HISTORICAL STUDY

EFFECTS OF CLIMATE ON COMBAT IN EUROPEAN RUSSIA



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EFFECTS OF CLIMATE ON COMBAT IN EUROPEAN RUSSIA

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PREFACE

This study was prepared by a committee of former German generals and general staff officers under the supervision of the Historical Division, EUCOM. The material, based on the personal experiences of the principal author and his associates, was written largely from memory, with some assistance from diaries, earlier studies, and documents. All the German officers involved had extensive experience on the Eastern Front during the period 1941–45. The principal author, for example, commanded in succession a panzer division, a panzer army, and an army group.

The reader is reminded that publications in the GERMAN REPORT SERIES were written by Germans from the German point of view. As in CMH Pub 104–12, Russian Combat Methods in World War II, and CMH Pub 104–5, Terrain Factors in the Russian Campaign, the "Introduction" and "Conclusions" to this study present the views of the German author without interpretation by American personnel. Minor changes in form and in chapter titles have been made to obtain greater clarity. However, passages which may reflect the authors' prejudices and defects, whatever they may be, have not been changed, and find the same expression in the following translation as they do in the original German.

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PART ONE
INTRODUCTION

The purpose of this study is to describe the climatic conditions encountered by the German armed forces during four years of struggle in European Russia. To this end the climate of the various regions is described together with its effects on men and equipment, combat and supply. Parts Two, Three, and Four are concerned with European Russia south of the Arctic Circle; Part Five treats of European Russia north of the Arctic Circle. The study emphasizes the lessons learned and improvisations employed to surmount difficult situations.

A Western European army fighting in Russia is faced with conditions entirely different from those to which it is accustomed, conditions rooted in the peculiarities of Russia and its people. The most unusual characteristic of the country is the climate, which affects terrain and vegetation and determines living conditions in general. The climate leaves its mark upon the Russian and his land, and he who steps for the first time on Russian soil is immediately conscious of the new, the strange, the primitive.

The German soldier who crossed into Russian territory felt that he entered a different world, where he was opposed not only by the forces of the enemy but also by the forces of nature. Nature is the ally of the Russian Army, and the struggle against this alliance was a severe test for the Wehrmacht, exacting great sacrifices. To conquer the raging elements of nature was the more difficult because their fury and effect were not fully recognized by the Germans, who were neither trained nor equipped to withstand them. The German command had been under the impression that the Red Army could be destroyed west of the Dnepr, and that there would be no need for conducting operations in cold, snow, and mud.

This publication replaces DA Pam 20-291, February 1952.

PART ONE

INTRODUCTION

PART TWO
WINTER

Chapter 1
General

Winter in most parts of European Russia south of the Arctic Circle sets in suddenly and lasts five to six months. The period of clear weather which follows the autumn muddy season lasts at most one month, too short a time for extensive military operations. Cold, ice, and snow may hinder operations as early as December, especially in the northern parts of the country.

Snowfall varies greatly in European Russia. It is greater in the northern and central regions than in the south. Along the lower Don and Donets, in the winter of 1942–43, the first snow fell in mid-December and did not affect mobility during the entire winter. The same winter saw more than eighteen inches of snow on the middle course of these rivers and in the Kharkov area. Snow depths of three to four feet are common in the north, where wheeled vehicles can move only on cleared roads, and huge snowdrifts build up in valleys and hollows. Here horse-mounted and dismounted troops move with difficulty except on roads, and trail breakers must be used for cross-country marches. In deep-snow country even tanks and other tracked vehicles are restricted to plowed roads.

In the Baltic and Leningrad regions the snow cover varies greatly from year to year. Leningrad and its vicinity, for example, may have as much as twenty-eight inches of snow in severe winters, while in mild winters there may be less than two inches. Water courses to the south of Leningrad often freeze over by mid-November, and temperatures there may fall as low as −40° F. Even during mild winters the mercury will drop to −20° F.

In central European Russia, the Smolensk–Vitebsk area has noon temperatures below freezing even during average winters. The Pripyat Marshes usually freeze over in winter, and only during exceptionally mild winters, or in case of an early snow cover, will large patches of the Pripyat remain unfrozen and impassable.

The winter of the southern steppes, longer and colder than that of Central Europe, differs little from the winter of central and northern Russia south of the Arctic Circle. In the Black Sea region, where two thirds of the annual precipitation occurs between September and March, the climate is of the Mediterranean type.

The winter of 1941–42 was most severe in European Russia. In the area northwest of Moscow the mean temperature during January 1942 was −32° F., and the 26th of the month in the same area saw the lowest recorded temperature of the entire Russian campaign: −63° F. The southern part of European Russia, too, had record low temperatures during the first winter, with readings ranging from −22° to −40° F., compared with temperatures of 14° to −40° F., in the same area during the following winter. A chart of temperatures and precipitation near Rzhev for the period January through April 1942 and October 1942 through January 1943 may be found in the Appendix.

The obliteration of landmarks in snow-covered terrain makes orientation difficult. Russian villages are hard to identify from a distance, and often a church built on high ground or a church tower is the only visible sign of an inhabited place. If neither is present, woods filled with screeching birds usually indicate that a village is near by. The Russian peasant stores his winter supplies in advance and digs in to spend the winter completely cut off from the outside world.

Cold reduces the efficiency of men and weapons. At the beginning of December 1941, 6th Panzer Division was but 9 miles from Moscow and 15 miles from the Kremlin when a sudden drop in temperature to −30° F., coupled with a surprise attack by Siberian troops, smashed its drive on the capital. Paralyzed by cold, the German troops could not aim their rifle fire, and bolt mechanisms jammed or strikers shattered in the bitter winter weather. Machine guns became encrusted with ice, recoil liquid froze in guns, ammunition supply failed. Mortar shells detonated in deep snow with a hollow, harmless thud, and mines were no longer reliable. Only one German tank in ten had survived the autumn muddy season, and those still available could not move through the snow because of their narrow tracks. At first the Russian attack was slowed with hand grenades, but after a few days the German prepared positions in villages and farmhouses were surrounded or penetrated.

The Germans held out to the northwest of Moscow until 5 December, and on the next day the first retreat order of the war was given. In the months of the offensive, German battalions and companies had dwindled to a handful of men. The Russian mud and winter had wrought havoc upon their weapons and equipment. Leadership and bravery could not compensate for the lowered fire power of the Ger-

man divisions. The numerical superiority of the Russians, aided by climatic conditions, saved Moscow and turned the tide of battle. Hitler neither expected nor planned for a winter war.

By mid-December, when the first phase of the German withdrawal ended, 6th Panzer Division was located in Shakhovskaya to refit and receive reinforcements. (Map 2) On Christmas Eve the 4th Armored Infantry Regiment, which had received replacements, was alerted to counterattack Russian forces that had broken through German positions on the Lama River west of Volokolamsk, in the sector of the 106th Infantry Division.

On 26 December the regiment moved out in a snowstorm over roads already covered with deep drifts. The German troops were inadequately clothed for the Russian winter, and in every village lengthy warming halts were necessary. Two days were needed to cover the twelve miles to the line of departure.

After a meal and a night's rest, 4th Armored Infantry Regiment attacked on 28 December together with German elements already in the area. Well supported by artillery and heavy weapons, the regiment advanced throughout the day, and in the evening made contact with the 23d Infantry Division to the north, thus closing the gap. Some shelter was found in near-by villages and farmhouses. Strong security detachments were posted, and relieved every half hour because of the extreme cold.

The plan for 29 December was to regain the former German positions on the Lama by envelopment of the Russian forces that had broken through. The regiment attacked eastward while the motorcycle battalion of the 6th Panzer Division, south of the main body, advanced northward toward Vladychino. By noon the enemy breakthrough force was surrounded.

Night temperatures dropped to between −30° and −40° F., and no shelter was available to the German troops. The near-by villages were destroyed and the entrenchments of the old German positions on the Lama were buried deep in snow. To remain exposed would have meant certain death to the troops who lacked adequate winter clothing, and withdrawal to a distant village was ordered.

When the Russians observed that the encirclement had been abandoned, they concentrated for a new break-through which eventually forced a withdrawal of the entire German front in the area. Success had turned to failure because the Germans were not equipped to withstand extreme cold.

Periods of moderate cold alternating with thaw are particularly dangerous. At the end of March 1942, in the Lake Ladoga region, noon temperatures rose to 41° F., followed by a sharp fall of the mercury at night. Boots, socks, and trousers that had become wet

during the day stiffened with the night cold and froze toes and feet. Serious frost injuries developed when troops overheated from combat were forced to spend the night in snow pits or windswept open fields, especially when the fatigued men took even the shortest of naps. A German company that spent a day during a thaw entrenching itself lost sixty-five of its ninety-three men as a result of a sudden severe cold wave at night.

Frostbite casualties among German troops were heavy during the first year of the war. At the beginning of December 1941, Fourth Army failed in an attempt to penetrate the outer defenses of Moscow because the Russians were able to use the rail net around the city to bring up strong forces. On the morning of 4 December, after three days of heavy losses, army fell back to its positions of 1 December to avoid further casualties.

On the same day, as the weather turned bitter cold, the Russians attacked, and by 20 December the entire army front was heavily engaged. A radio message intercepted at the time revealed that the Russian drive was an all-out effort to knock the Germans out of the war. Later information that the Russians had deployed 30 infantry divisions, 33 infantry brigades, 6 armored brigades, and 3 cavalry divisions on the Moscow front left no doubt as to their intent.

By 5 January, when temperatures had risen somewhat, Fourth Army counted 2,000 frostbite casualties and half as many from enemy action. At this point Hitler gave permission to pull back the army left wing in the face of a Russian envelopment, and the withdrawal was completed according to plan. There was no let-up in the battle, however, and German casualties from all causes continued to mount. A snowstorm which, since the 5th, had added to the German difficulties, stopped on the 10th, and clear cold weather with temperatures down to −13° F. followed. Here and there, supplies were moved up during quiet periods, but even then at great cost in lives and eqipment.

The Germans fell back steadily and in March heavy snowfalls hampered the withdrawal as the Russian offensive continued. On 18 April, the first warm, sunny day of spring, the Russian attacks ceased. Fourth Army suffered 96,535 casualties between 1 January and 31 March 1942, of which 14,236 were frostbite cases.

Frostbite was frequent among drivers and troops who were moved long distances in open trucks. So long as suitable clothing was not available, constant indoctrination in cold-weather precautions was necessary. Frequent halts were made so men could warm themselves by exercise. Front-line troops became indifferent in extreme cold; under constant enemy pressure they became mentally numbed. Medical officers and commanders of all ranks had to make certain that

soldiers changed socks frequently, and that they did not wait until swollen feet made it impossible to take off boots.

Some chemical heat packets were issued, but they protected only small areas of the body for short periods. Regular use of the *sauna*, a steam bath, was helpful in preventing illnesses caused by cold and exposure, but such baths were not always available.

The Russians, too, suffered from the extreme cold when forced to remain out in the open. Their supplies did not keep up with them, and they became weak and exhausted. Consequently, they always made a great effort to capture villages for overnight shelter. For example, in the winter of 1941–42, north of Rzhev, the Russians unsuccessfully attempted to drive German forces out of a village and were forced to spend the night in the open. Cut off from supplies and stiff with cold, the Russians were so weakened by their ordeal that they were unable to hinder a withdrawal of German troops, including two batteries, from north of the village, even though the Germans passed within 100 yards of the Russian forces.

Chapter 2

Snow

A war of movement is difficult in deep snow. Foot marches in twenty inches of snow are slow; in depths of more than twenty inches they are exhausting. When snow was not too deep, the Germans used details, in shifts, to tramp down snow trails. Ski troops were also used as trail breakers. The Russians used T34 tanks to pack down snow; the tracks used on German tanks during the first year of the war were too narrow for this purpose.

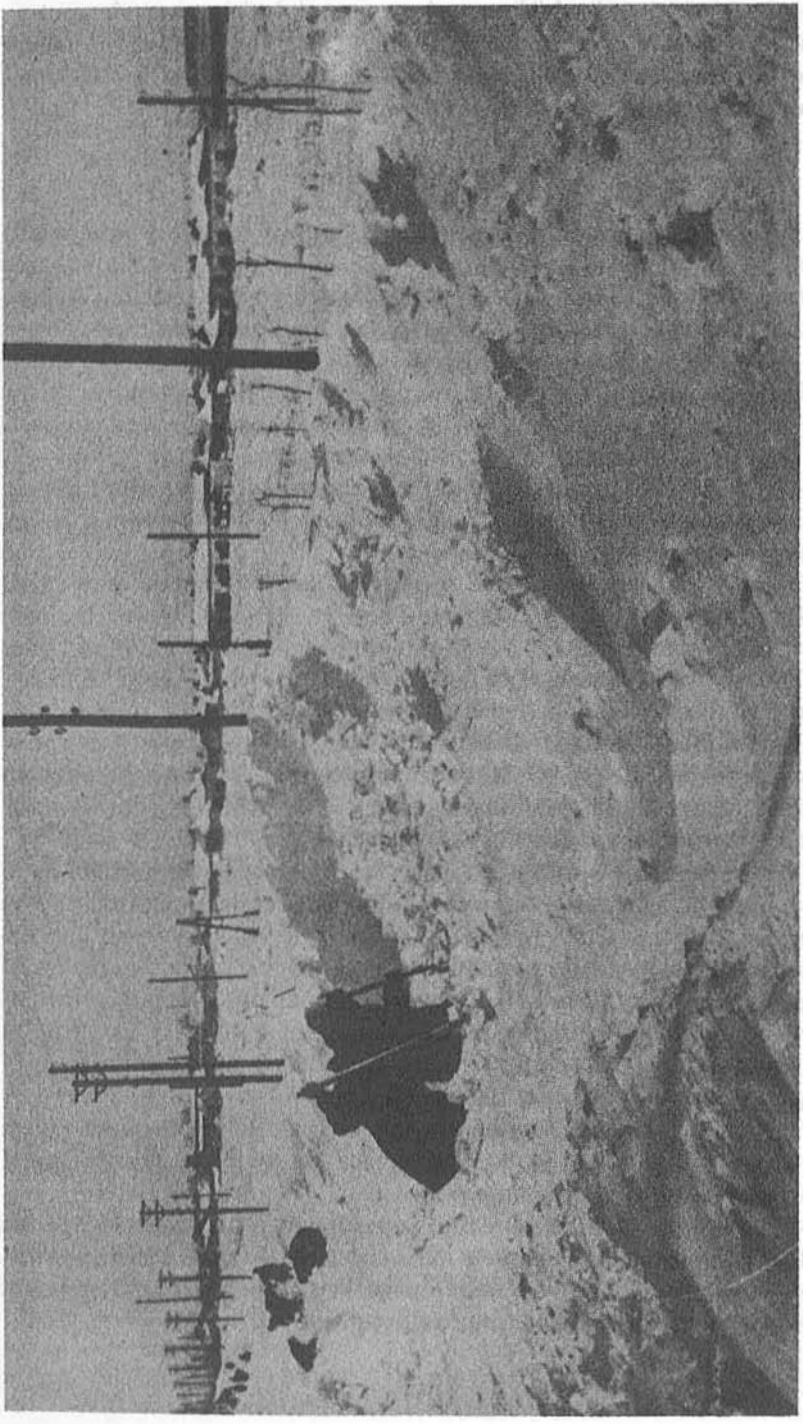
Movements on foot or with wheeled vehicles are impossible in snow depths above forty inches. Snow crust is sometimes strong enough to bear the weight of small groups. Hard-frozen snow, however, can be used only for night movement, because the approach of troops over a snow crust can be heard at a great distance. Snow in bushland, draws, and ditches will not support much weight.

Section I. Infantry

A normal infantry attack cannot be made in deep snow. Advancing by bounds is out of the question, because every movement must be made in the open, exposed to enemy fire. If infantry attacks had to be made, the Germans always sought areas where the snow was less deep. If such areas could not be found, the infantry had to work its way forward under cover of darkness, digging as it went, or following a beaten path against the flank and rear of the enemy.

Without adequate snow removal equipment, infantry movement during or after a snowstorm is difficult. In December 1942, for example, the defeat of Italian forces in the Voronezh area made it imperative that this sector of the front be reinforced. A German infantry division near Siniye Lipyagi was made available and ordered to march the fifty-five miles south to the endangered area. The march was to be made through the rear areas of several German divisions which were to assist the advancing unit by furnishing rations and quarters, and the movement was expected to take three days.

The division set out in the first flurries of what proved to be a twelve-day blizzard. The march route was over lateral roads not used for logistical support, and consequently not cleared of snow. It was just at this time that the desperate German attempt to relieve Stalingrad required all available snowplows. Instead of the expected three



RUSSIAN CIVILIANS, clearing drifted snow, Ukraine, 1942

days the march required fifteen. A command decision to make motorized snow-clearing equipment available would have aided the movement considerably. Such equipment, always scarce in the German Army, was controlled at army or army group level.

Section II. Artillery

Artillery was moved on existing roads, and if no roads were available, new tracks were shoveled. In deep snow it was often impossible for the infantry to take full advantage of artillery preparation, because it could not move forward fast enough. Such an instance occurred at Gaytolovo (a few miles south of Lake Ladoga) on 21 December 1941. The German infantry attacked at 0900 after a thorough artillery preparation. It took so long for the riflemen to reach the Russian positions that enemy bunkers went into action again, and the assault was delayed. By 1500, when the infantry had penetrated at several points, a withdrawal order was given. The troops would have frozen to death if they had spent the night in the open.

The effectiveness of artillery projectiles, particularly those of small caliber, and of mortar ammunition, was seriously hampered by deep snow. Snow dampened and reduced lateral fragmentation of artillery shells, and almost completely smothered mortar fire and hand grenades. Heavy artillery weapons, such as the German 210-mm. mortar, remained highly effective. Because of the cushioning effect of snow, mines often failed to detonate when stepped on or even when driven over by tanks. To keep detonators effective in extremely cold weather, gun crews often carried them in their pockets.

