

was the better of the two Dahlgren rifles. An 80-pounder model (6-inch bore) was less popular, due to its tendency to burst.

The Confederacy relied heavily on British imports for its naval armament. Naval variants of Armstrong, Whitworth, and Blakely weapons all saw service. In addition, the Confederate Navy used Brooke rifles manufactured in the South. The Confederacy also produced a 9-inch version of the Dahlgren shellgun that apparently found use both afloat and ashore.

Weapons at Vicksburg

The wide variety of infantry weapons available to Civil War armies is clearly evident at Vicksburg. A review of the *Quarterly Returns of Ordnance* for April-June 1863 reveals that approximately three-quarters of Grant's Army of the Tennessee carried "first class" shoulder weapons, the most numerous of which were British 1853 Enfield rifle-muskets (.577 caliber). Other "first class" weapons used in the Vicksburg campaign included American-made Springfield rifle-muskets (.58 caliber), French rifle-muskets (.58 caliber), French "light" or "Liege" rifles (.577 caliber), U.S. Model 1840/45 rifles (.58 caliber), Dresden and Suhl rifle-muskets (.58 caliber), and Sharps breechloading carbines (.52 caliber). Approximately thirty-five Federal regiments (roughly one-quarter of the total) were armed primarily with "second class" weapons, such as Austrian rifle-muskets in .54, .577, and .58 calibers; U.S. Model 1841 rifled muskets (.69 caliber); U.S. Model 1816 rifled muskets altered to percussion (.69 caliber); Belgian and French rifled muskets (.69 and .71 calibers); Belgian or Vincennes rifles (.70 and .71 calibers); and both Austrian and Prussian rifled muskets in .69 and .70 calibers. Only one Federal regiment, the 101st Illinois Infantry, was armed with "third class" weapons, such as the U.S. Model 1842 smoothbore musket (.69 caliber), Austrian, Prussian, and French smoothbore muskets (.69 caliber), and Austrian and Prussian smoothbore muskets of .72 caliber. After the surrender of Vicksburg, the 101st Illinois, along with about twenty regiments armed with "second class" arms, exchanged its obsolete weapons for captured Confederate rifle-muskets.

Although the Confederate records are incomplete, it seems that some 50,000 shoulder weapons were surrendered at Vicksburg, mostly British-made Enfields. Other weapons included a mix of various .58-caliber "minié" rifles (Springfield, Richmond, Mississippi and Fayetteville models), Austrian and French rifle-muskets in .577 and

.58 calibers, Mississippi rifles, Austrian rifle-muskets (.54 caliber), various .69-caliber rifled muskets altered to percussion, Belgian .70-caliber rifles, and British smoothbore muskets in .75 caliber.

The diversity of weapons (and calibers of ammunition) obviously created serious sustainment problems for both sides. Amazingly, there is little evidence that ammunition shortages had much influence on operations (the Vicksburg defenders surrendered 600,000 rounds and 350,000 percussion caps), even though the lack of weapons standardization extended down to regimental levels.

Whereas there was little to differentiate Union from Confederate effectiveness so far as small arms were concerned, the Union forces at Vicksburg enjoyed a clear superiority in terms of artillery. When Grant's army closed on Vicksburg to begin siege operations, it held about 180 cannon. At the height of its strength during the siege, the Union force included some forty-seven batteries of artillery for a total of 247 guns—13 "heavy" guns and 234 "field" pieces. Twenty-nine of the Federal batteries contained six guns each; the remaining eighteen were considered four-gun batteries. Smoothbores outnumbered rifles by a ratio of roughly two to one.

No account of Union artillery at Vicksburg would be complete without an acknowledgment of the U.S. Navy's contributions. Porter's vessels carried guns ranging in size from 12-pounder howitzers to 11-inch Dahlgren shellguns. The *Cairo*, which is on display today at Vicksburg, suggests both the variety and the power of naval artillery in this campaign. When she sank in December 1862, the *Cairo* went down with three 42-pounder (7-inch bore) Army rifles, three 64-pounder (8-inch bore) Navy smoothbores, six 32-pounder (6.4-inch bore) Navy smoothbores, and one 4.2-inch 30-pounder Parrott rifle. Porter's firepower was not restricted to the water. During the siege, naval guns served ashore as siege artillery.

