engine. Therein is a reason why Rommel gave his loyalty to Hitler. With the ascent of National Socialism, the Prussian grip on military policy was weakened enough so that those whom Rommel called the General Staff *avant-garde*—those pushing for mobile warfare such as Heinz Guderian—finally were heard.[35] In North Africa he found the space and political distance needed to explore fully the elements of this new warfare.

In retrospect, Rommel's innovations do not seem particularly remarkable. Many of them are now commonplace in armies, and similar ideas had been tried much earlier—the innovations applied to British light infantry training by Sir John Moore around 1800 were in many ways similar to what Rommel did. What stands out is that Rommel knew immediately what needed to be done and brought his innovations to fruition so rapidly, creating the cohesive force he needed to fight desert warfare.

CHAPTER 7

Generalship: The Variables of Battle (continued)

The impact of ideology and primary groups on unit cohesion and the will to combat are among the unquantifiable variables of battle. In this chapter, the list of variables continues, turning to more-concrete if not precisely quantifiable factors.

Rommel, having transformed his army, expected his men to fight tenaciously. Such tenaciousness not only emerged from unit cohesion and a will to combat but was also directly related to the weapons carried into battle and the confidence the troops had in them. The list of weapons variables is lengthy and creates a complexity of what John Keegan called categories of combat,[1] that is, the weapons-versus-weapons encounters that developed in the North African theater of war. To avoid the inevitable confusion resulting from trying to articulate every possible combination, only the major encounters will be considered.

INFANTRY VERSUS INFANTRY

The desert war in North Africa is often viewed as a mobile conflict dominated by tanks, obscuring the fact that infantry played an important role on both sides.

Rommel believed that infantry should occupy and hold positions that prevented certain enemy operations or forced the enemy into actions they did not anticipate. Once their goal was achieved, "the infantry must be able to get away quickly for employment else-

where."[2] That meant infantry should be motorized and be able to establish defensive positions where needed. This concept worked very efficiently in May 1942 when Rommel sent Italian infantry into a frontal attack at Gazala as a ruse to lead the British 50th Division and South African brigades into thinking it was the main assault. At the same time, the 90th Light Division was sent around the south flank, cutting British access to supply depots east of Tobruk.

Not all was dash and surprise. The static warfare of the Tobruk siege together with heavy transport vehicle losses created infantry conditions more akin to World War I. As one German soldier observed, "A great many infantrymen marched to Tobruk!"[3] Some marches were as long as twenty miles a day, each man weighed down by his rifle, combat pack, and perhaps ammunition boxes, or a mortar base, or a 70-pound machine gun—and this under desert sun with little water. The German infantry discovered at Tobruk that they were not invincible. The Australians they faced adapted more easily to desert conditions, were better shots, were fierce in bayonet attacks, and were better able to take advantage of what little cover the desert offered.

With additional experience and further training, the German infantry brought excellent fighting skills to their future desert battles. The 90th and 164th Light Divisions, so significant as rearguard during the withdrawal across Libya, were formidable foes. The 90th Light consisted of seven battalions: four of motorized infantry; two anti-tank; and one field artillery. The infantry battalions were equipped with light and heavy machine guns, 81mm and 50mm mortars, and infantry guns—both the 75mm (7.5cm) I.G. 18 with a range of 3,900 yards, and the 150mm (15cm) I.G. 33 with a range of 5,140 yards.[4] The major innovation was in transforming the mission of the light infantry battalions, turning them into anti-tank units. Each squad, or section, within each infantry battalion was supplied with one of the 7.62mm guns captured from the Russians in 1941. The same gun was also used by one of the anti-tank battalions and by the field artillery. The 7.62mm gun was capable of penetrating 3.2-inch armor at 1,000 yards.[5] The second anti-tank battalion used the 50mm (5cm) Pak 38 gun that could penetrate 2-inch armor at 1,000 yards.[6]

At Second Alamein, in the northern sector of the battlefield, Montgomery ordered four infantry divisions to attack behind the cover of a massive artillery barrage. Their objectives were to clear paths through the German minefields, overrun the forward anti-tank gun

batteries, and create corridors so that armor could directly attack and destroy the German positions. The 2/24th Australians had to cover 2,000 yards of open ground to reach their assigned destination on what was called Barrel Hill just east of the Rahman Track. The soldiers of the 90th Light Division were waiting for them. They jumped into rifle pits and carefully sited machine-gun posts. Mortar batteries were positioned to the rear. And they were also supported by a deadly 88mm gun. The Australian infantry advanced into a fire storm reminiscent of their fathers' war on the Western Front. Within a short time, a battalion that originally numbered nearly a thousand men was reduced to eighty-five.

British armor fared no better against the German light infantry. The 9th Armored Brigade moved forward through the supporting 1st South African Division and discovered that the 164th Light Division, the first division organized in Germany expressly for use in North Africa,[7] was still intact. The 9th Brigade lost eighty-five tanks—three-quarters of their armor. In Rommel's hands, light infantry was a potent force that erased or blurred the old distinctions between types of infantry formations.

That potency was further demonstrated during the withdrawal from Egypt and across Libya. The 90th performed their role as rearguard to the *Panzerarmee*, keeping the Eighth Army at a distance. Montgomery usually offered the 51st Highland and 2nd New Zealand Divisions as the points of pursuit. But even though these two infantry divisions usually had to claw their way through minefields to approach German defenses, there were relatively few infantry battles and those at long range. The reason is that Rommel had no intention of defending the lines at El Agheila, Buerat, or Homs,[8] instead using what mobility was left to him to escape either before or just as the British attacked. Demodernization was taking effect.

The character of infantry encounters changed as the battle zone moved into Tunisia. Small unit engagements became more frequent as a consequence of the mountainous terrain. Moreover, in contrast to the great withdrawal from El Alamein during which the light divisions were so important, the *panzergrenadier* regiments, the German armored divisions' infantry component, asserted their firepower, becoming primary assault troops.