Registration fire with aerial observation and with flash and sound was hampered because the snow swallowed projectiles and bursts. Artillery map firing was impeded by a vast difference between meteorological conditions in Russia and in Central Europe, and the resultant range dispersion. Metro corrections of German observation battalions were computed according to Central European standards, resulting in less accurate fire. Checking air observation by sound and flash ranging, and checking sound ranging by flash ranging and vice versa, disclosed deviations caused by climatic factors whose ultimate causes were never fully determined. The services of qualified meteorological technicians would have been useful.

By placing fire control and radio equipment in improvised wooden containers padded with blankets it was possible to protect them against frost damage and shock. Russian peasant sleighs with built-in boxes were often used for transporting radio equipment.

Section III. Armored Forces

The principal shortcoming of German tanks was the narrow width of their tracks. Tanks sank deep into the snow, and because of their limited ground clearance, ultimately became stuck. Russian tanks, particularly the T34, KV1, and KV2, were able to drive through deep snow because of their good ground clearance and wide tracks, and therein lay their special effectiveness in winter warfare. After the first winter of the war, Germans started to use wide, removable tracks. These solved the problem of snow mobility, but tanks so equipped could not be moved on German railroad cars and were too wide to cross the standard German military bridge. Russian wide tank tracks were factory equipment; the broad gage of Russian railroads with their correspondingly wide flat cars eliminated the transportation problem.

In December 1942 a German armored division, diverted from the abortive relief thrust on Stalingrad to consolidate an extremely critical situation on the Chir River front, was delayed twelve hours because the snow tracks of its tanks were too wide for a military bridge over the Don. The tracks of more than 150 tanks and assault guns had to be removed in total darkness and remounted on the far shore.

Chapter 3

German Tactics

Unless forced by circumstances to do so, the Germans did not launch offensives in midwinter. During local attacks communication trenches or tunnels for infantry could be dug through snow with considerable speed. While such trenches offered effective concealment if skillfully sited and camouflaged, they were practically useless for protection. Whenever artillery support was needed snow had to be cleared from firing positions and ammunition storage areas.

For individual movement through snow, skis are best. Large ski units are relatively ineffective since heavy weapons cannot be carried or supplied. The Germans did not use ski troops in units above battalion size, while the Russians used such troops up to brigade strength. Skis are a hindrance in combat; they have to be removed before going into action, and often become lost.

Ski troops are effective for reconnaissance missions. For example, in March 1942, a ski patrol of 20 volunteers from the reconnaissance battalion of 6th Panzer Division infiltrated 15 miles into enemy territory, captured 3 prisoners, and gained much valuable information. Russian civilians living in the area where the reconnaissance was made, who had been well treated by Germans billeted in their villages at an earlier date, were of great assistance. Local guides led the patrol around enemy and partisan strongholds, and provided shelter in farmhouses. The mission took four days.

With the onset of the Russian winter adequate shelter is a necessity in tactical operations. His intrenching tools useless in frozen ground, the German soldier could only cower in a snow hole and wait until a dugout or similar shelter was blasted out of the frost-bound soil. Blasted shelters were usually pitch dark, and the small, open fires used for heating filled every crevice with smudge and smoke. For above-ground shelter, the Finnish-type round tent proved highly serviceable. Troops were trained to construct igloos, but this type of shelter never became popular. Native log houses in the forests of the northern and central regions of European Russia are excellent heat retainers and are highly resistant to concussion.

When German troops were attacking Tikhvin in the winter of 1941, cold set in suddenly. Lacking winter clothing and adequate shelter, the Germans suffered more casualties from cold than from enemy fire, and the attack had to be halted as the more warmly dressed and

better-equipped Russians gained the initiative. The German troops were withdrawn to avoid further weather casualties.

The defender has a definite advantage in winter because, as a rule, his positions cannot be seen in snow except at very close range. He is able to keep his forces under cover and wait until the moment that fire can be used most effectively. The attacker, on the other hand, is impeded in his movements and is easily detected, even in camouflage clothing. The principal weapon of the defender is the machine gun. Its performance is not diminished by snow, in which mortars and light artillery lose most of their effectiveness.

When defensive positions were not occupied until winter, the Germans found it impossible to build shelters and emplacements in hard frozen ground. Machine guns and rifles had to be placed on a snow parapet that had been built up and packed hard. If well constructed, and water poured over it to form an ice coating, the parapet offered some protection against enemy fire.

Where organized positions are established before snowfall, parapets must be increased in height as the snow level rises, and care taken to keep trenches and approaches free of snow at all times. Trenches and dugouts provide better cover in winter than in other seasons. Snow-covered obstacles remain effective until covered by a snow crust that will bear a man's weight. Barriers against ski troops are effective only as long as they project above the snow. Obstacles must be removed when snow begins to melt, or they will obstruct visibility and fields of fire.

When swamps freeze over, the defender is suddenly faced with a situation changed to his disadvantage. German divisions that fought defensive actions when swamps were impassable barriers were at a great disadvantage against the same enemy, in the same location, when swamps froze over. The increased frontage created by the frozen swamp could be defended only by employing additional artillery and much greater quantities of all types of ammunition. Similarly, the winter freeze-up is disadvantageous to a weak defender behind a water barrier. The freeze turns rivers into routes of approach toward the defensive positions.

Since the Russians often penetrated artillery firing positions, the Germans trained artillerymen in infantry close-combat tactics. Because snow sometimes makes it impossible to evacuate guns, artillery crews were trained in demolition of field pieces.

The Russian winter covers roads, countryside, and vehicles with a crippling coat of ice and, when sand is not available, entire columns are forced to halt. Icy roads can rob an offensive of surprise or be fatal to a withdrawal. Ice conditions prevail every winter in all parts of Russia. During the German withdrawal from the Moscow

area in the winter of 1941–42, ice hindered the entire operation. A few days before the order to retreat from the suburbs of Moscow, 6th Panzer Division, by building a defense around its last five tanks, held off an attack by Siberian troops who presented prime targets in their brown uniforms as they trudged forward in deep snow. This local success facilitated the disengagement of the division and provided time for the destruction of its last 88-mm. antiaircraft guns, necessary because no prime movers were available. Twenty-five prime movers were lost in the autumn mud of 1941, and seven had fallen victim to winter cold and snow. The withdrawal proceeded according to plan on the first day but the next day, moving over hilly terrain, vehicles skidded on icy roads, and trucks which had been abandoned during the preceding muddy season blocked the roads, adding to the difficulties.

Fearful that the pursuing Russians would overtake and destroy the rear guard if time were spent in extricating each vehicle, the Germans loaded as much matériel as possible on trucks still serviceable and put the remaining equipment to the torch. The rear guard was reinforced, and the withdrawal continued with brief delaying actions based on villages. Inhabited places were vital to the Germans, who lacked winter clothing, and attractive, too, to the Russians who preferred permanent-type shelter. The retreat became a race from village to village.

In a few days the Germans reached Klin, northwest of Moscow, which could not be used to house the division overnight, as the city was on the main route of other divisions streaming west. (Map 1) However, a large quantity of explosives were found in Klin and were used to blast temporary shelters in the ground outside the city. Attempts to obtain dirt from the blasted shelters for sanding roads were useless because the explosions loosed great chunks of solidly frozen earth which could not be pulverized. The division held before Klin for one day, and then completed its withdrawal across the four-lane Smolensk–Moscow highway.

Russian air activity during the withdrawal was ineffective, because it was limited to scattered sorties of a few planes which strafed columns or dropped small fragmentation bombs. During air alerts the Germans burrowed in the snow at least 100 yards from the road. Some casualties were caused by delayed-action bombs when men failed to remain down long enough after the missiles were dropped. If the Russians had used strong bomber forces, the results would have been disastrous. In contrast to the losses from enemy air, German casualties due to cold weather and insufficient clothing were heavy.

The numerically superior enemy did not succeed in enveloping and annihilating the German rear guard, because he could not employ his

heavy weapons in a frontal attack in deep snow without suffering heavy losses. Successful envelopment was difficult for the Russians because such movements were usually attempted by cavalry, ski troops, and infantry mounted on sleighs who were unable to take their heavy weapons with them. The striking power that the Russian forces were able to bring forward was not sufficient to destroy the defender.

Chapter 4

Russian Tactics

The Russians usually attacked along existing roads or on paths beaten down by their tanks. Frequently, the infantry followed close behind their tanks, using the trail made by the tank tracks. In other instances infantry worked its way forward in snow tunnels toward German positions, despite the heavy losses which resulted from such tactics. In mass attacks the Russians usually debouched from woods and burrowed their way through the deep snow as quickly as possible. Mowed down by machine guns, the first wave would be followed by a second attack which moved forward a short distance over the bodies of the dead before coming to a standstill. This was repeated by as many as ten waves, until the Russians bogged down from heavy losses and exhaustion or until the German defenses were penetrated.

Russian infiltration tactics were most effective in winter, because the German defense system, based on strong points, practically invited such tactics. The Germans were forced to adopt the strong point system of defense because they lacked sufficient forces to occupy continuous lines backed up by reserves. The Russians always sought to split and annihilate defending forces, and to this end cavalry, ski units, airborne troops, and, above all, partisans were used in great numbers.

Section I. Ski Troops

On the night of 20–21 March 1942, six hundred Russian ski troops enveloped the command post of the 269th Division in a village twelve miles northeast of Lyuban. The flanking movement was made under cover of darkness over a bog which had a weak bearing surface and was therefore but lightly guarded by the Germans. As these troops assaulted the rear of the village, heavy attacks with armored support were launched against the entire division front. After a bitter fight, division service troops managed to drive off the ski troops.

Another instance of Russian use of strong ski forces occurred at the end of March 1942, after 6th Panzer Division had captured several villages southwest of Rzhev in a limited-objective attack. The area was immediately organized for defense; roads were cleared in the three-foot-deep snow, and paths cleared to the numerous bunkers taken in the action.

Under cover of darkness, a ski brigade of the Russian Thirty-ninth Guards Army, under command of a general officer, assembled in a

wooded area opposite a strong point held by the 114th Panzer Grenadier Regiment plus an artillery battalion and some flak. At daybreak, the ski brigade attacked the German position, with the main effort against the German rear. The defenders recognized the Russian intentions and withheld fire until the attackers came within two to three hundred yards. The Germans then opened fire with 500 rifles, 36 machine guns, and 16 artillery pieces. The effect was devastating. Such of the enemy as survived buried themselves in the snow in the hope of returning to the woods at night. Most of the weapons and all of the ski equipment of the force engaged in the main attack were captured. The greatest prize, however, was a map found on the dead commander which gave the disposition of the entire Thirty-ninth Guards Army.

The Russians failed in their mission because they could not achieve surprise. In cold weather sound travels a great distance, and their approach over the snow could clearly be heard. Furthermore, the attack carried across open terrain and all the roads and paths around the German positions were well guarded.

Russian ski units were more successful when used in combination with other arms. When Third Panzer Army was withdrawing west of Moscow in December 1941, a Russian force composed of ski troops, cavalry, and sleigh-mounted infantry succeeded in cutting off the 6th Panzer Division which was the rear guard of LVI Panzer Corps.

Section II. Unusual Russian Tactics

In October 1941 a Russian force crossed the ice-covered Gulf of Finland from Leningrad and made a surprise attack on the 212th Infantry Division. The attack, made under cover of darkness in a driving snowstorm, was thrown back to the shore after a stiff fight. The Russians had marched eastward across the ice from Leningrad to Kronshtadt and then southward to hit the German flank and rear.

Similarly, at the end of January 1945 the Russians tried to unhinge the left flank of Third Panzer Army, which was on the Deime River, by envelopment across the ice of the Kurisches Haff. Three times the enemy penetrated the army front as far as the town of Labiau, and each time was thrown back after hard fighting.

In the winter of 1941–42 the Russians supplied Leningrad day after day with food and ammunition by using an ice road over Lake Ladoga. The ice road, eighteen miles long, was nine to twelve miles from the southern shore. At night the same road was used to move regiments and even divisions from Leningrad to the Eighth and Fifty-fourth Russian Armies. The Germans fired 150-mm. artillery against the ice road, but could not stop the Russians. They continued moving troops and supplies despite all losses.

Chapter 5

Clothing, Equipment, Rations

Section I. Clothing

In the winter of 1941–42, the most severe in Russia in a hundred years, the Germans, if they had any winter clothing at all, carried only the regular issue overcoat, sweater, belly-band, and hood designed for winter wear in Germany. The bulk of the winter garments donated by the German people did not reach the front until the end of January 1942, after cold had done its damage. Frostbite casualties were numerous. For instance, a panzer division near Volokolamsk in January 1942 had up to 800 frostbite casualties a day.

During the inactivity of the autumn 1941 muddy period, fur pieces and felt boots were manufactured locally, purchased from civilians, or removed from dead Russian soldiers; but these sources supplied only a small number of troops. All available underwear was issued so that several sets could be worn at one time, and each man managed to obtain a piece of cloth for use as a belly-band or head protector. Some Germans acquired Russian-type fur caps, which proved dangerous, since, despite the addition of distinguishing insignia, the wearers were often mistaken for enemy and fired upon by friendly troops.

After the first winter of the war, clothing supplies improved, and although items lacked uniformity of appearance they served their purpose. Garments were worn in various combinations, such as: heavy quilted trousers, fur vest, regular jacket, and regular overcoat; quilted trousers, sweater, quilted jacket, and regular overcoat; heavy quilted trousers, sweater, regular jacket, and fur coat; or regular trousers, knee protectors, regular jacket, and fur coat. With these combinations each man wore warm underwear, gloves, scarf, and felt or felt-and-leather boots.

The Germans found the quilted suit with hood, worn over the regular uniform, plus a fur cap, felt boots with leather reinforcement or leather soles, and fur gloves best for cold weather. This was the type of winter uniform worn by the Russians. Long sheepskin coats should be worn by drivers and guards. Without winter clothing troops cannot remain out of doors in temperatures under −10° F.

White camouflage clothing should have some identifying feature. White-clad German ski formations moving at extended order through wooded areas, or advancing during snowstorms, were sometimes infiltrated by similarly dressed Russian troops.

Section II. Equipment

Weapons

Maintenance of weapons is difficult in winter. German rifles and machine guns developed malfunctions because the grease and oil used were not cold-resistant. Strikers and striker springs broke like glass; fluid in artillery recoil mechanisms solidified, crippling the piece. Light weapons had to be warmed in huts, and fires were lighted under the barrels of guns to get them back into action. Before suitable lubricants were available, troops found an emergency solution in the removal of every trace of grease and oil from their weapons. In the south of Russia, the abundantly available sunflower oil was used as a lubricant. It is acid-free and cold-resistant.

Vehicles

The need for spare motor vehicle and tank parts increases at low temperatures. The number of broken springs, for instance, reached unusually high proportions. The Germans cannibalized broken-down and abandoned vehicles to get spare parts. The policy of furnishing as many complete tanks and motor vehicles as possible to the front was detrimental to spare parts production. It was by no means unusual that some armored regiments sent their technical personnel on unauthorized trips to factories in Germany to obtain spare parts through personal contact.

Winter temperatures in Russia render self-starters useless. The Germans resorted to prewarming engines by building fires under them. In this way a few vehicles were started for towing. During alerts motors were frequently kept running for hours.

Section III. Rations

During winter, particular attention must be given to proper packaging and storage of foods sensitive to cold. At extreme low temperatures the Germans found that even the relatively short haul from field kitchens to men on the line sufficed to turn food into lumps of ice. Foods sensitive to heat kept almost indefinitely in cold weather.

Chapter 6

Transportation and Troop Movements

Section I. Roads

During winter, road conditions are usually favorable except during bad weather. Roads kept free of snow are easily passable, often better than in summer. With the onset of heavy snowfalls, however, difficulties arose on all traffic routes, which were counteracted by the road services of the various German armies. The assignment of one battalion per thirty miles of road proved satisfactory for snow clearance. Civilian labor was hired for shoveling and for driving horse-drawn plows.

At certain points along roads the Germans established relay stations to provide warm quarters and food for drivers and small units that were held up by snowstorms. Other stations, manned by engineer personnel, were in telephone communication with corps and army, to which road conditions were reported by 0800 each day. Army distributed daily bulletins with maps showing road conditions.

If at all possible, each emergency station had one motorized snowplow. Two or three motorized snowplows were held in reserve by army to clear the way for important troop movements. It was the German experience that during severe snowstorms at least six power plows were necessary to keep a road open for an infantry division.

Strong winds caused snowdrifts which blocked all traffic. Shoveling during storms was futile, for the roads quickly became covered again. To avoid drifts the Germans routed winter roads through woods, where drifts rarely occur, or along the crest of high ground, where the snow is usually less deep.

Snow Fences

Whenever roads across open terrain must be used, snow fences should be erected before the beginning of winter. The location of snow fences is important. They must be set up on both sides of the road, fifty to seventy feet from the shoulders. After a snowstorm the fences must be placed on top of the snow wall that has formed behind them.

In most instances the prewar snow fences had disappeared, and fences four to five feet high had to be improvised out of latticework, wickerwork, or branches of coniferous trees. If materials for con-

struction of snow fences were not available, the Germans used snow blocks.

Marking of Roads

If snow roads follow a different course from those indicated on maps, they should be marked on the ground so they can be followed after a heavy snowfall or when covered by drifted snow. The Germans marked roads with tall poles topped with straw or branches. Stakes with black or red tops or colored markers were also used.

Ice-Covered Roads

Serious traffic jams are often caused by icy roads. It is important to have towing service ready to render assistance in icy sections. In hilly terrain the Germans set up sand dumps, and all vehicles were ordered to carry sand. Vehicles with trailers were barred from icy roads, since they often became stuck even if roads were sanded.

