, and the order for 260 still had not reached Ordnance. At the end of February 1944,

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39 AGF Journal Chief of Staff, 16 December 1943, RG 338, Box 1002, NARA II, College Park, MD.
40 History Log T20, 76, RG 156, Box A 797, NARA II, College Park, MD.
41 Ibid. 78.
42 Ibid. 80.
Barnes notified the W.D. that they “must start now to supply tanks for 1945.”

Too many months had gone by without a firm decision from anyone at the War Department, AGF, or the ASF. By the spring of 1944, it was nearly too late for the US Army to have any T26 tanks in theater in any quantities whatsoever, even by 1945. The higher authorities had already procrastinated the decision and stopped new tanks from reaching European battlefields in 1944, and now were about to prevent a 1945 arrival of the M26 as well!

On 2 March 1944, General Barnes had had enough. The records of the activities of General Barnes for that day indicate that he “will write a letter for General Campbell’s signature, saying the Ordnance Department will assume no further responsibility for not having in the theaters tanks properly armored and gun[n]ed in the latter part of 1944-45 operations.” Barnes had issued more than enough warning calls in the previous years and knew that at some point Ordnance would be blamed for the problems he foresaw. Ordnance records also note an interjection from General George Marshall on 6 April 1944:

General Borden came in to tell General Barnes that he had an interesting talk with General Marshall and Col. Eddy. General Marshall asked the Ground Forces to advise him at once why we cannot send the tank to North Africa and if he does not hear, he will order the tanks himself."

Five days later, AGF would suddenly reverse their decision and place an order for 6000 T25 and T26 tanks. Clearly General Marshall’s reaction to the situation had an impact on the other organizations. Barnes response was rather forlorn; he commented that it “will change the history of the Ordnance Department, because a year from now we would be blamed for having an
obsolete tank.” Even though AGF finally came around because of the irritated demands of General Marshall, they still wanted Ordnance to make the new tanks with 75mm and 76mm guns. Ordnance replied that they were “not in a position to furnish a new tank carrying the same weapon, and this tank was built around a new gun. We would be open to criticism if we should come out with new tanks that do not have more firepower.”

One can only imagine the disappointment of the troops had they received a brand new vehicle that had the same cannon whose shells they had seen bounce off Panzers time and again. After two years of research, AGF refused to understand the big picture. By 31 August 1944—with almost three months’ experience after the Normandy invasion with the Sherman tank—Ordnance again proposed to standardize the T26, and AGF still turned down the request. By November 1944, General Barnes merely hoped that the T26 would at least see some use before war’s end:

The T26 is better than the M4, but more reliable and longer life. The rubber will have double life and it will be entirely free of suspension troubles unless they get a direct hit with a shell. It has a Ford engine, which we all have confidence in now, the cooling is licked, the steering is licked, the turret is very good. The tank will make a good name for itself, if it is not too late.

The T26 outclassed the M4 Sherman in nearly every way, but General Barnes and the Ordnance Department were not vindicated until March 1945.

**Mission Zebra: The M26 Pershing in Action**

In February 1945, a mission codenamed “Zebra” began. This mission
was the debut of the T26 in combat. Twenty were shipped over to the European Theater, with one half of the allotment being assigned to each of the 3rd and 9th Armored Divisions. After quickly training the tank crews with the new vehicle, the new tanks rode into the frontlines. Belton Cooper of the 3rd Armored Division described one of the first actions of the Pershings they received:

The Germans would try to pin down our forces with heavy fire, then launch a counterattack with armor on the flanks. The counterattack soon came, spearheaded by four Mark VI King Tigers and two Mark IV tanks. Fortunately, Task Force Lovelady’s brand new M26 had a good firing position on the flank and caught the Germans by surprise. It knocked out two Tigers and one Mark IV tank at a range of a thousand yards. The Germans had no idea that we had a tank that could knock out a [Tiger] at this range.50

Knocking out a Tiger tank at that range was certainly unheard of with a Sherman tank. This new M26 Pershing began from its first engagement to perform to the high standards that Ordnance had claimed it would. Not only was the tank proving much more capable of taking on the famed German Panzers, but it also demonstrated its ability to protect its crew and not catch fire so easily.

General J. Lawton Collins wrote to General Barnes about a Pershing under his command: “[W]e have had at least one specific case in which one of the tanks knocked out a Mark VI [Tiger]. Our tank received three hits itself and was put out of action, but it did not burn and in consequence will soon be back in the line again.”51 With the Sherman, it was much less likely to be able repair the tanks so quickly because of its fire problem. By 8 March 1945, only one of the twenty M26 tanks had been put out of action. The Pershing was immediately proving itself worthy of combat with the best and gave the

50Cooper, 248.
51Gen. J. Lawton Collins to Gen. Gladeon Barnes, 3 March, 1945, RG 156, Box A 778, NARA II, College Park, MD.
American tankers a weapon system with which they could confidently fight against German tanks—something they had lacked ever since the invasion of 1944.