The quantity of infantrymen assigned to panzer divisions increased from 1941 to mid-1943, and the number of tanks decreased. Panzer divisions in North Africa consisted of two tank battalions augmented

by anti-tank guns, three *panzergrenadier* battalions, an artillery regiment, an anti-tank battalion, and a reconnaissance battalion. The *panzergrenadier* battalions were heavily armed, enabling them not only to overpower the more lightly equipped Allied infantry formations but also to act with considerable battlefield independence where necessary. One infantry battalion was typically mechanized, transported in armored personnel carriers; the other two (motorized) were carried in trucks. A motorized battalion was armed, presuming the standard pattern and optimum conditions, with sixty-nine submachine guns, fifty-four light machine guns, twelve heavy machine guns, and six 81mm mortars. Additionally, the battalion heavy weapons company was armed with seventeen submachine guns, two light machine guns, four 120mm mortars, and six 20mm anti-aircraft guns.[9] In contrast, a British infantry battalion was equipped with only six 3-inch mortars and numerous Bren guns, but they lacked tripod-mounted light and heavy machine guns. Consequently, British units often functioned "without the heavy weapons 'framework' their German counterparts took for granted."[10]

American infantry were marginally better equipped than their British counterparts. Three infantry battalions, each of three companies, formed the regimental core. Each regiment was supported by an anti-tank company, their main armament the 37mm towed anti-tank gun, and a cannon company armed with 75mm self-propelled howitzers mounted on M-3 halftracks and M-7 105mm self-propelled howitzers mounted on M-3 General Grant tank chassis. Both these self-propelled guns were vulnerable because the tops were open and exposed to small arms fire, hand grenades, and mortar fire. The M-7 also required considerable maintenance. Each battalion had a heavy weapons company armed with eight .50 caliber machine guns and six 81mm mortars. A few 60mm mortars and Browning Automatic Rifles gave the platoons added firepower.[11]

Small unit fighting is exemplified by the engagement at Tebourba, on the western edge of the Tunis bridgehead, where the 2nd Battalion, the Hampshire Regiment, battled from 30 November through 4 December 1942 against elements of the 10th Panzer Division's Battlegroup Lüder. German infantry, supported by artillery, mortars, and Mk III and Mk IV tanks, bore down on the Hampshires. British companies and sometimes platoons, supported by a troop of 25-pounders and a troop of 6-pounders, engaged the Germans in fire fights and bayonet charges, struggling for a corner of a wood here, a farm house there, or a line of slit trenches. Although stronger than the British, the Germans seemed rather indifferent to the task, so much so that the divisional commander Wolfgang Fischer went to the front, leading small units himself, encouraging his men in their attacks, and directing fire. Finally, the battlegroup surrounded the remaining Hampshires. Rather than surrendering, the Hampshires broke into small groups and tried to get through the German encirclement back to their own lines. Only 120 men of an estimated 800 made it.[12]

Around Christmas 1942, small unit action dominated the fight for Longstop Hill. The 2nd Battalion, Coldstream Guards, took the crest in a night attack, but the relieving 1st Battalion, 18th U.S. Infantry could not hold the position against repeated attack by the 69th *Panzergrenadier Regiment.* The strongest German positions were not atop Longstop Hill but on the Djebel el Rhar which, although a short distance away, could not be seen in the dark and did not appear on the maps. The Coldstreams attacked the djebel, but machine guns hidden in the cracks and crevices of the hill and mortars firing from the reverse slope cut them down. Driving the Coldstreams down the Djebel el Rhar, the *panzergrenadiers*, supported by tanks, moved against the survivors atop Longstop, pushing them from the crest and forcing them to retire all the way back to their departure point.[13] The British would not see the crest again for months.

At Kasserine Pass, Rommel first sent Hans von Luck's reconnaissance battalion racing along the road through the pass, undoubtedly thinking they could take the American defenders off guard. They were beaten back by artillery fire. At that point, Rommel sent the *Panzergrenadier Regiment Afrika* forward to take the hills flanking the road. The 2nd Battalion in which Heinz Schmidt served was trucked to the base of the Djebel Semmama, dodging artillery fire as they sped along. The men leaped from the vehicles and ascended the slopes, "using every rock and fold of ground for protection against American artillery and infantry weapons."[14] The short rushes forward, then hitting the dirt, scampering behind a rock, or leaping into a ground fold was not a very different experience, excepting scale, than a charge in World War I along the Western Front. Even though they managed to take some prominent high ground, they could not continue the attack west because of artillery fire.

Menton sent some units of his 1st Battalion scrambling up the Djebel Chambi as others moved west along the road. They too were

stopped by artillery fire. That night small German patrols probed the American lines, at times infiltrating positions or attacking suddenly from the flank or rear. Badly shaken by the night fighting, some of the engineers fled to the rear. But others held their ground, denying the Germans undisputed possession of the heights. Rommel opted for an armored thrust through the pass on 20 February. Preceded by an intense artillery barrage, the panzers broke through the defenders.

Rommel's mistake at Kasserine was in not committing enough infantry during the initial attack on the 19th to first secure the heights. Moreover, there was not enough artillery to suppress the American gunners, and the *Luftwaffe* failed to provide air cover for the advance. Armor could not do the job alone, but neither could the infantry. Thus, the first assault into Kasserine Pass lacked the integrated arms approach for which Rommel's forces were justifiably famous.

Violent infantry engagements took place as units of the 10th Panzers moved up the Thala road on 21 February. Their tanks ploughed into the 2/5 Leicestershire Regiment, holding the last defenses before Thala, the infantry fighting back with "sticky bombs"—a kind of anti-tank grenade. German infantry followed their tanks and, in the ensuing darkness, created enormous confusion amid the surviving Leicesters. Platoons, sections, and even individual soldiers fired at each other from behind rocks and slit trenches; grenades arced through the air; at close quarters the soldiers thrust bayonets and gun butts at each other; mortar bombs churned the earth; German machine-gun fire enfiladed the British flanks: This was the stuff of infantry battle. Despite the fear, confusion, and heavy casualties wrought by the German attack, the British infantry held their ground. Thala was not taken.

German infantry was feared and admired for the relentless character of their fighting. But the battles in central Tunisia revealed that the green Allied infantrymen who landed in Operation Torch were catching up to the Germans. They had accumulated some battle experience and gained confidence in their weapons and their facility with them. A comparison of rifles—any infantryman's most valuable weapon—gives some insight into the leveling process that took place between German and Allied infantry.

