BUILDING GUDERIAN'S DUCK: GERMANY'S RESPONSE TO THE EASTERN FRONT ANTITANK CRISIS, 1941 TO 1945

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The appearance of the T-34 in 1941 caused a crisis for German antitank forces. Existing antitank guns were nearly impotent against the new Russian tank, while antiaircraft and artillery pieces, though successful when pressed into action, were insufficiently mobile to accompany mechanized forces. The German Army Ordnance Office, the Heereswaffenamt, was responsible for development of new weapons and would be responsible for countering the threat of Russian armor. The Heereswaffenamt would need to not only counter the T-34, but also do so in an environment of shifting political relationships and with an increasingly stressed industrial system. Utilizing lessons from the bitterly contested battlefields of western Russia, the Heereswaffenamt developed a tankdestroyer, the Jagdpazer IV, using the existing chassis of the Panzer IV tank, and the guns of both the Panzer IV and Panther tanks. The Jagdpanzer IV, known by its crews as GuderianŸs Duck, proved to be a capable tank killer against both the T-34 threat of 1941 and 1942, as well as the improved versions of 1943 and 1944.

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ABSTRACT

BUILDING GUDERIAN'S DUCK: GERMANY'S RESPONSE TO THE EASTERN FRONT ANTITANK CRISIS, 1941 TO 1945, by LCDR Scott M. Chafian, USN, 100 pages.

The appearance of the T-34 in 1941 caused a crisis for German antitank forces. Existing antitank guns were nearly impotent against the new Russian tank, while antiaircraft and artillery pieces, though successful when pressed into action, were insufficiently mobile to accompany mechanized forces. The German Army Ordnance Office, the *Heereswaffenamt*, was responsible for development of new weapons and would be responsible for countering the threat of Russian armor. The *Heereswaffenamt* would need to not only counter the T-34, but also do so in an environment of shifting political relationships and with an increasingly stressed industrial system.

Utilizing lessons from the bitterly contested battlefields of western Russia, the *Heereswaffenamt* developed a tankdestroyer, the *Jagdpazer IV*, using the existing chassis of the Panzer IV tank, and the guns of both the Panzer IV and Panther tanks. The Jagdpanzer IV, known by its crews as Guderian's Duck, proved to be a capable tank killer against both the T-34 threat of 1941 and 1942, as well as the improved versions of 1943 and 1944.

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Lastly, I humbly dedicate this to the millions of soldiers, both German and Russian, who honorably gave their lives for their countrymen. Regardless of ideology, they stood up for what they believed in, and paid the ultimate price.

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ACRONYMS

AP/CR	armor-piercing, composite rigid
BHP	brake horsepower
FlaK	*Fliegerabwehrkannon* (antiaircraft cannon)
FPS	feet per second
GW	*Geschützwagen* (gun carriage)
KwK	*Kampfwagenkannon* (tank cannon)
OKH	*Oberkommando das Heeres* (High Command of the German Army)
OKW	*Oberkommando der Wehrmacht* (Supreme Command of the German Armed Forces)
PaK	*Panzerabwehrkannon* (antitank cannon)
Pzgr	*Panzergranate* (armor-piercing round)
PzJg	*PanzerJäger* (tank hunter)
PzKw	*Panzerkampfwagen* (armored fighting vehicle)
SdKfz	*Sonderkraftfahrzeug* (special purposes motor vehicle)
SPW	*SchutzenPanzerWagen* (infantry armored vehicle)
StuG	*Sturmgeschutz* (assault gun)
StuK	*Sturmkannon* (assault cannon)

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CHAPTER 1

INTRODUCTION

Lithuania, 24 June 1941

About half-way to Rossienie . . . the only supply route to the bridgehead was blocked by a heavy tank of the KV type . . . . an antitank battery with 50-mm guns was ordered to work its way forward and destroy the tank . . . . The first round, from about 600 yards, was a direct hit. A second and third round followed. By the time the eighth hit was scored, the Russian tank crew had discovered the position of the firing battery. Taking careful aim, they silenced the entire battery with a few 76-mm shells. . . .

Since the 50-mm antitank guns had failed to pierce the 3-inch armor, it was decided that only the 88-mm flak gun with its armor-piercing shells would be effective. . . . Well camouflaged with branches and concealed by the burned-out German tanks lining the road, the gun safely reached the edge of the forest and stopped 900 yards from the tank.

Just as the German crew was maneuvering the gun into position, the tank swung its turret and fired, blasting the flak gun into a ditch. Every round scored a direct hit, and the gun crew suffered heavy casualties.

[The next morning, following an unsuccessful attack by combat engineers], a feint frontal attack was to be executed by a tank formation. . . while another 88-mm gun was to be brought up. . . .

The German armor deployed and attacked. . . while the 88-mm gun took up a position to the rear of the [Russian] tank. The very first round was a direct hit and, as the crew tried to turn the gun to the rear, a second and third shell struck home. Mortally wounded, the tank remained motionless, but did not burn. Four more 88-mm armor-piercing shells hit their mark.

The Germans closest to the tank . . . found that but two of the 88-mm shells had pierced the tank armor, the five others having made only deep dents. Eight blue marks, made by direct hits of the 50-mm antitank guns, were found. . . . No trace of the fire from the German tanks [conducting the feint] could be found. . . . Suddenly, the gun barrel started to move again, and most of the Germans scattered. Quickly, two engineers dropped hand grenades through the hole made by the hit on the lower part of the turret. A dull explosion followed, and the turret cover blew off. Inside were the mutilated bodies of the crew.[1]

Account from elements of the 6th Panzer Division, Army Group North, in the opening days of Operation Barbarossa.

Purpose and Organization of Thesis

Despite developing the tactics and doctrine that would dominate theories of mechanized combat for the rest of the century and cause the term blitzkrieg to be coined, Germany entered the Second World War with an army that was startlingly unprepared to defend against an armored attack. This void was not seriously challenged and could therefore be ignored or glossed over during the campaigns in Poland and the West. Germany's invasion of the Soviet Union in June 1941 however, brought Germany face to face with large numbers of tanks more heavily armed and armored than their own. Over the course of the following year, Germany introduced a number of hastily lashed-up antitank vehicles to counter the threat of Russian armor. By December 1942, the German Army Ordnance Office, the Heereswaffenamt, issued its first requirement for an actual tank destroyer, the Jagdpanzer IV. This thesis will investigate whether or not the Heereswaffenamt designed an effective tank destroyer to counter the antitank crisis of the Eastern Front in 1941-1943.

This study will be organized into five chapters. Chapter 1 outlines the structure of the thesis, defines measures of effectiveness, and provides a background to the antitank crisis of 1941 on the Eastern Front. It will briefly discuss the campaigns in Poland and France, German antitank organization on the eve of the invasion of Russia, and provide a summary of the course of events on the Eastern Front from the initial invasion, Operation Barbarossa, through the battle of Stalingrad. Chapter 2 describes the functions and responsibilities of the Heereswaffenamt and its subordinate offices, briefly discusses its relationship with the *Oberkommando das Heeres*, the High Command of the German Army, and summarizes the German companies involved in armored vehicle production.

Chapter 3 describes the Russian armor that precipitated the crisis, the relative effectiveness of German antitank forces at the time of the invasion; details the various ad hoc attempts to motorize and armor German antitank weapons between June 1941 and December 1942; and summarizes lessons learned from their employment. Chapter 4 explores the material options open to the Heereswaffenamt in design of the new tank destroyer; describes the finalized design, test performance, and production totals of the Jagdpanzer IV; and provides examples of Jagdpanzer IV combat experience. Chapter 5 concludes with assessment of the Heerewaffenamt's effort in designing the Jagdpanzer IV.

This thesis will assess the Russian threats from June 1941 to December 1942 that affected the design of the Jagdpanzer IV. Opposing armor that appeared after that time will not be considered in the assessment, but Jagdpanzer IV performance against these threats will be included to evaluate the consequences of designing a weapons system in a dynamic tactical and operational environment. Non-Russian threats will be excluded as Russian tanks posed a greater threat than American or British; success against Russian designs generally ensured success against other allied tanks. Additionally, the thesis will not address economic or industrial consequence or alternatives to Jagdpanzer IV production, but will be limited to choice of those platforms and weapons readily available to the Heereswaffenamt. Similarly, organization and employment, or failings thereof, of German or Russian forces will not be addressed.

Definitions

Germany produced a wide range of both purpose built and converted armored fighting vehicles during World War Two, with several different systems of nomenclature.

For ease of reading, German tanks are referred to as Panzer I, Panzer II, with the exception of late war tanks, which were generally referred to by name (Panther, Tiger, King Tiger). Self-propelled guns will be referenced by an abbreviation, (example: StuG for Sturmgeschütz or assault gun), unless commonly known by a noun name (example: *JagdPanther* or *Hetzer*). German armored infantry half-tracks will be referred to as SPW, for *SchutzenPanzerWagen* (infantry armored vehicle). German guns will be referred to using abbreviations *PaK* for *Panzerabwehrkannon* (antitank gun), *KwK* for *Kampfwagenkannon* (tank gun), and *FlaK* for *Fliegerartilleriekannon* (antiaircraft gun).

Russian vehicles will be referred to using their alphanumeric designator (example: T-34 or SU-85) and model amplification where necessary (example T-34/41).

An appendix will be provided summarizing the nomenclature and characteristics of all vehicles and equipment referenced in the thesis.

Measures of Effectiveness

Effectiveness of the Jagdpanzer IV design will be evaluated in the areas of firepower, protection, and mobility. While data from production tests may seem straightforward, they do not tell the story of how effective the Jagdpanzer IV was in action. Both test data and experience from actual engagements will be used for comparison of design goals against battlefield suitability and in determining Jagdpanzer IV design success or failure.

Firepower will be considered in terms of penetration of armor at given ranges and will be measured against three categories of threat: design, fielding, and future. Design threat is defined as the T-34/41 and KV-1 tanks, both in Russian service during the period the Jagdpanzer IV was being designed. Fielding threat is defined as the T-34/43, T-34/85,

and KV-85, all of which saw service within a year of the Jagdpanzer IV's fielding and were logical progressions of each design. Future threat is defined as the JS series of tanks, which saw service during the closing months of the war and represents an entirely new generation of tanks.

Protection will be considered in terms of survivability against major types of Russian antitank weapons. Tank cannon will provide three categories analogous to those used in firepower assessment, but will be somewhat simplified by the fact that several of the referenced tanks mounted the same gun. This category includes Russian self-propelled antitank guns of the SU series. Two additional categories will assess protection against Russian self-propelled assault guns of the SU and JSU series, and against infantry antitank weapons. While somewhat intangible, the protection afforded the Jagdpanzer IV by its low height when compared to other German designs will be discussed.

Mobility will be considered in more subjective than objective terms. Top speed and range will be discussed, but maneuverability characteristics as reported by troops in the field tell a more complete story. As these are not listed in specifications, issues with designs will be documented and assessments made thereon.

Background: German Antitank Forces, September 1939 to June 1941

At the start of the war, German infantry were equipped with the 7.92-millimeter *Panzerbüsch* (antitank rifle) 38 or 39, three of these weapons being assigned to a seven-man AT section within each infantry company. Antitank artillery units employed the 37-millimeter *PaK* 36, each German infantry division generally having 60 to 80 of these guns, evenly distributed between a single antitank battalion and the antitank companies of

the three infantry regiments. Panzer divisions usually contained only the antitank battalion.[2]

It was believed that these weapons would be sufficient to defend the German Army from tank assault. The belief would be put to the first test with the invasion of Poland.

On the morning of 1 September 1939, five German armies thrust into Poland. Large parts of the Polish forces were destroyed in the Danzig Corridor between Germany and German-controlled East Prussia. The German Fourth, Eighth, and Tenth Armies encircled the only remaining sizeable Polish forces in the vicinity of Poznan. Ranging further east, the German XIX and XXII Panzer Corps, under Generals Heinz Guderian and Sigmund List had met south of Brest-Litovsk on 17 September, enveloping almost all the remaining Polish forces. While isolated fighting would continue for several weeks, the war was all but over.

While the victory appeared to be a stunning success of Germany's mobile warfare doctrine, the lightening thrusts of the two Panzer corps had diverted attention away from the fact that the vast majority of the fighting occurred near the Polish-German border, and was conducted by marching or horse-drawn infantry, which made up 90 percent of the German Army. Additionally, as Poland possessed a small number of obsolete tanks, the Germans opposition consisted almost exclusively of infantry and horse cavalry. The two mechanized columns, consisting of tanks supported by infantry in trucks, had faced only sporadic opposition, rather than major fighting.[3]

Though a spectacular success, the invasion of Poland had not put German antitank defenses to the test. While the campaign in France that would soon follow saw changes to German offensive tactics, defensive doctrine continued unchanged, and reequipping of

the Panzer divisions with more modern tanks was only partially complete. On the eve of the invasion of France, Germany had barely 600 Panzer III and IV tanks, the bulk of the force relying on 1,000 Panzer II light tanks leavened with approximately 334 Czech Panzer 35(t) and 38(t) light tanks, while more than 500 Panzer Is were still in service.[4]

On 10 May 1940, Germany's 18th and 6th Armies, part of Army Group B, launched attacks into Holland and Belgium. The assault west, anticipated all winter, had begun. While French and British forces moved north to counter the perceived threat, Army Group A, consisting of the 4th, 12th, and 16th Armies, including seven Panzer divisions, slipped through the Ardennes and into France. By 13 May, German spearheads had crossed the Meuse River at Sedan, the Allies falling back in disarray at the flank attack. By 20 May, the German Panzers had reached the English Channel at Abbeville.[5]

This campaign remains the classic example of Blitzkrieg, with opposition crumbling in disarray, unable to adjust to the tempo of German operations. On 21 May, however, the day after Army Group A split the Allied forces, a British counterattack pointed to the way of things to come.

While the German Panzers were thrusting to the English Channel, they had bypassed large pockets of Allied resistance. Mustering the available forces in the area around Arras, a traditional logistics hub, the British 1st Tank Brigade, with support from the 50th Infantry Division launched a two-pronged counterattack against the exposed German flank. The British, suffering from organizational inefficiencies compounded by the general chaos stemming from the speed of the German advance, were unable to coordinate the counterattack with artillery support. Intelligence was negligible; the

British being unsure whether they would encounter the leading German armored formations or lightly armed supply troops.

Despite its lack of coordination, the British attack hit the flank of Rommel's 7th Panzer Division across an 8-kilometer front at 2:30 in the afternoon. In the rush of the advance, the German 25th Panzer Regiment had surged ahead of the 6th and 7th Infantry Regiments, now defended only by towed 37-millimeter *PaK* 36s. The British armor and infantry were soon separated, both by German action and the speed of the British tank's advance. Now devoid of their accompanying infantry, as planned for in German doctrine, the 58 Mk I and 16 Mk II Matilda tanks of the British force continued on into the German 6th Infantry Regiment. As the *PaK* 36s engaged the British, their projectiles merely hammered small dents into the armor of the British tanks; one Matilda took fourteen hits with no effect. Despite losing both of its tank battalion commanders and several tanks to incendiaries, mechanical problems, and German dive-bombers, the British counterattack continued, overrunning a German antitank battery, destroying the 6th Infantry Regiment, and causing the *S.S. Totenkopf* division to break and run. By 7:00 P.M. with the British attacking German 7th Infantry Regiment, Rommel had reversed the 25th Panzer Regiment and committed it to his own counterattack against the British flank.

The German Panzers, so successful in Poland, now found themselves at a disadvantage. Neither the 20-millimeter cannon of the Panzer II, the 37-millimeter gun of the Panzer 38(t), nor the low velocity 75-millimeter gun of the Panzer IV was able to reliably stop the British Matilda. Conversely, the Matilda's 2-pounder gun was capable of defeating the heaviest armor of all three panzers. At the end of the exchange, the Germans had lost six Panzer 38(t)s, three Panzer IVs, and four Panzer IIs.[6] British losses

amounted to seven Mk Is, and no Matildas. The panicked retreat of the SS-*Totenkopf* division, having just seen large numbers of German tanks knocked out of action by enemy armor, is perhaps the first example of German troops suffering from "tank terror".

Sensing the potential for a disaster, Rommel ordered the antiaircraft and artillery units in the divisions' rear area to engage the British with direct fire. Fire from the 88-millimeter *FlaK* guns and 105-millimeter howitzers finally penetrated the Matilda's thick hide, and halted the British advance.[7] The Battle of Arras was over.

However, the victory had come at a high price. The 25th Panzer Regiment had lost nine of its scarce Panzer 38(t)s and IVs, and the 7th Infantry Regiment was badly mauled. The 6th Infantry Regiment was nearly destroyed; one of its battalions suffering in one day more casualties than any other German battalion did over the entire campaign.[8] Rommel himself observed, "The anti-tank guns . . . showed themselves to be far too light to be effective against the heavily armoured British tanks, and the majority of them were put out of action by gunfire, together with their crews, and then overrun by the enemy tanks."[9]

The campaigns in Poland and France had offered some valuable lessons, but also gave false impressions. The overwhelming victory in Poland had raised the morale of the German Army, but had been fought against a weak opponent, employing small numbers of 1930's vintage British cavalry tanks.[10] The rapidity of victory over the French Army, ostensibly the most powerful in the world, overshadowed the lessons of Arras, and of engagements against individual French Char B1 and SOUMA tanks. Both of these tanks, as well as the British Matilda, had proven a match against even the latest antitank guns and Panzers, but the arithmetic blinded both the Germans and the Allies. A force of 2,600

German tanks had overcome 4,800 French and British tanks to cut France in half in little more than a week.[11]

Some of the lessons had been taken to heart. The firepower of the Panzer III was enhanced with the installation of a 50-millimeter gun, and antitank artillery performance was improved through the introduction of a new 50-millimeter towed antitank gun, the *PaK* 38, though in June 1941 the 37-millimeter gun was still prevalent in both roles. Despite these changes, the increase in firepower was negated by the expansion of the mechanized force between the surrender of France and the invasion of Russia. In this time, Panzer divisions had doubled in number from ten to twenty. While this increase was impressive on paper, it was predicated on a decree by Hitler that Panzer production be increased to one thousand vehicles a month. When the Heereswaffenamt informed Hitler this would be impossible given Germany's fiscal and manpower constraints, the number of tanks in each division was simply cut in half to support the expansion. At the same time, motorized divisions had similarly doubled without a corresponding increase in production, requiring a large number of captured vehicles be employed. As a result, the strength and mobility of Panzer and Motorized divisions would never again reach the standards of May 1940.[12]

In June 1941, on the eve of the invasion of Russia, confidence was high that Germany would win a quick victory. The battles in Poland and France had done nothing to shake the faith in the Army's equipment and operations. Opposition in Poland had been far too anemic for valid comparison of antitank defense. In France, the rapidity of the advance along with the relatively short distances involved combined to produce such shock among the French and British defenders that resistance often simply crumbled as

morale failed. As Germany was about to discover, the vast space of Russia and the character of her defenders would make the battle unlike the early victories.