The Confederates possessed a sizeable artillery capability but could not match Federal firepower. Taken together, the Confederate forces under Pemberton and Johnston possessed a total of about 62 batteries of artillery with some 221 tubes. Pemberton's force besieged in Vicksburg included 172 cannon—approximately 103 fieldpieces, and 69 siege weapons. Thirty-seven of the siege guns, plus thirteen fieldpieces, occupied positions overlooking the Mississippi. (The number of big guns along the river dropped to thirty-one by the end of the siege—apparently some weapons were shifted elsewhere.) The

thirteen field pieces were distributed along the river to counter amphibious assault. The heavy ordnance was grouped into thirteen distinct river-front batteries. These large river-defense weapons included twenty smoothbores, ranging in size from 32-pounder siege guns to 10-inch Columbiads, and seventeen rifled pieces, ranging from a 2.75-inch Whitworth to a 7.44-inch Blakely.

In most of the engagements during the Vicksburg campaign, the Union artillery demonstrated its superiority to that of the Confederates. During the siege, that superiority grew into dominance. The Confederates scattered their artillery in one- or two-gun battery positions sited to repel Union assaults. By declining to mass their guns, the Confederates could do little to interfere with Union siege operations. By contrast, Union gunners created massed batteries at critical points along the line. These were able both to support siege operations with concentrated fires and keep the Confederate guns silent by smothering the embrasures of the small Confederate battery positions. As the siege progressed, Confederate artillery fire dwindled to ineffective levels, whereas the Union artillery blasted away at will. As much as any other factor, Union fire superiority sealed the fate of the Confederate army besieged in Vicksburg.

Tactics

Tactical Doctrine in 1861

The Napoleonic Wars and the Mexican War were the major influences on American thinking at the beginning of the Civil War. The campaigns of Napoleon and Wellington provided ample lessons in battle strategy, weapons employment, and logistics, while American tactical doctrine reflected the lessons learned in Mexico (1846-48). However, these tactical lessons were misleading because in Mexico relatively small armies fought only seven pitched battles. Because these battles were so small, almost all the tactical lessons learned during the war focused at the regimental, battery, and squadron levels. Future Civil War leaders had learned little about brigade, division, and corps maneuver in Mexico, yet these units were the basic fighting elements of both armies in 1861-65.

The U.S. Army's experience in Mexico validated Napoleonic principles—particularly that of the offensive. In Mexico, tactics did not differ greatly from those of the early nineteenth century. Infantry marched in column and deployed into line to fight. Once deployed, an

infantry regiment might send one or two companies forward as skirmishers, as security against surprise, or to soften the enemy's line. After identifying the enemy's position, a regiment advanced in closely ordered lines to within one hundred yards. There, it delivered a devastating volley, followed by a charge with bayonets. Both sides used this basic tactic in the first battles of the Civil War.

In Mexico, American armies employed artillery and cavalry in both offensive and defensive battle situations. In the offense, artillery moved as near to the enemy lines as possible—normally just outside musket range—in order to blow gaps in the enemy's line that the infantry might exploit with a determined charge. In the defense, artillery blasted advancing enemy lines with canister and withdrew if the enemy attack got within musket range. Cavalry guarded the army's flanks and rear but held itself ready to charge if enemy infantry became disorganized or began to withdraw.

These tactics worked perfectly well with the weapons technology of the Napoleonic and Mexican wars. The infantry musket was accurate up to 100 yards but ineffective against even massed targets beyond that range. Rifles were specialized weapons with excellent accuracy and range but slow to load and therefore not usually issued to line troops. Smoothbore cannon had a range of up to one mile with solid shot but were most effective against infantry when firing canister at ranges under 400 yards. Artillerists worked their guns without much fear of infantry muskets, which had a limited range. Cavalry continued to use sabers and lances as shock weapons.

American troops took the tactical offensive in most Mexican War battles with great success, and they suffered fairly light losses. Unfortunately, similar tactics proved to be obsolete in the Civil War because of a major technological innovation fielded in the 1850s—the rifle-musket. This new weapon greatly increased the infantry's range and accuracy and loaded as fast as a musket. The U.S. Army adopted a version of the rifle-musket in 1855, and by the beginning of the Civil War, rifle-muskets were available in moderate numbers. It was the weapon of choice in both the Union and Confederate Armies during the war, and by 1862, large numbers of troops on both sides had rifle-muskets of good quality.