Section II. Railroads

Heavy snowfalls and drifting snow interrupt railway traffic, and the Germans used local civilian labor and snowplows to keep tracks clear. Cold reduced the efficiency of German locomotives which had been built for the milder temperatures of Central Europe. During the first winter of the war 70 percent of the German locomotives broke down. Only after a period of trial and error and protracted technical research which led to the introduction of a new type of locomotive, did the Germans overcome their difficulties. Railroad construction and maintenance requiring excavation slowed down or stopped completely in cold weather. Cold crippled operations, caused traffic congestion, and slowed supply movement.

In the winter of 1941–42, sometimes only one third, and frequently less, of the daily quota of twenty-eight trains got through to Army Group Center. The German Second Army and Second Panzer Army together required eighteen supply trains a day and received only two. In November 1941 these armies were unable to take Tula because their supply system had broken down. Even the most critical supplies did not reach the front in time.

Section III. Draft Horses

Most of the German horses became accustomed to the Russian winter, although they needed at least emergency shelter. In the open, horses freeze to death at temperatures under −4° F. Russian horses, with their thick shaggy winter coat can withstand temperatures as low as −58° F. if they are sheltered against the wind. Some German horses,

notably the heavy cold-blooded breeds, were unable to withstand the Russian winter, particularly those moved suddenly from the mild climate of France.

The Germans expected their draft horses to pull excessive loads in winter, and the animals became prematurely spent particularly when they were given insufficient care, forage, and water. Lighter breeds were better able to stand the cold, but were not strong enough to move the heavy German equipment; they became exhausted, and collapsed and died in the snow.

During the first winter of the war German horses frequently lacked winter shoeing, a factor which lessened their draft power on icy roads and caused them to fall. Sometimes ice was so bad that horses which had not been winter-shod could not be led from the railroad station to the stables.

A great many horses perished for lack of forage. In quiet sectors horses were worked as little as possible when feed was short. Work teams which were given extra feed were used for routine duties.

There were no horse diseases directly traceable to or aggravated by the Russian winter. Most of the 1,500,000 horses which the Germans lost in Russia were victims of battle wounds, overexertion, forage shortages, and cold.

Chapter 7

Health and Morale

Section I. Evacuation of Casualties

In some respects conditions for evacuation of casualties during winter were more favorable than during other seasons. Even after a heavy snow, road traffic was soon restored. In some sectors native sleighs were used for evacuation, and special sleighs with enclosed wooden superstructures were built and did good service. Battlefield evacuation was done with small one-man sleds which are easily pulled by one or two soldiers.

A plentiful supply of blankets is essential, and the Germans also used paper coverings to protect limbs of casualties in transit. Frost injuries rarely occurred during evacuation, and only during the first year of the war, when hospital trains were immobilized for hours by cold, did wounded freeze to death. Except for the length of time involved, evacuation generally caused little discomfort to casualties.



GERMAN SUPPLY COLUMN using Russian *Panje* sleighs.

Section II. Effect of Cold on Morale

The reverses suffered at Moscow lowered the morale of both officers and men who felt that lack of preparation for winter warfare was the cause of their defeat. Although it was too late to correct the basic mistakes, officers succeeded in convincing troops that the retreat would soon end, and that defeat would not become disaster.

Many men who had become separated from their units marched westward singly or in small groups and, when apprehended, freely admitted that their destination was Germany because "the war is over." These men were turned over to the nearest combat unit for rehabilitation. More serious were the cases of deserters who concealed themselves on farms and managed to obtain civilian clothes. The number of deserters to the enemy was few.

Since gasoline was precious, thefts of fuel were common. Troops helped themselves wherever they found unguarded stocks, and even drained tanks of unattended vehicles. Spare parts were scarce and were stolen whenever it was opportune to do so.

Chapter 8

Air Operations

Section I. Aircraft

In general, German aircraft stood up well even under the worst winter conditions. However, oil became quite viscous, and placed an excessive strain on various parts, especially hydraulic equipment, and a special type of winter hydraulic fluid had to be used. Lubricating oil was heated before starting engines, and electric storage batteries were also prewarmed because cold reduced their efficiency.

Aircraft tires did not show adverse effects at temperatures down to −30° F., but at lower temperatures tires started to become porous. Other rubber parts, such as self-sealing tanks and rubber packings of shock absorbers, deteriorated when exposed to prolonged, intense cold. Tarpaulins provided good weather cover for wings and tail units of aircraft parked in the open, and served as camouflage.

The Germans kept some planes in heated "alarm boxes" during periods of low temperatures to assure an immediate take-off during an alarm. Skis were installed on light liaison planes for landings away from airfields. Combat aircraft took off on wheels from packed-down runways.

Section II. Airfields

For winter operations, air installations must have adequate, heated working space, heating equipment, snow-removal and snow-packing equipment, and good quarters. The Germans found that aircraft mainteance in winter took several times as long as in summer unless heated working space was available.

Concrete runways and strips quickly become covered with snow, and careful maintenance through packing and removal of excess snow is necessary. Since snow in many areas of Russia remains dry and powdery throughout the winter, excessive snowdrifts pile up whenever there is a strong wind. All obstacles must be cleared from runways, for even small bushes and gasoline drums may be the cause of drifts several feet high.

In view of possible changes in plans involving the redistribution of units and the movement of reinforcements, the Germans tried to keep even unused airfields ready for winter operation. To get fields

into operation once winter had set in required a considerable expenditure of time and labor and sometimes necessitated the construction of roads if no railroad connection was available for movement of matériel.

Section III. Flight

The very short days of winter made night flying necessary for extended missions. German crews not qualified for night flying were therefore limited to missions of short duration.

Particular difficulties were encountered in orientation from the air because of the similarity of snow-covered ground to snow cover on frozen lakes and rivers. During winter—as well as during spring floods and mud—the Russian landscape bears little resemblance to what is shown on maps. New aerial photographic maps and sketches for each season are indispensable for navigation and for effective cooperation with ground forces.

During early winter, ceilings and visibility below the clouds are usually favorable enough to permit flights along coastal areas. Poor visibility and clouds resembling high altitude fog frequently appear within the cold continental air masses and western warm air masses over the Volkhov River and Lake Peipus. The danger of ice formation during all seasons is greater in European Russia than in Central Europe. Frequently when Germany and western Russia have good flying weather the intermediate area of eastern Poland has low overcasts, poor visibility, precipitation, and conditions which lead to formation of ice.

In the German experience the number of accidents caused by climatic conditions in Russia was neither greater nor less than in Central Europe. Emergency missions necessitated by the ground situation, such as low-level attacks to support armor, or supply flights—especially to Stalingrad—naturally brought about increased losses attributable to weather conditions. Virtually every emergency landing in winter resulted in total loss of the aircraft.

Section IV. Emergency Equipment

Based on the experiences gained in the first winter of the war, normal emergency equipment was supplemented by short skis with which flight crews could cover considerable distances if forced down. Snowshoes proved unsatisfactory and consequently ski boots were issued instead of air force fur-lined boots. Equipment for emergency landings in all seasons included abundant quantities of salt and pictures of saints which were used as barter items with the local population.

Section V. Rations and Clothing

The campaign in Russia taught the Germans nothing basically new in the matter of rations for flight personnel. Standard preparations for long-range and high-altitude flight assured that personnel were properly fed for extreme climatic conditions.

Normal-issue cold-weather clothing was adequate for flight and maintenance personnel.

PART THREE
SPRING AND AUTUMN

Chapter 9
General

The rain and mud of spring and autumn have a decisive effect upon military operations in European Russia. Because both seasons are similar, they are dealt with in the same part of this study. Mud is the dominant climatic factor in military operations during spring and autumn. With the first thaws of spring, most of European Russia below the Arctic Circle becomes a muddy mass. The spring muddy season lasts from four to six weeks, and ends when the ground is sufficiently thawed to absorb melted snow. The autumn muddy season starts in early October and lasts about four weeks. In sandy regions or on high ground the adverse effects of mud upon military operations are less severe.

The melting snows of spring cause heavy floods in addition to mud conditions. The spring muddy season does not end everywhere at once; there are extensive wooded and swampy areas which do not dry out until summer, sometimes not even then. The autumn muddy season ends suddenly—after the first frosts mud rarely recurs again.

Section I. Spring

In the northern and central areas of European Russia the melting snow, often accompanied by heavy rainfall, begins between the end of March and the middle of April. During the first days of this period, recurrences of cold spells with frost or snow are likely, followed by quickly rising temperatures which rapidly melt the snow. The spring floods swell all streams. Rivers increase to as much as ten times their normal width, and floating ice threatens bridges often causing their collapse. All river traffic is suspended while rivers are at flood stage. The excess water flows off in a comparatively short time and leaves the countryside an ocean of mud. In open country one often sinks knee-deep; paved roads give way and motor vehicles become hopelessly stuck. All attempts to use force usually make mat-

ters worse, lead to useless waste of energy and terrific consumption of fuel, and end with the complete breakdown of the vehicle. Few railroads, and fewer roads remain passable during the muddy season, and often aircraft offer the only means of transportation. In swampy terrain the muddy season is particularly troublesome because all contact with surrounding areas is interrupted. Roads previously dry are saturated, and impassable even on foot.

In the south, spring begins toward the end of February in the lowlands, and in the higher regions one or two weeks later. Here the muddy period usually lasts about four weeks, and is particularly severe in the black earth belt of the Ukraine. Here, too, unsurfaced roads become bottomless, although most surfaced roads can still be used by motor traffic. In some regions of the south the muddy period does not start as suddenly; moreover in its early stages it is limited to daylight hours. Night temperatures fall below freezing, permitting only a superficial thawing; the ground underneath remains solidly frozen. This makes it possible to continue large-scale movements through the first half of the muddy period.

Along the northern coast of the Sea of Azov the muddy period, with brief interruptions, lasts throughout the winter, because in this coastal area winter temperatures fluctuate between just above and just below freezing. Although the muddy period here lasts much longer than in other areas, it presents problems no different from those in other parts of the southern Ukraine.

In the Crimea, north of the Yaila Mountains, climatic conditions at the beginning of spring are similar to those in the southern Ukraine, and are marked by warm weather and rapidly melting snow after mid-March. The coastal strip south of this mountain range has a subtropical climate because of its geographic location, being sheltered from northern winds and open to the south toward the Black Sea.

Section II. Autumn

In northern and central Russia the autumn season is limited to September and October, while the south benefits from an additional month of autumnal weather. During the first half of autumn the weather is dry and temperatures are moderate, and summer operations can continue through this time without interruption. During the second half of autumn temperatures drop and the rains begin, ushering in the muddy period. In the steppe regions farthest to the south the autumn muddy season is less severe, but everywhere else traffic over open terrain and on loose surface roads is tied up.

Chapter 10

Mud

Section I. General

The spring and autumn muddy seasons are the greatest obstacles to a war of movement in Russia. The attacker, who must seek to retain the initiative, is much more affected by mud than the defender. Operations are impracticable even for troops that are familiar with and equipped for the muddy periods.

The Russians are by no means immune to local climatic hardships. During World War II they made it a point not to launch or continue large-scale operations during the muddy season. They went so far as to halt their winter offensive before Moscow on the first warm, sunny day of spring (18 April 1942) despite the fact that their objective—turning the tide against the German invader—was virtually within their grasp. Whenever the situation forced them to move despite mud and mire, countless Russian tanks would wallow helplessly, and if the Russians were forced to withdraw, these tanks became a total loss. More than once an entire Russian tank corps got barely a dozen machines into combat—the rest were stuck and churned through the mud for days before catching up. But Russian tanks are designed to take the worst of punishment and usually reached their objective.

Large-scale operations are impossible during the muddy season. In the autumn of 1941, an entire German army was completely stopped by mud. The muddy season of that year began in mid-October and was more severe than any other muddy season experienced in World War I or World War II. During the first stages cart and dirt roads were impassable, and then the road from Roslavl to Orel became mud-choked. Supply trucks broke through gravel-top roads and churned up traffic lanes until even courier service had to be carried out with tracked vehicles. Finally only horse-drawn vehicles could move; all other transport and the bulk of the tanks and artillery were stopped dead. The muddy season lasted a month.

Pursuit of the enemy who had been beaten at Bryansk was impossible. Only divisions which had reached the Bryansk–Orel–Tula road could move. Units became separated and intermingled, with only scattered elements in contact with the enemy. The bulk of the

force stuck fast or moved fitfully forward in short marches. Motor vehicles broke down with clutch or motor trouble. Horses became exhausted and collapsed. Roads were littered with dead draft animals. Few tanks were serviceable. Trucks and horse-drawn wagons bogged down and railroad supply was not equal to the situation.

Defense in place is effective during the muddy season. Any defensive operation involving movement is hampered by the same difficulties as offensive actions. An organized position is more easily defended during the muddy season than in dry weather—the attacker is at a disadvantage in mud and has to confine himself to local actions. The defender has time to organize his position well in advance of the muddy season. He can establish communications that enable him to shift reserves to threatened sectors. The defender of an organized position usually has rearward communications or adequate supplies at his disposal. He can counteract cold and dampness by preparing heated shelters and fortifications. His signal installations can be given regular maintenance. Defending infantry can fight from dry, well-concealed positions, while attacking infantry offer a prime target as it clumsily trudges through knee-deep mud.

A forced withdrawal from an organized position is the worst possible turn of events for a defender. All his former advantages become hindrances, and he is as handicapped by the terrain as the attacker. Further, he is pressed for time and is likely to lose his weapons, vehicles, and supplies. Defense begun without prepared positions, and a defense requiring mobile defense tactics, are normally carried on from villages or farmhouses until the situation permits establishment of a continuous line.

Section II. Infantry

Limited-objective attacks during a muddy period are feasible when units equipped with tracked vehicles are used in conjunction with infantry. In October 1941, for instance, such a combination of forces captured Kursk. Tracked vehicles in the lead, the Germans advanced about twelve miles eastward from Dmitryev Lgovski to the Usozha River, where the bridge had been burned and Russian labor battalions offered strong resistance on the east bank. Suddenly, Russian cavalry supported by T34 tanks made a surprise raid on the stalled German column. Only the timely arrival of German dismounted armored infantry, which succeeded in destroying a large number of T34's, prevented a serious set back. Engineers replaced the bridge and the advance continued. The Russians fought on, but the 95th Infantry

Division made a wide sweep east of the road to Kursk and captured that strongly fortified city.

Section III. Artillery

Artillery must be light to retain mobility in mud. The German pieces were too heavy for muddy terrain, and guns became so badly bogged down that teams of horses could not budge them.

The roads, mud, and swamps of northern Russia posed entirely new problems for the German artillery. Tactical concentration, normally a routine matter, became an art in the desolate morass where new problems had to be solved each day. Reconnaissance, selection, and occupation of observation and firing positions, and the installation of wire required hours of labor and a great deal of ingenuity. Work on roads and bridges was even more time consuming. In many places extensive networks of corduroy roads had to be built, often by combat troops as there were not enough engineers to do the job. Prior training of artillerymen in road construction would have been useful, but the necessity therefor was not foreseen, much less planned for. Poorly constructed roads that constantly broke down under heavy loads of ammunition resulted. The maze of corduroy roads through swamps and thinly wooded marshy forests had but little natural cover and were easily seen by enemy air reconnaissance. To counteract this condition, roads were built far beyond gun positions and dummy roads constructed. These deceptive measures were not particularly effective since the artillery was of necessity confined to the few dry areas available.

The Russians are familiar with the swamp country and know exactly where such areas can be crossed. They often penetrated or outflanked the weak German infantry and popped up in front of artillery positions. Every gun position had to be made a strong point, and artillery troops given basic training in infantry tactics, a subject which had received little attention in artillery training up to that time.

Mud impairs the effectiveness of artillery fire, dampens splinter effect, and causes a high number of duds, making fire adjustment extremely difficult.

Section IV. Armored Forces

German losses of tanks and motorized equipment of all types were extraordinarily high during the autumn muddy period of 1941, the first time that the mud of Russia was encountered. For example, Second Panzer Group, operating in the Orel area at that time, lost 60 percent of its tanks in mud. A division of Fourth Panzer Group,

operating in the area north of Gzhatsk during the same period, lost fifty tanks without a shot being fired, thirty-five of them within three days. These losses were most serious since no replacements were received. Germany at that time was producing only eighty-five tanks and forty assault guns monthly.

Armored operations in mud are most difficult. For instance, in February 1944 when two German corps were encircled at Cherkassy, an attempt by a strong armored force to crack the Russian ring from the outside bogged down within sight of the encircled corps, although the relief force did come close enough to its objective to make contact with some troops who had fought their way out on foot. In another instance, in March 1944, six thousand German troops cut off in the city of Ternopol were lost because a tank force of 35 Tiger and 100 Panther tanks attempting a relief thrust were prevented by mud from reaching the beleaguered city. The task force was able to cross the Strypa River and knock out strong antitank defenses, but had covered only half of the twelve miles to Ternopol when forced by mud to give up. Thousands of hours of labor were needed to restore roads and small bridges sufficiently to retrieve the stranded armor.

In early spring major operations with limited objective are possible if timed for the period when daytime thaws and night frost leave but a thin layer of mud on deeply frozen ground. Operations begun just before a muddy season, however, run the risk of failure because there is no way of estimating how long terrain will remain passable. For instance, in March 1943 when two panzer armies, together with two German infantry corps, started an operation to retake Kharkov, their advance carried into high country, where spring usually begins later than in the lowlands. There was still some snow on the ground when the attack was launched. Just before the Germans reached their objective—the upper course of the Donets—a sudden rise in temperature created a severe muddy condition. All vehicles except those on the only hard-surfaced road in the area, leading from Kursk to Kharkov, became helpless. The infantry was able to slog forward, but heavy weapons and artillery were delayed and finally moved up with great effort. Even the T34 tanks of the Russian rear guard became embedded and could not be retrieved by the Germans until warm weather.