The Model 98 Mauser was the basic rifle used by German infantrymen. Although designed at the end of the nineteenth century, it underwent subtle design transformations; nevertheless the gun carried into Tunisia was fundamentally the same weapon carried in World

War I. But the German Mauser was, and remains today in sport conversions, an excellent weapon. It fires a 7.92mm bullet from a five-shot stripper clip. The bolt action used to place a cartridge in the chamber and eject a spent one is long and smooth operating. The gun's effective range was 800 yards, but a skilled marksman could easily add another 200 yards.[15] The long bolt pull and the necessity of removing the rifle from firing position to insert a new clip gave a firing rate of ten to fifteen aimed shots a minute.

British infantry used the Short Magazine Lee Enfield (SMLE, or "Smelly" to the troops), its basic pattern developed during the Boer War. The rifle used in Tunisia was Model Number 1, Mark III, designed just before World War I. Like the Mauser, the Mark III is a fine bolt-action repeating rifle; nevertheless, the British believed that they owned the superior weapon. It fires .303 caliber ammunition from a 10-shot clip easily and quickly inserted down into the magazine at the front of the trigger guard. The bolt is shorter and its action arguably smoother than the Mauser's. The result was a firing rate of twenty-five aimed rounds a minute. In another war, at Mons in 1914, captured German officers believed that British infantry, using the Lee Enfield, were firing machine guns.[16]

American infantry used the M-1 Garand, designed in 1929 and adopted by the Army in 1936. The M-1 replaced the 1903 Springfield, Mauser-like, bolt-action rifle, famous for its long-range accuracy. The Garand was a gas operated, semi-automatic rifle that shot a .30 caliber bullet. Firing a cartridge released gasses within the chamber, activating a mechanism that opened the bolt and ejected the used cartridge case. A spring mechanism automatically closed the bolt and positioned another cartridge in the firing position. Reloading was by an 8-shot clip through the open bolt cover. The empty clip automatically ejected after the last shot was fired. What the M-1 gave the American troops was firepower. The 8-round clip was emptied as rapidly as the trigger could be pulled. The rifle could be reloaded rapidly without taking it from the shoulder. Rommel, a shrewd judge of ordnance, must have been as envious of the M-1 as he was of American heavy equipment.

Undoubtedly, the superiority of the Lee Enfield and M-1 Garand over the Mauser contributed to the growing confidence of Allied infantrymen.

The Tunisian landscape was ideal for one of the most potent infantry weapons used: the mortar. The Germans used this support

weapon with considerable imagination. Night patrols probed British and American defenses, firing indiscriminately, enticing the Allied soldiers to return fire and revealing their positions. Then the Germans would pull back. Thinking they had the Germans on the run, the Allied soldiers ran after them. At that moment, German mortars, sited on the reverse slope of the hills, opened fire. This was very unnerving because mortar bombs do not make much noise as they descend. So shaken were British troops, that fear of mortar attacks accounted for 43 percent of psychiatric disabilities in Tunisia.[17]

INFANTRY VERSUS ARTILLERY

The traditional role of field artillery was redefined by Rommel during the early fighting in Egypt's Western Desert and across Cyrenaica. As Bruce I. Gudmundsson states, "The field artillery was both reduced in numbers and diverted from its now traditional mission of indirect fire by the additional task of serving as yet another means of combating tanks by direct fire."[18] The necessity of beating back tank attacks accounts as well for the abundance of anti-tank guns in infantry formations within the *Panzerarmee*, especially the light divisions. The long-range consequences of this change were disastrous.

As the British Official History points out, German field artillery was unbalanced and heterogeneous.[19] It was as if the Germans could not make up their minds what they wanted their field artillery to do and so put a variety of weapons in the field to cover all contingencies. Prominent were the 7.5cm (75mm) infantry gun and the 15cm (150mm) heavy infantry gun with respective ranges of 3,900 yards and 5,140 yards. The 10.5cm (105mm) field howitzer had a range of 13,480 yards.[20] These guns were good enough, but there never were enough of any one type nor enough ammunition to effectively engage in indirect fire missions or counter-battery fire for protracted time periods. Thus, early at Second Alamein, General Georg Stumme, commanding the *Panzerarmee* during Rommel's absence, refused to allow his artillery to fire on British troop and armored concentrations or engage in counter-battery fire to lessen Montgomery's opening bombardment. The result was that the 382nd Infantry Regiment of the 164th Light Division was so battered that they were overrun. The 90th Light Division lost half its men. The Trento Division's 68th Regiment simply disappeared.[21]

The British developed artillery domination during the Alamein battles and retained it into Tunisia. Prior to the Alamein battles, the British often used the 25-pounder gun in an anti-tank role. But Auchinleck concentrated his field artillery at First Alamein and brought Rommel to an abrupt halt. At Second Alamein the division of labor between field artillery and anti-tank roles was even more pronounced. The massive bombardment by a thousand field guns allowed the Eighth Army's infantry formations to penetrate Rommel's defenses. The advantage to the British was that their guns typically outranged German artillery. The 25-pounder fired 13,400 yards, the 4.5-inch gun had a range of 20,500 yards, and the 5.5-inch howitzer could fire 16,200 yards.[22]

Once in Tunisia, the heavy weapons framework of Rommel's *panzergrenadier* infantry was neutralized time and again by Allied artillery. At Kasserine Pass, Menton's *Panzergrenadier Regiment Afrika* made in-roads against Stark's U.S. 26th Infantry, taking several crests of the Djebel Semmama. But, descending the western slopes, the *panzergrenadiers* were stopped by American 105mm howitzer fire. The U.S. 6th Armored Infantry, supported by artillery, attacked the *panzergrenadiers* the next day, pushed them from most of the crests, and linked up with the remainder of Stark's 26th Infantry.

At Sbiba Gap, *Kampfgruppe* Hildebrandt charged toward the Allied defenders. The Germans received a shock as artillery shells from British 25-pounders and U.S. 105mm howitzers poured shells into pre-sited patterns, turning the plain the panzers crossed into a killing ground. The truck-borne *panzergrenadier* infantry, gamely thrusting forward with their tanks, were turned aside by the gunfire and never closed on the Allied lines. Hildebrandt made a feeble attempt to clear Allied infantry from the high ground around the gap. His only artillery were 7.5cm infantry guns, and there were too few of them. The next attack by concentrated armor, the one ordered by Rommel, failed. Infantry, its vulnerability to artillery fire exposed, did not join in the attack.