Barbarossa to Stalingrad: June 1941 to February 1943

On 22 June 1941 Germany unleashed the most massive invasion in history against a stunned and ill-equipped Soviet Army. Operation Barbarossa, Hitler's plan for the conquest of Russia, drove 151 divisions divided into Army Groups "North", "Center", and "South", crashing across a line running from the Baltic to the Black Sea, a distance of over 1,000 miles.[13] The destruction of the Russian Army was to take place as it had before in Poland and France; the *Luftwaffe* conducting a powerful bombardment from the air, while Panzers broke through the defender's "crust" and split enemy forces, the following infantry and artillery destroying the survivors, or compelling their surrender.[14]

At first it appeared Germany would achieve its goals in spectacular speed and style. Exploiting Russian confusion and their own mobility, German mechanized forces crashed through the defenders with unprecedented speed. By late July, Army Groups North and South had each advanced over 100 miles, while Army Group Center had covered an amazing 285 miles.[15]

By 17 July however, separation of Panzers and supporting forces were occurring across the front. As this separation grew and the supply situation grew worse, German momentum began to falter. At this crucial point, indecision and conflict at the highest levels of the German command structure caused delays far more costly than those of the Russian defenders.

Friction between the *Oberkommando der Wehrmacht* (*OKW*, Supreme Command of the German Armed Forces) and the *Oberkommando das Heeres* (*OKH*, High

Command of the German Army), led to delays in setting the next phase of the invasion in motion. While Hitler's mid-September decree that the operational goals had been met in the north and south, and therefore the drive on Moscow could continue restored unity of purpose, over two months had been lost.

By the end of September, Army Group Center was prepared to launch Operation Typhoon, the final drive on Moscow. While initial gains were once again impressive, momentum began to flag as German units felt the effects of four months nonstop fighting and extended logistics tails. This was exacerbated by the onset of winter, the first snows falling on 7 October.[16]

On the night of 4 December, seventeen Soviet Armies, led by Siberian units recently transferred from the Far East, fell upon the German flanks north and south of Moscow. In sub-zero temperatures the winter-equipped Siberians overwhelmed the German defenders.

The Russian counteroffensive, though off to a good start, was hampered by poor coordination and a lack of operational sophistication. After initially cracking under the unexpected Soviet advance, the Germans regrouped and fought back bitterly, and the Russian advance ground to a halt by February 1942. Despite being better equipped for the winter weather, Russia's Army lacked the strength to decisively destroy the German armies. The offensive, while savaging both sides, resulted in relatively small gains and left the Russians in at least as precarious a position as the Germans. It proved to be enough, however, to ensure Moscow was never seriously threatened again. With their air of invincibility shattered, the Germans regrouped, awaiting the spring thaw and renewed offensives.[17]

By the spring of 1942, the German Army, while on paper appearing stronger than the year before, was actually no better off. An increase in Panzer divisions from nineteen to twenty five meant little as few battalions were up to authorized strength of twenty two Panzer IIIs and IVs. The Panzer IIIJ with the 50-millimeter L/60 gun as well as the Panzer IVF2 and StuG IIIF, both with the 75-millimeter L/43, began appearing in growing numbers, as well as early examples of the *Marder* series of tank destroyers, mounting the captured Russian 76.2-millimeter antitank gun; though none of these constituted a complete solution to the T-34. As a partial counter to this each Panzer division now included a full battalion of 88-millimeter guns.[18]

German plans for 1942 would revolve around the Caucuses, though again debate between *OKW* and *OKH* led to fatal delays. Army Group South, now the main effort in the East, made excellent progress throughout the summer, until the German 6th Army reached the Don on either side of Voronezh on 5 July. At this point Hitler sent the 4th Panzer Army, which had been supporting the 6th Army, on a pointless three-week detour south towards the Caucasus oil fields, only to reverse himself on 29 July. While the foot-bound 6th Army slogged east, now focused on the Russian industrial city of Stalingrad, the mobile 4th Panzer Army struggled to extricate itself from the approaches to the Caucasus. Simultaneously, Russian reinforcements were streaming into Stalingrad. Once again, the delay was just sufficient to overcome German plans. While the assault on the city was opened in mid-August, the Germans were never able to clear the entire city of Russian defenders.

On 18 and 19 November, 500,000 Russian troops and 900 new T-34s, in four tank corps, three mechanized corps, and fourteen independent tank brigades north and south of

Stalingrad rolled over the poorly equipped Rumanian divisions protecting the Army Group's flanks and their light German reserve.[19] By 22 November, the Russian pincers had closed at Kalach on the Don, trapping over a quarter of a million men. The Germans fought desperately, but by mid-January, conditions in the pocket were almost inhuman, and on 1 February 1943 the remaining troops surrendered. [20]

Lessons

While in 1941 the Germans swept across the Russian countryside, individual Soviet units had put up stubborn defenses. Generally, these pockets were quickly reduced, but cracks were starting to show in the supposed German juggernaut. When faced with Russian T-34 and KV-1 tanks, whether in the advance or in and encirclement, the Germans found themselves outgunned and insufficiently armored. In July of 1941, 6th Panzer Regiment lost 21 tanks (over 50 percent of its strength) to a handful of T-34s. On other occasions, advances were simply held up as the German tank guns bounced ineffectually off the thick Russian armor. On 8 July the Operations *Abteilung* Diary of LVII Panzer Corps recorded the appearance of "heavy tanks of a type not seen before. 5cm antitank cannot penetrate them."[21] German troops came to believe "That you always had to kill a Russian twice over."[22]

Perhaps the only solace the Germans could take on the initial appearance of the T-34 and KV-1 was that they were available only in small numbers and piecemealed out in support of infantry.[23]

The lessons of 1942 were, beneath the initial veneer of summer's victories, more ominous. Following German success with mixed formations, Russian armored brigades had been reorganized into effective combined arms units.[24] Further, while the German

offensive was, if anything, even more successful than in 1941, the fighting took on a different character. Though large numbers of Soviet men and equipment still fell to the German onslaught, the Russians had, in general, learned to give ground rather than be encircled and destroyed. A news correspondent for the *Völkischer Beobachter* summed up the situation.

> The Russian, who up to this time had fought stubbornly over each kilometre, withdrew without firing a shot. Our advance was only delayed by destroyed bridges and by aircraft. When the Soviet rearguards were too hard-pressed they chose a position which enabled them to hold out until night. . . . It was quite disquieting to plunge into this vast area without finding a trace of the enemy.[25]

When the Soviet counteroffensive around Stalingrad opened, it showed that the Russians had learned their offensive lessons well. The counteroffensive plan's relatively limited goal of destruction of the 6th Army was diligently adhered to; despite several opportunities, the Soviets did not repeat the failures of 1941 and overreach themselves in fruitless frontal assaults.[26] Germany could no longer count on salvaging the results of operational indecision through Soviet tactical blunders. Nor could German victory any longer be won through a single lightening stroke or by exploiting enemy defensive ineptitude. The struggle ahead would rest on a direct clash of arms.

In 1942, because most of the Russian tank production facilities had fallen to the German offensive, tank production was limited, and the number of T-34s and KV-1s remained relatively limited. This would change as factories relocated east of the Ural Mountains in 1942 began to turn out an immense wave of these tanks, improved by two years of battle experience, in 1943. The German antitank inventory, woefully inadequate in 1941 and improved only through desperate stopgaps in 1942, would have to be quantitatively improved to meet the challenge.

[1]U.S. Army Armor School, "Armor in Battle." FKSM 17-3-2, 1986, 2-2 – 2-7.

[2]United States War Department, *Handbook on German Military Forces*, with a forward by Stephen Ambrose (Baton Rouge, LA: Louisiana State University Press, 1990), 318, ch. II passim.

[3]John Keegan, *The Second World War* (New York: Viking, 1989), 44-46; H. B. C. Watkins, "Only Movement Brings Victory: The Achievements of German Armor" in *Armored Fighting Vehicles of Germany*, ed. Duncan Crow (New York: Arco, 1978), 7-8.

[4]Watkins, 8-9.

[5]Ibid., 11-12.

[6]Dr. Russel H. S. Stolfi, *A Bias for Action: The German 7th Panzer Division in France and Russia, 1940-1941: Perspectives in Warfighting Number One* (Quantico, VA: Marine Corps Association, 1991), 35-36.

[7]Alistair Horne, *To Lose a Battle: France 1940* (London: Macmillan, 1969), 437-444; Hans von Luck, *Panzer Commander: The Memoirs of Colonel Hans von Luck* (New York: Praeger, 1989), 32.

[8]Stolfi. Stolfi lists German losses as including Panzer IIIs, but Rommel's 7th Panzer division had few if any of this type. The losses were much more likely to have been of Panzer 38(t)s which were used to arm the division when it was upgraded from a light to a panzer division.

[9]Horne, 443-444.

[10]Rudolf Steiger, *Armor Tactics in the Second World War: Panzer Army Campaigns of 1939-41 in German War Diaries*, translated by Martin Fry (New York: Berg, 1991), 4-6.

[11]Ibid., 7.

[12]Watkins, 13; Alan Clark, *Barbarossa: The Russian-German Conflict, 1941-1945* (New York: Morrow, 1965; reprint, New York: Quill, 1985), 17-18.

[13]David M. Glantz, *Barbarossa: Hitler's Invasion of Russia 1941* (Charleston, SC: Tempus, 2001), 35.

[14]Earl F. Ziemke and Magna E. Bauer, *Moscow to Stalingrad: Decision in the East* (Washington: D.C.: Center of Military History, 1987), 13-15; Albert Seaton, *The Russo-German War, 1941-1945* (Novato, CA: Presidio Press) 1993, 63.

[15]Ziemke and Bauer, 28; Glantz, 37-42

[16]Ziemke and Bauer, 33-68; Seaton, ch 12-13; and Glantz, ch 7.

[17]Ziemke and Bauer, 63-68, 173-175; Glantz, ch 9; and Clark, 183-191.

[18]Clark, 190-192; While German Panzer production for 1941 totaled 3,256 tanks, almost 3,000 had been destroyed in Russia. Additionally, the surviving Panzers I and II had been withdrawn from frontline service, reducing the number of vehicles even further.

[19]Ziemke and Bauer, 468-472; Clark, 240-247. The Rumanian divisions were poorly led and equipped. Organized along the lines of a French Infantry Division circa World War One, the Rumanians were woefully under equipped to counter the Russians. Each division had a single antitank company with 47-millimeter antitank guns. A half-hearted attempt was made in October to increase this firepower by supplying six 75-millimeter guns to every division! The German reserve was the 48th Panzer Corps, which was at little more than division strength, and in any case, had only 92 Rumanian Panzer 38(t)s. An additional 51 German Panzer IVs had been assigned, but were still engaged in the rubble of Stalingrad.

[20]Ziemke, 473-474; Clark, 197-209, 247-288. Kalach was the site of the bridge over which *all* of 6th Army's logistics had to pass and had been wired for destruction by the Germans. It was taken when several dozen Russians in German Horch personnel carriers with 22nd Panzer Division insignia drove onto the bridge unopposed by the defending engineers, who were then cut down by the Russians.

[21]Steiger, 79.

[22]Clark, 146.

[23]Richard N. Armstrong, ed., *Red Armor Combat Orders: Combat Regulations for Tank and Mechanized Forces 1944*, trans. Joseph G. Welsh (Portland, OR: Frank Cass, 1991), xii.

[24]Ibid., 196-197; The Russian armored brigades of 1942 consisted of 2 or 3 battalions of T-34s and KV-1s, a motorized infantry battalion, a mortar company, and an anti-tank company equipped with high-velocity 76.2-millimeter guns. By May 1942 over twenty of these formations had been created.

[25]Clark, 208.

[26]Ibid., 257-258.

CHAPTER 2

THE HEERESWAFFENAMT AND GERMAN INDUSTRY

The Heereswaffenamt (Army Ordnance Office) was the organization responsible for development of new weapons systems within the German Army. While the structure of the HWA remained essentially unchanged throughout the war, its effectiveness would be seriously challenged by changes in both organization and politics in the German Army. These changes would set the conditions under which any new weapon would be developed.

Oberkommando das Heeres and Subordinate Weapons Development Commands

Before mobilization of the German Army in 1939, the Heereswaffenamt was directly responsible to the *Oberkommando das Heeres* (*OKH*, High Command of the German Army). Following mobilization, the position of Commander of the Replacement Army was established in August 1939. The Commander of the Replacement Army was responsible to the Army Commander in Chief and *OKH* for equipping of the army in the fields of personnel, material, and finance; accordingly, the Heereswaffenamt became subordinate to the Commander of the Replacement Army. In early 1940, the Commander of the Replacement Army received the additional title of Chief of Army Equipment.[1]

The Heereswaffenamt developed new weapons systems after receiving direction from, and with the cooperation of the General Army Office's Arms Inspectorates. The Arms Inspectorates were responsible for establishing organization, training, and specifications for new weapons systems, organized by function; Inspectorate 6 had

responsibility for armored troops, including tanks, tank guns and self-propelled antitank weapons.[2]

Heereswaffenamt

The Heereswaffenamt was directly subordinate to the Chief of Army Equipment and Commander of the Replacement Army and was responsible for, "development, procurement, and acceptance of weapons, ammunition, and equipment for the Army. . . as well as for the production capacity of the armament industry assigned to him or its enlargement."[3] Lieutenant General Emil Leeb, Chief of the Heereswaffenamt throughout the war described it as the, "central agency responsible for the technical [design] and manufacturing of arms, equipment and ammunition."[4]

In support of these tasks, the Heereswaffenamt was organized into groups according to responsibility. Overall administrative control, including organization and legal matters, was the jurisdiction of the *Zentral-Amtsgruppe* (*Wa Z*, Central Group).

The *Amtsgruppe für Entwicklung und Prüffung* (*Wa Prüf*, Development and Testing Group), received requests for new weapons, ammunition, and equipment from the Arms Inspectorates, though occasionally recommendations would come direct from the Field Army via the *OKH*. The *Wa Prüf* was also responsible for observing foreign developments and testing captured weapons. Twelve functional branches within the *Wa Prüf* corresponded to the designations of the Arms Inspectorates; accordingly, the *Panzer und Motorisierungsabteilung* (Panzer and Motorized Equipment Branch), responsible for tanks and self-propelled antitank guns, was designated *Wa Prüf* 6. Heereswaffenamt organization is depicted in figure 1. A full listing of *Wa Prüf* Branches is provided in appendix A.

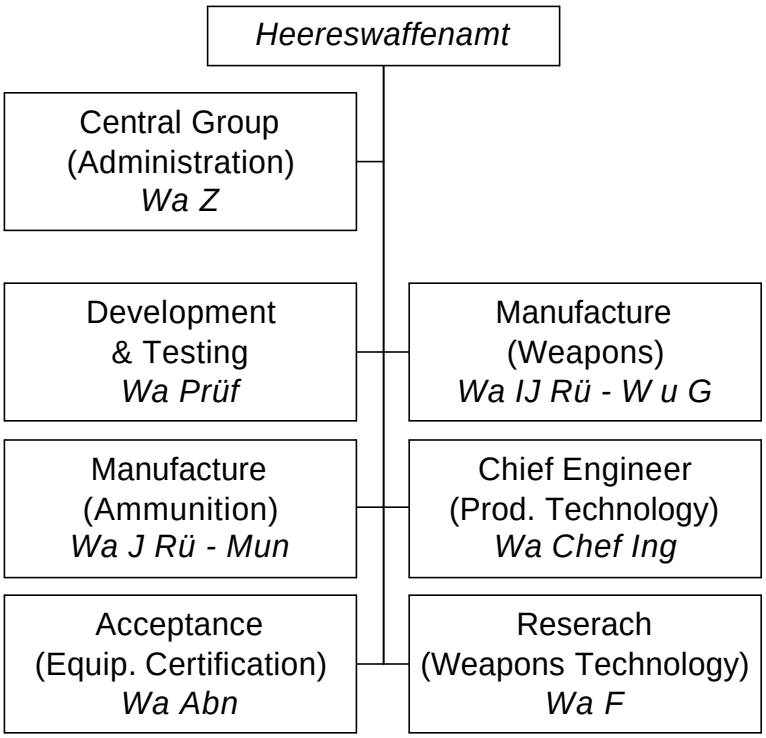

Figure 1. Heereswaffenamt Organization

The *Amtsgruppe für Industrielle Rüstung – Waffen und Gerät* (*Wa IJ Rü – W u G*, Group for Weapons and Equipment Manufacture) gave production orders to industry for equipment and spares, excluding ammunition. The *Amtsgruppe für Industrielle Rüstung Munition* (*Wa J Rü – Mun*, Group for Ammunition Manufacture) fulfilled the same role for ammunition. The *Amtsgruppe Chefingenieur* (*Wa Chef Ing*, Chief Ordnance Engineer Group) was charged with ensuring manufacturers were provided with the latest technology for design and mass-production, and supervising the use of critical raw materials. The *Forschungsabteilung* (*Wa F*, Research Group) tracked all theoretical and applied research in the arms field (for example, development of the hollow-charge), both within Germany and in foreign countries. The *Amtsgruppe für Abnahme* (*Wa Abn*,

Acceptance Group) inspected and accepted completed weapons, equipment, and ammunition, or their component parts, at the factory. This was a certification function, and did not constitute taking possession or assembling component parts of systems, which was the responsibility of the General Army Office's Ordnance Inspectorate.

Uniformed soldiers and civilian engineers constituted the majority of the Heereswaffenamt personnel, augmented by a small number of civilian economists. The military officers with higher engineering degrees generally performed development functions, while those without generally served as liaison to the field forces (via the Arms Inspectorates) within their limited area of expertise. Between six and seven thousand personnel were assigned to the Heereswaffenamt, the number decreasing as the war drew on.[5]

Theoretical Tank Development Cycle

Development and procurement of a new weapon system followed a generally standard cycle from the pre-mobilization period until 1942, when the process was complicated by the inclusion of the newly created Ministry for War Production. Under the pre-1942 system, (used for simplicity) the request for a new armored fighting vehicle would proceed as follows.

Field forces would forward their request for a new vehicle to the General Army Office's Inspectorate for Armored Troops (Inspectorate 6). Inspectorate 6 then determined the vehicle's desired capabilities, including required training and organizational changes if necessary. Coordination with the Infantry and Signals Inspectorates would begin at this point for development of the vehicle's secondary

armament and radio gear. Once completed, the specifications would be forwarded to the Heereswaffenamt for action.

Within the Heereswaffenamt, *Wa Prüf* 6 (the Panzer and Motorized Branch) would become the lead office for development, coordinating with other branches as required for supporting equipment (for example, *Wa Prüf* 1, the Ballistics and Ammunition Branch, if a new main gun was required). After initial assessment, the Heereswaffenamt would assign the development project to civilian companies, each of which would then produce a design proposal.

Once industry provided their initial designs to the *Heereswafenamt*, representatives of all involved *Wa Prüfs* and Arms Inspectorates met to assess the submissions and reach a consensus on the best design features and any required changes. Each *Wa Prüf* would then begin development of construction details, while the other organizations established acceptance standards, training requirements, and organizational documentation.