Operations begun when spring mud starts to recede and roads are usable can be successful. In March 1944, one panzer division and two infantry divisions, using a main road passable for wheeled vehicles, made a twenty-five-mile thrust which liberated First Panzer Army from encirclement near Buchach.

Local, limited-objective offensives are possible during the muddy season if rail transport is available to the attacking forces. In Oc-

tober 1941, at the height of the autumn muddy season, the Germans determined by air reconnaissance that the Orel–Kursk railway was intact except for destroyed switches and water towers. Only partisans and weak Russian cavalry were believed to be in the area, and the Germans decided to attack from Orel to establish a supply base at Ponyri, about half way to Kursk.

Two armored trains captured from the Russians were in the Orel rail yards. One regiment of infantry, some artillery, railroad engineers, and flak were entrained and quickly moved south, completely surprising the enemy. After several minor engagements on the way, the combat team reached Ponyri and the rail lines were firmly in German hands. The operation took two days.



GERMAN COLUMN on road near Lake Ilmen, spring muddy season.

Chapter 11

Clothing, Equipment, Rations

Section I. Clothing

The wet and muddy weather of spring and autumn subjects clothing to excessive wear and tear. Uniforms become matted and quickly go to pieces. Accessible facilities for the rapid repair of clothing are essential, and ample supplies must be located as near as possible to the front.

Footwear rapidly deteriorates. For wearing quality and protection, the Germans found their half-length infantry boot best for muddy season wear. Rubber boots are too cold when worn alone, although they are well suited for wear over shoes. Wrap puttees are unsatisfactory because they become waterlogged and saturated with mud. Footwraps are warmer, cleaner, and more durable than socks. Adequate shoe repair facilities are necessary.

Section II. Equipment

Supply

The inevitable paralysis of highway transportation during the muddy seasons requires long-range planning of a supply organization that remains unaffected by climatic conditions. Supply dumps and depots are best located at points which can be reached by motor transport even in the most inclement weather. It is well to remember that woods or terrain offering concealment usually become inaccessible during muddy seasons, and goods stored in such places must be removed well in advance of thaw or rains and dumped along roads. This system is disadvantageous in that it wastes manpower in moving stocks, requires dual administrative records, and calls for twice the usual number of guards.

Weapons

Protecting weapons against the weather is difficult during the muddy seasons. Neglect of protective maintenance, shortages of cleaning materials and protective lubricants, or failure to shield weapons from wind and weather result in such serious waste that even a well-functioning supply organization cannot replace losses. Pro-

tective coverings for small arms bolt assemblies are especially important.

Section III. Rations

The Germans found that a good way to prevent shortages of rations—as well as equipment—was to store a three to four weeks' reserve in depots close to the front. Withdrawals from these stores must be prohibited as long as supply continues from the rear. Similar steps must be taken to forestall shortages of forage, which are apt to be serious during autumn when railroads are busy hauling winter supplies. Expedients such as loading pressed hay and straw in crevices between other cargo are not enough to cover forage requirements.

In the autumn of 1941 German troops were without bread for days and had to live off the land and such local food supplies as the Russians had not destroyed. Requisitioning of food in unoccupied territory was possible only with strong parties, as such areas were infested with partisans and scattered Russian soldiers.

Chapter 12

Transportation and Troop Movements

Section I. Roads

The road net of European Russia is sparse and, except for a few well-built roads, is not equal to sustained use by heavy vehicles. The effect of the muddy season on roads and highways is so devastating that movement slows to a snail's pace and eventually comes to a complete standstill. Most hard-surfaced roads lack good foundations and become so waterlogged that they cave in under the smallest load. Roads need continuous maintenance, a job that requires thousands of laborers. Most of the bridges on main roads and all those on secondary roads were very weak, and the Germans had to replace them with more adequate structures. The peak of road and bridge construction and maintenance occurs during the muddy seasons.

The Germans had no conception of mud as it exists in European Russia. In the autumn of 1941, when front-line troops were already stuck fast, the German High Command still believed that mud could be conquered by main force, an idea that led to serious losses of vehicles and equipment. At the height of the muddy season tractors and wreckers normally capable of traversing difficult terrain are helpless; and attempts to plow through the muddy mass makes roads even more impassable. Tanks, heavy wreckers, and even vehicles with good ground clearance simply push an ever-growing wall of mud before them until they finally stop, half buried by their own motion. A sudden frost in the autumn of 1941 cemented a crippled, buried column into a state of complete uselessness, and it never moved again. Because it could not be reached in any other way, gasoline, towropes, and food supplies were airdropped along this line of stranded armor, but all attempts to move were futile. Often, when drivers found themselves bogged down far from any habitation, they abandoned their vehicles and set out on foot to contact friendly troops in the nearest village, or sought food and shelter from local civilians in order to remain alive until the worst of the muddy season passed.

For the muddy seasons, vehicles with high ground clearance, light weight, and low unit ground pressure are necessary. German trucks had low ground clearance, and could not get traction in deep mud. Since German supply carts had wheels too narrow for muddy terrain, they sank deep into soft ground. Even the German *Maultier* and

Ostschlepper of the later war years bogged down in mud; their tracks were too narrow. The awkward-looking and slow Russian tractor of prewar vintage salvaged the heaviest, most deeply mired loads after German equipment failed to budge them. Russian trucks, too, were much better for muddy terrain, and the Germans promptly put captured Russian vehicles into service.

The Russians know the effect of mud upon dirt roads, and therefore restrict traffic to paved roads during the muddy seasons. Their tanks and cross-country vehicles have wide tracks, and these they allow to travel alongside dirt roads, while light traffic is permitted on roads when they are hardened by night frost.

After their first experience with mud, the Germans adopted the Russian method of preserving roads through the muddy seasons. Troops were supplied in advance with food and ammunition, and dirt roads were closed off. Single vehicles were allowed to travel parallel to roads, with the distance between vehicles regulated by a block system. Repair and maintenance of roads was assigned to engineer troops and to Organization Todt [*Ed*: paramilitary construction agency of the Nazi Party, auxiliary to the Wehrmacht]. Corps headquarters were responsible for roads in corps areas, although in practice army assumed responsibility for main traffic arteries. Changes were reported to the army engineer and road maps distributed daily, as during winter. One battalion could maintain thirty miles of dirt road in the muddy season. The Germans used a large number of Russian civilians, mostly women, for draining roads and making other improvements. Roads that become badly rutted during the muddy season do not dry out to a usable condition unless leveled while still soft. In dry weather graded dirt roads are as good as hard-surfaced roads, but the slightest rain makes them slippery.

The Germans sometimes had to construct corduroy roads during an attack. In the autumn of 1941, when panzer units of Army Group North were given the threefold mission of cutting off Leningrad, establishing contact with Finnish forces, and seizing the bauxite mines east of Tikhvin, the operation degenerated into a struggle against mud and swamp. Each unit had to construct its own corduroy road since the terrain was almost impassable, even for tracked vehicles. The Germans did reach Tikhvin, but did not accomplish their entire mission.

In another instance on the Leningrad front, in the autumn of 1942, when the Eleventh Army was to attack across the Neva River, the operation did not get beyond the planning stage because of the lack of usable roads through the mud and swamp of the area. Neither the time nor the materials were available to build the corduroy, concrete, or steel plank roads that would have made the terrain passable.

Section II. Railroads

The few railroads of European Russia are the only means of long-distance transportation during the muddy season, and overburdening their facilities is inevitable. Operating schedules are disrupted because muddy highways prevent access to railheads. Repairs to damaged sections of track consume endless time because labor and materials must be transported by rail to the damaged places. The right of way must be restored step by step, as simultaneous work on several sections of track is out of the question. Supply shipments suffer serious delay. During the German autumn offensive of 1941 the supply flow was so reduced that operations in some areas came to a complete halt.

As an expedient, supplies were sometimes shuttled over serviceable sections of track. This was difficult when intact sections of track could not be reached because of muddy roads. In such situations men and matériel were flown in by gliders to the place where rail movement could be made.

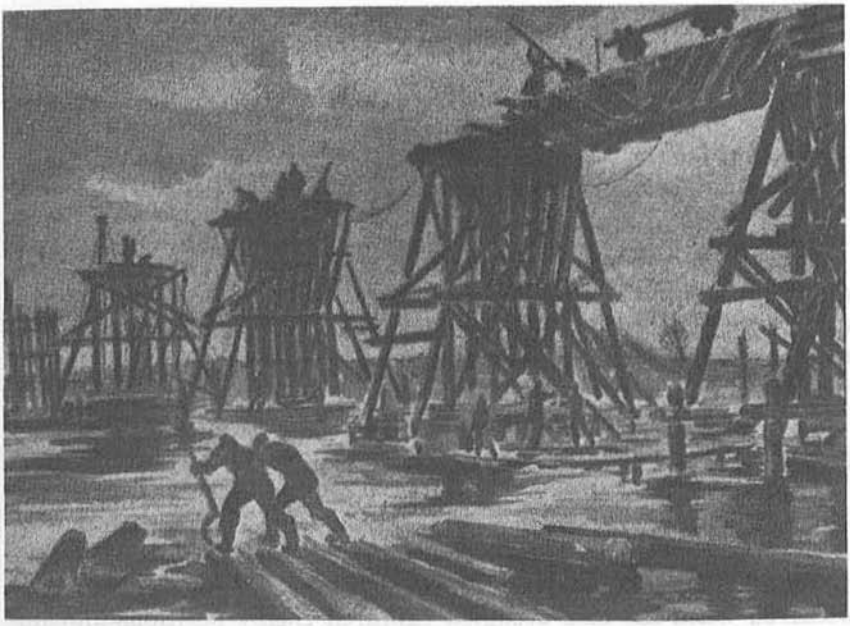
Mired roads make movement of troops and vehicles on top of dry railroad embankments a great temptation, but it must be avoided. Vehicles damage rails and switches which are hard to replace.

Russian railroad bridges are usually high enough to escape harm from spring floods. In only a few instances will the water level reach a railroad span. Even then superstructures suffer little damage, despite the fact that they are invariably of poor construction.

Section III. Bridges

Most rivers in Russia are not regulated, and after snow melts in the spring the rushing waters make river beds extremely muddy, especially near the banks. High water and muddy river bottoms make bridge construction difficult. For example, after the German attack across the Dnepr in 1941, a military bridge settled and broke under the weight of the first tank to cross. The trestles, which were placed on an apparently firm gravel bottom, had sunk through a layer of mud below the gravel. The small footings used were not suitable for supporting weight on a muddy river bed. The six-hour delay during which the bridge was repaired prevented a panzer corps from achieving a tactical surprise.

Flood waters carried heavy, floating ice which threatened bridges, and only high spans equipped with ice fenders withstood this danger. Well-anchored underwater bridges were widely used by the Russians. High waters can cut off bridgeheads from supplies, and for this reason both Russians and Germans repeatedly abandoned bridgeheads before spring floods.



GERMAN BRIDGE CONSTRUCTION, Lovat River

Section IV. Small Boats

Flood waters form channels and sand bars in rivers, and these irregularities constantly change. Because of this the Germans abandoned the use of deep-draft motorboats and replaced them with shallow-draft assault boats for river crossings in spring. Boat crossings during high water periods are dangerous, and fording streams, other than small brooks, is hazardous.

Chapter 13

Health

Section I. Troops

During the rainy and muddy periods the humidity and cold induced mild forms of respiratory diseases which, however, rarely required hospitalization. Except for a lowering of resistance, the Germans found that the general state of troop health remained satisfactory.

Of great concern throughout the Russian campaign was the typhus plague. During autumn—and winter—the infestation of troops with lice reached serious proportions in front-line positions. Typhus was less common among combat troops than among service personnel in rear areas, because front-line troops had much less contact with the civilian population. Major outbreaks of typhus among combat troops occurred when the men occupied captured enemy positions and immediately bunked on straw they found in dugouts and other shelters. In some cases the Germans had to withdraw and quarantine whole companies.

Continuous delousing is most important in fighting typhus. During the first year of the Russian campaign the Germans did not have effective antivermin powders, and only at the end of 1942 did front-line units get mobile delousing stations. Wherever possible, *sauna* baths were installed at supply units, and a more or less effective delousing of clothing was carried out. The benefits were but temporary; after using the *sauna*, soldiers had to be returned to the front with its vermin-infested positions, and they once again fell prey to lice.

Evacuation of wounded is so difficult during the muddy seasons that unnecessary losses of personnel can be avoided only if facilities for emergency treatment are placed well forward in the combat zone. Hours are needed to carry serious cases through a mile of knee-deep mud and marsh to aid stations. In situations where casualties could be evacuated only under cover of darkness, four litter bearers often required an entire night to bring out one man.

Motor transport of wounded to hospitals which cannot be reached via a hard-surfaced road is a torturously slow procedure; ambulances towed by prime movers must wind their way through mile after mile of vehicles bogged down in mud. A thirty-mile trip under such conditions often takes six to eight hours. So many ambulances broke

down that the Germans started to evacuate wounded in supply trucks returning to rear areas, an advantageous method. Eight to ten wounded can be transported in a truck, while only four can be carried by an ambulance.

Section II. Horses

During spring and autumn, diseases among horses were no higher than in other seasons. Exposure of animals to dampness after sweating caused colds, and deaths from overexertion were numerous. Horses collapsed on the road and had to be given weeks of rest. Supply difficulties during the muddy season caused shortages of feed which led to the loss of many draft animals.

Chapter 14

Air Operations

Advance preparations must be made for draining airfields during spring thaws; otherwise, they turn to mud and remain unusable for weeks. Drainage ditches are rarely sufficient; as much snow as possible should be removed before it starts to melt. It is frequently helpful to puncture the ground frost, permitting water to drain off.

During the spring thaw the ground often heaves with such force that runways are destroyed for great lengths, seriously interfering with air operations.

PART FOUR
SUMMER

Chapter 15

General

Summer comes suddenly south of the Arctic Circle, and literally overnight all traces of spring disappear. The ground hardens, roads dry out, and the mud of spring becomes a hard crust or turns to dust. Days are warm, nights are cool, and only in the southern region is the heat intense. Moors and swamps dry up, and swampy lowlands which are impassable during the muddy seasons may be used by peasant carts and, to a limited degree, by wheeled and tracked vehicles. Narrow paths emerge from swampy terrain, and islands rise out of the receding waters to furnish partisans with hiding places. The paths to these island strong points are water covered in many places, and contact with the enemy is difficult. The rapid growth of vegetation, especially in the south, provides natural cover which has a definite effect upon operations.

All roads are passable in summer, and even driving in open terrain is possible, despite numerous fissures and cracks in the ground. So-called summer roads can be created at will without engineers or laborers—they form themselves by use. Speeds up to fifty miles per hour are possible on summer roads and they are often preferred to regular roads which are full of holes. Summer roads are useless after rain, but if not used while wet they dry out to a smooth surface and full-scale movement can be resumed.

Summer not only dries out roads, but reduces the level of rivers and streams as well. Rivers can be forded, and smaller streams are only minor obstacles. Swampy terrain remains a serious barrier.

Summer is the most favorable period for operations in European Russia. All arms are capable of optimum mobility. Counterattacks and raids on communications can slow an offensive, but are rarely enough to bring it to a halt. The attacker can bypass fortifications or bring up his heaviest weapons against them.

Section I. Sudden Changes in Ground Conditions

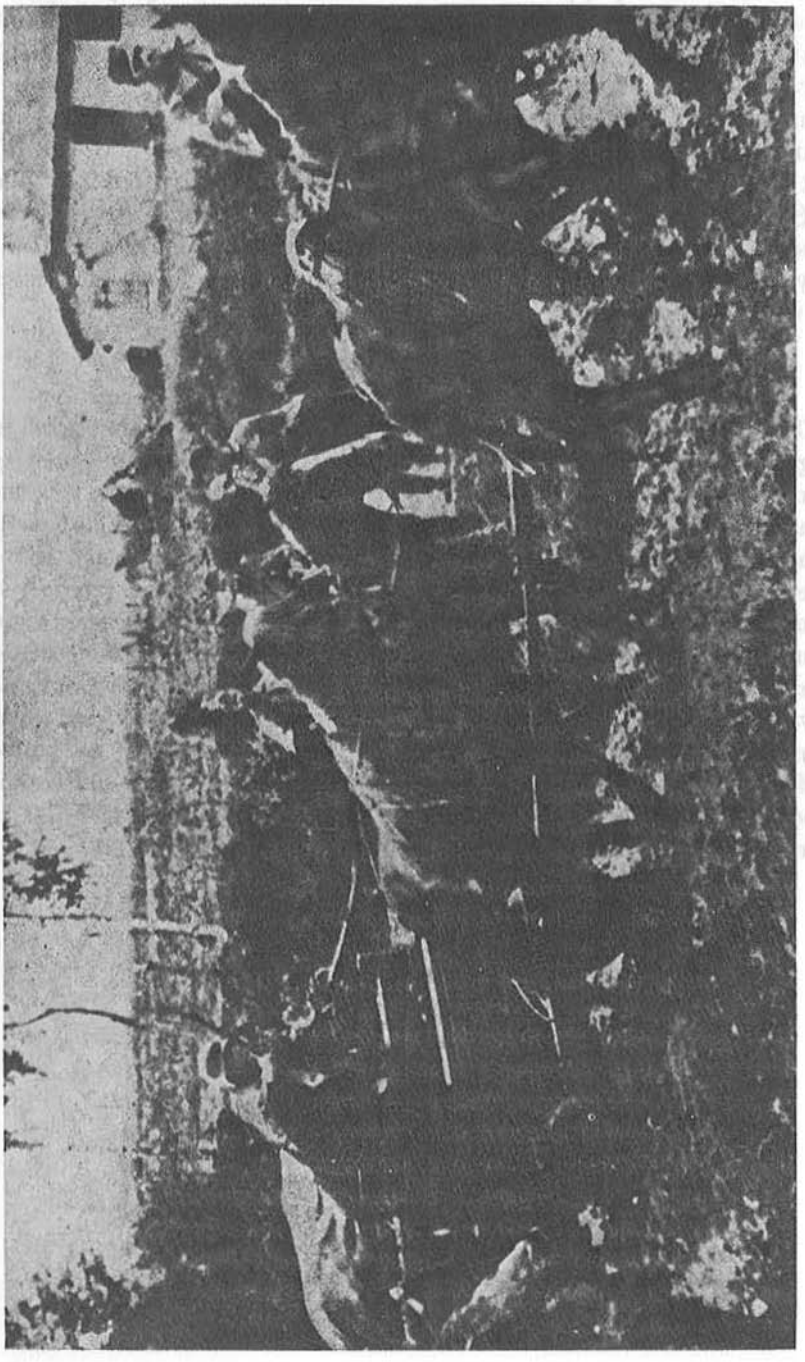
Sudden thunderstorms can change easily passable dirt roads and open terrain into mud traps. Near Kiev, in August of 1941, such a storm was almost fatal to a regiment of a German motorized infantry division. The division was ordered to block the last escape route of Russian forces encircled north of Cherkassy. Moving over dry roads, the division reached the area of encirclement in good time and, despite a strong attempt at breakout by the enemy, accomplished its mission. Relieved from the blocking position, the division was ordered to join Second Panzer Group for the drive on Bryansk. Hardly had the first elements moved out when a heavy rain began, and the roads became such a slippery mass that the last regiment stuck fast. At this critical moment Russian tank forces, attempting a relief thrust on Kiev, hit the rear of the mud-bound regiment; the Russian armor with its wide tracks could still move over the muddy ground, but the German motorized infantry was anchored by its own wheels. Lacking the fire power to mount a defense against the tanks, the infantry set fire to its vehicles and set out on foot to join the division which was also bogged down to the north.