At Thala, von Broich's planned attack by the 10th Panzers never left the start line. British artillery—the ubiquitous 25-pounders playing a major role, and much strengthened by the timely arrival of LeRoy Irwin's American 105mm howitzers and the 155mm Long Toms that fired 27,500 yards—slammed the German front. Tanks pulled back, trucks swerved away from the line, and infantry scattered. Von Broich decided to wait—a fatal decision that gave Nick Force time to reinforce the defenses.

The Battle of Medenine was a triumph for British gunners. The three advancing panzer divisions were slammed by indirect fire from 350 25-pounders. The effect was ferocious. The ground shook violently. Shell splinters flew in all directions. Shock waves knocked flat the infantrymen who fled their trucks. Dust was everywhere, so thick that German artillery spotters could not call for counter-battery fire. The *panzergrenadiers* wandered about in shock, their confidence badly shaken by the ordeal. Those infantrymen who stayed in their trucks lurched forward into British anti-tank gunfire—6-pounders and newer 17-pounders that fired high-explosive shells. The soft-skinned trucks offered no protection.

Medenine is described as a slaughter by the historian David Irving.[23] That is an over-statement. Axis casualties numbered 635, two-thirds of them German (the British casualties were 130 killed and wounded).[24] British artillery fired 30,000 rounds. About forty-seven rounds were fired for every casualty. That is a simplistic ratio because not all casualties resulted from artillery fire and not all fire was directed at human targets. Nevertheless, it took a lot of ammunition to hurt one man. That is not news to soldiers. Killing or maiming the enemy is important in battle, but more important is the ability to create havoc and fear. British officers observed that the Germans who did break into the defenses seemed confused, especially along the 201st Guards Brigade sector where the fighting was intense. Therefore, the demoralization caused by artillery was more important in disrupting the attack than were the casualties. Guns and machines are nothing without focused men to turn them into lethal weapons. When that focus is shattered, the weapons become less effective. Advantage to the British.

ARTILLERY VERSUS TANKS

Infantry without artillery was vulnerable to tank attacks. A soldier might snap off a shot at a passing tank commander who was stupid enough to stand up in his turret hatch, or lob a grenade in frustration, or simply curse and shake his fist, as a British soldier did near Thala when a passing German tank scattered dirt into his slit trench.[25] The American bazooka was available but few in number, and the firing teams were ill-trained if trained at all. The British and Germans did provide infantry with anti-tank weapons, but their use demanded Victoria Cross courage. The British used the No. 74 (ST) anti-tank grenade, also known as the "Sticky Bomb." The cannister-shaped bomb weighed 36 ounces, had a five-second fuse, and was partially covered with an adhesive. The luckless infantryman slapped it against or hurled it at a passing tank. The grenade was used during the fight for the last ridge position before Thala, accounting for six German tanks.[26] The German version of the sticky bomb required the soldier to board a tank from the rear as it moved by and plant the device between the hull and the turret, then roll off the tank before it exploded.[27] Wanting to survive, soldiers typically threw the grenade at the tank.

Rommel realized during the invasion of France that anti-tank warfare needed to be more sophisticated than using sticky bombs, but the available 37mm Pak gun was inadequate. This little anti-tank gun fired APC (Armor Piercing Capped) shot. The cap prevented the shot from disintegrating when hitting armor. Unfortunately for the Germans, their shot merely bounced off the 78mm frontal armor of the British "Matilda" infantry tank. That is when Rommel utilized the versatility of the 88mm gun, turning the anti-aircraft weapon into an anti-tank weapon. But the 88, with a high profile, was difficult to conceal once in the desert. Furthermore, it was heavy and difficult to move, and its tractor sent up dust clouds that could be seen for miles. But the weapon developed such a reputation for accuracy and range that the British attacked 88 positions with reluctance.

The 37mm Pak gun, although remaining in use throughout the Tunisian campaign, was superseded by the Pak 38 50mm gun.[28] The Pak 38, together with the 75mm Pak 40 and the Russian 76.2mm guns, fired APCBC projectiles (Armor Piercing Capped Ballistic Capped), meaning that the APC projectile was given a streamlined cap to increase velocity and penetrating power.[29]

Rommel's use of these weapons demonstrated both skill and imagination in excess of his enemies. Two tactics used were leapfrogging and ambush.

Leapfrogging was perfected during Rommel's early desert campaign. The tactic required the front line to establish covering fire as a second line filtered through and established a new front. They put down covering fire as the former front line filtered through and established yet another line, and so on. In January 1941, for instance, having pulled back from Sidi Rezegh and Tobruk, Rommel launched an attack near El Agheila. The *Afrika Korps* advanced, supported by indirect artillery fire. Their tanks deployed in hull-down positions

from which they gave covering fire during the advance of 50mm anti-tank gun batteries that used direct fire against British anti-tank guns and armor. The tanks then advanced under that covering fire. And so the attack continued methodically and confidently, each arm supporting the other. The attack fractured the British who were forced into a wholesale retreat.

Rommel developed ambush into an art of desert warfare exemplified by the entrapment of British armor near Agedabia during the withdrawal from El Alamein. Colonel Menton's Special Group 288 were part of the rearguard. He positioned his regiment along a string of sand hills, looking east across gently rolling country. Heinz Schmidt, commanding a company of 288, immediately arrayed his 50mm and 76.2mm anti-tank artillery and covering machine guns behind a camel thorn screen. Mortars were hidden to the rear in a wadi. These skilled soldiers needed only a few minutes to establish their line. Taking a direct lesson from Rommel, Schmidt walked the ground in front of his guns to inspect their concealment. Suddenly, but not unexpectedly, a lookout shouted that tanks were coming from the northeast. Thirty Sherman tanks, probably from the 6th Royal Tank Regiment, moved into a shallow wadi to the German front and were soon joined by two gun batteries and infantry. Three Shermans advanced out of the wadi. The rest soon followed. Schmidt's gunners patiently, silently waited. The tanks reached a predetermined range and the Germans opened fire. One round scored a direct hit on the lead tank's turret—and bounced off. The tank stopped, then slowly turned away, exposing the flank armor to gunfire. The Sherman burst into flame. Schmidt commented that "We had found a vulnerable spot even in this [the Sherman] monster."[30]

Again and again British tanks charged forward, challenging German armor to come out and fight, as it were fleets of tanks engaging the enemy on a sand sea. For the British believed that the best tank destroyer was another tank.[31] But the Germans tricked the British land fleets onto their anti-tank guns. At Ruweisat Ridge in July 1942, the British 23rd Armored Brigade lost 167 Valentine tanks in a single day charging into German anti-tank gunfire.[32] The charges persisted. At Second Alamein, the 9th Armored Brigade lost seventy-five of ninety-four tanks as they charged toward German positions on Aqqaqir Ridge.