The Heereswaffenamt next instructed two or more companies to produce prototype vehicles, which were delivered to and tested by *Wa Prüf* 6 (with assistance from associated branches) to ensure they met design specifications; the vehicles were also assessed by *Wa Abn* (the Acceptance Group) to determine production acceptance criteria. The prototypes were then passed to the Arms Inspectorates to ensure tactical requirements had been met. The Chiefs of Army Supply and Transportation were also included in assessment, to determine if new ammunition or rail transportation equipment would be necessary for the new vehicle.

The best design was selected, and orders for pre-production vehicles sent to the manufacturer. If changes to the prototype were required, they were incorporated at this time. Once pre-production vehicles were completed, they were delivered to the Heereswaffenamt for testing in special demonstration units. Upon successful completion of the demonstrations, an initial run of vehicles was ordered. These were issued to the field forces for combat trials. The sequence of modification and delivery to field test units was repeated until a finalized design was determined. At that time, mass-production orders were placed with one or more companies. Throughout, the *Wa Chef Ing* (Chief Engineer Branch) would ensure that the involved companies were employing the latest production technologies.[6]

German Tank Industry, 1943

Germany began the rearmament of her tank force in 1933, when the Heereswaffenamt issued development contracts for what would become the Panzer I. While German's tank designs would improve in the next six years, her capacity for mass production of heavy vehicles was sorely deficient at the outbreak of war. Because they were American owned, Ford and Opel, the two companies in Germany with significant mass production experience, were excluded from military vehicle development contracts, shifting the burden to Germany's relatively anemic heavy equipment industry. Nonetheless, several firms successfully developed and produced tanks and self-propelled guns for the German Army, though maximum output was relatively low due to inefficiency. This was somewhat mitigated by the expertise of the German optical and armament industries, notably Krupp and Rhinemetall-Borsig. Table 1 lists the major German armored vehicle manufacturers and their assigned projects in 1943-1944.

Table 1. German Armored Vehicle Manufacturers 1943-1944

COMPANY	VEHICLES IN PRODUCTION
Altmaerkische Kettenfabrik GmbH (Alkett)	Marder II, Pz III, StuG III
Boehmish-Maehrische Maschinenfabrik (BMM)	Marder III
Daimler-Benz	Panther
Deutsche Eisenwerke	Pz IV, Nashorn, Hummel
Fahrzeug-undMotorenbau GmbH (Famo)	Marder II, Pz III
Henschel	Panther, Tiger, Tiger II
Krupp	Pz III, Pz IV
Maschinenfabrik Augsburg Nuernberg AG (MAN)	Marder II, Panther
Muehlenbau-und-Industrie AG (MIAG)	StuG III
Maschinenfabrik Niedersachen Hannover (MNH)	Panther
Nibelungenwerke (Steyr-Daimler-Puch)	Pz IV, Elefant
Vogtlandische Maschinenfabrik AG (Vomag)	Pz IV

Notes: *BMM* was *Ceskomoravska Kolben Danek* (*CKD*) before annexation of Czechoslovakia.
Hummel was a 155-millimeter SP artillery piece on the same hybrid Pz III/IV chassis as the Nashorn.

The Panzer III, numerically the most important German tank at the beginning of the war in the east, was being phased out of production by 1943. The resulting excess capacity was used to produce the StuG III and later versions of the Panzer IV, which became the core of German infantry support and tank forces for the remainder of the war. *Henschel*, *MAN*, and *MNH* were, from late 1942, completely occupied with Panther and Tiger development and production. *BMM*, maker of the excellent Panzer 38(t) chassis, was incapable of producing heavier vehicles at its Czech facilities, and, along with *Marder* production, focused on developing an improved chassis, the Panzer 38(t). Production of new vehicle designs from 1943 on would have to come at the expense of existing types.[7]

Operational Dynamics

While the Heereswaffenamt remained generally unchanged throughout the war, the same could not be said of the surrounding organizations. Personality conflicts, changes in the OKH structure, and the unstable character of the entire Third Reich reduced the Heereswaffenamt's effectiveness throughout the course of the war.[8] The evolution of the *Waffenamt*'s situation can be broken down into three periods: Mobilization through dismissal of the Army Commander in Chief (fall 1939 to 19 December 1941); Chief of the Replacement Army's decreasing influence to the attempt on Hilter's life (spring 1942 to 20 July 1944); and loss of Army control to the end of the war (summer 1944 to May 1945).

When the position of Commander of the Replacement Army was activated in August 1939, Lieutenant General Karl von Stuelpanagel was assigned to the post in accordance with the mobilization plan. Within days however, he had fallen from Hitler's favor, and the position was filled by the then Chief of the General Army Office, Lieutenant General Friedrich Fromm. Fromm held both positions until February 1940, when Major General Friedrich Olbricht was named to be Chief of the General Army Office, Fromm remaining Commander of the Replacement Army. Throughout the first year of the war, the Replacement Army was focused on the task of mobilization. The consolidation of all equipment and personnel activities under the unified organization of the Commander of the Replacement Army greatly eased this process.

Fromm's appointment, however, was a source of frustration to the head of the Heereswaffenamt, Lieutenant General Emil Leeb. Leeb, being senior to Fromm, believed he should be answerable directly to the Army Commander in Chief, rather than the

Commander of the Replacement Army. Despite Leeb's appeals, the *OKH* clearly stipulated in late 1939 that the *Waffenamt* was subordinate to the Commander of the Replacement Army, and assigned the later the additional title of Chief of Army Equipment. Additionally, Fromm was promoted to General to reinforce the point. Nonetheless, friction between the two organizations continued to a varying degree throughout the war.[9]

While the early tumult in the Replacement Army and *Waffenamt* chain of command was being resolved, the agencies themselves were taking on the challenge of arming the newly mobilized German Army. From 1934 to 1939, Germany had prepared to mobilize forty conventional infantry divisions and sixteen panzer, mechanized, and light divisions. The relatively sudden mobilization in 1939 added an additional seventy-five divisions, which could not be equipped from existing stocks; the German military had been directed to prepare for war in the early to mid-1940s.[10] To some extent, this problem was alleviated by the annexation of Czechoslovakia (with her not insignificant arms industry) and the short, relatively low-cost victories in Poland, and Norway.

Nonetheless, it was increasingly apparent, even after the Polish campaign, that production was not up to the requirements of the conflict. Rather than mobilize the economy for war, Hitler chose to create the Ministry for Armaments and Munitions, headed by Fritz Todt, on 17 March 1940. Initially, the Ministry's role was solely oversight of civilian industry, and the Heereswaffenamt maintained its role in weapon design and production.[11]

The quick victory in France combined with the apparent success of the cooperation between the Replacement Army and the Ministry for Armaments and

Munitions gave Hitler a false sense of confidence in Germany's ability to support and supply the army. This was further reinforced by the early successes of Operation Barbarossa. Accordingly, General Fromm received a Fuehrer directive on 14 July 1941 directing a reduction in army equipment production in favor of the Air Force and Navy. Though relations between the Ministry and the Replacement Army had been good up to this point, Todt acted on Hitler's orders before Fromm could contest them, reducing the army's share of civilian industrial capacity.[12]

This was to have devastating consequences in the winter of 1941-1942. The losses of the Russian winter campaign (amplified by Hitler's refusal to equip the troops with winter clothing for fear of damaging morale) were shattering. Reserves that had been husbanded at rear depots made good the losses, but following that surge, German production would be in a tail chase to catch up. This situation was bad enough in and of itself, but the appearance of the T-34 had completely upset the design schedule of the Heereswaffenamt. Before this, Germany's campaigns had been short enough and separated in time sufficiently to allow combat experience to be analyzed and incorporated into new designs. Now interim weapons had to be rushed into production while lessons from the front were digested and new designs developed.

The difficult situation was exacerbated on 19 December 1941, when Hitler relieved General Field Marshal Walther von Brauchitsch as Army Commander in Chief, and assumed the job himself. At this point the influence of the Heereswaffenamt, and in fact the entire army, began to wane. Rather than have General Fromm report directly to him, Hitler appointed the Chief of the *Oberkommando der Wehrmacht* (*OKW*, Supreme Command of the German Armed Forces), General Field Marshal Wilhelm Keitel, as

Deputy Army Commander in Chief. As such, Fromm was obliged to report to Keitel. Keitel's weak personality, combined with the absence of a dedicated Army Commander in Chief, put the army at a distinct disadvantage when competing with the air force and navy for scarce resources. In addition, Hitler's megalomania and paranoia began to affect the arms industry. His faith in the army's allegiance almost gone, Hitler began to trust more to loyalty than expertise, more in himself than his advisors.[13] In the words of General Leeb,

> The Commander in Chief of the Wehrmacht [Hitler] displayed increasing distrust and exerted increasing direct influence on technical matters. To an ever increasing degree the "revolutionary" element entered into the sphere of cooperation. Makeshift remedies gradually became the rule, the "specialist" was being suspected, amateurs were selected as leaders. The influence of the Party was growing constantly, the soldier, more than ever before, had to fight against the encroachments of the Party.[14]

On 8 February 1942, Fritz Todt died in an aircraft crash, and was succeeded by Albert Speer. With the change in leadership came a change in title; the Ministry for Armaments and Munitions became the Ministry for Armaments and War Production (Armament Ministry). While Speer's measures facilitated more efficient mass production, the increase came at a cost. The Ministry's relationship with the Heereswaffenamt and the Chief of Army Equipment, strained even in the latter days of Todt's leadership, began to crumble. The *Waffenamt*'s influence over development and procurement began to diminish, as the Speer's Ministry placed civilians (mostly industry representatives) in positions of responsibility. Development contracts, originally given to two or more firms were issued to only one, in the interest of time, with a resulting loss in design quality. The Chief of Army Equipment was no longer the authority for development and production orders; the Armaments Ministry, or more frequently Hitler,

directed which equipment should be procured. This led to reduced production of items of little interest to Hitler, but critical to the Army's operations; these included equipment as diverse as fire control equipment, field kitchens, and entrenching tools. As the Army's control over production was lost, increasing amounts of raw material and equipment were siphoned off to organizations of the Speer Ministry, the SS, or the Nazi Party.[15]

Hitler's faith in General Fromm, and consequently the entire Replacement Army and Army Equipment organizations, including the Heereswaffenamt, was lost completely with Fromm's presentation of the "Height of Power and Glory" memorandum in November 1942. While he kept his position, Fromm was never again granted access to the Fuehrer, and he effectively exercised no influence from that point on.[16]

Following the 20 July 1944 attempt to assassinate Hitler, Fromm was arrested, though later released by the Gestapo when the evidence bore out the fact that he had not been involved in the plot. Nonetheless, Fromm was court-martialed and sentenced to death for cowardice in failing to take sufficient measures to prevent the attempted coup.

With Fromm's death, *Reichsfuehrer* Heinrich Himmler, head of the SS, was appointed as Chief of Army Equipment and Commander of the Replacement Army. Himmler appointed *SS-Obergruppenfuehrer* Hans Juettner permanent deputy and de facto head of the organization. Juettner's previous position had been as head of the SS Main Operational Department and Organizer of the Waffen SS, and as such, he had experience in military organization and equipment. Himmler largely left Juettner to operate as he saw fit, though Himmler would demand preferential issue of equipment for the field units he nominally commanded in the last year of the war. Paradoxically, Juettner's appointment returned a large portion of the authority and power that Fromm's

fall from favor had lost, as Juettner could take action in the name of Himmler and the SS. However, the renewed power of the Chief of Army Equipment and Commander of the Replacement Army was too little too late; as Anglo-American and Russian forces converged in 1945, German production and distribution was increasingly hamstrung by incessant attack until the end.[17]

Summary

By the time of the antitank crisis on the eastern front, the Heereswaffenamt was in the midst of a planned cycle of armored vehicle development. This was completely disrupted by the appearance of the T-34, and designers scrambled to find a response. While General Leeb, as head of the Heereswaffenamt, was a source of friction for his superiors, the true challenge came in overcoming the mounting disfavor in which Hitler held the Chief of Army Equipment, General Fromm. As this tension increased, the appointment of Albert Speer as Minister of Armaments and War Production led to draconian measures to increase production. New designs were judged not only on technical merit, but also on their impact on the economy as a whole. Weapons that took advantage of existing tooling and technology were favored over new designs, unless the project had Hitler's personal interest. Further, until July 1944, industry played too large a role in development decisions, with civilian financial interest interfering in the tactical needs of the army. The Heereswaffenamt would have to answer the threat of the T-34, but satisfy the representatives of German industry and Speer's Ministry at the same time.

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[1]Carl Erik Koehler, *The Chief of Army Equipment and Commander of the Replacement Army in the Army High Command*, MS# P-041dd, trans. H. J. Baerwaldt and W. Luetzkendorf, ed. L. F. Schaefer (Washington: D.C.: Department of the Army, Office of the Chief of Military History, 1954), 146-147.

[2]Ibid., 11-16; Hellmuth Reinhardt, *The General Army Office*, MS# P-041ee (Washington: D.C.: Department of the Army, Office of the Chief of Military History, 1954), 1-2.

[3]Koehler, 115.

[4]Emil Leeb, *The Army Ordnance Office 1938-1945,*MS# P-041ff, trans. A. Rosenwald, ed. P. L. Muschamp, Draft Translation (Washington: D.C.: Department of the Army, Office of the Chief of Military History, 1950), 3.

[5]Ibid., 3, 13-16, 40; Koehler, 116-117.

[6]Reinhardt, 111-115.

[7]Dr. F. M. von Senger und Etterlin, *German Tanks of World War II: The Complete Illustrated History of German Armoured Fighting Vehicles 1926-1945*, trans. J. Lucas, ed. Peter Chamberlain and Chris Ellis (New York: Galahad Books, 1969); United States Joint Chiefs of Staff Combined Intelligence Objectives Sub-Committee, "Interrogation of Dr. Stiele Von Heydekampf, President of the Panzer Kommission," File No. XXVII-47 Item No. 18 & 19, 1945, 11, appendix 2 sheet 2.

[8]A list of key persons is provided in Appendix B.

[9]Koehler, 146-147; Reinhardt, 5-6.

[10]Koehler, 29-30; As an example, the army had planned on reaching its required ammunition stocks for war in 1945.

[11]Koehler, 150-151; Leeb, 5-6. Fritz Todt had joined the Nazi Party in 1923 and, in 1931, was appointed as a colonel in the SS. In 1933 he was made head of the Organization Todt, a quasi-military engineering corps, assigned projects such as construction of important military fortifications and the autobahn.

[12]Koehler, 162-164; As an example, by the fourth quarter of 1941, allocation of steel to army production was less than half of what was required.

[13]Koehler, 119-120, 143, 163-199; Leeb, 5-7.

[14]Leeb, 7.

[15]Koehler, 181-183; Leeb, 12, 17; This situation contributed to Hitler's near psychotic misperception of German strength as the war went on. Leaders of civilian industry cared little whether the recipient of their product was the Army, the Organization Todt, or the SS, while the Armaments Ministry continued to report all production figures to Hitler.

[16]Koehler, 178-179. The memorandum, which began, “At the height of power and glory it is proper to make an account.” stressed to Hitler the fact that Germany was at the apex of success, and that no further victories were possible. Accordingly, Fromm felt that all efforts should be made to consolidate success and sue for peace. The entirety of the memorandum is contained on pages 178-179 of Koehler’s work.

[17]Ibid., 196-201.

CHAPTER 3

THE CRISIS: RUSSIAN ARMOR AND GERMAN GUNS

The T-34 and KV-1 presented the greatest threat to German armor, and their descendents would continue to throughout the war. Despite indications that Russia possessed a design more advance than their own, the appearance of the T-34 was a profound shock to the Germans.[1] Almost nothing in the German inventory was capable of destroying the T-34 in 1941; 1942 would see a host of new equipment cobbled together to meet the Soviet armor.

T-34 and KV-1

Low, fast, heavily armed and armored, T-34s in their dark green summer or whitewash winter camouflage ranged across the battlefields of the Eastern Front in mounting numbers as the war waged on. First presenting isolated but stubborn pockets of resistance to the German invader, then stemming the enemy's advances at the gates of Moscow, Stalingrad, and Kursk, before finally carrying the Red Army banner into the streets of Berlin, the T-34 became a symbol of Russian armored might.

Building on lessons learned in combat in Spain, the Far East, and Finland, Russia began development of a new medium tank in 1939. Designated T-34, this was first placed in service in September 1940. The T-34 was an outstanding design, combining the attributes of speed, protection, and firepower in a vehicle that was simple for the Soviet arms industry to produce in quantity, and was not beyond the functional and maintenance capabilities of the average Russian soldier. Until late 1942, the T-34 was capable of defeating all German tanks, including the Panzer IVF, which mounted 50 millimeter

frontal armor. Conversely, very few German weapons were able to pierce the T-34's sloped armor. Sloping armor was a relatively new concept that allowed for increased protection by presenting a surface that induced deflection of horizontal shot and presented an increased cross section compared to the same thickness of armor.

The T-34 suffered from few problems, though key among these was a four-man crew, which required the commander to serve as gunner as well. Combined with a deficiency in optics when compared to their German opponents, these hampered the T-34 in long-range engagements. Produced in four main variants, the T-34/76 would be the front-line Russian medium tank until late 1943, and constituted a major portion of the Red Army's armored strength throughout the remainder of the war. Over 34,000 T-34/76s were produced between 1941 and 1944.[2]

The primary Soviet heavy tank throughout the first half of the war was the KV-1. At the time of its introduction in 1940, the KV-1 was one of the most powerful tanks in the world, though it was eclipsed by the superlative performance of the T-34. While the two vehicles shared similar armament, the KV-1 was less mobile, suffering from an incredibly poor transmission and greater weight of armor.

What the KV-1 lacked in mobility, it more than made up for in protection. The front hull armor was 75 millimeters thick, while that on the turret was 90 millimeters, making the KV-1 essentially invulnerable to almost all antitank weapons at any but point-blank range. While thick, the armor was not sloped as on the T-34, limiting the future potential of the tank. In time, the increasing lethality of German antitank weapons would lead to additional armor, further decreasing KV-1 mobility. A modified version, the KV-1S, was introduced in late 1942 to restore mobility and allow easier cooperation with T-

34 units. With lighter armor than the standard models the KV-1S proved unpopular, but its improved power plant and suspension played an important role in the development of Soviet tanks in the second half of the war.[3] More than 4,000 KV-1s were built before production ceased in 1943. Specifics of the T-34/76 and KV-1 are presented in table 2.

Table 2. T-34 and KV-1 Comparison 1941-1943

	ARMAMENT			ARMOR (actual / vertical equivalent, mm)		
	MAIN GUN	PENETRATION (mm @ vertical)		TURRET FRONT	HULL GLACIS	HULL SIDE
		500 yds	1000 yds			
T-34/41	76.2mm F-34	78	73	52	45 / 90	45
T-34/43	76.2mm F-34	78	73	70	47 / 94	60
KV-1A	76.2mm F-34	60	52	90	75	90
KV-1B	76.2mm F-32	60	52	120	110	90-130
KV-1S	76.2mm F-32	60	52	82	75	60

Notes: T-34 glacis sloped at 60° producing greater equivalent armor protection.
KV-1B hull augmented with bolt-on plates in some instances.