In another instance, a brief rainy period at the end of July and the beginning of August 1941 prevented First Panzer Group from closing a ring around Russian forces in the southern sector of the Uman area. The Germans started their advance east of Berdichev in three columns. The first two, using tracked vehicles and horse-drawn Russian peasant carts, made slow progress; the third and strongest element, using wheeled motor vehicles, bogged down completely. Mud and the German shortage of proper equipment enabled a considerable number of enemy forces to escape encirclement.

After the return of sunshine, dirt roads dry out rapidly and can be used for normal traffic, provided undisciplined, over-eager drivers have not plowed them up while the roads are still soft. After 22d Panzer Division broke through the Parpach battle positions preparatory to seizing the Kerch Peninsula in the summer of 1942, a sudden cloudburst so mired the road that movement was impossible. A perimeter defense was thrown up, and the division sat it out until the storm was over and the summer sun had dried the road to a passable condition.

Section II. Dust and Sand

Right at the beginning of the Russian campaign the Germans experienced the havoc which dust can wreak with motor vehicles. Even German tanks sustained severe damage from the dust they stirred up while crossing vast sandy regions. Many tanks had no dust filters,



GERMAN HORSE-DRAWN WAGON in summer mud, 1941.

and on those so equipped the filters soon became thoroughly clogged. Quartz dust was sucked into engines, which became so ground out that many tanks were rendered unserviceable. In other tanks the abrasive action of dust reduced engine efficiency and increased fuel consumption; thus weakened, they entered the autumn muddy season which dealt them the death blow. Sand roads greatly slowed, but did not stop trucks. The *Volkswagen* [*Ed:* German counterpart of the U.S. jeep], which otherwise proved highly serviceable, stuck easily in sand because of its narrow wheels. Huge dust clouds raised by convoys frequently provoked air attacks that resulted in serious losses of vehicles and horses.

Section III. Water

The water supply in European Russia varies greatly from region to region. During summer it is uniformly poor. Generally, the quantity and quality of drinking water deteriorates toward the south. To the north, nearly every inhabited place has an adequate number of wells that furnish potable water. Between Leningrad and the Luga River there are many wells sunk as deep as eighty feet; the water from these sources is cold and of excellent quality. Each village in central and southern Russia has one or two wells, but during summer their water is scant and warm, and drinking water must be taken from brooks and rivers. Many wells and cisterns in southern Russia nearly dry up in summer droughts, and such water as they furnish must be boiled before drinking. The water supply in the bend of the Don River is poor. German forces that fought between the Don and the Volga in the battle of Stalingrad had practically no local water supply.

Chapter 16

German Tactics

Section I. Swamp and Sand

Even in summer, swampy and sandy terrain can have a decisive effect upon movement and combat. It is impossible to estimate the time required for a march through such areas, and careful ground and air reconnaissance must be made to compare maps with actual terrain conditions. Provision must be made for supplementary gasoline. Extra engineer troops are necessary, and portable bridging equipment is indispensable for crossing water holes and swampy areas. Wreckers must be spotted to provide help where the going is particularly rugged. The small and light column with the same organic structure as its parent unit is at a definite advantage in sand and swamp.

On 11 July 1941, 6th Panzer Division was diverted from its eastward advance toward Porkhov and Dno to assist 1st Panzer Division whose drive via the Pskov-Leningrad *Rollbahn* [*Ed:* road designated as a main axis for motorized transportation] toward Luga had run into stiff enemy resistance near Novoselye. (Map 3) Hardly had Flying Column Raus, the leading echelon, started for the trouble spot, than the road, shown on the map as leading directly through a swampland to Novoselye, came to an end. Local residents said no such road had existed for forty years. With guides and engineers to the front, the column took up a zigzag course from village to village over the best wagon roads that could be found. At the first swampy hole, about thirty feet wide, an apparently sturdy bridge collapsed under the weight of a light tank. The advance was delayed for five hours while a new bridge was built.

Wherever possible, driving in the tracks of preceding vehicles had to be avoided, otherwise wheels sank deeper and deeper until they became completely stuck. The column had to cross twelve swampy brooks, and at each one a long delay was necessary while rotted bridges were strengthened with girders or entirely rebuilt. In trying to detour swampy spots, vehicles and tanks broke through the crusted top layer of ground and became so mired that they had to be towed out by other tanks. In many instances the towing vehicle sank in beside the one it was trying to assist. Sometimes vehicles roped together to help each other became so badly stuck that they had to be pulled out one by one by the most powerful wreckers. To get the

huge wreckers to points where they were needed was an entirely separate problem. The cart roads were so narrow and clogged that there was little opportunity to turn out. Commanders had difficulty in exercising leadership because emergencies developed everywhere at the same time and bottlenecks could be reached only on foot.

To keep the column from becoming scattered, it had to be halted at regular intervals, where the terrain permitted, so that vehicles could close up. Such a halt was made ten miles south of Novoselye to let the troops assemble and recover their strength for the impending engagement. The first vehicles reached the halt point at 2000 after a day in which the only fight was made against the swamp. At 0400 next day the last truck pulled in. The rate of march had averaged about one mile an hour. Men and motors had run out of water and the troops were exhausted from the burning summer heat.

The rest of 6th Division was notified by radio of the conditions encountered and took another route. The all-day struggle with the swamp, caused by the inaccuracy of available maps and the lack of engineer equipment, prevented the column from attacking near Novoselye on 11 July.

Next morning the advance guard of the German column attacked the flank of the Russian forces, guarding the *Rollbahn*, whose presence south of a small, swampy stream had been reported the day before. After a short, sharp engagement in which both sides used tanks, the flank guard was thrown back across the river. American amphibian tanks made their first appearance on the Russian front in this action, and six of them fell victim to antitank and panzer fire at close range from a wooded area—three knocked out on land and three while crossing the small stream. Two amphibians which were still serviceable were seized by the first German troops to gain the north bank.

A bridge was constructed so that the main body of the flying column could cross the six-foot-deep, swampy stream which was not fordable. Toward 1000 the entire column was across, and after destroying more Russian light tanks, drove the enemy to a point just south of Novoselye. In the afternoon the Germans launched an all-out flank attack while another force, including a panzer battalion, hit the enemy rear. After a bitter fight the main attack caved in the enemy flank, and as the panzer thrust hit the rear, the entire Russian defense collapsed. The 1st Panzer Division took up the pursuit.

Hardly had the flying column reorganized than it was ordered to march northward to seize the bridge over the Plyussa River at Lyady and establish a bridgehead on the far bank. The order ruined all chances for a night's sleep, and early on 13 July, after three hours of rest, the march began. The advance led through many swampy

places and moved forward slowly. Time and again single vehicles or whole sections of the convoy stuck in swamp or intermediate sandy areas, and motors ran hot as they were forced under the strain. Numerous halts to add water to radiators were necessary and consumed much time. At several steep places trucks had to be towed by tanks or wreckers.

South of Lyady the forward elements ran into light enemy resistance, which was quickly smashed, and the immediately following pursuit brought the bridge intact into German hands. The span was over 600 feet long, of new wooden construction, and quite sturdy. After the last remnants of enemy resistance were cleaned out of Lyady, the bridgehead was established. The objective had been reached after a march of thirty-seven miles in nine hours—a rate of slightly better than four miles an hour.

The troops had just finished a meal and completed first echelon maintenance preparatory to taking a well-earned rest when they were alerted for a new mission. The corps commander appeared and ordered the divisional column to make a quick thrust to seize and hold the two large wooden bridges over the Luga near Porechye, the so-called Gateway to Leningrad. With the order, the importance of the assignment became clear. Up to that time no German unit had been able to penetrate the Luga River line which was protected by an extensive swamp and defensive fortifications. Eighteenth Army was stalled in front of Narva to the north, and Fourth Panzer Group was held up before the city of Luga to the south.

The slogan "Open the gates to Leningrad" had a magical effect, and weariness was forgotten as unit after unit rolled toward the new objective. The road was good, and it was hoped that the sixty miles could be covered in a few hours. At the entrance to the swampy area southwest of Lake Samros hopes were dashed when the road became a swampy path of the worst type. Progress became increasingly difficult, and before dusk tanks that had tried to skirt especially bad spots and those that tried to drive through swampy ponds by main force were stuck fast. After hours of work by every officer and man to make the way passable by the use of tree trunks, boughs, planks, and the last available fascine mats, the first moor was crossed.

The column gained momentum beyond the swamp, but relief was short-lived as a burnt-out bridge loomed up to the front, its timbers still glowing. Quickly, a diversionary route was found through a neighboring village. As the leading elements approached the village, explosions were heard from all sides, followed by fires which soon engulfed the narrow road through the settlement. For the next two hours the fire made movement impossible. As the flames died the column moved slowly through the smoldering embers and falling

boards. By then it was midnight and a great distance remained to be covered. Time and again radio messages were received urging speed because of the importance of the mission. With great difficulty vehicles tried to find their way in the dim light, and for a few thousand yards the column moved jerkily forward. Then real trouble started. Swamp hole after swamp hole appeared, and bridge after bridge broke under the weight of tanks and disappeared in the mud. Time and material to rebuild bridges were not available; tree trunks were gathered and thrown over the collapsed bridges until a sufficient, though precarious bearing surface was built up. This method was followed in numerous places until the hard-surfaced road near Zaruchye was reached eight hours later.

On the good road speeds up to twenty miles an hour were possible but in a short time there was another halt—the bridge across a deep swamp lake was on fire. Engineer troops rushed forward in armored vehicles and extinguished the blaze. The span was blackened, but still serviceable, and the column rolled on.

Suddenly the cry "Enemy aircraft!" was heard but the planes made no attack, and the column continued. Again the planes appeared, signalled with lights, and dropped pamphlets. "Identify yourselves or we will fire," was the Russian demand as translated by the interpreter. The march continued, nor did it halt as the pamphlets were again dropped, and the planes flew away. Their doubt was understandable. The Germans had advanced through a large, swampy area with enemy on both sides, and were deep in enemy territory. The position of the German units had given the pilots cause for suspicion, but the continuance of the column must have convinced them that the troops were Russian. This is borne out by the fact that the planes neither attacked, nor reported the presence of the column, because little less than an hour later both Luga bridges were captured without a shot being fired, the small Russian security detachments surprised and overcome, and a bridgehead was established. Shortly thereafter the last Russian in the area was rooted out of his observation post in a church tower overlooking the near-by Russian airfield. He was completely surprised and apparently had not seen the action which led to the seizure of the bridges. A German tank attack toward the airfield answered the request to "identify yourselves"—an immediate attack by planes from every airfield in the Leningrad area, including naval planes, left no doubt on that point.

In three days and nights of continual struggle against climate and terrain Flying Column Raus had advanced 160 miles, and on 14 July stood at the gateway to Leningrad, sixty-five miles from the city itself.

The movement of the flying column through the swamp area southwest of Lake Samros had so torn up the dirt roads and turned them into such a morass that the following divisions completely bogged down and required days to cover the same distance. They had to make completely new roads with tree trunks and fascine mats placed parallel to the unusable route. The first troops to get through were those of a motorcycle battalion, whose men carried their motorcycles and side cars over the swamp areas for five days and nights.

Meanwhile the flying column in the bridgehead was surrounded by three Proletarian divisions reinforced by over 100 tanks and all the air strength in the Leningrad area. Time and again the Russians attacked the bridgehead in attempts to take it at all costs. The situation was very serious. The Germans had no communication with their follow-up forces. The message which reported establishment of the bridgehead reached corps only because a signal detachment moved back about thirty-five miles to relay the news, as the German radios could not span the entire distance over the swamp. This procedure could not be repeated because the approach route had fallen to the enemy—a Russian infantry regiment reinforced by artillery hammered the German rear. The Germans could not contact their air support, whose communications center was on the move and no longer operational in its old location. (The story of the German breakout from the bridgehead area may be found in CMH Pub 104–12, Russian Combat Methods in World War II, pages 81–82.)

Section II. Swampy Forests

At the close of the spring muddy season of 1942, Fourth Panzer Army attempted to destroy or rout a large enemy force which was operating between army rear and army group, and succeeded only because the Russians delayed the start of their summer campaign for almost a full month. (Map 4)

Throughout the spring of that year, a force under General Belov constantly harassed the rear of Fourth Panzer Army, which was under heavy attack from the east. On 18 April, the first day of the muddy season, the main Russian attacks ceased. The Germans decided to destroy the enemy to the rear at the close of the muddy season. This decision was made even though the Germans ran the risk that Russian attacks from the east might be resumed during the large-scale mopping-up operation.

Despite this danger, army group furnished a corps with three divisions, and army made two divisions available for the undertaking. Since five divisions were not enough to completely surround Force Belov, the first phase of the operation was limited to the swampy forest of Bogoroditskoye.

The German assembly, which began in mid-May, was hampered by continuous rains which muddied roads to a great depth. No postponement to await better weather was possible, because the troops loaned by army group were scheduled for a later operation in another area.

On 24 May the Germans jumped off in a pouring rain and ran into very strong resistance, especially from the cavalry and parachute troops which were part of Force Belov. Almost worse than the enemy were the swollen rivers and muddy terrain. The large bridge at Znamenka was swept away, and the Ugra River was crossed with great difficulty. Guns sank up to the axles in mud, and as the rain continued next day even the light prime movers and horse-drawn Russian peasant carts used by the Germans bogged down. Some of the infantry slogged barefoot through the muddy water. The rain stopped on 26 May, but terrain conditions did not improve very much as the troops struggled slowly forward.

As the Russians attempted to break out of the forest toward the west, the two German flank divisions started an envelopment which linked up at Fursovo on the afternoon of 27 May. The next few days were spent in cutting up the encircled elements of the Belov force. At this point one division reverted to army group for commitment elsewhere.

The rapidity with which the first phase was completed, plus the failure of the Russian forces facing the Fourth Panzer Army front to attack, prompted army to order the mop-up continued, with the enemy in the Yelnya area as the next objective.

The new attack was made on 3 June. On 2 June there were cloudbursts in the area of the two divisions on the right, and on the day of the attack there were numerous thundershowers. Terrain and roads were again deeply mired, and in a short time most of the tanks and all of the guns bogged down. Force Belov, which had received reinforcements by air, fought bitterly, and the German spearheads inched forward through a maze of Russian mine fields as the main bodies engaged in a series of fire fights. The German armor could not gain the momentum required to carry out the army plan of quick armored thrusts which were to fan out and block the Russian forces, and the advance became a slow push instead of a quick punch.

On 5 June forces from army group thrust northward and linked up with the left division of the German attack forces, cornering Russian elements in the Chashchi area and preventing their movement west. The two divisions on the right took Dorogobuszh on 6 and 7 June, and the elements of Force Belov around Chashchi were left to army group troops as the two divisions on the left continued west.

The Russians in the swampy forest and around Chashchi were no longer a factor, and the bulk of Force Belov was blocked to the west and southwest by army rear area troops. The enemy sought and found an escape route south near Yelnya, which was lightly held by two weak German security divisions. By the afternoon of 9 June 8,000 to 10,000 Russians and over 1,000 vehicles had broken through, with the apparent intention of joining with forces in the Klin forest for a drive to the east. Three divisions of the German force were now transferred to another area, and the remaining divisions plus some army rear area troops were moved quickly south to surround the Klin forest.

General Belov rallied such of his force as was in the southern part of the forest and, on the night of 16 June, broke through to the east in unknown strength. A blocking line was set up to prevent the break-out force from reaching Kirov, and German mobile units pursued and destroyed most of the Russians in the southern part of the forest. The enemy in the northern sector of the Klin forest was destroyed, and on 22 June Force Belov ceased to exist as a fighting force. Russian losses were over 4,300 dead and 9,000 captured.