Rommel also lost many tanks during the desert campaign. At Sidi Rezegh in November-December 1941, the British destroyed 220

German tanks—85 percent of Rommel's strength. Most were hit when DAK commander Ludwig Crüwell called a counterattack by the 21st Panzer Division on 21 November—*Totensonntag*, or Sunday of the Dead or, in Americanese, Bloody Sunday.[33] Crüwell faced the division north and charged directly into the British defenses, a ruthless, bludgeoning maneuver that destroyed the 21st but probably saved the day for Rommel.

The British scrambled to catch up to Rommel's anti-tank tactics. How they did it was partially dependent on improving their anti-tank artillery. At the war's beginning the main British weapon was the 2-pounder (40mm) that proved effective against the lightly armored Italian tanks and the German Mk IIs they faced in France and in the desert. The 2-pounder worked well at ranges less than a hundred yards against the Mk III and IV models the Germans initially used. At longer ranges, the British solid shot usually bounced off. The 2-pounder continued to be used because of muddled war production planning, a familiar bogey in Britain. The more effective 6-pounder anti-tank gun, although designed in 1938, was not approved for production until 1940. By that time, with the fall of France and the Dunkirk evacuation, and with the Battle of Britain unfolding, the crisis of survival was at hand. The 6-pounder was lost in the flurry of Big Decisions necessary for immediate Insular defense. Thus, the 2-pounder, readily available and coming off the factory floors without need of re-tooling, stayed in service. The first 6-pounders did not reach North Africa until the late spring of 1942.

British anti-tank capabilities depended as well on improving their ammunition. The 2-pounder and early 6-pounder anti-tank guns could fire only solid armor-piercing shot. APC shot was not introduced until May 1942, and the APCBC shot came soon after.[34] The inability to fire high-explosive rounds remained. Solid shot was generally ineffective, for instance, against infantry and other anti-tank guns. The addition of the M-3 General Grant changed the situation somewhat because the American-built tank, as the historian Kenneth Macksey notes, "at last gave British tank crews a weapon [the 75mm gun] which could fire high explosives . . . against enemy anti-tank positions."[35] The Sherman tank added versatility because of its fully rotating turret.

Rommel witnessed at Alam Halfa the dangers of running his own armor onto anti-tank defenses without proper support. With fuel running low, and with the 7th Armored Division prepared to attack his

flanking maneuver, Rommel was forced to pull his attack away from the coast and re-direct it toward Alam Halfa Ridge, the hub of British defenses. The ridge, bristling with anti-tank guns, was beyond the reach of the *Afrika Korps*. At Second Alamein, Rommel's forces slowed the British advance, causing grievous casualties in both infantry and armored units. But when the 15th and 21st Panzer Divisions tried to counterattack from Aqqaqir Ridge, they charged into well-emplaced British anti-tank guns disguised amid the ruins of earlier fighting. At the beginning of Second Alamein, Rommel deployed about 200 tanks. He had only twenty left at the end of the battle. The British lost nearly 500 tanks. The significance of these numbers was that the British quickly replaced their losses; Rommel waited for what little he could get.

American anti-tank gun capability was weak as they entered the war. Even though the 57mm gun was developed, the 37mm nonetheless remained the principal anti-tank gun in infantry regiments. Like the British 2-pounder, the 37mm gun could not protect infantry against German tank attacks. U.S. Army planners, much impressed by the 1940 German blitzkrieg in France, concluded that infantry was vulnerable to armor if they passively waited to be attacked. A more aggressive posture was needed. They developed tank destroyer battalions to actively seek out enemy armored units and attack them before they reached American infantry formations.[36]

The M-3 halftrack mounting a 75mm gun gave weight and mobility to anti-tank artillery. But in Tunisia, tank destroyer battalion strength was dissipated by pressing the M-3s into frontline service with the M-7s for indirect fire missions. American anti-tank warfare did show its power when properly concentrated. Robinett's CCB met the *Afrika Korps* attack at Djebel Hamra on 21 February. Rather than running about looking for German armor, they let DAK come to them. The withering fire of two tank destroyer battalions, hull-down tanks, and field artillery brought an end to Rommel's plan of exploiting the Kasserine breakthrough to Tebessa.

At Medenine, three panzer Divisions rolled across an open killing ground against unseen Eighth Army positions. British artillery mercilessly hammered the divisions, dispersing the German infantry and tank formations. The British anti-tank gunners held their fire against the remaining panzers until the last moment, drawing them further and further into the trap and then firing at nearly point-blank range. German tanks that broke through the British gun line were quickly

destroyed. The anti-tank guns knocked out the clearly silhouetted lead tanks of the 21st Panzers that climbed to the top of a hill. In another action, a single anti-tank gun manned by a crew in its first tank battle destroyed five tanks.[37] When this armored *Götterdämmerung* was over, about 52 German tanks of an original 141 were left burning on the field. The Italians lost 41 tanks. The British did not lose any.