From the time of Barbarossa through 1943 then, the most significant qualitative threat to the Panzers were the T-34/41, with as much as 70 millimeters of well-sloped armor, and the KV-1 series, armored with 75-120 millimeters of armor, though not sloped as in the T-34. Both tanks mounted the 76.2-millimeter L/41.2 gun, capable of defeating all German Panzers of the time. In the following year, Germany would improvise numerous counters to the Russian threat, based upon existing weapons, both German and captured.

German Countermeasures, 1941

As German forces struggled to counter the thick hides of the T-34 and KV-1, and the ineffectiveness of the 37-millimeter *PaK* 36 and 50-millimeter *PaK* 38 became more apparent, the German Army turned to whatever weapon it could to stop the new Russian tanks. 1942 would see a host of improvisations fielded, based on experiences with the tools employed in the fall and winter of 1941.

Towed Antitank Guns

Germany began the war with the 37-millimeter L/ 45 *PaK* 36 serving as the primary antitank weapon at the company level and above.[4] As in France, its performance was severely lacking; appearance of the T-34 and KV-1 only exacerbated the problem. New weapons were obviously required.[5]

First among these was the 50-millimeter L/60 *PaK* 38, initially employed in Greece and North Africa in early 1941. While more powerful than the *PaK* 36, there were not enough available and they required the scarce *Panzergranate* (*Pzgr*) 40 round to be regularly effective against the Russian tanks.[6] Therefore, when large numbers of Soviet antitank guns were captured, the Germans put them into service.

The major Soviet type used by the Germans in the antitank role was the 76.2-millimeter L/54 *PaK* 36(r), converted from the Russian model 296 field gun. The gun was initially used with captured ammunition, and later rechambered for German ammunition. Performance was excellent; the *Pzgr* 39 round fired from the *PaK* 36(r) being able to penetrate the armor of both the T-34 and KV-1, though the latter would have to be inside 400 yards.

Success of the captured Russian weapons, and the need to improve upon the performance of the 50-millimeter *PaK* 38 led the Germans to develop the 75-millimeter L/46 *PaK* 40. While essentially a scaled up *PaK* 38, the *PaK* 40 was far heavier than the 50-millimeter weapon due to the shortage of advanced alloys used in the earlier weapon. The *PaK* 40 entered service in late 1942. Performance was very similar to that of the captured Russian *PaK* 36(r).[7]

The most powerful of all German antitank guns, the "Eighty-Eight", ironically, did not begin life as an antitank weapon. Originally designed as an anti-aircraft gun, the 88-millimeter *FlaK* 18/36 had already proven an exceptionally capable weapon at Arras in 1940, and would be used to great effect against British armor in the Western Desert. This weapon was developed into the 88-millimeter *FlaK* 41, with a lower overall height and modified mechanical arrangements to make it more suitable for the antitank role. Later in the war, further modified solely for the antitank role the 88-millimeter L/71 would serve as both an antitank gun (the *PaK* 43, towed or self propelled in the Nashorn and *Jagdpanther*) and as a tank cannon (the *Kampfwagenkannonen* or *KwK* 43 in the King Tiger) with outstanding performance. In any form, the 88-millimeter series of guns were able to defeat any tank of the war.[8] The performance of German antitank weapons in 1942 and 1943 is summarized in figure 2.

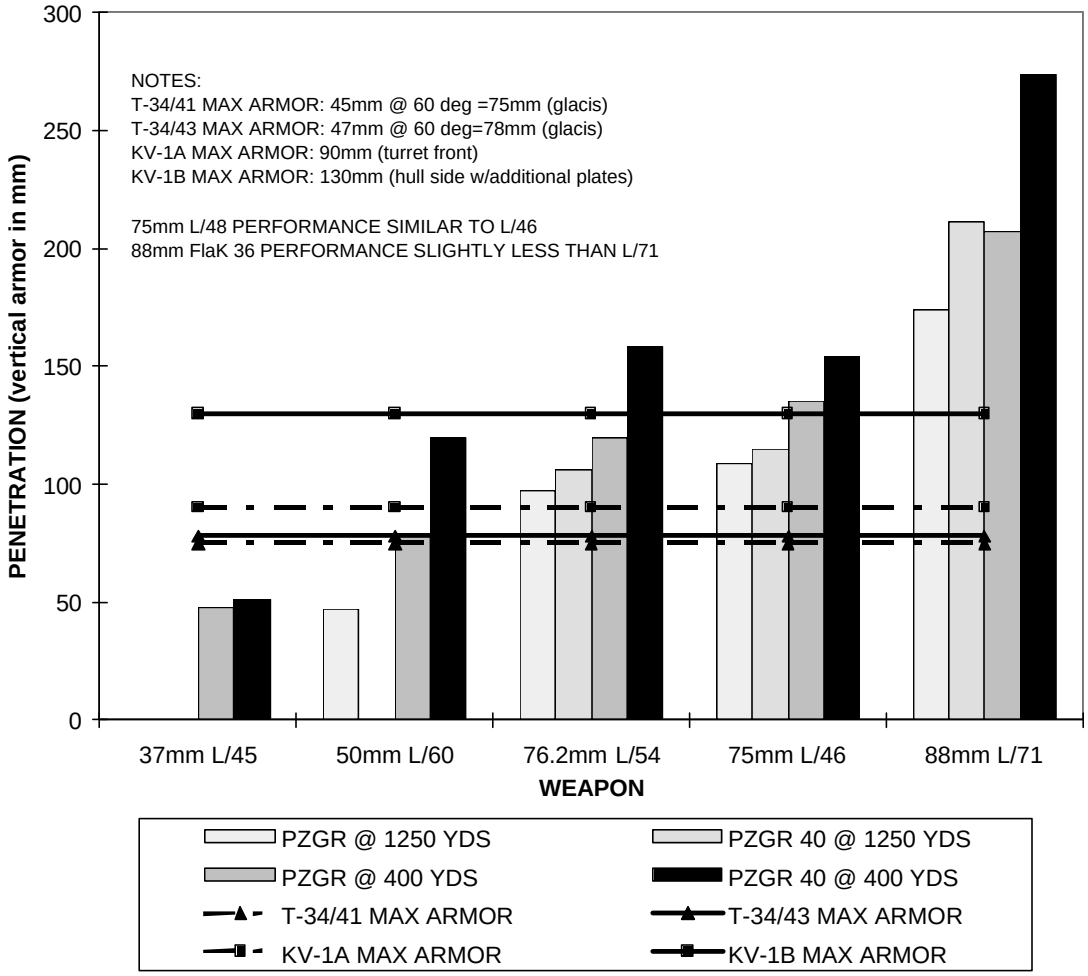

Figure 2. German Antitank Weapon Performance, 1941-1943

Panzerjäger and Sturmgeschütz

Given the limitations in up-gunning the existing Panzers and the vast amount of captured war material in German possession, the logical next step in producing a mobile antitank gun would be to mount a high-velocity gun on a readily available chassis.

The first of these weapons, the PanzerJäger (PzJg) I, was first manufactured in 1939, and was still in service in June 1941. Mounting a captured Czech 47-millimeter L/43.4 *PaK*(t) on the chassis of the Panzer I with light front and side armor, it provided

troops in infantry divisions with a more powerful and mobile alternative to the 37-millimeter *PaK* 36. Somewhat overloaded and awkward to maneuver, lightly armed and armored, and with an overall height of 8.5 feet rather difficult to conceal, the PzJg I nonetheless showed that, by foregoing a turret and full armor, antitank guns could be mobilized on tank chassis that would otherwise be obsolete.[9]

As Germany fought the second year of the war in the east, numerous vehicles in this mold were developed as interim solutions to the problem of mechanizing antitank weapons of sufficient power to defeat the T-34 and KV-1. While the high-velocity 75-millimeter and 88-millimeter weapons were demonstrating the ability to reliably knock out Soviet tanks, neither was in great supply at first. Further, the level of mobility required to keep up with the Panzer division spearheads required a tracked chassis. While gun crews had always been vulnerable to both small arms and high explosives, the relatively small size of the guns made concealment a valid method of defense. With the guns now mounted on vehicles, protection for the crew would have to be provided. The initial solution, building on experience with the PzJg I, was to mount Russian antitank guns on captured or obsolete tank chassis. Several combinations along these lines were produced, the most important being the *Marder* series.

The first of these was produced in response to a December 1941 Heereswaffenamt order for a self-propelled antitank vehicle mounting the captured Russian 76.2-millimeter gun. No development orders were issued, production beginning almost immediately in response to the urgency of need. The vehicles were very basic, consisting of the captured gun mounted with shield (but minus trails and wheels) on top of the superstructure of either a Panzer IID or E or Panzer 38(t) chassis. Light armor, open at the top and rear,

and a high silhouette were characteristics of both vehicles. Both vehicles entered service in early 1942, designated 7.62-centimeter *PaK 36(r) auf GW II Ausf D* (or *E* as applicable) *SdKfz 132 Marder II* (for the Panzer II version) or 7.62-centimeter *PaK 36(r) auf GW 38 SdKfz 139 Marder III* (for the Panzer 38(t) version). *MAN* and *Alkett* produced 185 early *Marder* IIs and *Böhmisch-Mährische Maschinenfabrik* (*BMM)* 344 early *Marder* IIIs.[10] Figure 3 shows an early *Marder* III.

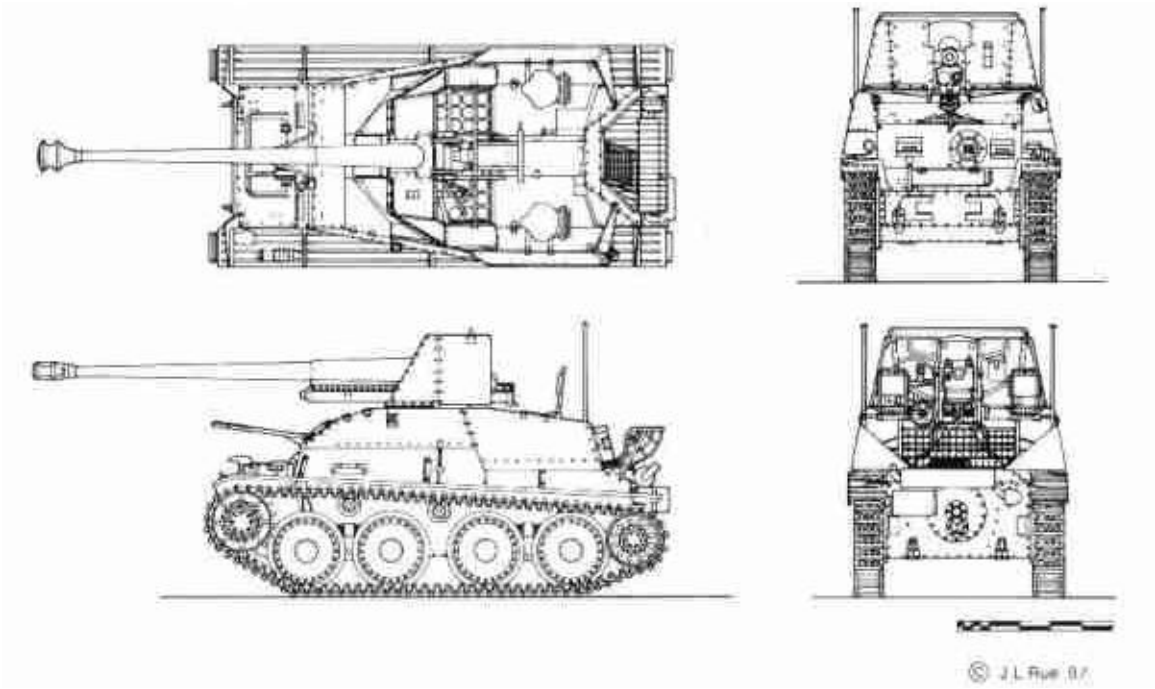

Figure 3. 7.62-centimeter *PaK(r) auf Gw 38(t) Marder III*, *SdKfz* 139

Source: Arsenal of Dictatorship, www.geocities.com/pentagon/2833

Following the first hurried *Marders*, the 75-millimeter *PaK* 40 came into service, the first German antitank gun capable of reliably defeating the T-34. With this, designs employing the new gun were ordered.

On 18 May 1942 the Minister for Arms and Armament ordered a new self-propelled antitank gun from the Heereswaffenamt (requirement 6772/42g). Development responsibilities were assigned as follows: chassis, *MAN*; superstructure, *Alkett*; armament fitting; *Rheinmetall-Borsig*. After trials with the 50-millimeter *PaK* 38 indicated this gun was insufficient to meet the Russian threat, the 75-millimeter *PaK* 40 was selected for employment. The new weapon was designated 7.5-centimeter *PaK 40/2 auf GW II Ausf A-C* or *F Marder II, SdKfz 131*, in reflection of the use of Panzer II A, B, C, or F chassis. The gun was still mounted in a lightly armored open top superstructure, though with a slightly lower profile than in the previous *Marder II*. The initial trials vehicles were delivered in June 1942, a total of 1216 being produced thereafter.[11]

The same order that resulted in the late-model *Marder II* was also answered by mounting the 75-millimeter *PaK* 40 on the Panzer 38(t) chassis. The first of these were issued in June 1942, and received the designation 7.5-centimeter *PaK 40/3 auf GW 38 Marder IIIH, SdKfz 138 Ausf H*. Similar in concept to the first *Marder III*, mounting of the *PaK* 40 required substantial modification to the chassis, which resulted in a severe top-heavy condition. Production continued until the design was modified in March 1943.

The requirement to modify the chassis to accommodate the *PaK* 40 stemmed from employment of the Panzer 38(t) chassis in its original form, with the engine compartment at the rear of the vehicle and the fighting compartment in the center. Accordingly, the engine was repositioned to the center of the vehicle in later versions, with the designation changing to 7.5-centimeter *PaK 40/3 auf GW 38 Marder IIIM, SdKfz 138 Ausf M*. Production ran from 1943 to 1944. This change provided not only a lower silhouette, but

also more room for the crew, and better protection. In total, 418 *Ausf H* and 799 *Ausf M* were produced, all by *BMM*.[12]

While not a perfect solution, the *Marders* proved successful at improving the mobility of medium anti-tank guns. Given the superlative performance of the 88-millimeter series of guns, attention was next given to developing a heavy antitank vehicle.

This requirement culminated in the *8.8-centimeter PaK 43/1 auf GW III/IV Nashorn* (Rhinoceros) *SdKfz 164*.[13] As the name implies, this was a *Marder*-like mounting of the 88-millimeter PaK 43 on a hybrid Panzer III/IV chassis. This chassis, an attempt at standardization of the Army's two main battle tanks, used the hull and running gear of the Panzer IV with the engine and transmission of the Panzer III. The engine was moved forward to just behind the transmission, producing a large, uncluttered fighting compartment at the rear, as in the *Marder IIIM*. Entering service with Heavy Antitank Battalions in November 1942, the *Nashorn* provided much-needed mobility for the 88-millimeter *PaK* 43, but the gun's weight (almost four times that of the 75-millimeter PaK 40) limited the amount of armor that could be carried. 473 *Nashorn* were produced.[14]

The weapon that showed the greatest potential to stem the Russian tide had never been intended as an antitank vehicle. The Sturmgeschütz (StuG) III, originally requested in 1936 as a close-support vehicle for the infantry mounting the 75-millimeter L/24 *Sturmkannon* (*StuK*) 37, employed the Panzer III chassis, but with a fully armored superstructure instead of a turret. The fixed superstructure was necessitated by the requirement for a low silhouette (six feet, four inches was achieved), however the weight savings allowed 50 millimeters of frontal armor to be mounted, more than on

contemporary German tanks. While reliable and successful, the appearance of the T-34 and KV-1 limited the usefulness of the StuG III while armed with the L/24 gun. On 28 September 1941, Hitler directed that future StuG variants be armed with the higher-velocity L/43 weapon, and up-armored. The resulting StuG IIIF was in service in early 1942, and shortly thereafter was up-gunned with the 75-millimeter PaK 39 L/48. The ultimate version, the StuG IIIG, was introduced in 1943 and carried 80-millimeter of armor, as well as having a redesigned superstructure. When armed with the high-velocity 75-millimeter guns, the StuG III was a viable counter to the T-34 and KV-1. The 10,000 StuG III produced during the war were responsible for destroying several times their own number.[15]

Lessons

The Eastern Front antitank crisis of 1941-1942 had been answered by improvisation and adaptation. The first generation of German tank destroyers, the *Marders* and *Nashorn* had proven effective, if awkward, counters to the T-34 and KV-1, but shortcomings limited their effectiveness. The lessons learned in areas of firepower, protection, and mobility would serve as a basis for further development.

Off all the German weapons available in 1942, only the 75-millimeter *PaK* 40 and the 88-millimeter *PaK*/*FlaK* series had been found to be adequate to deal with the T-34. The captured Russian weapons, though powerful, would not be available in sufficient numbers to arm new tank destroyer models. With improved models of both the T-34 and KV-1 appearing every year with heavier armor, it became obvious that only a high-velocity weapon of 75-millimeter caliber or greater would be appropriate.

Protection of the *Marders* and *Nashorn* were inadequate to the role they filled. Weight considerations limited the armor that could be mounted; the front armor provided protection against small arms fire, while the side armor only protected against shell fragments. Overhead and rear protection was non-existent, making the crew vulnerable to artillery and mortar fire. No protection was provided against the very tanks that the Panzerjägers were meant to face. Eventually increased frontal protection was provided by repositioning the engine compartment in front of the fighting compartment in the *Marder Ausf M*, but only with a major restructuring of the chassis.

Mobility was, of course, the driving factor behind the Panzerjäger concept. All of the designs, based upon existing tank chassis, provided sufficient operational mobility. Tactical mobility was increased over towed guns by virtue of all Panzerjägers employing tracked platforms, but there was some shortfall in agility. All of the *Marders*, with the exception of the *Ausf M*, mounted their guns on top of an existing design's superstructure, which made them top-heavy and difficult to maneuver, as well as presenting too great a silhouette. The *Nashorn* presented a high silhouette as well, though this is mitigated by the firepower and range capabilities of the 88-millimeter *PaK* 43. The gun, however, was too much for the chassis of the hybrid Panzer III/IV, which limited protection, and again made the vehicle difficult to maneuver.

In contrast to these designs, the Sturmgeschütz proved surprisingly successful in its unintended role of tank destroyer. The StuG III had demonstrated excellent protection, maneuverability, and, when armed with the 75-millimeter L/43 and L/48 guns, sufficient firepower to meet the Army's needs. Through use of a purpose-designed superstructure,

the StuG III mounted all-round armor protection, of greater degree than contemporary German tanks, and retained good mobility.