The first attacks against the Fourth Panzer Army front were made on 17 June north of Kirov. The Russians had made no attempt to rescue Force Belov, and the position of Fourth Panzer Army was considerably improved.

Chapter 17

Russian Tactics

Entirely new to the Germans was the Russian use of forest fires as a hot weather weapon. In midsummer, when the trees were tinder-dry, the Russians attempted to delay German forces by putting forests to the torch. Not only the physical, but the psychological impact of such fires was severe. The crackling of burning trees, the acrid gray-black smoke, the increasingly unbearable heat, and the feeling of uncertainty put troops under a severe strain. Fleeing before towering sheets of flame, men would fight through mile after mile of burning forest only to be confronted by enemy bunkers and fortified positions. Ammunition dumps blew sky high and gave the impression that fierce battles were raging to the rear.

The command post of a German brigade was nearly wiped out by a fire in a pine forest on the Luga River in July 1941. The bivouac area was near a sand road which led through the forest, with a cleared area thirty to sixty yards wide between the road and the forest itself. The cleared area was overgrown with swamp grass. All the vehicles of the brigade headquarters and the artillery echelon were parked in the underbrush and were well camouflaged by the high trees. The entire area was under enemy observation, and shells continually landed within 90 to 120 yards of the camp perimeter with no hits scored on important targets. There was no wind. In the belief that the position was secure, no thought was given to the possibility of forest fire.

One day a strong easterly wind came up, and artillery fire into the area ceased except toward the east, where an occasional muffled burst was heard to which no attention was paid. Suddenly the German sentries ran out of the woods with bewildered expressions shouting "Fire! Fire!" And behind them could be seen a high, wide wall of fire rushing and roaring toward the command post at great speed. At the edge of the clearing the progress of the flames slowed, but the fire crept along through the high grass. At one point a row of trees near the sand road burst into flames, but the threat to the wooded area across the road did not materialize.

Brief, short orders organized the soldiers, and in a moment everyone was battling the blaze with pick and shovel, cutting trees, and smothering the fire with sand. Only the fact that the command

post was opposite a cleared area prevented great loss of life and matériel.

As the danger of forest fires became apparent, bivouac areas were more carefully selected, and precautionary measures increased. A few weeks after the fire on the Luga River, 2,000 trucks of a panzer division were dispersed in an extensive wooded area along the only approach route to the Luga bridgehead. The forest was lightly wooded, had sandy soil with little undergrowth, and was broken by numerous open spaces. Many cart roads wound through the widely spaced trees to individual parking spaces, and trucks were well dispersed in depth. Each vehicle had room to turn in its own area, and was parked facing the road, some 200 yards distant, with drivers close by. A fire guard and signal system was set up, and a field grade officer with a small staff placed in charge of fire discipline. The evacuation plan was tested in a fire drill.

Flames broke out one day a few hundred yards north of the dispersal area and the alarm was sounded. Fanned by a light wind, the blaze advanced slowly through the woods, its progress broken here and there by the sandy open spaces. Evacuation was carried out as planned, and all vehicles were saved except a few which were trapped in the sand near the point at which the fire started.

Several square miles of forest were destroyed, and the reeking, charred hulks of the trees which still stood made the area unbearable. In any event, all natural cover was destroyed, and the site was no longer suitable for dispersal. A good fire plan saved nearly all the division's vehicles.

Chapter 18

Clothing, Rations, Draft Horses

Section I. Clothing

The clothing worn by the German soldier proved too heavy for summer. As a result, men perspired too easily, became very thirsty, and were soon caked with dirt. Only the mountain trousers and field jackets which were worn by the mountain and light infantry are practical for year round wear. For protection against dust, masks for mouth and nose and goggles should be issued. Individual equipment should include a mosquito head net. Hard-packed dirt roads cut like glass into shoe leather, and boot soles quickly go to pieces. Spare boots should be carried by every soldier.

Section II. Rations

Even during the first summer of the Russian campaign, the Germans were able to obtain part of their cereals and forage from local sources, although the retreating Russians burned large quantities of grain and destroyed many agricultural implements. Some grain and almost all the cattle of the collective farms were carried away in the Russian retreats.

Local procurement improved in direct ratio to the ability of the German civil government detachments to regulate cultivation and harvests. Local potato supplies were sufficient until the autumn of 1941, and thereafter they ran short. Vegetable cultivation was generally limited to small garden plots which barely covered the needs of the civilian population. Fruit was available only in the south, and then in limited quantities. Forage is plentiful in summer; sufficient pasture land is available in almost all parts of the country.

Local procurement improved after the first year of the war and the Germans were independent of grain and flour shipments from Germany. Only at the time of the great German reverses did this advantage diminish. To the very end of the war, however, the rations of the combat forces remained relatively unaffected by retrograde movements. In summer small German units used wood fires for cooking.

Section III. Draft Horses

During summer German horses as well as those from German-occupied western countries soon became accustomed to the Russian climate. Diseases directly traceable to the climate were extremely rare. By subjecting horses to a quarantine period before shipping them to the Russian front, communicable diseases remained practically unknown. The only exception was sporadic outbreaks of mange, which always required replacement of the entire horse strength of the unit affected.

The light and medium breeds of western European countries proved generally satisfactory for summer duty. Heavier breeds were less hardy and needed excessive amounts of forage. It would have been better not to have used heavy breeds in Russia.

The *Panje* horses [*Ed*: the small native breed of Eastern Europe] proved extremely enduring, as well as easy to feed, handle, and stable. They have very hard hoofs and need not be shod for soft ground. In all seasons and in all situations this horse proved outstanding for pack and draft use. It is *the* horse for European Russia.

Chapter 19

Health

During summer the woods and swamplands of Russia teem with mosquitoes, including malaria carriers, which for weeks scourge man and beast. Even mosquito nets do not furnish complete protection against bites on the head and neck. Flies torment men and animals in hot weather. Many of the wooden huts in the northern and central regions are infested with vermin such as bedbugs, fleas, head lice, and body lice. The mud huts of the south are cleaner, but the dust storms of this area cause inflammation of the eyes and respiratory organs.

The health of German troops during summer remained generally good. Diarrhea was frequent during the midsummer fly plague, but seldom required hospitalization. In swamp regions there were isolated cases of malaria, and occasionally cases of cadaveric poisoning were noted. Volhynia fever appeared in 1942, some cases requiring long convalescence. Many soldiers contracted jaundice diseases which lasted two or three weeks, and sometimes required hospitalization. Gas gangrene was not infrequent. Vaccinations may be credited with preventing epidemics.

Evacuation of sick and wounded during summer was often handicapped by bad road conditions, heat, and dust. Moreover, when roads were being used for sizable troop or convoy movements, delays made evacuation trips a torture. The Germans took full advantage of air evacuation of casualties. Medical liaison aircraft often picked up casualties from right behind the front lines.

Chapter 20

Air Operations

Aircraft engines need special protection against summer dust. Precautions must be taken against raising dust on unpaved airfields. Dust storms in southern Russia occur immediately after the end of the spring muddy season, and visibility during take-offs and landings is greatly reduced.

PART FIVE
NORTH OF THE ARCTIC CIRCLE

Chapter 21
General

The Arctic zone of European Russia extends from the arctic coast east of Kirkenes southward to the Bay of Kandalaksha, a distance of about 190 air miles. This area contains the southward routes of land communication from Murmansk and commands the shipping lanes to the White Sea ports. Climatic conditions in this land of midnight sun and polar night pose serious problems not only in the conduct of military operations, but also for mere survival.

North of the Arctic Circle the conduct of operations is circumscribed by time and space elements unknown in temperate regions. The midnight sun of summer, the twenty-four-hour night of winter, and the muddy transition periods of spring and autumn nullify conventional concepts of freedom of maneuver.

In the arctic a military decision communicated by an order is irrevocable. Whatever forces have been committed, whatever course of action has been initiated, an interminable time elapses between original impulse and final effect. Once started, the chain reaction must run its course. To stop, to reverse, to change direction is to run the risk of losing the initiative. First decisions must be correct. Command procedure must be adapted to the unorthodoxies of warfare in the north. Leaders at all levels, down to the squad, must make decisions far transcending the scope of their usual responsibilities.

North of the Arctic Circle the enormous land mass of European Russia, with its wide seasonal range in temperature, borders on the Barents Sea region which is moderated by the warm current of the Atlantic Drift. While the oceanic influence is strongest in the fjords on the arctic coast, the continental climate of interior Russia dominates the inland sea. A comparison of mean temperatures in northern Karelia with those in corresponding latitudes in Siberia strikingly illustrates the influence of the Atlantic Drift. In winter, for example, this warm current raises the level of mean temperatures by at least 35° F., and, through the warming influence of the sea quickly decreases

toward the interior, the January mean in the inland area of the Kola Peninsula is still 18° F. higher than in corresponding latitudes of Siberia.

The mean winter temperature on the Murman coast, 13° F., is the same as the January mean at Minneapolis, Minnesota. The mean temperature during July—the hottest month—is 53° F., equal to the average May temperature on the North Sea coast of Central Europe. The comparison, however, applies only to mean values; actual day-to-day variations in temperature are substantially greater and much more abrupt than in Central Europe. In winter a transition from thaw to severe frost may be a matter of a few hours, and the mercury may rise again just as suddenly. Winter readings on the arctic coast range from 43° to −31° F. Summer maximums on the coast vary between 75° and 85° F., with temperatures in the interior rising as high as 95° F. Night frosts are nevertheless fairly common during the subpolar summer. Only the coastal region has one whole month of temperatures above freezing—July.

Generally speaking, there are but two seasons north of the Arctic Circle: the long, cold, and dark winter; and the short summer with no night. The ideal time for large-scale ground operations is late winter, the two-month period beginning around March. At that time the days grow longer, lakes and swamps are still frozen, and ice roads can be used to move men and matériel. Early winter, right after the formation of ice, is also favorable, but an operation in early winter runs the risk of continuing into the adverse conditions of the polar night. Summer is the season least suited to ground operations. Large areas of the terrain are impassable, and the land routes of the arctic are in the worst possible condition at this time.

Housing is virtually nonexistent in the high latitudes of European Russia. Finnish-type log huts are best for permanent quarters up to latitude 69° N., and farther north timbered dugouts are best. The Germans found collapsible wooden barracks useful throughout the north. Snow is usually too loose and powdery for igloos, and ordinary shelter tents are inadequate. The Finnish plywood tent and the Swedish cloth tent with stoves are excellent, and in emergencies snow-covered windbreaks having pine-bough roofs and heated by low reflecting fires offer good protection.

Section I. Infantry

Small unit actions, away from established front lines, are feasible in the desolate arctic. The limited visibility of the polar night favors operations at company, battalion, or, in exceptional cases, regimental strength. Operations are usually of limited duration, because every

bit of equipment must be carried along. Only troops in excellent physical condition can be used. Fighting and marching through wasteland, forest tangle, and brush demands endurance, *esprit de corps*, and the ability to exploit every terrain feature to the utmost.

The Germans learned that only mountain and ski troops should be used in the arctic, and that such troops are most effective when organized in ski units or mobile task forces. The mobile task force should include both combat and supply elements, and a large percentage of its personnel should be equipped with skis to prevent the force from becoming roadbound. Its heavy weapons should be suitable for break down into one-man loads for the same reason. Ski units should be capable of at least three days of combat in any kind of terrain without resupply.

Visibility in the close terrain of the arctic is so poor that the Germans were forced to organize infantry observation battalions to direct fire of infantry howitzers and mortars. Captive balloons were also used for observation. The XXXVI Mountain Corps, on the Kandalaksha front, had a permanently attached balloon section.

Finnish Tactics

Finnish units in the arctic operated with what they called *Sissi* and *Motti* tactics which are planned to permit small, battle-seasoned units to fight on even terms against numerically superior forces.

Sissi combat denotes small unit actions which have the objective of hitting the enemy at one point. Each participant is briefed on the objective, and the method of execution is left up to the group.

Motti tactics are, on a small scale, analogous to the envelopment tactics of German doctrine. *Motti* uses small forces for enveloping—almost sneaking around—the enemy, and attacking and annihilating him once the ring has been closed.

Both methods take advantage of concealment, defilade, and flank protection offered by lakes and watercourses, and depend upon the self reliance, initiative, and fighting spirit of officers and men.

Commando-type Actions

Commando-type missions in the arctic require highly trained special purpose units. Finnish troops who raided the Russian-held Murmansk railway were specially trained and equipped.

The Russians dropped parachutists, including female radio operators, behind the German lines. The presence of these Russian teams usually became known only through interception of radio messages.

Section II. Artillery

Artillery for the virtually roadless arctic must be light and mobile. Long-range artillery is useless in close terrain. The Germans entered the arctic campaign of World War II with divisional artillery that required ten horses for displacement and GHQ artillery that included 175-mm. and 280-mm. pieces. These were soon supplemented with light and medium mortars because the big guns had no targets at which to fire. The Germans used antitank guns to knock out enemy bunkers above ground, while the Russians used antiaircraft artillery against ground targets.

In winter, artillery can be displaced over ice. Many Russian attempts to cross ice under cover of darkness were foiled by the German method of stationing sound-ranging teams, equipped with seismological instruments, at the edge of frozen lakes to detect enemy movement.

Generally, German artillery techniques in the arctic were no different than those used in winter in the lower latitudes of European Russia.

Section III. Armored Forces

Tanks and self-propelled artillery are of limited value in the arctic region of European Russia. Huge granite boulders cover the landscape, making cross-country operations impossible. Armor can be moved only on the few available roads. No German tank or self-propelled gun ever saw action north of the Arctic Circle in World War II.

The climatic conditions of the arctic can be and were mastered by the Germans who were able to learn many lessons from the Finns, but nevertheless had to go through bitter experiences of their own. The observations on polar warfare presented in this study were drawn from both sources. A number of other lessons, such as the reorganization of units for arctic warfare, special training, the flow of replacements, and Russian and Finnish combat methods are treated in CMH Pub 104–1, Military Improvisations During the Russian Campaign; CMH Pub 104–12, Russian Combat Methods in World War II; and CMH Pub 104–24, Warfare in the Far North.

Chapter 22

Clothing, Equipment, Rations

Section I. Clothing

Winter uniforms must be designed to give protection against the extreme cold of the arctic region. The Germans found several layers of clothing better than merely thick, heavy apparel. Trousers should fit loosely enough to permit wearing of at least two pairs of drawers; trouser legs should be cut full around the calf and fit tightly about the ankle. Blouses must be large enough to be worn over extra underwear and a fur vest. Windproof, snowproof parkas are essential for ski troops. Chemical warming pads inserted under clothing add to physical comfort. Fur outer clothing is required for sentries, drivers, and others engaged in limited physical activity. Fur clothing is not suitable for ski troops because it induces perspiration; quilted uniforms are best for ski wear. A wool toque plus a felt or fur cap with ear flaps is best for winter. White camouflage coats or coveralls are essential for combat troops, and the Germans also found white face masks useful. Camouflage covers are needed for headgear.

For summer wear in the arctic, the regular uniform plus a mosquito veil and sunglasses proved adequate.

The jagged rocks, swamps, and snow of the arctic require sturdy, waterproof boots, which should be adaptable for skiing. Only boots of top-grade, double-stitched leather give adequate protection against frostbite and trenchfoot. Russians taken prisoner complained that their U. S. army boots were not water-repellent, were inadequately stitched, and were generally unsuited to arctic wear. Ski boots must be large enough to permit extra socks and felt inner soles to be worn. The best ski boot is double-stitched with a long tongue that is securely stitched to the upper, and full leather sole under a ribbed composition sole. Soles should extend beyond the sides of the toe caps and be covered with brass inserts. Canvas leggings provide good protection in loose, deep snow.

Fur-lined boots large enough to accommodate heat packets are needed for sentries, and drivers should have felt boots. Lapp shoes, soft shoes made of reindeer hide, are needed by ski troops for tent wear.

A limited quantity of rubber boots, enough for about 15 percent of combat personnel, is required for thaw and muddy periods and for occasional summer wear.

Section II. Equipment

Individual Equipment

In the arctic the primary consideration is not how much the individual can carry, but how much he can possibly leave behind without impairing his chances for survival. The German soldier undoubtedly presented a more military appearance than the Finn or Russian, but many of the German items turned out to be mere ballast. About all the Finnish soldier carried was a rifle or submachine gun and a dagger on his belt. He carried no gas mask, no steel helmet, no bayonet.

For construction of shelter and clearance of trails combat troops need saws or hatchets that can be carried on the rucksack or pack.

The Finnish oil-filled wrist compass is best for extreme temperatures, but even this type compass is subject to serious deviations due to natural mineral deposits and the effects of the aurora borealis.

Pack Equipment

The rucksack is the best pack for the arctic. It offers less interference in passing through narrow clefts or underbrush, and is more comfortable for skiing. The Germans found that forty pounds is the maximum which should be carried on lengthy missions; heavier loads impair speed and mobility.

Ski Equipment

Most ski movement in the arctic is over flat terrain, and skis should therefore be light and narrow, about two and one-half inches wide, without reinforced edges. Tips should be slightly turned, and holes provided for pull ropes. Snow should be used for camouflage, since paint dries skis and leads to damage. A simple cross-country binding is best for arctic use.

The Germans found steel ski poles with tightly woven webbing adequate, although steel deflects compasses. Ski climbers are necessary when pulling sleds or similar loads. An important item for ski troops is a small tool kit, about one per squad, for emergency repairs.

Snowshoes

Snowshoes are needed for personnel carrying heavy loads. The Germans found that wooden-frame snowshoes with leather webbing

rendered excellent service, while snowshoes with willow webbing proved unsatisfactory.