Medenine is one of the great ironies of military history: Rommel's panzers, so adept at entrapping British tanks in webs of anti-tank gunfire, were at last hoisted on their own petard, falling into the trap of masked British anti-tank guns. Indeed, John D'Arcy-Dawson estimated that 90 percent of tank losses in Tunisia were inflicted by anti-tank artillery.[38]

TANKS

Tank warfare already has been discussed as an element in infantry and artillery encounters, largely because of Rommel's combined arms approach to battle. Nonetheless, the next logical encounter is tank versus tank. That variable of battle would loom large were this study a general history of the North African war. But beginning with Rommel's withdrawal from El Alamein and continuing across Libya, the number of tank encounters diminished. Montgomery was reluctant to cut off the *Panzerarmee* with protracted desert sweeps, and Rommel avoided major battles for lack of equipment and fuel. Tank-versus-tank encounters in Tunisia, the battles at Faid Pass and Sidi Bou Zid notwithstanding, continued the downward trend. Tanks, so often effective on the flat sands of the desert, frequently bogged down in Tunisian mud and became entrapped by the mountainous terrain. Less-obvious reasons for diminished tank encounters must include the generals' perceptions of the quality of their tanks and their expectations of what the armor could achieve. Those perceptions and expectations in turn rested on the characteristics of the available tanks.

Rommel's theory of mobile warfare was straightforward: "Everything turns [on the tank] and other formations are mere auxiliaries."[39] Tanks should not be used to destroy other tanks. That role belonged to anti-tank artillery. Instead, tanks should be held for the moment when the enemy teetered toward disintegration. Then, under an intense artillery barrage, tanks would roll through the shattered enemy lines or sweep their flank to hit soft targets in the rear for-

mations, closing the pathways to escape, bringing complete defeat to the enemy.[40] Tanks had to be maneuverable, fast, and armed with a long-range gun. Increasing the thickness of armor for protection was defensive and could not compensate for poor speed and an inadequate gun.[41]

A variety of German tanks, from Rommel's first offensive in April 1941 into the summer of 1942, dominated the North African fighting.[42] The Mk II light tank, proven substandard in France, was obsolete in North Africa. Weighing only 10 tons and mounting a 37mm gun, the machine could not endure artillery fire or battle with British tanks. But its 26 mph speed made it useful in a reconnaissance role. The early workhorse of DAK was the Mk IIIJ that weighed 22 tons. The IIIJ carried a long-barreled 50mm gun (an earlier version was armed with a short-barreled 50mm gun) that fired both APCBC and high-explosive projectiles. Speed was 25 mph. The tank's 30mm armor was light, a defect supposedly rectified by adding 60mm spaced face-hardened armor plating. Sturdiness and reliability gave the tank a good reputation and long service. The first true medium tank used by DAK was the Mk IVF Special. A long-barreled 75mm gun replaced the short-barreled gun of an earlier version, extending range and increasing velocity. Its 50mm armor made it harder to kill than the Mk III. The Mk VI Tiger, introduced in Tunisia, was a monster. Weighing 56 tons, with 102mm armor and an 88mm gun, it moved cross-country at a credible 12 mph. But maintainance was a constant problem, and the tank was difficult to maneuver. Tigers easily bogged down in mud, becoming easy prey for Allied artillery. Although Rommel wanted von Arnim's Tiger detachment, he never really considered them essential to his plans.

The British entered the desert war with distinct advantages. First, the 7th Armored Division, trained in the Western Desert since the mid-1930s, understood the complexities of fighting in the bleak environment. Second, they began the war with a major victory when Richard O'Connor's Western Desert Force met the Italians head-on in late 1940 and, in February 1941, destroyed the Tenth Army at Beda Fomm. Third, the Matilda infantry tank was queen of the battlefield. With 78mm armor it was impervious to anything in the Italian arsenal. Even its slow 7 mph cross-country speed and 2-pounder gun were not drawbacks when fighting Italian "sardine tins."

But the Matilda fell into obsolescence against faster moving, better gunned German tanks. Something of an inferiority complex festered

within the Eighth Army based on the shared belief that their armor was not as good as the Germans, and that a three-to-two superiority in tank numbers was needed to achieve battlefield parity.[43]

British tanks, at first glance, did seem inferior. The thinly armored Vickers Mark VI was a gas-driven high-profile coffin that even the Italians stopped. The American-built M-3 Stuart, the Honey, replaced the Vickers in 1941. Mounting a 37mm gun, with 43mm armor, and 35 mph speed, it dominated the Italians but was outgunned by the German Mk IIIs and IVs. Vickers Cruiser-class tanks, some six models of them, proved inadequate against the Germans. Their 2-pounder guns were ineffective at ranges above 200 yards, and they consistently broke down. The Valentine tank proved more reliable. Carrying 65mm frontal armor and with a cross-country speed of 8 mph, the tank withstood considerable punishment. Unfortunately designed for the 2-pounder gun, Valentines had to move well within German gun range to be effective. In Tunisia, the Valentine Mark IX series mounted a 6-pounder gun, but it was squeezed into the turret made for the 2-pounder. That reduced the turret crew from three to two men, leading to inefficiency in loading and firing, and diminished the on-board ammunition supply.

The Churchill Mark III overcame some of the early deficiencies. Even though clanking along at only 6 mph, it could climb steeper gradients than any German tank, a great advantage in Tunisia. Its 88mm armor withstood most German gunfire. The Churchill's 6-pounder fired APC, APCBC, and high-explosive shells. That was a better gun than any other British tank carried—but it was not good enough. For by 1943, the standard tank gun was the 75mm. British designers of the Churchill failed to maintain, much less anticipate, modern tank trends.

No wonder that the British relied more and more on American tanks. The General Grant was a good stop-gap machine until the M-4 Sherman was supplied to the Eighth Army. The 75mm gun fired APC, APCBC, and high-explosive shells. The tank's 88mm frontal armor was impervious to most any German gun except the 88mm. Welded construction, a molded fully rotating turret, and mechanical reliability in desert conditions gave the crews equality with German tanks and a measure of needed confidence.[44]

But the belief that British tanks, despite their lean specifications, were inherently inferior to the German machines was a myth that conveniently cloaked tactical and organizational ineptitude: The pref-

erence for unsupported tank attacks; the related lack of integrated arms tactics; the jealousy between branches of the service that impeded integration; and the penchant of the British high command to cycle veteran battalions out of the Eighth Army and replace them with green units—all contributed to the conspicuous defeats British armor experienced.