Another Pershing went into action in Cologne, Germany, in March, 1945. By the time the tank arrived, resistance in the city was light and mostly consisted of random sniper fire, but one Panther tank still stood defiantly strong in front of the city’s famously massive cathedral. After one Sherman tank was destroyed by the Panther, a Pershing raced into the town to engage the German tank. The Pershing took to the Panther by surprise and, following three shots, the Panther was set ablaze and burned for three days.52

The reaction in the 3rd Armored Division was practically unanimous. After describing how the M26 was used in his units, Gen. Collins added:

All of the officers of the 3d Armored Division with whom I have talked are enthusiastic about the new tank and are desirous of getting more of them as soon as possible. The Germans appear to be using more heavy tanks for the defense of key localities, and the present M-4s cannot successfully engage the [Tiger] except under most favorable conditions. Usually it has been necessary for three or four M-4s to attack a [Panther] or [Tiger] simultaneously. The new tank would give us a great edge in the final drive to knock out German armor.53

General Courtney Hodges wrote that the Pershing “is proving itself in excellent fashion.”54 All Army commanders that reported on Zebra’s mission wrote very favorably of the M26 Pershing and wished for more of them without delay.

General Maurice Rose, also of the 3rd, added that he could not “urge too strongly that the shipment of these tanks overseas be expedited in order that

52 Cooper, 259-260. This entire action was filmed by American combat cameramen, and is among the most dramatic footage of the war. The History Channel has aired this fight, and in the film one can see the rounds penetrating and the wounded tankers fleeing their burning tanks before they continue to explode. 53 Ibid.
54 Gen. Courtney H. Hodges to Gen. Gladeon Barnes, 11 March 1945, RG 156, Box A 778, NARA II, College Park, MD.
the M4 and M4A3 be replaced at the earliest possible moment.”

General Barnes wrote back that if “all organizations of the Army were so receptive to new equipment our job would be very much easier than it has been.” Indeed, General Barnes and the Ordnance Department faced very unreceptive commanders and organizations throughout the entire research program for both the M26 Pershing and the M36 Jackson tank destroyer. Barnes’ repeated pleas to use newer weapons had been either unheard or denied for years. Despite whatever claims General McNair, AGF, ASF, or the “using forces” had made, the Pershing was exactly what the ETO commanders had wanted and needed. As a result, field commanders and their tank crewman did not receive the new weapons until it was no longer possible to have made a difference in the overall European campaign.

55 Gen. Maurice Rose to Gen. Gladeon Barnes, 2 March 1945, RG 156, Box A 778, NARA II, College Park, MD.
56 Gen. Gladeon Barnes to Gen. Maurice Rose, 6 March 1945, RG 156, Box A 778, NARA II, College Park, MD.
Conclusion

“[W]e must try these things before they are needed,” cried General Gladeon Barnes in March 1943. These words read especially poignantly seventy years later. Ordnance Department records indicate that the M26 Pershing could have arrived on the Western Front roughly in the middle of 1944. To replace all Shermans with Pershings would have taken much longer, but significant enough numbers of Pershing tanks could easily have arrived in the key sectors during the November offensive of 1944. A few more decisive choices in 1943 may have been enough for the 2nd and 3rd Armored Divisions to overcome the mud and impressive defensive network the Germans established in the Siegfried Line area. This is to speak of several “could haves” and “would haves” of speculation, but certainly a casualty rate lower than 580 percent is not unreasonable to imagine.

Still, some explanations for this controversy remain unsolved. The death of General McNair in 1944 eliminated any dissenting testimony from his perspective. The limitations of this project’s research leaves other questions unanswered as well. British officers agreed to order 1,000 Pershing tanks at General Barnes’ recommendation in September 1943. Yet, this part of the story ends there when following U.S. Army documentation. Clearly, this order did not take place, so came of this? British Army archives likely hold an explanation. Along the same line of thought, it is curious that the British also failed to produce a tank similar to the Pershing during the war. The British Army had two years more experience than the U.S. Army in World War II, and this experience came in particularly key moments of early armored warfare in France and North Africa. How did the British not recognize this problem
earlier? A difference could be that the British mainland was on the frontlines and had a less capable vehicle industry than the United States. Even still, if the British properly recognized the problem, they could easily have applied pressure to or even commission the U.S. Army to develop a tank suitable to their needs. Instead, the British forced themselves into ad hoc solutions, such as the Sherman Firefly tank.¹

The quality of weaponry greatly impacts the effectiveness of an entire army and the pace of a war. This applies to all military history, before and after the tank controversy of the World War II. Nuclear weaponry is commonly thought to have ended classic conventional warfare, but fighting has raged incessantly despite the threat of nuclear weapons and even the end of the Cold War. Obviously a conventional war on the scale of World War II has yet to occur, but complacency is especially dangerous in a volatile world.