Small Arms

In the wilderness of the north, where the fire fight is usually carried on at close range, a high cyclic rate of fire in small arms is more important than accuracy. The submachine gun is ideal for arctic combat. The early type of German submachine gun frequently jammed at low temperatures and, until an improved design was brought out, German troops preferred to use the Russian model. In extreme cold air-cooled weapons are superior to water-cooled. Ammunition was usually a critical item for Germans in the arctic, and strict fire discipline was maintained. A plentiful supply of ammunition for a few weapons is better than many weapons with little ammunition. German experiences with small arms in the arctic differed little from those in Russia generally.

Hand Grenades

The stick hand grenade was found to be unsafe in the arctic; it catches on trees and rocks, and the Germans replaced it with egg-type grenades. Deep snow renders grenade bursts harmless.

Mortars

Ski troops effectively employed 81-mm. mortars. Medium mortar shells are effective, even in deep snow.

Radio Equipment

Arctic warfare consists mostly of small unit actions, and therefore great reliance must be placed on radio communications. German equipment was too bulky and too limited in range for arctic use, and the small, powerful American-made equipment used by the Finns was much better. The component parts of signal equipment must be adaptable to pack-animal transport .

Low temperatures damage storage batteries, and the Germans cradled them between heating pads to preserve their power. Troops starting on extended missions should take freshly charged batteries.

Radio communications in the arctic are disturbed by the aurora borealis and by magnetic fields.

Vehicles

Motor vehicles must have good ground clearance to permit passage over rocks and boulders which protrude from such roads as are found in the arctic. Roads are too narrow to allow passing, and long drives

in low gear strain engines and transmission. Starting vehicles required the same precautions as those used by the Germans in Europeana Russia below the Arctic Circle. Fascine mats are useful in mud and snow, and adequate stocks of snow chains and sled runners are important.

German horse-drawn wagons are suited only for movement over roads, and found little use in the arctic. The two-wheeled Finnish cart drawn by one native horse is well adapted to arctic conditions. Terrain impassable for wheeled vehicles can be traversed by the *purilla*, a sledge fashioned from a forked bough or two slender tree trunks. The *purilla* can easily be pulled over rocks and mud and can carry twice the payload of a pack animal.

The Finnish peasant horse sleigh is practical for arctic use, as are the Finnish *akja* and *loijakka*. The *akja* is a small boat-shaped sled which weighs about thirty pounds, readily glides over obstacles, and always maintains a steady balance. The *loijakka* is a larger *akja*, and is suitable for moving bulky cargo. Both are usually drawn by reindeer, though they can be pulled by ski personnel. Two men can pull 100 pounds in flat country, and three men can pull the same load in mountainous terrain.

Motorized combat sleighs armed with a heavy machine gun and carrying three to five men were extensively used by the Russians. The Germans made a few experiments with this type of equipment. The German models were successful only on frozen lakes with a thin snow cover.

Section III. Rations

The rigors of the arctic require foods which provide extra energy. The Germans issued extra fats and bread, while the Finns relied on extra rations of sugar. German winter food supplies consisted of frozen beef, pork, and vegetables; dehydrated potatoes and legumes; cheese and canned foods. Since the Baltic Sea was usually blocked all winter, food was stocked in advance for an entire year.

Chapter 23

Transportation and Troop Movements

Section I. Roads

There are few roads in the arctic wilderness. On the Kandalaksha front in World War II a sector extending 250 miles in a north-south direction contained only one east-west road which, by European or even Russian standards, was not a road at all.

Scouts probing into enemy territory had to mark out a route of advance for infantry. Later, construction troops transformed the track into a wagon trail. At first, the wagon trail would be the only supply route, and thousands of hours of work were needed to widen the trail to accommodate horse-drawn vehicles and trucks. The Finns had some American road-building machinery which was most helpful.

The Germans found that a corps needed two to four battalions of engineer troops to maintain roads once they were built. Jagged rocks constantly worked to the surface, and in muddy terrain corduroy or chespaling had to be used.

During summer the numerous lakes, swamps, and rivers of the arctic make large-scale operations entirely dependent upon man-made routes of communication. Progress is inevitably slow. Sometimes the enemy is able to control available roads so effectively that only wide envelopment, sometimes upward of ten miles laterally, can reduce his positions and open the way for the advance of friendly forces. For instance, in the summer of 1941, when the Germans were inexperienced in arctic warfare, the Russians blocked the sole route through the wilderness to Kandalaksha with a line of bunkers reinforced by artillery, while the road itself was patrolled by tanks. Any German maneuver short of wide envelopment would have meant a costly hammering at the Russian positions. Wide envelopment, however, required construction of paths for the main attack and trails for the secondary close-in envelopments. The Germans found that every one of four twelve-mile advances in the operation required four weeks of preparation for seven days of combat.

Terrain difficulties are less pronounced in winter, when frozen lakes, swamps, and rivers become good routes of communication.

Snow and Ice Roads

An ice cover of three feet or more on a lake supports the heaviest loads, and the Germans made ice roads by simply clearing snow with a conventional or rotary snow plow.

Snow roads were built over swamps by removing snow and then pouring water over the cleared surface until a frozen surface was built up. The Russians used forty-four regiments in the construction of snow roads on the Kandalaksha front in 1944. Each man was made responsible for about five square yards a day, and in this manner two 65-mile stretches were completed virtually overnight.

Snow clearance was carried out and snow fences were built in the same way as in other parts of Russia.

Section II. Railroads

Locomotives for arctic use must be designed to burn wood, the only fuel available in high latitudes. Locomotives equipped with snow plows were used to keep railroads open, and in one instance the Germans converted a Russian tank into a motor-driven armored railway car that was equipped for double duty as a snow plow. Russian and Finnish railroads are broad gauge.

Railroads Over Ice

In the winter of 1941–42 the Baltic froze over, completely cutting off German forces in Finland from sea communication with their homeland. Even the most powerful Swedish ice breakers were unable to get through. A plan for a railroad over the ice from Reval to Helsinki, similar to the Russian undertaking on Lake Ladoga, was abandoned because the ice of the Baltic was constantly in motion. The Finns attempted unsuccessfully to move motorized columns across the narrowest part of the Gulf of Bothnia in the winter of 1939–40.

Section III. Ski and Dismounted Movement

Ski marches are the most practical form of movement during winter. In difficult terrain with a moderately deep snow cover, the Germans found that small units should not exceed two to two and one-half miles per hour, and larger units about one and one-half miles per hour. Foot troops should move about one-half mile per hour, or about one-third mile per hour when carrying loads or evacuating casualties. Unreasonable speed on skis or on foot stimulates perspiration and induces chills and frostbite.

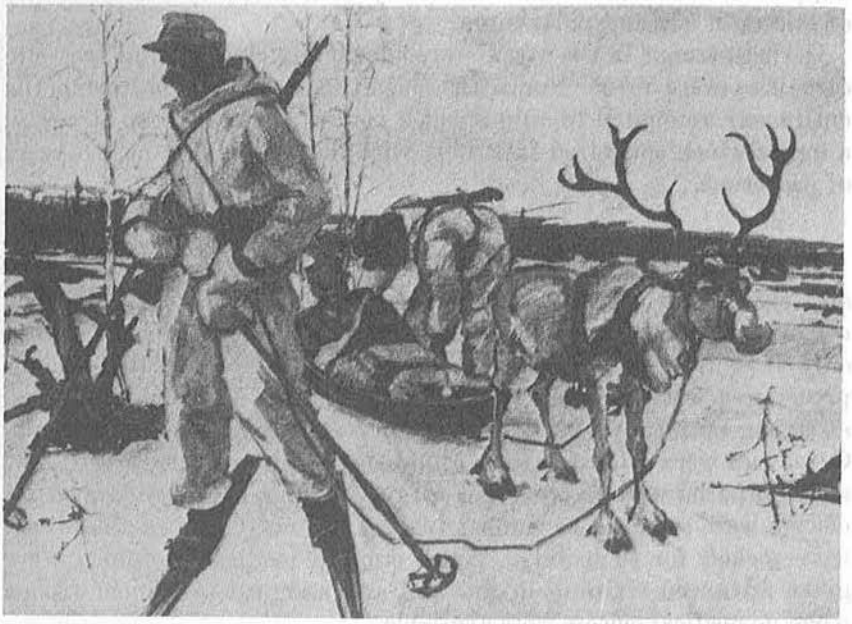
Section IV. Draft and Pack Animals

Heavy, cold-blooded horses lack the stamina required for service in the arctic. Finnish, Esthonian, and the small Norwegian horses proved best for pack and draft duty. Mere windbreaks suffice for their shelter, and they readily accept thawed-out hay. Sickness among horses was rare.

The reindeer is a better work animal than the horse in the arctic. It is efficient in deep snow, gets along with very little forage, and needs little shelter. Despite the reindeer's normal self-sufficiency, pasturage must be selected in advance of the winter season, and moss and similar forage gathered to avoid starvation in case of unusually deep snow.

Only reindeer broken to harness are suitable for military purposes. Trained reindeer are capable of pulling 150 to 250 pounds up to thirty-five miles a day, with one day's rest alternating with two days' work. As a pack animal, the reindeer can carry forty to sixty pounds. In deep snow it is advisable to have skiers break trail for reindeer.

By late spring, the reindeer reverts to its wild state of roaming the forest, and does not seek contact with man until the autumn. The reindeer cannot endure a strange scent, and can be handled only by its owner. It even refuses to drink except from its individual water hole.



REINDEER used in evacuation of German wounded, Kandalaksha front.

Chapter 24

Health and Morale

Section I. Health

Lack of sunshine during the long polar night causes deficiency symptoms, and the Germans rigidly supervised daily administration of vitamins, particularly vitamin C and cod liver oil.

German troops in the arctic suffered kidney diseases, perhaps as a result of colds, although Finnish medical authorities spoke of the presence of a communicable kidney ailment. Leptospirosis, a communicable sickness of about twelve-days' duration, and having malarialike symptoms, was widespread. This disease was attributed to contact with the excrement of lemmings, molelike brown and white rodents.

The *sauna*, or steam bath, was widely used by the Germans. It toughens the body and builds up resistance to the arctic climate. Its regular use not only helps prevent colds and rheumatic ailments, but also constitutes a vital morale booster in cases of so-called Lapp-happiness, the melancholia which may be induced by the monotony of midnight sun and polar night.

German troops in the arctic were adequately clothed, and frostbite casualties were rare. Nonbattle casualties in the arctic during the entire war amounted to only about 2 percent of total troop strength, a figure which compared favorably with that of the best health years of peacetime.

Medical Care

The Germans found that during the polar night prompt treatment and evacuation of casualties, no matter how lightly injured, was essential to speedy recovery. Early medical aid could be rendered only if skilled medical personnel were immediately available, and procedures were devised for rendering first aid on combat patrols, at strong points, and on the firing line. The difficulties were many. Casualties were often far from established positions, roads were few, and footpaths were narrow and rocky. Young, able-bodied medical officers were attached to combat troops, and only doctors able to ski were picked for such duty. Some enlisted medical personnel were given advanced training in first aid and assigned to combat troops when no medical officers were available.

Evacuation

Finding and evacuating casualties in deep snow or close terrain is difficult, and the Germans sometimes used dogs to track down wounded or injured personnel. Evacuation was accomplished on stretcher frames slung between two horses hitched in tandem, by *purilla*, or by single-wheel mountain litter. Reindeer were also used to pull the *akja* in evacuation operations.

Emergency sleds for evacuation can be fashioned from skis, using ski adapters or ski poles. Dog teams were used for evacuation over flat or gently rolling terrain. Evacuation by litter bearers was slow, and required large numbers of personnel. Casualties located in extremely inaccessible parts of the wilderness were frequently evacuated by aircraft. In winter frozen lakes provided landing areas, and in summer lakes were used for hydroplane landings.

Section II. Morale

The psychological strain of the twenty-four-hour summer day and the seemingly endless polar night had an adverse effect on troop morale. The Germans found that combat personnel past their mid-twenties were more affected by arctic conditions than younger troops.

Whenever possible the Germans, to raise morale, encouraged hunting, fishing, regular use of the *sauna* bath, and provided the opportunity for soldiers to cook a meal of their own choice.

The use of distinctive insignia for arctic troops bolsters morale considerably.

Chapter 25

Air Operations

Section I. General

If proper preparations are made, air operations can be conducted the year round in the arctic. In summer, each lake is a sheltered water landing and, in winter when frozen over, an excellent landing field for aircraft of moderate size. With air superiority and suitable landing areas, air transport is an important factor in supplying advanced ground units and in relieving other supply facilities. Small units can be supplied by airdrop.

It is difficult to camouflage air installations in the far north. There are either huge wooded areas into which the profile of an airfield cuts sharply or the terrain is bare and rocky, and thus susceptible to enemy observation. The German remedy in the latter instance was to hollow bunkers and hangars out of the rocks.

Latticed wooden runways were used with success by the Germans during the spring and autumn muddy periods. When this was done aircraft were, of necessity, parked near the landing strips; construction of latticed taxi strips would have involved tremendous extra effort.

Section II. Flight

Snow covers all irregularities in the terrain during winter, ice makes coastal boundaries indistinct, and orientation during flight is generally difficult. Flat vapor and fog layers seen from the air are difficult to distinguish from snow.

Warm fronts from over the Atlantic are frequent in January. These fronts produce heavy cloud formations over land and sea, fog that extends to high altitudes, and scattered rain or snow. Icing and poor visibility result.

Over the Arctic Ocean ice will begin to form at 6,500 feet, even in summer. During spring and autumn ice forms at very low altitudes in cloud formations, and in winter this danger increases. In winter even comparatively thin cloud layers produce snow.

In extremely cold weather, pools of very cold, dense air form over the interior of fjords. If a strong wind blows across a fjord at a certain angle, some of this cold air will be sucked out, and replaced by warmer air from above. This process can cause a violent storm in a

matter of minutes, with winds of high velocity accompanied by a sudden rise in temperature.

Modern air forces may revolutionize arctic warfare. In summer every lake provides a convenient water landing; in winter an extensive airfield. Anticipatory measures to use the arctic for air operations can be taken at any time. Such preparations can counteract to some extent the difficulties presented by lack of overland routes and the inhospitality of the polar region. Even with extensive use of aircraft, the lessons presented in this study will remain valid.

PART SIX
CONCLUSIONS

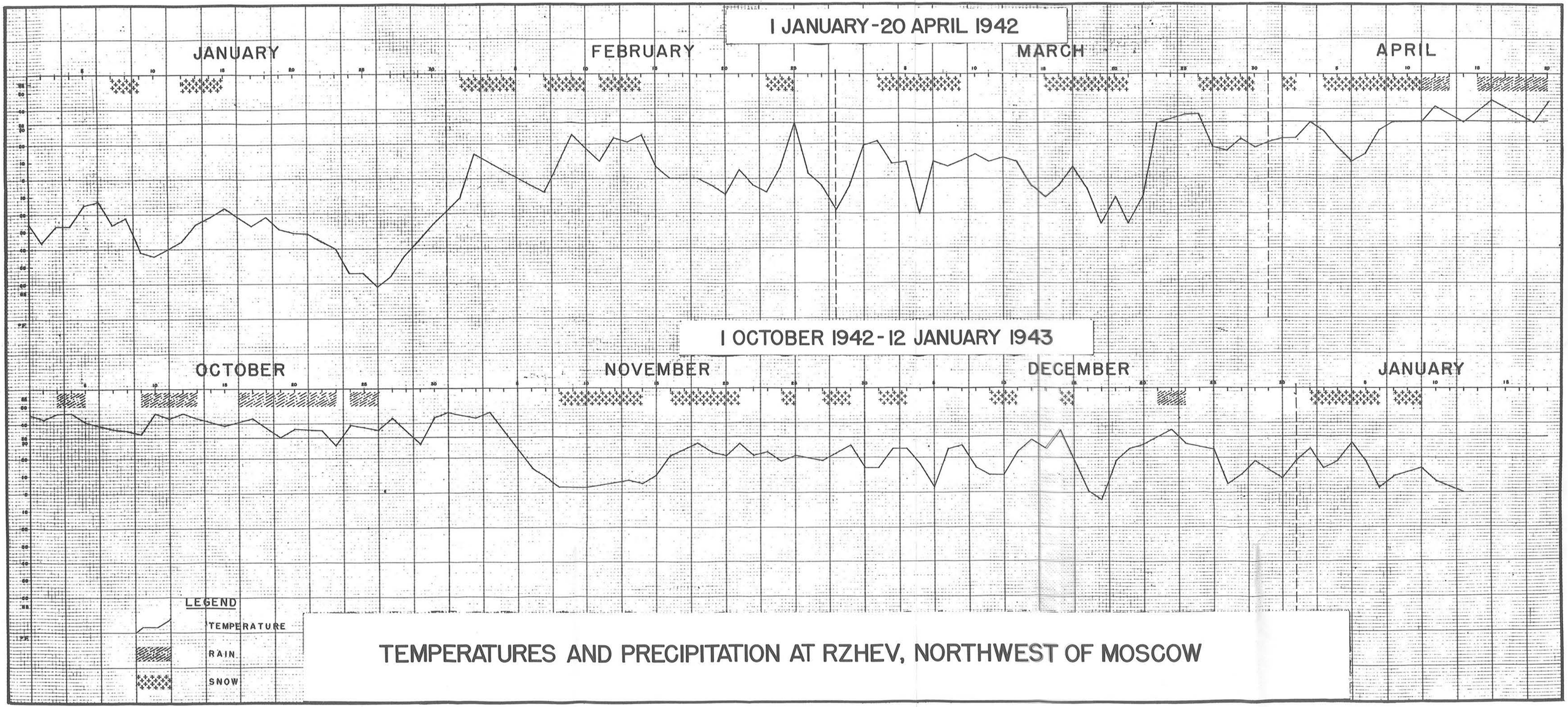
Combat in European Russia was greatly influenced by climatic conditions. Large-scale operations and small unit actions were equally affected. The influence of climate was felt in every effort of the German military establishment, whether on land, over water, or in the air.