Then there were the tanks themselves. J.A.I. Agar-Hamilton and L.C.F. Turner made a detailed comparison of British and German tanks used in the Sidi Rezegh battles of November 1941.[45] They concluded that the alleged superiority of German tanks was marginal. The short-barreled, short-range, low-velocity guns of the early Mk IIIs and IVs restricted their effectiveness against tanks. They found better use as assault guns. Moreover, German tanks were not particularly well-armored. The 30mm armor of the Mk IIIs, for example, was easily penetrated by British 25-pounders. If a cruiser or Valentine could get close enough, the armor was penetrated by the 2-pounder. Even the 50mm armor of the Mk IVs cracked when the British turned the 6-pounder anti-tank gun against them. German tank crews invented short-term solutions to their vulnerability. They wrapped their tank hulls with tank treads and piled on sand bags. A better solution was the addition of 60mm spaced face-hardened plating, but even this eventually failed because repeated hits caused the plating to break down.

Yet, the open ground of the desert gave Rommel's tanks an advantage over the British. His command of maneuver warfare brought him victory after victory. But, at El Alamein, with his *Panzerarmee* hemmed in by the sea on one flank and the Qattara Depression on the other, he fought static battles of attrition, losing three in succession. In Tunisia, Rommel was short of equipment and deprived by the Italians of a concentrated integrated arms approach to the battles for Kasserine Pass, Sbiba Gap, and Thala. Furthermore, the mountainous terrain limited the panzers' maneuverability. The Allies constructed static anti-tank gun and artillery defenses. Rommel lost again. The tank, queen of battle for two years, was dethroned.

MINES

Land-mine warfare was an essential part of the North African fighting. Minefields are a passive defense system used to delay an advancing enemy. Defending soliders must continuously watch for breaching attempts. At the first sign of enemy activity, they blanket the minefield with rifle, machine-gun, and mortar fire.[46] The sapper has the job of cutting paths through minefields. Sappers in North Africa did their job with courage, patience, and accummulated knowledge. The work required the "best and bravest of the army."[47] Lines of sappers, sometimes under enemy fire, crawled forward or walked in a stooped posture in front of their own lines, sliding their bayonets into the ground at shallow angles. If the point bumped something—perhaps a mine—the dirt was carefully whisked away. The sapper then gingerly felt around and beneath the mine with his fingers, feeling for any trip wires or booby traps. If none were found, and depending on circumstances, the fuse was removed and the mine lifted. Some ease of discovery was added with the use of metal detectors. The British soldiers using them were dubbed "housemaids armed with Hoovers."

But the only certain way to speed the job under harrowing conditions was to possess sound knowledge of enemy mines and mine-laying techniques. Some British sappers, according to Brigadier B. K. Young, developed a kind of sixth sense about mines,[48] recognizing a minefield by observing the land surface and comparing it to the surrounding area. But most British sappers trained at the mine warfare school just behind El Alamein. With Rommel's retreat, the school was moved forward first to Benghazi and then to Tripoli.

Rommel's *Panzerarmee* used anti-tank and anti-personnel Tellermines supplemented by S-type personnel mines. Tellermines were activated by weight, the sensitivity varying from 175 pounds pressure to 500 pounds. The disc-shaped mines were about 12 inches in diameter, and 3½ inches high. The heavier pressure-activated mines crippled tanks by snapping the tread. Anti-tank guns could then destroy the machine.[49] Pressure or trip wires activated the S-type mines. A small charge in an outer cylinder sent an inner cylinder about 5 feet into the air where it exploded, sending shrapnel—360 metal balls or small steel rods or scrap metal—whistling in every direction with great lethality.[50]

At Alam Halfa the *Afrika Korps'* advance was much delayed by British mines, and they stalled the Ariete Division long enough to weaken Rommel's thrust to the coast and forcing DAK into the abortive attack against Alam Halfa Ridge. At Second Alamein, German

minefields slowed the Eighth Army's northern attack, allowing Rommel time to shift his forces, construct defenses, and finally to disengage and begin the Great Withdrawal.

An "orgy" of minelaying accompanied the withdrawal, in which "the desert was drenched" with all sorts of devices.[51] Three characteristics of the withdrawal dictated intensive mine use: The *Panzerarmee*'s only escape route was the single coast road; except for the marshy ground at El Agheila, most German positions had desert flanks open to quick offensive maneuvering; something was needed to slow otherwise unimpeded advances over vast distances.

After Second Alamein, the British pursuit was slowed when they discovered that the Germans, besides ripping up rails and ties, mined the bed of the railroad that served several ports west of Alexandria. Sappers were diverted from the front to that job. The Germans also mined the coastal road, potholes a favorite site. They even placed mines to cause later delays. Sappers dug a deep hole in the road, stacked three Tellermines in it, and then covered the hole with loose soil. Trucks might bump over the hole in complete safety for a few days, but each one displaced some of the dirt. Eventually a truck pressure-activated the mine. Every vehicle in the vicinity came to a stop until sappers swept the the whole area for more mines.[52] Sappers mined road junctions, well-traveled desert tracks, culverts, bridges, pump houses, uninhabited houses, latrines, and signal posts. Landing fields were ploughed and the foroughs mined. The edges of any shell and bomb craters were also favorite sites.[53]

Mines crippled and destroyed equipment and maimed and killed soldiers. They also created anxiety among troops unfamiliar with them. The dreaded cry "Mine!" froze men in their tracks, some shaking with fear, some crying, others wailing "What do we do?" A few might panic and run, the victims of their fear. A good officer might get his men free from that small hell or have them wait patiently for sappers. Rommel knew that mines would not stop the Eighth Army, but the great elephant might be more cautious where it stepped next.

A NOTE ON THE AIRCRAFT VARIABLE

German aircraft sent to bolster Rommel's ground forces was standard *Luftwaffe* equipment.[54] The famous Messerschmitt Bf 109G was their principal fighter. Highly maneuverable, with a speed of 378 mph, and mounting two 7.9mm machine guns and three 20mm cannon, it was a formidable foe. On the negative side, a narrow cockpit, a machine housing between the pilot's feet, and poor pilot visibility meant discomfort. The Messerschmitt Bf 110, a twin-engined machine, mounted heavy front-end armament—two 20mm cannons and four 7.9mm machine guns—useful in ground support. But the 110 could not compete with Allied fighters because it attained a speed of only 350 mph and was not especially maneuverable. That restricted its role as a bomber escort.