As 1942 drew to a close, the Heereswaffenamt began evaluation of these lessons in order to design a new vehicle that would improve upon the Panzerjäger and successfully equip the German Army's antitank force through the rest of the war.

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[1]Heinz Guderian, *Panzer Leader*, with a forward by Captain B.H. Liddell Hart, trans. Constantine Fitzgibbon (New York: E.P. Dutton & Co., 1952), 143.

[2]Tim Bean and Will Fowler, *Russian Tanks of World War II; Stalin's Armored Might* (St. Paul, MN: MBI Publishing, 2002), ch 5; Peter Gudgin, *Armored Firepower: The Development of Tank Armament, 1939-1945* (Gloucestershire: Sutton, 1997), ch 5; Valeriy Potapov, "Medium Tanks of the T-34 Series" [article on line] (accessed 26 February 2004); available from *The Russian Battlefield* http://www.battlefield.ru/t34_76_2.html. The first four variants of the T-34 were designated by their year of introduction, i.e., the T-34/41 being introduced in 1941. For clarity the designation "T-34/76" is used to refer to 1940-1943 models, reflecting the 76.2mm main armament of all four.

[3]Bean, ch 6; Gudgin, ch. 5; The KV-1, like the T-34, was produced in several variants. The designation system either mirrored that of the T-34, or used alphabetic subtypes, i.e., KV-1A. As all were substantially the same they have been grouped together as the KV-1.

[4]United States War Department, *Handbook on German Military Forces,* with a forward by Stephen Ambrose (Baton Rouge, LA: Louisiana State University Press, 1990), ch. II passim.

[5]The following references are used for German AT gun performance: Dr. F.M. von Senger und Etterlin, *German Tanks of World War II: The Complete Illustrated History of German Armoured Fighting Vehicles 1926-1945,* trans. J. Lucas, ed. Peter Chamberlain and Chris Ellis (New York: Galahad Books, 1969); Peter Gudgin, *Armored Firepower: The Development of Tank Armament 1939-1945* (Gloucestershire: Sutton, 1997); United States War Department, *Handbook on German Military Forces,* with a forward by Stephen Ambrose (Baton Rouge, LA: Louisiana State University Press, 1990); T.J. Gander, *German Anti-tank Guns 1939-1945*. (London: Almark, 1973). All provide similar data for weapons in most cases. Von Senger will be specifically sited and any discrepancies noted where they exist.

[6]Gudgin 185-186; *Panzergranate* (Pzgr) was the German term for anti-tank rounds. Usually the term was accompanied by a two digit numeric indicating the year of

the rounds introduction. The Pzgr 40 differed from the standard rounds in that it was an armor-piercing/composite rigid (AP/CR) round. AP/CR rounds used a tungsten core surrounded by light alloy support rings and nose cone. The tungsten core was capable of impacting targets at higher velocity than steel without shattering. The alloy frame work was necessary to compensate for the weight of the tungsten, which is greater than that of steel.

[7]von Senger, 209; Gander, 14-37.

[8]von Senger, 210; Gander, 26, 28; Gudgin, 235; Von Senger does not specifically site data for the FlaK 18/36, but calculations from barrel length supplied in the War Department *Handbook* indicated the FlaK 18/36 shared an L/56 length with the Tiger's 88mm KwK 36. As this weapon was used only in the Tiger I, data has been used for the FlaK 41 / PaK 43, which, like all subsequent 88mm German anti-tank weapons, had an L/71 rating, and was the heavy SP weapon of choice from 1943 on. It seems unlikely that the L/56 weapon would have been considered for use in the Jagdpanzer IV.

[9]Ibid., 23.

[10]von Senger, 27, 30, plates 213-218; United States Joint Chiefs of Staff Combined Intelligence Objectives Sub-Committee,. "Interrogation of Dr. Stiele Von Heydekampf, President of the Panzer Kommission", File No. XXVII-47 Item No. 18 & 19, 1945, appendix 2 sheet 2; Peter Chamberlain and Hillary L. Doyle, "Illustrated Summary of German Self-Propelled Weapons 1939-1945" in *Armored Fighting Vehicles of Germany*, ed. Duncan Crow (New York: Arco, 1978), 216; Numerous designations are applied to the series of *Marder* vehicles. The term Marder II and Marder III each apply to several vehicles, and each of these vehicles has multiple forms of nomenclature. Where there is variance in the sources, von Senger has been deferred to. In broad terms, *Marder II* is the Panzer II chassis armed with either the German 75mm or Russian 76.2mm gun. *Marder III* is the Panzer 38(t) chassis with the same armament. Not included is the *Marder I*, which mounted the 75mm gun on a captured French Lorraine Tractor chassis, as this combination was used only in France (von Senger, plate 205).

[11]von Senger, 27, plates 211 and 212; Heydekampf Interrogation, ibid.; Chamberlain and Doyle, 215; Heydekampf lists only 531 75mm *Marder* II being produced. *Ausf* is an abbreviation for *Ausführung*, which translates to mark (Mk) or model.

[12]von Senger, 30-31, plates 214-217; Heydekampf Interrogation, ibid.; Chamberlain and Doyle, ibid.; von Senger lists 75mm *Marder* III production as either 799 total for *Ausf H* and *M*, or 418 *Ausf H* and 799 *Ausf M*. Heydekampf lists 75mm *Marder* III production as 1217 as well.

[13]The Jagdpanzer IV(P) *Elefant* is not included, as this vehicle was based on the chassis from the abandon Porsche Tiger program, and was developed more to make use of surplus vehicles than in any sort of progressive development program.

[14]von Senger, 56, plates 222, 223; Heydekampf Interrogation, ibid.; Chamberlain and Doyle, 217; Gudgin, 234-235; The *Nashorn* was originally known as the *Hornisse* (Hornet), but this name was changed at Hitler's direction.

[15]Bryan Perrett, *Sturmartillerie and Panzerjäger* (London: Osprey, 1979), 7-8; von Senger, 39-40.

CHAPTER 4

THE DESIGN: THE JAGDPANZER *IV*

Design and Production

In light of the lessons learned in 1941-1942, the Heereswaffenamt issued a requirement for a vehicle designed solely for antitank work, using a 75-millimeter gun. In response, *Vogtlandische Maschinenfabrik AG* (*Vomag*) produced a wooden model, which was shown to Hitler on 14 May 1943 and approved for production. The first production model was completed on 20 October 1943 and, now given the designation Jagdpanzer IV, entered service in early 1944. From then on, the Jagdpanzer IV would see service on both the East and West Fronts in a number of variants.[1]

As a tank destroyer, the primary requisite of the design was necessarily firepower. Prior experience had shown weapons smaller than 75-millimeter to be ineffective. Accordingly, the 75-millimeter L/48 *PaK* 39 was chosen to arm the new Jagdpanzer. Like its towed counterpart the *PaK* 40, the *PaK* 39 was capable of defeating both the T-34 and KV-1 using either conventional or tungsten core ammunition. While even greater performance would have been possible with the 88-millimeter family of weapons, experience with the *Nashorn* had shown them to be too heavy for the hybrid Panzer III/IV chassis, let alone the smaller Panzer 38(t).

Choice of the Panzer IV chassis was dictated by several factors. The Czech Panzer 38(t) chassis was already in use as the basis of the *Marder* family of vehicles, and was capable of carrying the PaK 40; however, *Boehmish-Maehrische Maschinenfabrik* (BMM), the Czech manufacturer of the Panzer 38(t) was, in 1943, completely committed to production of *Marder* chassis.[2] Despite production by five companies, Panzer III

chassis were being wholly employed for both the Panzer III itself and the StuG III. The StuG III, though, especially when armed with the PaK 39, was an extremely successful tank destroyer. In 1943, the StuG III superstructure was mated to the Panzer IV chassis, producing the StuG IV. The new vehicle mounted the same 75-millimeter L/48 behind 80-millimeter of frontal armor.[3] With the Panther and Tiger designs still in development, and the StuG IV in service, it was a relatively simple decision for *Vomag* to develop an improved variant of the Panzer IV specifically for the antitank role.

With the 75-millimeter *PaK* 39 and the Panzer IV chassis decided upon, it remained to determine the vehicle's protection. Unlike the StuG IV, the Jagdpanzer IV was a completely new design, which allowed a revised interior and adoption of sloped armor. Forward armor on the first production Jagdpanzer IVs was 60 millimeters at a slope of 45 degrees, giving protection equivalent to over 80 millimeters of vertical armor. Early in the production run this was increased to 80 millimeters, yielding protection similar to 113 millimeters of vertical plate. Armor on the vehicle's other facings was much lighter, 20-40 millimeters, but provided protection against small arms and shrapnel, unlike in the Panzerjägers. The initial Jagdpanzer IV, fully designated Jagdpanzer IV *für 7.5*-centimeter *PaK* 39, was produced by *Vomag* with increasing output as its Panzer IV production drew down.[4]

In May 1944, *Vomag* began development of a Jagdpanzer IV armed with the 75-millimeter L/70 *StuK* 42. This gun, developed and initially produced in 1942 for the Panther tank, was able to defeat any Russian tank of the war. The new design, designated Jagdpanzer IV *für 7.5-centimeter StuK 42*, entered service in August 1944, *Vomag* shifting all production to the L/70 variant through August and September. This weapon

proved even more lethal than the earlier Jagdpanzer IV, but the increased weight of the long barreled gun made the vehicle nose heavy and awkward to maneuver, especially off road. Most vehicles with the *StuK* 42 were fitted with all steel internally sprung roadwheels replacing the first two conventional wheels on either side, but this did not fully eliminate the problem.

During 1944 it had become increasingly apparent that the Panzer IV design, limited by turret width to the 75-millimeter L/48 gun, would not be able to keep pace with Russian tank developments. In mid-1944, Hitler decreed that production of the Panzer IV as a battle tank was to cease in favor of using the chassis for self-propelled guns. While this potentially disastrous order was, by and large, essentially ignored, *Alkett* developed a prototype Jagdpanzer IV employing an unmodified Panzer IV chassis. Because the *Alkett* version was designed with a view to the most rapid production possible, the Panzer IV chassis was not modified from its original form, leaving the fuel tanks under the center of the vehicle. As a result, it was necessary to insert a 38 centimeter (15 inch.) vertical extension around the top of the chassis in order to raise the main gun's axis and provide for full elevation; the existing Jagdpanzer IV superstructure was then mounted on the extension. Because of this, the *Alkett* Jagdpanzer IV provided only half the effective chassis protection compared to the other Jagdpanzer IVs. The gun in the new vehicle was designated 7.5-centimeter L/70 *KwK* 42, though it was identical to the StuK 42.[5]

With the increased emphasis Hitler placed on the Jagdpanzer IV and his decree that the Panzer IV be phased out of production, L/70 versions of the Jagdpanzer IV were redesignated Panzer IV *lang* (V) or (A) depending on design; *lang* meaning long in

German, being used to differentiate from the L/48 versions of the Panzer IV.[6] Because of its nose-heavy characteristics and General Guderian's view that the Jagdpanzers were unnecessary, the crews christened the Panzer IV *lang* variants *Guderian's Ente*, meaning Guderian's Duck, or Chicken.[7] Over 1500 Jagdpanzer IV and Panzer IV *lang* (V) were produced, along with several hundred Panzer IV *lang* (A).[8] A Panzer IV *lang* (V) is depicted in figure 4. A list of Jagdpanzer IV variants is presented in table 3.

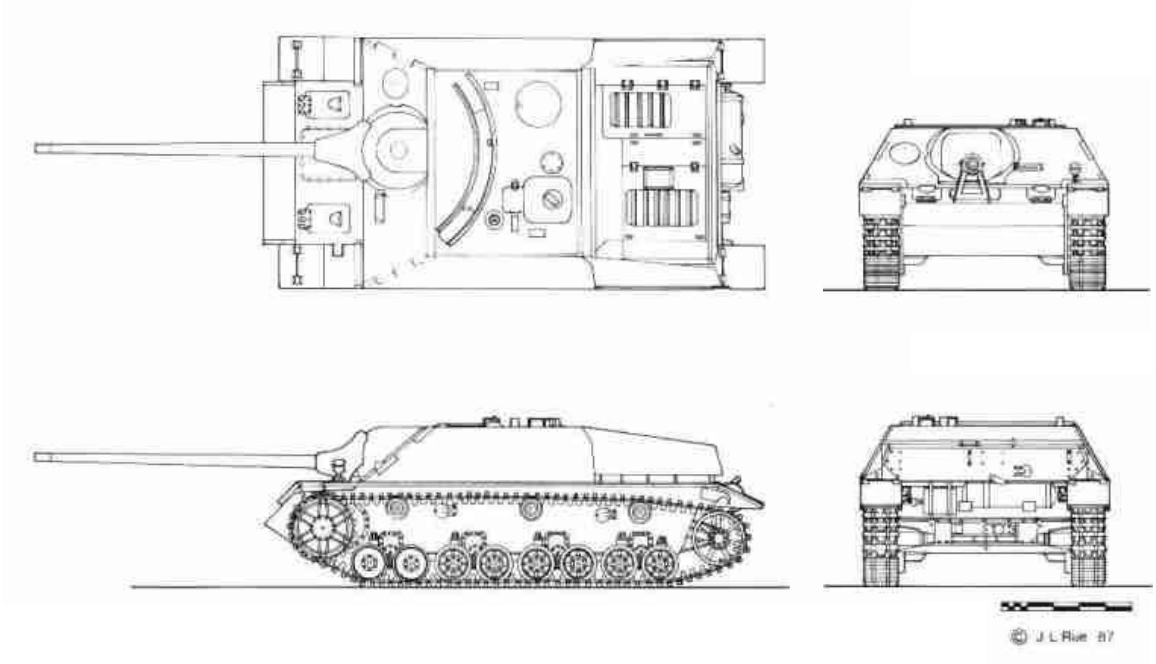

Figure 4. 7.5-centimeter Jadgpanzer IV/70 'Panzer IV *lang* (V) ', SdKfz 162/1

Source: Arsenal of Dictatorship, www.geocities.com/pentagon/2833

Table 3. Jagdpanzer IV Variants

	ARMAMENT			ARMOR (actual / vertical equivalent, mm)	
	MAIN GUN	PENETRATION (mm @ vertical)		SUPER-STRUCTURE	HULL GLACIS
		400 yds	1250 yds		
Sturmgeschütz IV	75mm L/48 StuK 40	135	109	80	80
Jagdpanzer IV	75mm L/48 PaK 39	135	109	60 / 84	60 / 84
Panzer IV lang (V)	75mm L/70 StuK 42	174	149	80 / 113	80 / 113
Panzer IV lang (A)	75mm L/70 KwK 42	174	149	80 / 113	80

Notes: Penetration with *Panzergranate* 40 round.
Jagdpanzer IV superstructure improved to 80 / 113 millimeters early in production.
Speed and range on-road are greater than off-road.
Vomag variants frontal armor sloped at 45-55 degrees.
Alkett variant hull 20 millimeters at 70 degree slope and 80 millimeters vertical extension.

Performance

The Jagdpanzer IV was designed as a tank destroyer, not a tank. It consequently differed in fundamental concept from tanks in many ways. Therefore, I have compared only the characteristics of firepower and protection in this chapter; further discussion of the Jagdpanzer concept is included in chapter five. Additionally, though not appearing on the battlefield until early 1944, the Jagdpanzer IV had been designed to counter the threats of 1941 and 1942, specifically the 76.2-millimeter armed variants of the T-34 and KV-1. An objective assessment of the Jagdpanzer IV's performance must be taken with this in mind. Accordingly, Russian armored threats have been segregated into three categories for comparison. These categories are described in table 4.

Table 4. Russian Armor Comparison Categories

DESIGN THREAT 1941-1942	FIELDING THREAT 1943-1944		FUTURE THREAT 1945
T-34/41	T-34/85	SU-100	JS-2
T-34/42	KV-85	SU-152	JS-3
KV-1B	JS-1	JSU-122	
KV-1S	SU-85	JSU-152	

All four of the Design Threat's tanks, the T-34/41, T-34/42, KV-1B and KV-1S, were armed with a 76.2-millimeter gun capable of penetrating 60-78 millimeters of armor at 500 yards, and 62-73 millimeters at 1000 yards. The maximum armor on the T-34/42 was equivalent to 94 millimeters of vertical plate, while the KV-1B mounted 120 millimeters.[9]

In both firepower and protection, the Jagdpanzer IV was easily superior to either the T-34/42 or KV-1B. Neither Russian gun was capable of penetrating the Jagdpanzer's frontal armor at either 500 or 1000 yards. Conversely, both tanks were vulnerable to the 75-millimeter L/48 at 500 yards, and even the KV-1's armor was hard pressed at 1000 yards. With the L/70 gun there is almost no comparison, both Russian tanks being defeated by the Panzer IV *lang* at over 1,000 yards.

It is not surprising that the Jagdpanzer IV held so great an advantage to either the T-34 or KV-1; the L/48 and L/70 versions of the 75-millimeter gun had been developed specifically to counter them.[10] By 1943 it was apparent to the Russians that their relative advantage over the Panzers had come to an end. While visiting Factory #112 following the Battle of Kursk, People's Commissar for Tank Industry V.A. Malyshev stated:

> Enemy tanks opened fire on ours at distances of up to 1,500 metres, while our 76-millimeter tank guns could destroy "Tigers" and "Panthers" at distances of only 500-600 metres. . . . A more powerful gun needs to be put into the T-34 quickly.[11]

Accordingly, Russia fielded a new wave of tanks and self-propelled guns in late 1943, aimed specifically at maintaining superiority over German armor. These vehicles form the Jagdpanzer IV's Fielding Threat.

With the utmost imperative to increase firepower, the Russian designers responded in much the same way the Germans had in 1942, by modifying a large-caliber anti-aircraft gun into an antitank weapon. This gun, the D-5 and its successor the ZIS-S-53, formed the main armament of the T-34/85 and the KV-85, as well as the new SU-85 tank destroyer. The SU-85, based on the T-34 chassis, was rapidly superceded by the 100-millimeter armed SU-100. A similar conversion using the KV-1 chassis with the 152-millimeter ML-20 cannon created the SU-152. Late in 1943, a small number of new JS-1 (named for Josef Stalin) heavy tanks were built and its chassis was used as the basis for the JSU-152 assault gun. Shortages of the ML-20 cannon led to substitution with the 122-millimeter D-25S, creating the JSU-122. This became the most effective Russian self-propelled antitank weapon of the war.[12] Characteristics of the Fielding Threat vehicles are summarized in table 5.