Climate is a dynamic force in the Russian expanse; the key to successful military operations. He who recognizes and respects this force can overcome it; he who disregards or underestimates it is threatened with failure or destruction.

In 1941 the Wehrmacht did not recognize this force and was not prepared to withstand its effects. Crisis upon crisis and unnecessary suffering were the result. Only the ability of German soldiers to bear up under misfortune prevented disaster. But the German Army never recovered from the first hard blow.

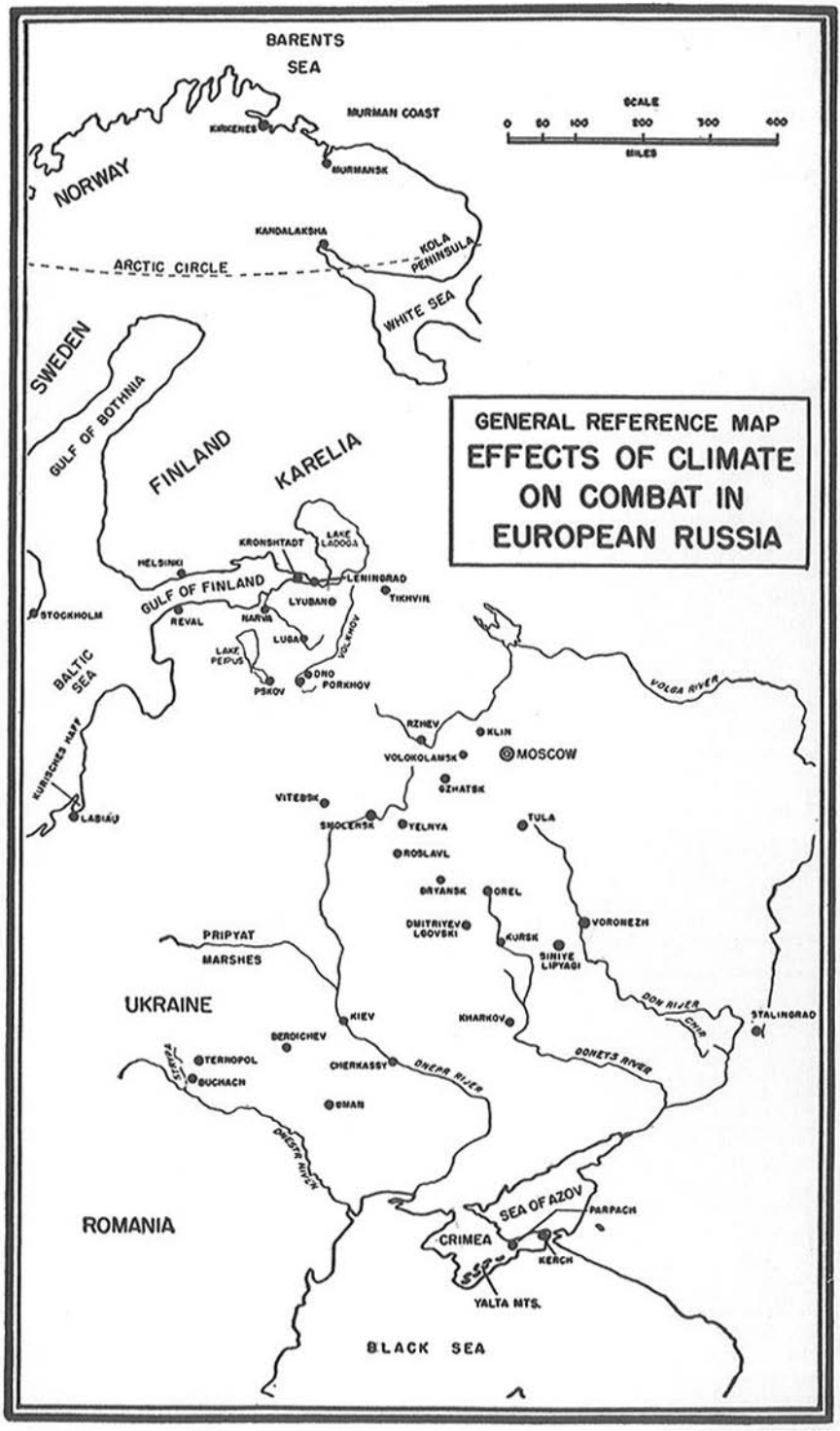
Later the German armed forces understood the effects of climate and overcame them. That victory remained beyond reach was not due to climate alone, but in great measure to the fact that the German war potential was not equal to supporting a global war. The Wehrmacht was weakened by climatic conditions, and destroyed by the overpowering might of enemy armies.

APPENDIX

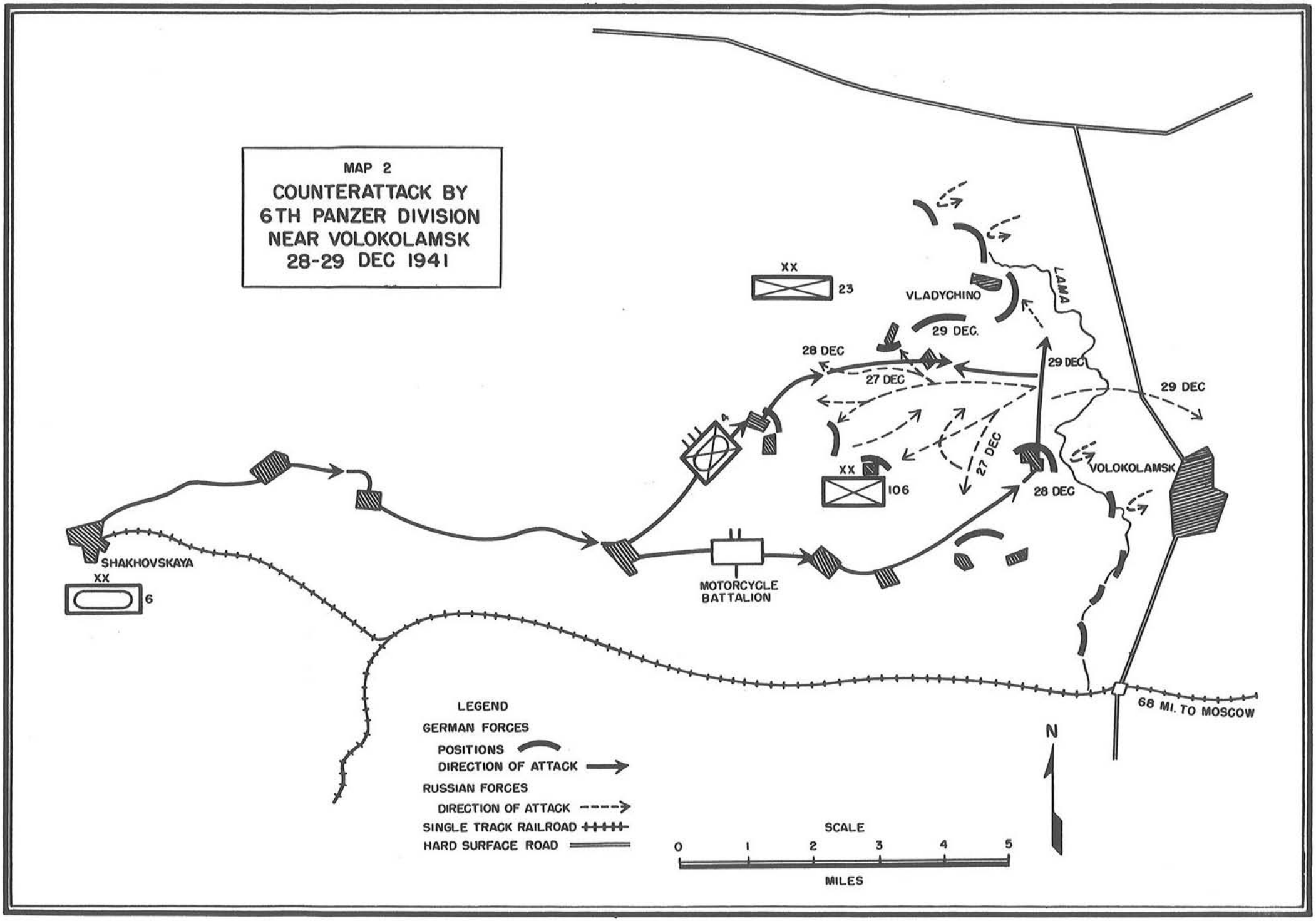


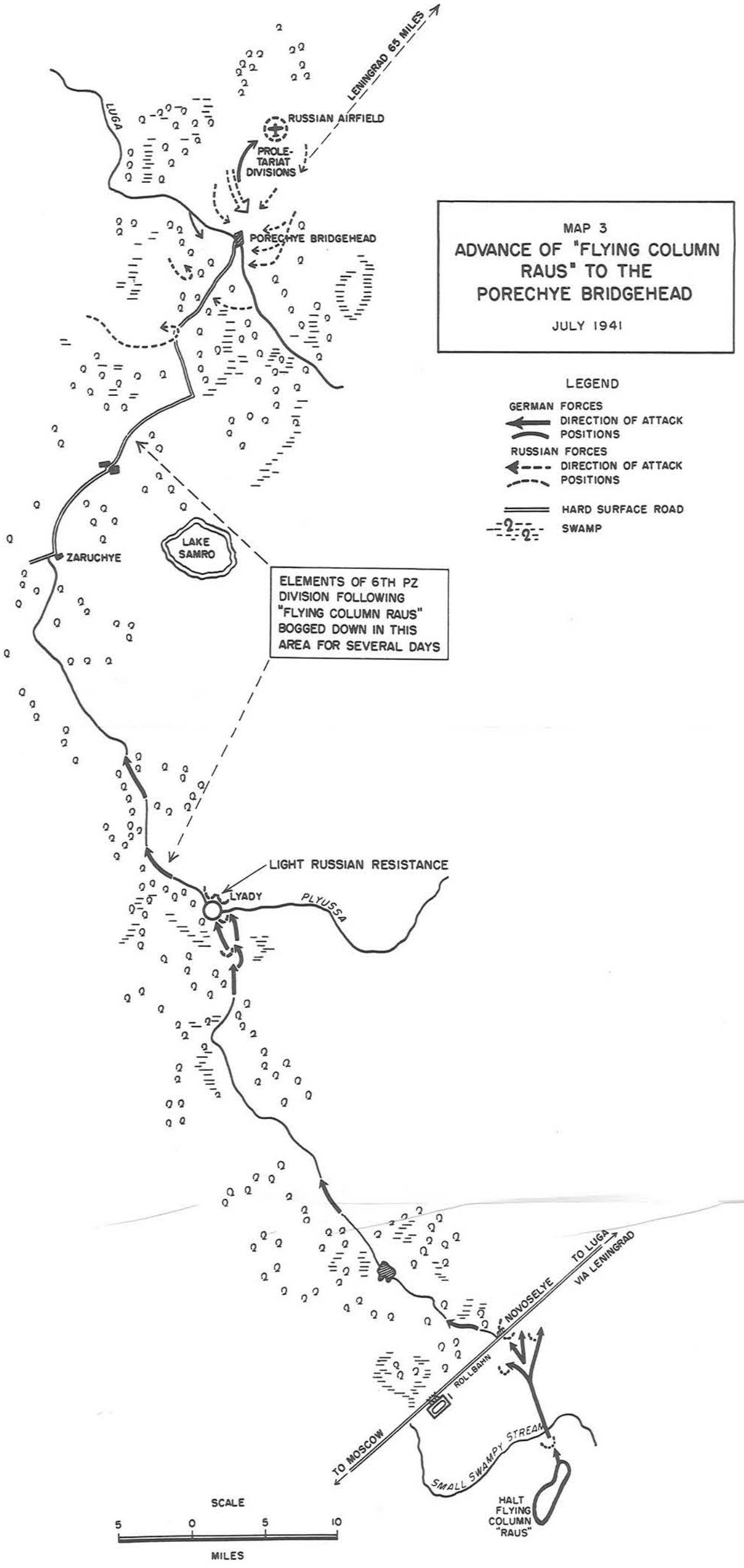
TEMPERATURES AND PRECIPITATION AT RZHEV, NORTHWEST OF MOSCOW

MAP 1



U.S. GOVERNMENT PRINTING OFFICE : 1986 O - 155-674


MAP 2
COUNTERATTACK BY
6TH PANZER DIVISION
NEAR VOLOKOLAMSK
28-29 DEC 1941
XX
23
VLADYCHINO
LAMA
29 DEC.
28 DEC
29 DEC
27 DEC
29 DEC
4
XX
106
27 DEC
28 DEC
VOLOKOLAMSK
SHAKHOVSKAYA
XX
6
MOTORCYCLE
BATTALION
68 MI. TO MOSCOW
LEGEND
GERMAN FORCES
POSITIONS
DIRECTION OF ATTACK
RUSSIAN FORCES
DIRECTION OF ATTACK
SINGLE TRACK RAILROAD
HARD SURFACE ROAD
N
SCALE
0 1 2 3 4 5
MILES



MAP 3

ADVANCE OF "FLYING COLUMN RAUS" TO THE PORECHYE BRIDGEHEAD

JULY 1941

LEGEND

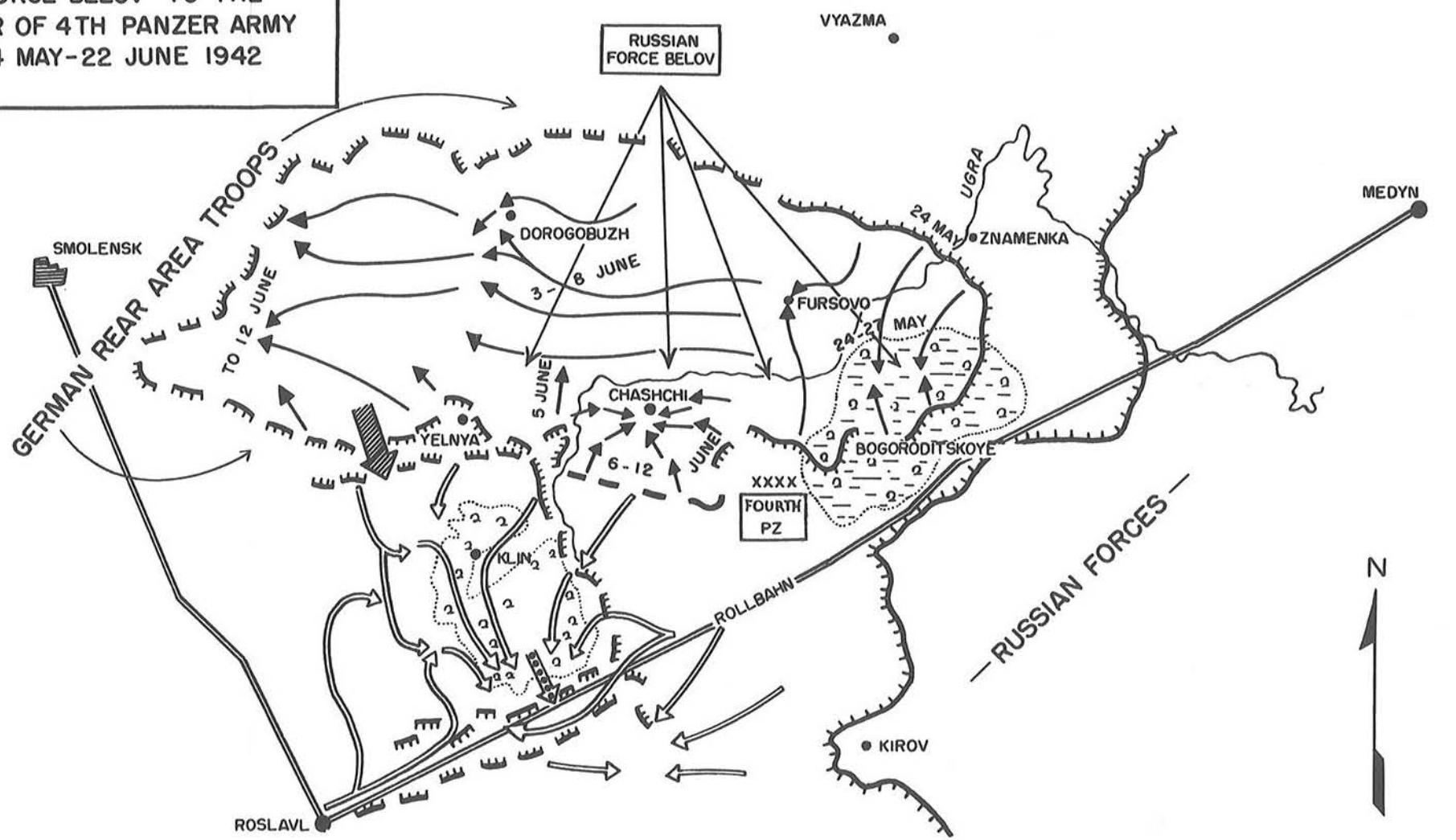
GERMAN FORCES
DIRECTION OF ATTACK
POSITIONS

RUSSIAN FORCES
DIRECTION OF ATTACK
POSITIONS

HARD SURFACE ROAD
SWAMP

MAP 4

DESTRUCTION OF RUSSIAN "FORCE BELOV" TO THE REAR OF 4TH PANZER ARMY 24 MAY-22 JUNE 1942



SCALE

10 5 0 10 20 30

MILES

LEGEND

GERMAN FORCES
- POSITIONS 24 MAY
- POSITIONS 5 JUNE
- DIRECTION OF ATTACK

RUSSIAN FORCES
- ESCAPE TO KLIN FOREST
- CONCENTRATION 9-16 JUNE
- BREAK-OUT ATTEMPT

- FOREST
- SWAMPY FOREST