Official tactical doctrine prior to the beginning of the Civil War did not clearly recognize the potential of the new rifle-musket. Prior to 1855, the most influential tactical guide was General Winfield Scott's

three-volume work, *Infantry Tactics* (1835), based on French tactical models of the Napoleonic Wars. It stressed close-order, linear formations in two or three ranks advancing at “quick time” of 110 steps (eighty-six yards) per minute. In 1855, to accompany the introduction of the new rifle-musket, Major William J. Hardee published a two-volume tactical manual, *Rifle and Light Infantry Tactics*. Hardee’s work contained few significant revisions of Scott’s manual. His major innovation was to increase the speed of the advance to a “double-quick time” of 165 steps (151 yards) per minute. If, as suggested, Hardee introduced his manual as a response to the rifle-musket, then he failed to appreciate the weapon’s impact on combined arms tactics and the essential shift the rifle-musket made in favor of the defense. Hardee’s *Tactics* was the standard infantry manual used by both sides at the outbreak of war in 1861.

If Scott’s and Hardee’s works lagged behind technological innovations, at least the infantry had manuals to establish a doctrinal basis for training. Cavalry and artillery fell even further behind in recognizing the potential tactical shift in favor of rifle-armed infantry. The cavalry’s manual, published in 1841, was based on French sources that focused on close-order offensive tactics. It favored the traditional cavalry attack in two ranks of horsemen armed with sabers or lances. The manual took no notice of the rifle-musket’s potential, nor did it give much attention to dismounted operations. Similarly, the artillery had a basic drill book delineating individual crew actions, but it had no tactical manual. Like cavalymen, artillerymen showed no concern for the potential tactical changes that the rifle-musket implied.

Regular Army infantry, cavalry, and artillery practiced and became proficient in the tactics that brought success in Mexico. As the first volunteers drilled and readied themselves for the battles of 1861, officers and noncommissioned officers taught the lessons learned from the Napoleonic Wars and validated in Mexico. Thus, the two armies entered the Civil War with a good understanding of the tactics that had worked in the Mexican War but with little understanding of how the rifle-musket might upset their carefully practiced lessons.

Early War Tactics

In the battles of 1861 and 1862, both sides employed the tactics proven in Mexico and found that the tactical offensive could still be successful—but only at a great cost in casualties. Men wielding rifled weapons in the defense generally ripped frontal assaults to shreds, and

if the attackers paused to exchange fire, the slaughter was even greater. Rifles also increased the relative numbers of defenders, since flanking units now engaged assaulting troops with a murderous enfilading fire. Defenders usually crippled the first assault line before a second line of attackers could come forward in support. This caused successive attacking lines to intermingle with survivors to their front, thereby destroying formations, command, and control. Although both sides favored the bayonet throughout the war, they quickly discovered that rifle-musket fire made successful bayonet attacks almost impossible.

As the infantry found the bayonet charge to be of little value against rifle-muskets, cavalry and artillery made troubling discoveries of their own. Cavalry soon learned that the old-style saber charge did not work against infantry armed with rifle-muskets. Cavalry, however, retained its traditional intelligence-gathering and screening roles whenever commanders chose to make the horsemen the "eyes and ears" of the army. Artillery, on its part, found that it could not maneuver freely to canister range as it had in Mexico because the rifle-musket was accurate beyond that distance. Worse yet, at ranges where gunners were safe from rifle fire, artillery shot, shell, and case were far less effective than close-range canister. Ironically, rifled cannon did not give the equivalent boost to artillery effectiveness that the rifle-musket gave to the infantry. Moreover, the increased range of cannons proved no real advantage in the broken and wooded terrain over which so many Civil War battles were fought.

There are several possible reasons why Civil War commanders continued to employ the tactical offensive long after it was clear that the defensive was superior. Most commanders believed the offensive was the decisive form of battle. This lesson came straight from the Napoleonic Wars and the Mexican-American War. Commanders who chose the tactical offensive usually retained the initiative over defenders. Similarly, the tactical defensive depended heavily on the enemy choosing to attack at a point convenient to the defender and continuing to attack until badly defeated. Although this situation occurred often in the Civil War, a prudent commander could hardly count on it for victory. Consequently, few commanders chose to exploit the defensive form of battle if they had the option to attack.