The Junkers Ju 87, the infamous Stuka dive-bomber, obsolete by 1941, was used from beginning to end in North Africa. A slow speed of 240 mph, an armament of only three 7.9mm machine guns, and poor maneuverability made the plane easy prey for Allied fighters. Yet its 2,200-pound bomb load delivered in a screeching dive terrorized battlefields. The Ju 88, designed as a light attack bomber, carried a 4,000-pound bomb load and became the *Luftwaffe*'s primary bomber in North Africa, but it was augmented by the fighter-bomber capabilities of the Focke-Wulf Fw 190 that carried a 550-pound bomb load.

The story of air power in North Africa, with momentary exceptions, follows the general tendencies of the ground war: initial German dominance followed by a slow decline. Two problems contributed to that decline.

First, as Rommel himself noted, the *Luftwaffe*, as early as 1941, determined its own priorities and flew widely scattered strategic missions rather than tactical ground support for the *Panzerarmee*.[55] This situation was compounded by a chronic aircraft shortage. In February 1941, for example, at the dawn of Rommel's desert campaign, the *Luftwaffe* did not have enough aircraft to dislodge the British from El Agheila. In May 1941, during the siege of Tobruk, Rommel needed extra planes to bomb ships supplying and reinforcing the garrison. Although squadrons were released from duty in Crete and Greece, none of them headed for North Africa.[56]

By the time of the Battle of Alam Halfa, 30–31 August 1942, the *Panzerarmee* could not maneuver freely because of Desert Air Force's low-flying attacks that caused about 4,000 casualties and destroyed fifty tanks and 400 trucks. At Second Alamein, the *Luftwaffe* flew 1,624 sorties—938 by fighters trying to stem British raids. They failed. The *Luftwaffe* retaliated with their own bombing raids, but it was a weak effort at best. They dropped a total of only 240.8 tons of bombs in nine days, ranging from a low of 5 tons on 24 October

to a high of 43.3 tons on 31 October. That figure dropped to 12.8 tons the next day.[57] The *Luftwaffe* never regained aerial superiority during the long retreat.[58]

Once in Tunisia, there was a moment of glory when they flew from all-weather fields at the same time Allied planes moving east from Algeria were mired in mud on second-rate landing fields. That situation changed with the weather, and by putting down steel mesh over the muddy runways. Still, American fighters, such as the P-40 Tomahawk and the P-39 Airacobra, offered German fighters little competition. The British helped by giving the Americans a few squadrons of Spitfires.

A second major cause of the *Luftwaffe's* demise in North Africa was the German high commmand's inability or unwillingness to modify their aircraft to meet the needs of desert warfare. The Me 109s and the Ju 87s and 88s that entered the North African fight in February 1941 were still the same kind of aircraft committed to battle in February 1943. The absence of modifications on existing aircraft and the long-range resistance to developing a true heavy bomber resulted in the *Luftwaffe* experiencing the processes of demodernization felt by the army.

The British, in contrast to the Germans, readily adapted their aircraft to meet new needs. The Hawker Hurricane fighter, mounting eight to twelve .303 machine guns, proved very versatile. The Hurricane IICs carried four 20mm cannons, and the IIDs—committed to tank-busting—mounted two 40mm cannons. Rommel was so upset by the results of the IID's gunnery that he took a 40mm projectile with him to Berlin and presented it to Göring and Hitler as proof that the British were shooting up his tanks. Göring's reply was, "That's impossible."[59]

The RAF gave Rommel more to worry about. The Spitfire Mark VC mounted four 20mm cannons, and the Mark VI and Mark IX both carried two 20mm cannons and four .303 machine guns. The Spitfires, with speeds ranging from 375 mph to 405 mph and one of the most maneuverable aircraft of the war, could best any German aircraft and were deadly in ground support missions. Moreover, the in-line Merlin Rolls-Royce engine caused little vibration, the cockpit was comfortable with tuck-and-roll leather seating, and the bubble canopy provided the pilot excellent visibility. The Spitfire was a very comfortable plane to fly.

The RAF's growing domination of the skies was signaled by their

bombing runs at Second Alamein.[60] Despite the *Luftwaffe's* attempts to stem the raids, eighteen to twenty bombers appeared over the battlefield at hourly intervals day after day, destroying equipment, causing casualties and, as Rommel observed, producing in his men fatigue and feelings of inferiority because there was nothing they could do.[61] The British flew Wellingtons and Blenheim Mark V bombers (the version dubbed "Bisley"). The Americans supplied additional bombers such as the Douglas DB-7 and Martin 187 Baltimores, both with at least 2,000-pound bomb loads, and the Martin B-26 Marauder carrying a 5,000-pound bomb load. These planes matched or exceeded anything the Germans mustered. Assuming that British bombers averaged a 3,000-pound bomb load, the RAF then delivered approximately 30 tons per raid, every hour, every day of the battle.

The U.S. Army Air Force added enormous bombing capacity in Tunisia with the Boeing B-17 Flying Fortress that carried a 12,000-pound bomb load. The British picked up their end by adding the Halifax Mark II that carried a 13,000-pound load for short distances.

With the improvement of fields in Algeria, with the RAF flying across the Gulf of Sidra and from bases on Malta, the domination of the air war turned completely in the Allies' favor. A wide range of aircraft, flexibility in adapting fighters for ground support missions, and the ease of replacement for lost aircraft spelled doom for Rommel's army.

CODA

The spatial and psychological separation from Europe that Rommel enjoyed came at a high price. The German high command considered North Africa a side-show, especially after opening the Russian front, and often chose to ignore Rommel's pleas for assistance. *Commando Supremo* hectored him, wanting the Italian empire preserved and, at the same time, strangling the *Panzerarmee* with a faulty supply system. Kesselring alternately supported Rommel's ideas and complicated their implementation, as if marching to a drumbeat only he could hear.

German equipment was of good quality, but, as Rommel feared, the British and Americans proved indomitable in catching-up to German standards and, in many instances, surpassing them in both quantity and quality. Rommel's tactics were usually inventive, sur-