Table 5. Fielding Threat: Russian armor 1943-1944

	ARMAMENT			ARMOR (actual / vertical equivalent, mm)		
	MAIN GUN	PENETRATION (mm @ vertical)		TURRET FRONT	HULL GLACIS	HULL SIDE
		500 yds	1000 yds			
T-34/85	85mm ZIS-S-53	105	100	90	47 / 94	60
KV-85	85mm D-5S	105	100	100	75 / 86	60
JS-1	85mm D-5T	105	100	100	120 / 139	60
SU-85	85mm D-5S	105	100	45 / 70	45 / 70	45
SU-100	100mm D-10S	155	135	75 / 117	75 / 117	45
SU-152	152mm ML-20	130	120	75 / 87	N/A	60
JSU-122	122mm D-25S	152	142	80 / 92	N/A	90
JSU-152	152mm ML-20	130	120	80 / 92	N/A	90

Notes: Jagdpanzer IV front armor equivalent to 113 millimeters vertical.
75-millimeter PaK 39 L/48 500m / 1000m penetration: 135 millimeters / 109 millimeters.
75-millimeter StuK 42 L/70 500m / 1000m penetration: 174 millimeters / 149 millimeters.
T-34 glacis sloped at 60° producing greater equivalent armor protection.
SU-85 and -100 forward armor sloped at 60° producing greater equivalent armor protection.
ML-20 damage from impact induced spalling vice penetration.
SU-152 and JSUs glacis was so shallow as to present no target.
Very few KV-85 and JS-1 built.

It can be seen that the Jagdpanzer IV in its initial form would have been able to defeat all Russian 1944 armor out to 1000 yards, with the exception of the SU-100 and, possibly, the JS-1 (the glacis of the JS-1 was a very small fraction of the tank's forward silhouette). When equipped with the L/70 gun, the Jagdpanzer IV was capable of defeating all Russian Fielding Threat vehicles. On the defensive, the Jagdpanzer IV's sloped armor narrowly provided sufficient protection against the 85-millimeter D-5T, at least in frontal attacks, but the 100-millimeter D-10S and particularly the 122-millimeter D-25S would defeat the Jagdpanzer. While the SU-152 gained an impressive reputation, and was nicknamed *Zvierboy*, Animal Killer, for its ability to kill the entire "zoo" of

German armor, the Panther, Tiger, and Elefant, it was neither intended nor fully equipped for the antitank role.[13]

While mid-war Soviet designs were good, it was soon apparent that the larger 100-millimeter and 122-millimeter guns would be required in tanks as well as self-propelled guns in order to keep ahead of the German threat.[14] Accordingly, KV-85 and JS-1 production was limited while improvements were designed into the next Joseph Stalin tank. The resulting JS-2 mounted a high-velocity 122-millimeter gun and improved upon the JS-1s protection by sloping rather than adding armor. The JS-2 entered service in April 1944 and was a potent weapon, though never serving in numbers anywhere near as large as the T-34.

In the last year of the war, analysis and correction of the JS-2's weaknesses resulted in the JS-3, which introduced an improved hull design known as the "Pike Nose" and a reshaped "frying pan" turret, though retaining the JS-2s 122-millimeter gun. It is questionable whether or not the JS-3 saw service during the war, but it is included, along with the JS-2, in the category of Future Threat, in order to assess Jagdpanzer IV capability compared to Soviet designs following the T-34/KV-1 generation. JS-2 and -3 characteristics are provided in table 6.[15]

Table 6. Future Threat: Russian Armor 1945

	ARMAMENT			ARMOR (actual / vertical equivalent, mm)		
	MAIN GUN	PENETRATION (mm @ vertical)		TURRET FRONT	HULL GLACIS	HULL SIDE
		500 yds	1000 yds			
JS-2	122mm A-19	152	142	100	120 / 240	100 / 103
JS-3	122mm D-25T	152	142	250	120 / 388	* / 124

Notes: Jagdpanzer IV front armor equivalent to 113 millimeters vertical.
75-millimeter PaK 39 L/48 500m / 1000m penetration: 135 millimeters / 109 millimeters.
75-millimeter StuK 42 L/70 500m / 1000m penetration: 174 millimeters / 149 millimeters.
JS-3 side armor compilation of 30-millimeter skirt at 30 degrees and 90-millimeter vertical armor.
"Pike Nose" of JS-3 provided better protection than any other vehicle of the war.

Both the JS-2 and -3 presented formidable challenges to the Jagdpanzer IV in terms of both firepower and protection. While the Jagdpanzer IV had the potential to penetrate the turret front of either tank, both the JS-2 and -3 turrets had a substantial mantle, (the forward housing and armor supporting the main gun's barrel and recoil system) that provided considerable additional protection. Combined with the turret armor of the JS series, hits in this area were more likely to damage the gun than knock out the tank entirely. While it seems that Jagdpanzer IVs, and most other German armor, would be hard pressed to deal with either of tank until a flank shot presented itself, Russian metallurgy failings created an Achilles heel for the JS-2 and -3. As early as March 1944, Russian tests indicated that the 76.2-millimeter L/41 ZIS-5 (the towed version of the T-34/76's F-34) created significant spalling of the JS-2's armor at 600 yards. Attempts at tempering the armor proved too costly, and the JS-2 and -3 continued production with lesser quality armor.[16]

In summary, the Jagdpanzer IV was sufficient against either of the Russian tanks of 1941-1942 that it was designed to defeat, and was as capable as any other German

armor of destroying the Russian threats of 1943-1944. When compared to the Russian heavy tanks of 1945, the Jagdpanzer IV was limited in both firepower and protection. In large part, this was due to the Jagdpanzer IV's roots in a 1930's design and the technological developments of the Second World War. The last chapter will discuss, given this performance, Heereswaffenamt's degree of success or failure in designing a counter to the Russian armored threat of 1941-1942.

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[1]Dr. F. M. von Senger und Etterlin, *German Tanks of World War II: The Complete Illustrated History of German Armoured Fighting Vehicles 1926-1945,* trans. J. Lucas, ed. Peter Chamberlain and Chris Ellis (New York: Galahad Books, 1969), 53; Rudolf Lusar, *German Secret Weapons of the Second World War,* trans. R. P. Heller and M. Schindler (New York: Philosophical Library, 1959), 41; Peter Chamberlain and Hillary L. Doyle, "Illustrated Summary of German Self-Propelled Weapons 1939-1945" in *Armored Fighting Vehicles of Germany,* ed. Duncan Crow (New York: Arco, 1978), 220; For simplicity, all variants will be collectively designated as Jagdpanzer IV though numerous different designations were used both as a result of production modification and clerical changes in the German ordnance system. See also note 6.

[2]Albert Speer, *Infiltration*, trans. Joachim Neugroschel (New York: Macmillan, 1981), 89-91; Speer attributes the poor production at the BMM factory to mismanagement by the SS, which controlled all production in the Czech protectorate [of the Reich] until 1944. Once corrected, the Panzer 38(t) would be the basis for the successful Jagdpanzer*38(t)*.

[3]von Senger, ibid.; "Interrogation of Dr. Stiele Von Heydekampf, President of the Panzer Kommission". File No. XXVII-47 Item No. 18 & 19, 1945, appendix 2 sheet 1. Lusar, 32; Ian Hogg, *Tank Killing: Anti-Tank Warfare by Men and Machines* (New York: Sarpedon, 1996), 118; Von Senger states that the *StuG IV* was designed to fill production potential at *Krupp-Grussen* when Panzer IV production at that facility ceased. Hogg states that the *StuG IV* was produced by *Krupp-Essen* as a stopgap after Allied bombing interrupted *Alkett's* production of *StuG IIIs*. Though Hogg provides neither a source document for this statement nor a bibliography, his description seems plausible as both von Senger and Heydekampf identify *Alkett* as the primary *StuG* producer.

[4]von Senger, ibid..

[5]von Senger, passim; Chamberlain, ibid.. Heydekampf Interrogation, op. cit.. Peter Gudgin, *Armored Firepower: The Development of Tank Armament 1939-1945* (Gloucestershire: Sutton, 1997), 234; Hogg, 118-119; Thomas L. Jentz, *Panzer Tracts No. 9:* Jagdpanzer (Darlington, MD: Darlington Productions, 1997), 9-14 – 9-33.

[6]Nomenclature of the Jagdpanzer IV, especially the L/70 variants, is confusing at best. Von Senger refers to both *Vomag* variants as Jagdpanzer IVs, and the *Alkett* variant as Panzer IV *lang*, while Chamberlain refers to both L/70 variants as Panzer IV *lang*. Further complicating matters is the case of the Sturmgeschütz IV, which is sometimes classified as a tank destroyer vice an assault gun. While the StuG III and IV were unquestionably used in the anti-tank role, they were allocated to assault gun units and belong to that category. Much of the Jagdpanzer IV – Sturmgeschütz IV confusion may stem from some sources referring to the *Alkett* Jagdpanzer as *Sturmgeschütz neu Art* (new model) because the Jagdpanzer superstructure was simply attached directly to the Panzer IV chassis, much like the procedure that produced the StuG IV.

[7]Guderian believed the StuG III to be sufficient as a self-propelled gun, and felt production should have been focused on tanks. See also comments in Chapter 5.

[8]von Senger, 212; Heydekampf Interrogation, appendix 2 sheet 2; Jentz, ibid.; Von Senger and Heydekampf cite the same numbers; 1531 combined Jagdpanzer IV and Panzer IV *lang* (V), and 313 Panzer IV *lang* (A). Jentz lists 784 Jagdpanzer IV, 930 Panzer IV *lang* (V), and 278 Panzer IV *lang* (A). These numbers are based on monthly *Wa J Rue* production reports backed up by Ministry for Armaments and War Production reports and, in the case of the Jagdpanzer IV and Panzer IV *lang* (V), Strategic Bombing Survey reports from *Vomag*. The von Senger and Heydekampf numbers on the Panzer IV *lang* (A) are questionable, as they include 98 vehicles built in 1942-1943 and are therefore obviously not Jagdpanzer IV variants.

[9]Armor statistics can vary to a great degree between sources. In order to provide objective assessment, the following standards have been applied. Penetration figures measured against vertical armor have been used exclusively. Vertical armor equivalent of all vehicles has been computed using the following formula: armor thickness divided by cosine of the armor's slope from the vertical.

[10]Tim Bean and Will Fowler, *Russian Tanks of World War II; Stalin's Armored Might* (St. Paul, MN: MBI Publishing, 2002), 128-129.

[11]Valeriy Potapov, "The T-34-85 Medium Tank: Development History", trans. Douglas Rauber [article on line] (accessed 26 February 2004); available from *The Russian Battlefield* http://www.battlefield.ru/t34_85.html.

[12]Bean, 133-137; Valeriy Potapov, "Assault Guns of the ISU Series" [article on line] (accessed 26 February 2004); available from *The Russian Battlefield* http://www.battlefield.ru/isu122_152.html

[13]The ML-20 cannon was designed for infantry support and provided with only high explosive or semi-armor piercing rounds, explaining the relatively low penetration of its 152mm round. The sheer force of the round's impact, however, caused internal spalling sufficient to destroy any German tank of the war.

[14]Valeriy Potapov, “The T-34-85 in Action”, trans. Douglas Rauber [article on line] (accessed 26 February 2004); available from *The Russian Battlefield* http://www.battlefield.ru/t34_85_2.html; Russian armaments technology was deficient in interior ballistics (the design and performance of the round within the gun itself). Due to high barrel wear, it was not possible to simply increase the length of the barrel to increase velocity as it was with German guns.

[15]Bean, 139-142; Valeriy Potapov and Eugeni Boldyrev, “Development History of the JS-1/JS-2” [article on line] (accessed 26 February 2004); available from *The Russian Battlefield* http://www.battlefield.ru/is2_1.html.

[16]Potapov, JS-1/JS-2, ibid.

CHAPTER 5

CONCLUSION

Introduction

Germany developed a multitude of vehicles and systems to oppose the threat of Russian armor in the Second World War. The Jagdpanzer IV was the first fighting vehicle designed specifically as a tank destroyer by the Heereswaffenamt; its success or failure must be measured primarily in terms of performance against enemy armor, but the exceptional circumstances of procurement in the Third Reich provide a lens through which such judgment must be made. Further, analysis of the design can not simply be made against "Russian armor", a category so broad as to encompass light vehicles that were obsolete before the war began through heavy tanks that formed the basis of Soviet tank development for the majority of the Cold War. Accordingly, the Jagdpanzer IV will be judged against criteria of feasibility, acceptability, and suitability.

Feasibility is a measure of whether or not the technology required to support the design was available. The chassis, main gun, and armor are the elements that will be assessed for feasibility.

Acceptability is a determination of the design and its components against their perceived cost to other areas of production interest. By 1943, the Heereswaffenamt's influence had waned to the point that any design proposed would have to meet the desires of not only the Army, but also other government and civilian agencies as well. Unlike feasibility and suitability, acceptability is mostly subjective.

Suitability is a mostly empirical assessment of the design's effectiveness against its designed goals. In the case of the Jagdpanzer IV, this is the Russian Design Threat of 1941-1942.

While this analysis alone is sufficient to answer the question of whether or not the Jagdpanzer IV proved an effective counter to the antitank crisis of 1942, further lessons can be drawn from its development and fielding. Therefore, an examination will be made as to how well the Jagdpanzer IV performed against the Russian Fielding Threat and Future Threat in order to assess the Heereswaffamt's efforts in a dynamic technical environment.

Design Accomplishment

The Jagdpanzer IV was feasible by the standards of 1943, the year of its design. The Panzer IV chassis was in widespread production, was familiar to the entire armored force of the German Army, and most of all, was an inherently reliable design. Both the 75-millimeter L/48 *PaK* 39 and L/70 *StuK* 42 (in the form of the Panther's *KwK* 42) were also in production. The *PaK* 39 had been introduced in March 1942 and would serve, along with its variants, as the primary German tank and antitank gun throughout the war. The *StuK* 42, developed from the Panther's *KwK* 42, had been in production since June of 1942. Ammunition for both was in production and readily available.

Armor protection of the existing Panzer IV was recognized as being inadequate, and there was little prospect of either improving upon the metallurgical quality of the plate or providing additional thickness without incurring significant weight penalties. The appearance of the T-34 in 1941 had heralded a revolution in armored design, however. By 1943, the concept of sloping armor to provide enhanced protection was well

understood, and allowed nearly double protection with no increase in actual armor thickness between the Panzer IV and Jagdpanzer IV.[1]

Given the constraints of the procurement procedure by 1943 (described in Chapter 2), the Jagdpanzer IV design was acceptable. The convoluted nature of procurement in the Third Reich required that the design be acceptable to not only the Heereswaffenamt in particular and the Army in general, but also to the Ministry of Armaments and War Production, as well as civilian industry.

The Heereswaffenamt's and General Army Office's acceptability concerns revolved around how well the new vehicle could be sustained logistically, and whether or not the design could accomplish its tactical goals more efficiently through use of new techniques.[2] Logistic support was largely already in place, due to the commonality between the Panzer IV and Jagdpanzer IV and the use of existing gun types. The tactical goal of increased firepower was achieved through substitution of the rotating turret with a fixed superstructure large enough for installation of the powerful *StuK* 42. As described above, it was impossible to provide better protection for the Panzer IV without incorporating sloped armor, which would have required a production pause for retooling. Conversely, construction of the Jagdpanzer IV required factories to retool before beginning production; there was therefore no delay in incorporating the new armor design. Financial constraints were not a concern of the Heereswaffenamt in development; however, the Ministry of Armaments and War Production did base production decisions upon real and perceived needs and desires of industry.

By 1943, Germany had a desperate need for armored vehicles of all types. Speer's program of mass production and rationalization was beginning to show signs of

success, but with a corresponding price; production had to continue unabated. There was no room for delay, so with the exception of special programs, retooling for major industrial change was out of the question. The majority of new development and production capacity was tied up in the Panther and Tiger projects. *Henschel, MAN,* and *MNH* were all fully engaged in this effort; no chassis were available for tank destroyer production. Even had excess Panther or Tiger capacity been extant, neither design was mature enough to serve as a basis for a self propelled mount.[3] While the Panzer III was being phased out of production, much of the existing Panzer III capability was being shifted to StuG III production. *BMM*, in Czechoslovakia, was at (an artificially limited) maximum capacity producing the *Marder III* series.[4] With the StuG III incapable of mounting a gun larger than the 75-millimeter L/48, the only production capacity available for immediate development was in the Panzer IV program.

The Jagdpanzer IV was an eminently suitable vehicle measured against the Design Threat in the areas of firepower and protection, though somewhat lacking in maneuverability. Figure 5 illustrates the ranges at which the Jagdpanzer IV and Russian design threat armor (T-34/76 and KV-1) were capable of penetrating the other's armor.

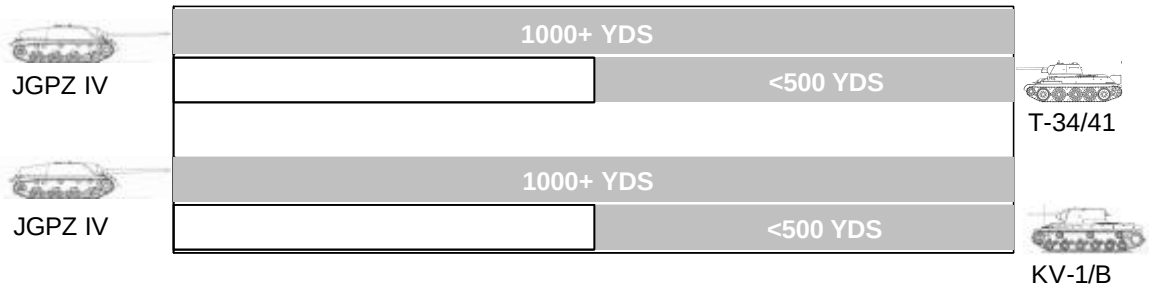

Figure 5. Jagdpanzer IV Design Threat Comparison

As can be seen, the Jadgpanzer IV, even with the less powerful (compared to the *StuK 42*) *PaK* 39, was capable of defeating both the T-34 and KV-1 well before it was vulnerable to them. It is important to note that German optics were significantly better than those of the Russians; German gunners were able to routinely engage targets at ranges over 1000 yards, a feat only the most skilled of their Russian opponents could duplicate, [5] making the Jagdpanzer IV's maximum effective range essentially equal to its maximum range.[6]

While more than adequate in terms of firepower and protection, the Jagdpanzer IV was somewhat deficient in maneuverability. General Franz Halder, *OKH* Chief of Staff, wrote after the war that an ideal tank-destroyer would achieve a horsepower to weight ratio of at least 14 hp/ton;[7] the Jagdpanzer IV was rated at only 11 hp/ton.[8] This was exacerbated by the entire Panzer IV family's maneuverability problems, which stemmed from a relatively narrow track coupled with increasing gross weight[9]. Nonetheless, as Halder notes, tanks had gained too great an advantage over towed guns as the former became more mobile, and the Jagdpanzer IV provided a much needed mobile, fully armored antitank weapon. Neither Jagdpanzers, nor the Sturmgeschütz that preceded them, were tanks, nor were they expected to perform like tanks (though they were often forced into that role).[10] The ability to mount a larger gun than a tank of corresponding size, and the fact that they were not expected to fight without infantry support, made the sacrifice of a turret in the Jagdpanzers and Sturmgeschütz tolerable. Indeed, Halder believed vehicles without turrets, being substantially lower than conventional tanks, would therefore be better able to accompany infantry in restricted terrain.[11] Though not ideal, the Jagdpanzer IV was more maneuverable than the *Nashorn*

and *Marders* that preceded it, and possessed adequate maneuverability to support mechanized forces.