The 2003-2012 War in Iraq has demonstrated lack of foresight and preparation on a smaller scale. Press criticism of the Army’s conduct has also increased significantly since the 1940s. While the regime of Saddam Hussein collapsed very quickly, sporadic fighting varying in intensity continued for a full decade. A large percentage of American and coalition casualties in the War in Iraq resulted from poorly armored Humvees and similar transport and patrol vehicles. Roadside bombs, rocket propelled grenades, and other improvised explosive devices (IEDs) killed and maimed coalition soldiers routinely during

¹ The Sherman Firefly was a standard 1944 issue Sherman tank, but refitted with the British 17-pounder anti-tank cannon. The 17-pounder packed a considerably more devastating punch than either the 75mm or 76mm guns on the Sherman, and it could also engage enemy targets at much greater ranges. The British armored units, however, were only able to outfit one Sherman as a Firefly model per every five Shermans they had on the frontlines. Coincidentally, Germany’s greatest tank ace, Michael Wittmann, was killed in action by a Firefly in August 1944. See the two volume series by Patrick Agte, *Michael Wittmann and the Waffen SS Tiger Commanders of the Liebstandarte in WWII* (Mechanicsburg, PA: Stackpole Books, 1996).
this ten year struggle.

It did not take long this time for the press to go public with this criticism. In a February 2004 article, Slate.com ran a headline not unlike those covering the Sherman debates in 1945: “Why is the White House underfunding armored Humvees?” Only two months later, NBCnews.com published an article criticizing “Lessons unlearned” in Iraq. The commentary cites clear problems with lack of Humvee armor dating clear back to the 1993 conflict in Somalia and an official study by Major Clifford E. Day published in 1997. Major Day wrote how “the reliance on soft-skinned Humvees ‘needlessly put [American] troops in harm’s way without the proper equipment to successfully complete the mission.’” Day’s criticism about the weaknesses of Humvees would easily fit within any of the pages of this thesis describing the Sherman’s performance during World War II.

In fact, the Inspector General’s office in the Department of Defense issued a report on the Humvee and the MRAP (Mine Resistant Ambush Protected, the Humvee’s successor) in December 2008. The Marine Corps requested this study for the purpose of reviewing “the Marine Corps decision making process to determine whether the decision makers responded appropriately and timely to the February 2005 Urgent Universal Need Statement (UUNS) submitted by field commanders for Mine Resistant Ambush Protected (MRAP)-type vehicles.” While this study was limited to the Marine Corps (as this report was requested by the Marine Corps), the Inspector General

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came to conclusions that echo the Sherman-Pershing debacle:

[The Department of Defense] was aware of the threat posed by mines and improvised explosive devices (IEDs) in low-intensity conflicts and of the availability of mine-resistant vehicles years before insurgent actions began in Iraq in 2003. Yet DoD did not develop requirements for, fund, or acquire MRAP-type vehicles for low-intensity conflicts that involved mines and IEDs. As a result, the Department entered into operations in Iraq without having taken available steps to acquire technology to mitigate the known mine and IED risk to soldiers and Marines.\(^4\)

Just as the Ordnance Department had complained about the delayed response to the needs at the frontlines, this report investigated allegations that the Marine Corps did not act “promptly” and “cost Marines their lives.”\(^5\) The wording in this audit from the Inspector General’s nearly copies the arguments put forth in Belton Cooper’s memoir.

The threat of improvised explosive attacks on American and Allied vehicles did not disappear after 2004 and they were not limited to Iraq. The Washington Post reported in January 2011 that the “number of U.S. troops killed by roadside bombs in Afghanistan soared by 60 percent” beyond the total in 2010 and that “insurgents planted 14,661 IEDs” that same year.\(^6\)

Fortunately, MRAP vehicles and similar upgrades came in time to make a difference in the current conflicts in the Middle East, whereas the Pershing did not get such an opportunity. Still, much of the information about this ongoing event remains classified. In the years to come, perhaps further connections to America’s past wars will come to light.

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\(^5\) Ibid. 1.

Studying tank technology of a war already seventy years old is not without its modern applications. Historian Michael Doubler wrote that “In lieu of actual combat experience, the armed forces must turn to military history to gain insights into the experience of battle.” Proactive investigation and analysis of past combat holds the keys to better success in future warfare. No matter how obscure the details, lessons are hidden throughout history. The lives of many brave soldiers may depend on constant awareness of the past.

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7 Michael D. Doubler, Closing with the Enemy: How GI’s Fought the War in Europe, 1944-1945, (Lawrence, KS: Univ. of Kansas Press, 1994), 9.
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