In one respect, however, the Jagdpanzer IV's low silhouette worked against it. While its 1.8 meter height made it readily concealable, the Jagdpanzer IV's main gun was mounted at a firing height of only 1.4 meters; this made uneven terrain a greater impediment to the Jagdpanzer IV's line of fire than to almost any other armored fighting vehicle of the war.[12] This concept is illustrated in figures 6 and 7.

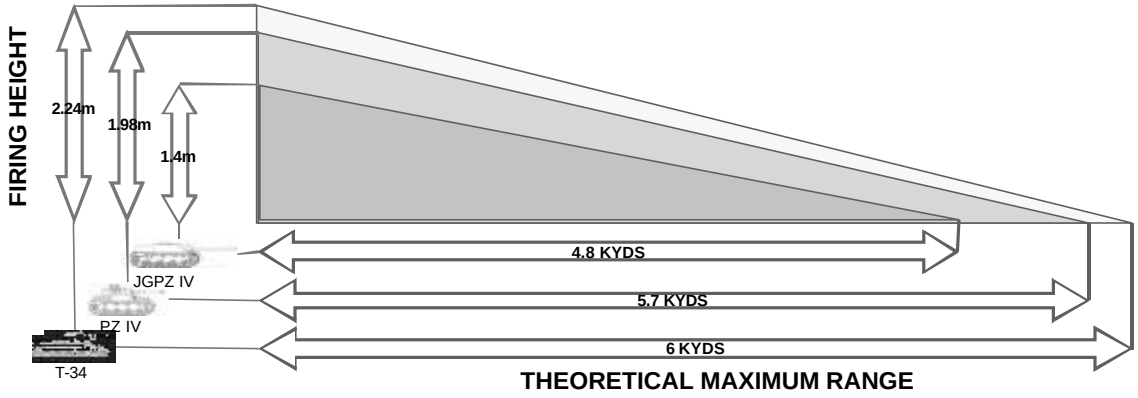

Figure 6. Firing Height / Maximum Range Comparison

As can be seen, increased firing height equates to increased theoretical maximum range.[13] All of the listed ranges are greater than the corresponding weapon's maximum effective range, however. The detrimental effect of lower firing height is illustrated by introducing an intervening obstruction, as in figure 7.

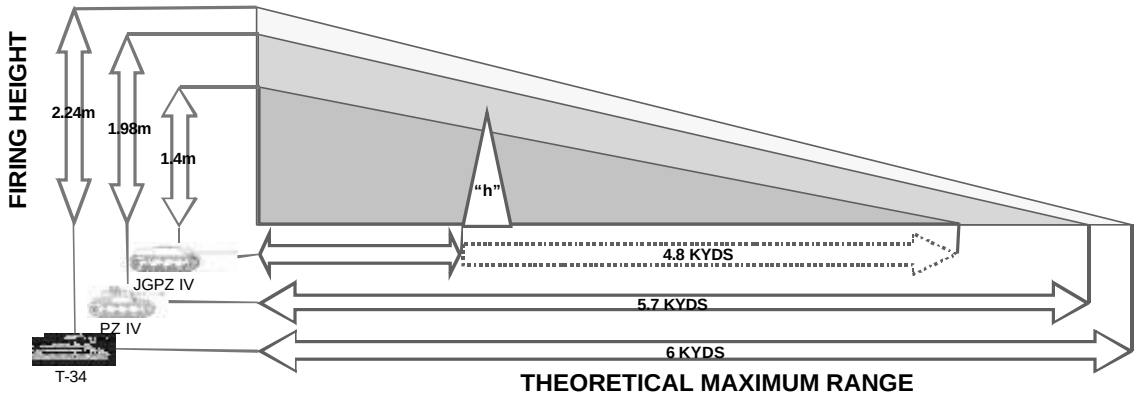

Figure 7. Effect of Lower Firing Height

The introduction of an intervening obstacle, or even simply uneven terrain, of any given height "h" will, at the appropriate range, block the Jagdpanzer IV's line of fire, but not the T-34's or Panzer IV's.

The tactical effect of this shortfall would be minimized when the Jagdpanzer IV was employed in a deliberate defense with sufficient time to select the best possible fighting positions. However, when establishing hasty defensive positions or in a fluid battle, as the Germans increasingly faced as the war progressed, the Jagdpanzer IV's low firing height would become detrimental. Though no specific information is available on the Heereswaffenamt's assessment of the Jagdpanzer IV's firing height, it can be assumed that the detrimental effect of low firing height was not foreseen in the design process. Further, once appreciated, it appears the Heereswaffenamt considered this trait unfavorable as following Jagdpanzers had greater firing heights than the Jagdpanzer IV.[14]

In total analysis, the Jagdpanzer IV was a successful design for countering the Russian armored threat of 1941-1942. It was technically feasible and acceptable to both the military and civilian industry. Most importantly, it was suitable to the task of

destroying the T-34 and KV-1 that plagued the German Army after the start of Barbarossa.

Fielding Threat Comparison

The Heereswaffenamt's efforts in designing the Jagdpanzer IV had not occurred in a vacuum, however. By the time of the Jagdpanzer IV's introduction in early 1944, the Russians had introduced a new generation of tanks and self-propelled guns that capitalized upon lessons learned about both German tanks' capabilities and Russian tanks' shortcomings. This generation, the Fielding Threat, is characterized by the T-34/85 and the SU-100. These vehicles were both developments of the original T-34 that were designed to counter the German Tiger tank, which appeared in late 1942. As such, they were both powerful vehicles, but logical, developments of the T-34, employing new features that were evolutionary rather than revolutionary and should have been easily foreseen by the Heereswaffenamt. The SU-100 in fact owed its heritage to the same source as the Jagdpanzer IV, the success of the StuG III in the antitank role. The Jagdpanzer IV was still successful against the Russian Fielding Threat, though the L/48 gun was only capable of penetrating the SU-100 within 500 yards. The Jagdpanzer IV had been designed with further development in mind however, and the deficiency against the SU-100 was overcome with the introduction of the L/70 armed Panzer IV *lang* variants.[15] Performance against representative vehicles (the T-34/85 and the SU-100) is depicted in figure 8.

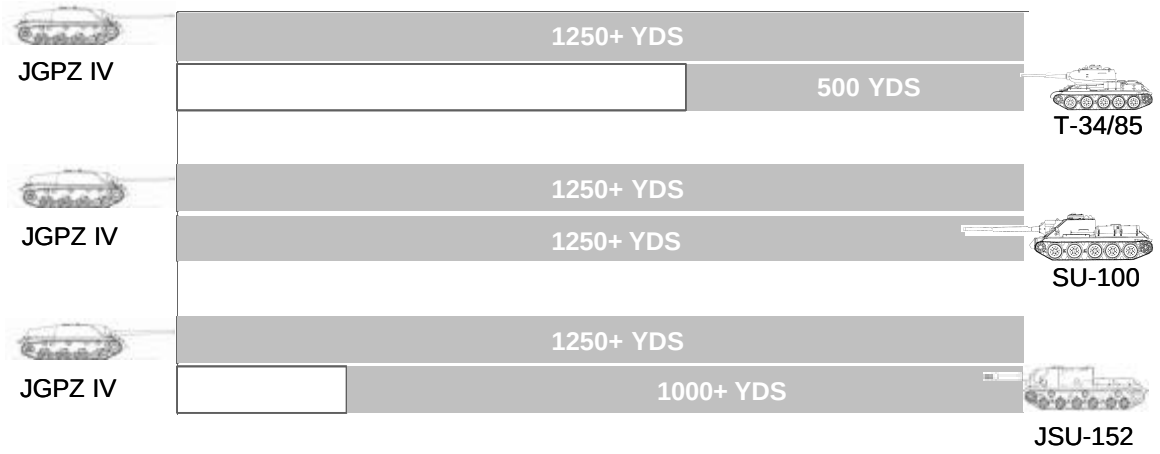

Figure 8. Panzer IV *lang* Fielding Threat Comparison

While the JSU-152, and particularly the SU-100 reached parity with the Jagdpanzer IV, the German's enjoyed notable technical advantages in ballistics and communications that negated much of the Russian vehicles' capabilities. Most importantly, the German superiority in optics again gave the Panzer IV *lang* a considerable edge; while the SU-100's 100-millimeter D-10S gun was comparable to the Panzer *lang's* 75-millimeter L/70 *StuK* 42, the Russians' inferior sights limited the maximum effective range of the D-10S to less than 1000 yards, as noted earlier. The ML-20 gun of the SU-152 and JSU-152, though not capable of actually penetrating the Jagdpanzer IVs armor at over 1000 yards, would produce potentially fatal spalling beyond this range. This was the case against almost all German tanks, regardless of armor protection, and again, shortfalls in optics reduced the probability of long-range hits.

By 1944, antitank guns were not the only threat to German armor. In this case, it was not the Russians but the Americans that fielded the most efficient Allied infantry antitank weapons. To fairly analyze the Jagdpanzer IV, it is therefore necessary in this

instance to deviate from the Russian standard of comparison. Infantry of all nations employed all measures at hand to deal with armored vehicles in desperate situations and, at close quarters, every vehicle was vulnerable to being disabled if not destroyed outright. Development of the hollow charge projectile however, made possible production of man-portable weapons specifically designed for destroying tanks. The most successful of these faced by the Germans was the American Bazooka.

While better than the antitank rifles that made up the majority of infantry antitank weapons that preceded it, the Bazooka was not routinely capable of defeating German tanks.[16] The Jagdpanzer IV's well sloped frontal armor was reasonable protection against the Bazooka, and the relatively lightly armored flanks were eventually protected (like those of many German armored fighting vehicles) with sheet metal "skirts" that prematurely detonated the hollow charge warhead of the Bazooka. While the Jagdpanzer IV's relatively thin side armor made it more vulnerable to this type of weapon than tanks of the period; it was projected that Jagdpanzers, as with the Sturmgeschütz, were not tanks and must be employed in close coordination with infantry protection to the flanks at all times.[17]

Though designed against the Russian armor of 1942, the Jagdpanzer IV had been planned with sufficient room for development that it was successful against the Russian designs of 1944, as well as, with the addition of "skirt" armor, hollow charge infantry weapons. This is reinforced by the standards for optimized armored vehicles set forth by General Halder after the war.

Halder called for a vehicle of no more than 35 tons, with a weapon of the highest possible muzzle velocity, but with a round small enough to be carried in quantity and

loaded by one man. Further, the vehicle should be no more than 6.2 meters long and 2.9 meters wide so as to fit easily on rail transport, and be less than 2.9 meters high to present a low tactical silhouette. He went on to state that firepower was the primary requisite, and that armor was secondary; this was to be accomplished by focusing armor at key points; in the case of a tank destroyer, on the front surfaces.[18]

While the Jagdpanzer IV fell short of the logistic transport requirements in length and width, it met all of Halder's tactical requirements; high velocity gun with manageable shell, low silhouette, and armor focused at the front of the vehicle. In short, the Jagdpanzer IV packaged decisive firepower in a relatively small, well defended vehicle. Moreover, the Heereswaffenamt designed this vehicle in 1943; fully two years full of development before the final battles that formed the basis of Halder's opinions.

All of this was accomplished using a basic platform that had been designed in 1934. This age, however, limited ultimate development potential of the Jagdpanzer IV. It was impossible to mount a more powerful gun in the Panzer IV chassis without hopelessly overloading the vehicle, as had been proven in the *Nashorn* design. Even the *StuK* 42 pushed the edge of the design's limits; its weight was so great that the Panzer IV *lang* variants so equipped required revised front road wheels to cope with the extra weight. This weight limitation also meant increased armor protection was not possible. Additionally, the gun created an overhang of more than seven feet, significantly reducing the Jagdpanzer IV's mobility over uneven ground. Against the Russian Future Threat JS-2 and JS-3, this would limit the Jagdpanzer IV's effectiveness. Performance against these tanks is illustrated in figure 9.

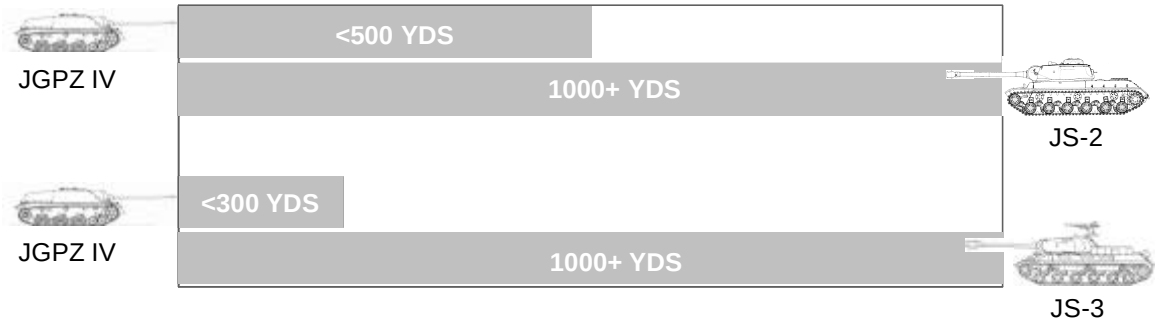

Figure 9. Panzer IV *lang* Future Threat Comparison

The diagram shows that the Jagdpanzer IV was at a significant disadvantage against both the JS-2 and JS-3. Though metallurgical problems (discussed in chapter 4) gave the Jagdpanzer IV a limited capability against the JS-2, the Russian tank grossly overmatched it. The JS-3 on the other hand, represented an entirely new concept in tank construction. The angling of forward armor in both the horizontal and vertical planes was a quantum leap ahead in armored vehicle design, as was the "frying pan" turret. Though the JS-2 and -3 were the final generation of Soviet heavy tanks, the technology they pioneered would influence tanks for the next decade. While the Heereswaffenamt had stretched the Panzer IV chassis to its fullest potential, its 1930s technology was simply unable to match the designs of 1945.

Conclusion

In the Jagdpanzer IV, the Heereswaffenamt developed a successful counter to the Russian armored threat of 1941 and 1942. Their design, though based on a tank almost ten years old, proved effective and adaptable enough to be operationally adequate against

even the following generation of Soviet armored fighting vehicles. It was only with the introduction of completely new concepts and technology that the Jagdpanzer IV reached obsolescence.

What conclusions can be drawn from the development of the Jagdpanzer IV? Most startlingly, the Jagdpanzer IV's decline from a powerful antitank weapon to near impotence took less than two years. To some extent, this can be seen as "bad luck"; the Jagdpanzer IV was one of the last weapons to be designed before the revolutionary JS-3 appeared. This belies the fact that if the Jagdpanzer IV were compared to the world's armories of 1941, only two years before its introduction, it would have been a truly formidable foe. The stimulus of war, applied to weapons of the industrial age, resulted in improvement at a pace never before seen.

This rapidity of change leads to the next question; how to effectively design a weapon system that will be survivable for not only the current generation, but also the next generation of threat? Obviously, the system's fundamental underpinnings have to be solid and reliable. The basis of the Jagdpanzer IV, the Panzer IV, though designed in 1934, was inherently reliable, and performed well. This allowed lessons from other vehicles (the Sturmgeschütz and the T-34) to be incorporated throughout the vehicle's life.

No matter how well new technology can be added to an old design, it will almost never be as satisfactory as a vehicle designed to take advantage of that technology. The solution to this is twofold. First, the design process itself must be efficient enough to produce a new weapon in relatively short order when necessary. Second, once involved in conflict, pure economic concerns must be reprioritized to some extent and new

vehicles developed once new technology requires, rather than the peace-time paradigm of "making-do" with new technology scabbed onto an old design. If a design infrastructure is robust enough to meet these standards, then the older design is required to "hold the line" for a minimum amount of time before new equipment restores superiority, or at least equality, on the battlefield.[19]

It is the lack of this type of design infrastructure that ultimately affected Heereswaffenamt development of an effective tank destroyer. While the Jagdpanzer IV was a success, it most likely was a waste of effort. The very vehicle that inspired the Jagdpanzer IV, the StuG III, was in full production when the Jagdpanzer IV was designed, and was in fact the most produced German armored fighting vehicle of the war.[20] The StuG III possessed equivalent firepower to the Jagdpanzer IV in the 75-millimeter *PaK* 39, and nearly the same armor protection as the early variants of the tank destroyer. It was not possible to simply produce StuG IIIs as tank destroyers, though, because *Wa Prüf* 4, the Artillery Branch, handled assault gun design while tank destroyer design was the responsibility of *Wa Prüf* 6. Had the StuG III been produced as a tank destroyer in place of the Jagdpanzer IV, significant savings could have been realized in key materials, notably copper, aluminum, and zinc.[21] Even without the later L/70 gun of the Jagdpanzer IV, the StuG III proved to be an effective tank destroyer. Introduction of the L/70 armed Panzer IV *lang* came several months *after* the introduction of the more powerful *JagdPanther*. The *JagdPanther* equaled or eclipsed the Jagdpanzer IV in all areas, yet less than 300 were produced, as compared to over 1500 Jagdpanzer IV.[22] Had Jagdpanzer IV development been rendered superfluous by use of the StuG III, far more resources could have been allocated to this more effective weapon.

This duplication of effort was relatively minor compared to the vast inefficiencies of the Third Reich; it is in some ways surprising that the Jagdpanzer IV or any other effective vehicles were produced. It provides yet another lesson however. When conflict reaches the point at which resources are stretched to their limits, unintentional duplication of effort can be harmful, if not catastrophic.

Though the nature of military technology continues to evolve from mechanical-centric to electronic-centric, these qualities still apply; rapidity of change, the need for expandability of design, the requirement for responsive design processes, and establishment of a procurement process that avoids unnecessary redundancy.

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[1]Dr. F.M. von Senger und Etterlin, *German Tanks of World War II: The Complete Illustrated History of German Armoured Fighting Vehicles 1926-1945*, trans. J. Lucas, ed. Peter Chamberlain and Chris Ellis (New York: Galahad Books, 1969), 43-58, 61, 211-212; Over 9,000 Panzer IV in a number of variants were produced during the war, not including chassis that were used for the Jagdpanzer IV as well as the *Nashorn / Hummel* hybrid, a weapons carrier, and a series of *Flakpanzers*.

[2]Emil Leeb, *The Army Ordnance Office 1938-1945*,MS# P-041ff, trans. A. Rosenwald, ed. P.L. Muschamp, Draft Translation (Washington: D.C.: Department of the Army, Office of the Chief of Military History, 1950), 11; The *Heereswaffenamt* developed and modified designs with a view to: functional security, production simplicity, use of new techniques, better efficiency, and conservation of scarce materials.

[3]Eventually the Panther, Tiger, and Tiger II would each serve as the chassis for a self-propelled gun. The *JagdPanther* tank destroyer, introduced in 1944, was the best German tank destroyer of the war, and possibly the best of any nation. In 1943 however, the Panther itself was still suffering from development problems that were exacerbated by Hitler's insistence that it be rushed into service for the Kursk offensive. The Tiger chassis was used for the *SturmTiger*, designed for urban combat, but very few were made, Tiger production being halted in favor of the refined Tiger II. The *JagdTiger*, based on the Tiger II, was exceptionally well armed with a 128mm gun, and equally well armored, but presented a nearly insurmountable transportation problem due to its weight and bulk. The Tiger II was nowhere near production in 1943 though, and would not have been an acceptable choice for the underpinnings of a new tank destroyer.

[4]See Chapter 4 note 2.

[5]Peter Gudgin, *Armored Firepower: The Development of Tank Armament 1939-1945* (Gloucestershire: Sutton, 1997), 208-209; Valeriy Potapov and Eugeni Boldyrev, "Development History of the JS-1/JS-2" [article on line] (accessed 26 February 2004); available from *The Russian Battlefield* http://www.battlefield.ru/is2_1.html; British Intelligence Objectives Sub-Committee, "Investigations in Germany by Tank Armament Research, Ministry of Supply" [article on line] (accessed 19 November 2003): available from http://www.warlinks.com/equipment/tank_research/contents.html; In British investigations after the war, it was found that the Heereswaffenamt standard, provided to at least both Rheinmetall and Krupp was no more than ± 50 cm dispersion in a one kilometer shot with a 75mm L/48 gun.

[6]Maximum range is the longest distance over which a weapon maintains sufficient power (in the case of an anti-tank gun this equates to penetration). Maximum effective range is the longest distance over which a weapon can be employed given its supporting equipment (sights, mounting, etc.).

[7]Franz Halder, *Integrated Armored Army*, MS# 39a/b, (Washington: D.C.: Department of the Army, Office of the Chief of Military History, 1950), 13.

[8]von Senger, 202.

[9]The gross weight of the Panzer IV had increased by almost 50% between the initial production models and the 1943 models (17 tons for the Panzer IVA as compared to 25 tons for the Panzer IVH).

[10]Though neither designed nor considered a tank destroyer per se, the StuG III, because of its anti-tank capability and German tank shortages, was sometimes issued to Panzerjäger (anti-tank) battalions and, as Germany's situation became desperate, even to panzer regiments.

[11]Halder, 12.

[12]Firing height, or trunion height, is the measure of distance above the ground of the main gun's centerline. The Jagdpanzer IV's firing height was 1.4 meters, compared to 1.96 meters for the Panzer IV, and 2.24 meters for the T-34 and Panther. Data taken from von Senger and Jentz.

[13]This effect is due to the curvature of the Earth. Maximum range for a direct line of sight taking the curvature of the Earth is computed using the following formula: square root of the firing height in feet multiplied by 1.17. The result is in nautical miles, equivalent to 2000 yards, or approximately 2 kilometers. The resulting slope is actually logarithmic, but is illustrated here as a straight line for clarity; the difference at the ranges being discussed is negligible.

[14]von Senger, 202; and Jentz 9-4, 9-16, 9-35, 9-50. The *Jagdpanther and Jagdtiger* had firing heights of 1.96 meters and 2.15 meters respectively. The Jagdpanzer

38 (sometimes known as the *Hetzer*) also had a 1.4 meter firing height, but was an expedient design to employ the Czech tank production capability that would otherwise have been squandered.

[15]The Heereswaffenamt had considered development of a 75mm L/70 armed Jagdpanzer as early as September 1942, but it is unclear why the L/48 was chosen as the initial armament. The most likely reason is the demand for the L/70 to support Panther production.

[16]U.S. Army Armor School, "Technology", Military History Supplemental Material, Armored Section Study Number 53, Section 6, United States vs. German Equipment, passim.

[17]Halder, ibid..

[18]Ibid., 6-13; The Jagdpanzer IV dimensions were: length – 8.6m, width – 31.8m, height – 1.8m, weight – 25.8 tons. It could carry 55 rounds of ammunition; less than the 80-100 called for by Halder, but far more than the 34 of the SU-100 and 20 of the JSU-152.

[19]The tanks that bracketed the Panzer IV chronologically also illustrate this point. The Panzer III was initially armed with a 37mm gun to achieve commonality with the infantry. Had it been armed from the outset with a 50mm gun it would have been a vastly more successful vehicle. The Tiger, designed in 1941, was not the result of combat experience against the T-34, but a massively armed and armored development of the concepts that developed the Panzer III and IV. This limited its development potential, much in the manner of the KV-1. The ultimate Tiger, the Tiger II, had more in common with the Panther than its earlier namesake.

[20]von Senger, 211-212; Over 10,000 Sturmgeschütz were produced. The next most common type, the Panzer IV, amounted to just over 9,000 vehicles.

[21]Ibid., 46.

[22]Ibid., 202, 209-212.

GLOSSARY

Armor-piercing, composite rigid (AP/CR). An antitank round consisting of a subcaliber dense core surrounded by a light steel or alloy nosecone and body of full-caliber only at the base of the nosecone and tail. The alloy nosecone would shatter on impact with the target, leaving the core to penetrate the armor.

Face Hardened Armor. Armor that has been manufactured such that its outer face that is very hard and brittle (and therefore not malleable) and an inner face that is less hard and brittle (and therefore more malleable). Though more complex to produce than homogenous armor, it was used extensively in early German tanks because of its ability to resist penetration. With the advent of sloped armor, however, face hardened armor became less effective than homogenous armor.

Firing Height. Distance above ground of a weapon's centerline. The greater the firing height, the less uneven ground or obstacles affect line of fire. Also known as trunion height.

Guderian's Ente / Guderian's Duck. "Nick-name" given to Jagdpanzer IV variants armed with long L/70 gun. Name based on the vehicle's nose-heavy handling, and Colonel-General Heinz Guderian's belief that the Jagdpanzer *IV* was unnecessary, given the performance of the *Sturmgeschütz* III. Sometimes translated as Guderian's Chicken.

Heereswaffenamt. The German Army Ordnance Office sometimes shortened to *Waffenamt.* A subordinate command of the German Chief of Army Equipment and Commander of the Replacement Army, its responsibilities were "design, testing, development, and acceptance of all ordnance equipment." The *Waffenamt* was divided into Groups or *Amtsgruppe.* The *Amtsgruppe für Entwicklung und Prüfung* (Development and Testing Group), known as *Wa Prüf,* was responsible for "development and testing of ordnance equipment for all arms and services."

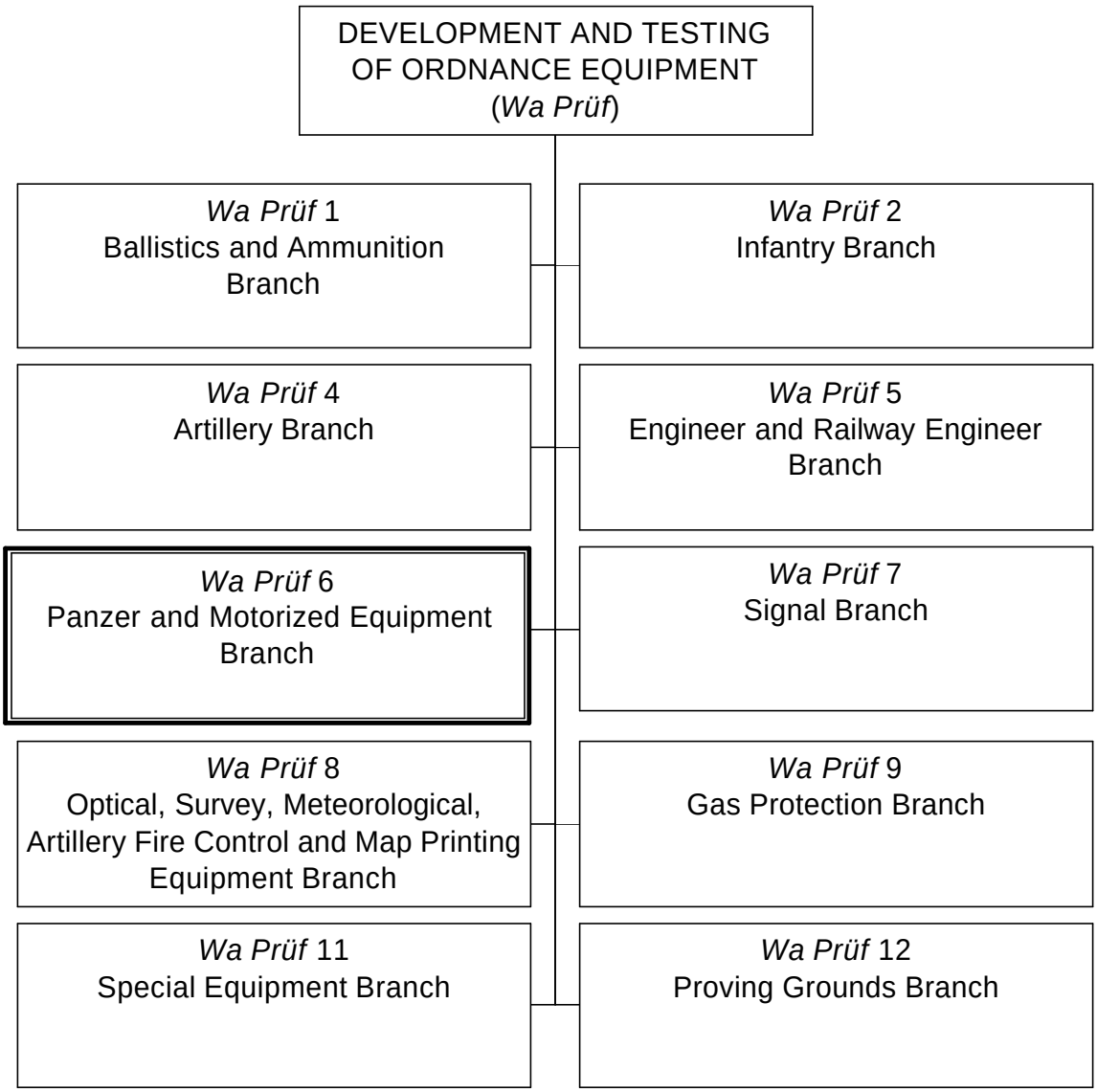
Homogenous Armor. Armor that has the same qualities of hardness and brittleness throughout its cross section. When used in sloped armor, homogenous plate is superior to face hardened plate because of its greater malleability.

Spalling. Fragmentation of interior of armor plate from intense impact that does not penetrate. Spalling can be just as, if not more, lethal to a tank crew than a penetrating round. Spalling can be mitigated by using homogenous armor.

Wa Prüf. Abbreviation for *Amt gruppe für Entwicklung und Prüfung* (Development and Testing Group). The *Wa Prüf* was divided into branches for development of specific types of equipment. *Wa Prüf* 6 was the branch responsible for Armored and Motorized equipment.

APPENDIX A

WA PRÜF ORGANIZATION



APPENDIX B

KEY PERSONS

Brauchitsch, General Field Marshal Walther von. Army Commander in Chief until retired / relieved by Hitler in December 1941.

Fromm, Generaloberst Friedrich. Chief of the General Army Office at the start of the war. Appointed Chief of Army Equipment and Commander of the Replacement Army. Delivered the memorandum "Height of Power and Glory" to Hitler in November 1942, falling from favor in the process. Though not involved, executed in the wake of the July 1944 plot to assassinate Hitler.

Himmler, *Reichsfuehrer* Heinrich. Head of the SS, appointed Chief of Army Equipment and Commander of the Replacement Army following Fromm's execution.

Juettner, *SS-Obergruppenfuehrer* Hans. Head of the SS Main Operational Department and Organizer of the Waffen SS. Appointed by Himmler as permanent Deputy Chief of Army Equipment and Commander of the Replacement Army.

Keitel, General Field Marshal Wilhelm. Chief of Staff of the Supreme Command of the German Armed Forces. Upon Hitler's assumption of Army Commander in Chief in December 1941, designated Deputy Army Commander in Chief.

Leeb, General der Artillerie Emil. Chief of the Heereswaffenamt throughout the war.

Olbricht, Generalleutnant Friedrich. Chief of the General Army Office after Fromm was appointed Chief of Army Equipment and Commander of the Replacement Army.

Speer, Albert. German architect, made Minister of Armaments and War Production upon Todt's death in February 1942. Responsible for rationalization program that increased German war production despite Allied bombing.

Stuelpanagel, General der Infantrie Karl von. First Commander of the Replacement Army. Relieved following dispute with Hitler, and replaced by Fromm.

Todt, Fritz. Minister of Armaments and Munitions. Died in plane crash, February 1942.

APPENDIX C

ARMORED VEHICLE CHARACTERISTICS

GERMAN TANKS

PANZER I
INTRODUCTION 1934
MAX ARMOR 13mm
(VERTICAL EQUIVALENT)
MAIN
ARMAMENT 2 x 7.92mm MG

PANZER II
INTRODUCTION 1935
MAX ARMOR 30mm
(VERTICAL EQUIVALENT)
MAIN
ARMAMENT 20mm KwK 30

PANZER IIIA-D
INTRODUCTION 1937
MAX ARMOR 30mm
(VERTICAL EQUIVALENT)
MAIN
ARMAMENT 37mm KwK L/45

PANZER IIIE-H
INTRODUCTION 1940
MAX ARMOR 30mm
(VERTICAL EQUIVALENT)
MAIN
ARMAMENT 50mm KwK L/42

PANZER IIIJ-L
INTRODUCTION 1941
MAX ARMOR 50mm
(VERTICAL EQUIVALENT)
MAIN
ARMAMENT 50mm KwK 39 L/60

PANZER IIIM-N
INTRODUCTION 1942
MAX ARMOR 70mm
(VERTICAL EQUIVALENT)
MAIN
ARMAMENT 75mm KwK L/24

PANZER IVA-F2
INTRODUCTION 1937
MAX ARMOR 50mm
(VERTICAL EQUIVALENT)
MAIN
ARMAMENT 75mm KwK L/24

PANZER IVF2-G
INTRODUCTION 1942
MAX ARMOR 50mm
(VERTICAL EQUIVALENT)
MAIN
ARMAMENT 75mm KwK 40 L/43

PANZER IVH-J
INTRODUCTION 1943
MAX ARMOR 80mm
(VERTICAL EQUIVALENT)
MAIN
ARMAMENT 75mm KwK 40 L/48

PANZER V "PANTHER"
INTRODUCTION 1943
MAX ARMOR 98mm
(VERTICAL EQUIVALENT)
MAIN
ARMAMENT 75mm KwK 42 L/70

PANZER VI "TIGER"
INTRODUCTION 1942
MAX ARMOR 100mm
(VERTICAL EQUIVALENT)
MAIN
ARMAMENT 88mm KwK 36 L56

PANZER VIB "TIGER II"
INTRODUCTION 1944
MAX ARMOR 130mm
(VERTICAL EQUIVALENT)
MAIN
ARMAMENT 88mm KwK 43 L/71

GERMAN SELF-PROPELLED GUNS

STURMGESCHÜTZ IIIA-E

INTRODUCTION	1940
MAX ARMOR (VERTICAL EQUIVALENT)	50mm
MAIN ARMAMENT	75mm StuK 37 L/24

STURMGESCHÜTZ IV

INTRODUCTION	1943
MAX ARMOR (VERTICAL EQUIVALENT)	50mm
MAIN ARMAMENT	75mm StuK 40 L/48

MARDER SERIES

INTRODUCTION	1942
MAX ARMOR (VERTICAL EQUIVALENT)	20mm
MAIN ARMAMENT	75mm L/48 or 76.2mm L/54

JAGDPANZER IV

INTRODUCTION	1944
MAX ARMOR (VERTICAL EQUIVALENT)	113mm
MAIN ARMAMENT	75mm PaK 39 L/48

JAGDPANZER 38(T) "HETZER"

INTRODUCTION	1944
MAX ARMOR (VERTICAL EQUIVALENT)	93mm
MAIN ARMAMENT	75mm PaK 39 L/48

STURMGESCHÜTZ IIIF-G

INTRODUCTION	1942
MAX ARMOR (VERTICAL EQUIVALENT)	50mm
MAIN ARMAMENT	75mm StuK 40 L/48

PANZERJÄGER I

INTRODUCTION	1940
MAX ARMOR (VERTICAL EQUIVALENT)	13mm
MAIN ARMAMENT	47mm PaK (t) L/43

NASHORN (PANZERJÄGER III/IV)

INTRODUCTION	1942
MAX ARMOR (VERTICAL EQUIVALENT)	30mm
MAIN ARMAMENT	88mm PaK 43/1 L/71

PANZER IV LANG (JAGDPANZER IV L/70)

INTRODUCTION	1944
MAX ARMOR (VERTICAL EQUIVALENT)	113mm
MAIN ARMAMENT	75mm StuK 42 L/70

JAGDPANTHER

INTRODUCTION	1944
MAX ARMOR (VERTICAL EQUIVALENT)	98mm
MAIN ARMAMENT	88mm PaK 43/3 L/71

RUSSIAN TANKS AND SELF-PROPELLED GUNS

T-34/41-43

INTRODUCTION	1940
MAX ARMOR (VERTICAL EQUIVALENT)	94mm
MAIN ARMAMENT	76.2mm F-34

KV-1/S

INTRODUCTION	1942
MAX ARMOR (VERTICAL EQUIVALENT)	75mm
MAIN ARMAMENT	76.2mm F-32

KV-85

INTRODUCTION	1943
MAX ARMOR (VERTICAL EQUIVALENT)	86mm
MAIN ARMAMENT	85mm D-5S

JS-2

INTRODUCTION	1944
MAX ARMOR (VERTICAL EQUIVALENT)	240mm
MAIN ARMAMENT	122mm A-19

SU-85

INTRODUCTION	1943
MAX ARMOR (VERTICAL EQUIVALENT)	70mm
MAIN ARMAMENT	85mm D-5S

SU-152

INTRODUCTION	1943
MAX ARMOR (VERTICAL EQUIVALENT)	87mm
MAIN ARMAMENT	152mm ML-20

KV-1/A-B

INTRODUCTION	1940
MAX ARMOR (VERTICAL EQUIVALENT)	110mm
MAIN ARMAMENT	76.2mm F-32

T-34/85

INTRODUCTION	1943
MAX ARMOR (VERTICAL EQUIVALENT)	94mm
MAIN ARMAMENT	85mm ZIS-S-53

JS-1

INTRODUCTION	1943
MAX ARMOR (VERTICAL EQUIVALENT)	139mm
MAIN ARMAMENT	85mm D-5T

JS-3

INTRODUCTION	1945
MAX ARMOR (VERTICAL EQUIVALENT)	388mm
MAIN ARMAMENT	122mm D-25T

SU-100

INTRODUCTION	1944
MAX ARMOR (VERTICAL EQUIVALENT)	117mm
MAIN ARMAMENT	100mm D-10S

JSU-152 / -122 1944

INTRODUCTION	1943
MAX ARMOR (VERTICAL EQUIVALENT)	87mm
MAIN ARMAMENT	152mm ML-20 / 122mm D-25S

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