The offensive may have been the decisive form of battle, but it was very hard to coordinate and even harder to control. The better generals often tried to attack the enemy's flanks and rear but seldom achieved success because of the difficulty involved. Not only did the

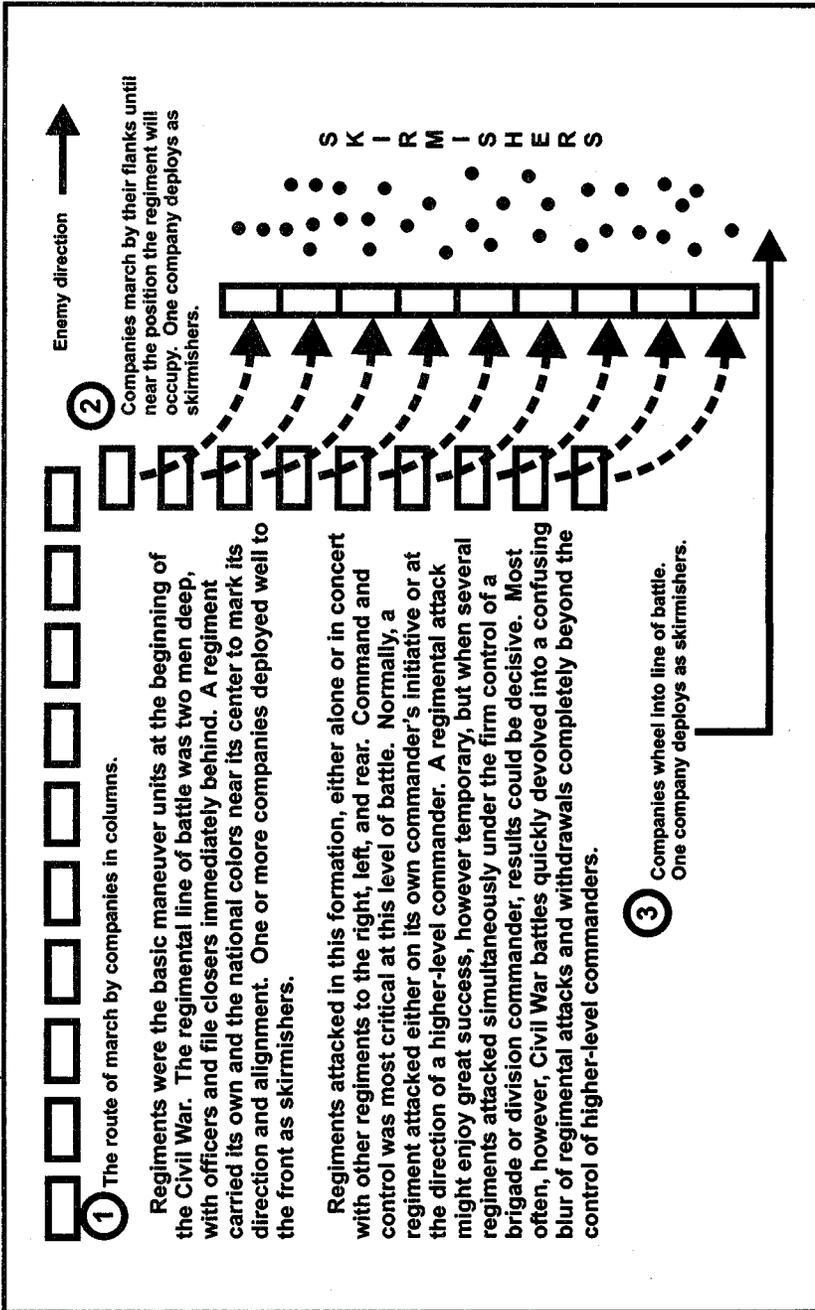


Figure 1. Regimental line of battle from the march column.

commander have to identify the enemy's flank or rear correctly, but also he had to move his force into position to attack and then do so in conjunction with attacks made by other friendly units. (For the procedure involved in moving a regiment into line of battle from march column, see figure 1.) Command and control of the type required to conduct these attacks was quite beyond the ability of most Civil War commanders. Therefore, Civil War armies repeatedly attacked each other frontally, with resulting high casualties because that was the easiest way to conduct offensive operations. When attacking frontally, a commander had to choose between attacking on a broad front or a narrow front. Attacking on a broad front rarely succeeded except against weak and scattered defenders. Attacking on a narrow front promised greater success but required immediate reinforcement and continued attack to achieve decisive results. As the war dragged on, attacking on narrow fronts against specific objectives became a standard tactic and fed the ever-growing casualty lists.

Later War Tactics

Poor training may have contributed to high casualty rates early in the war, but casualties remained high and even increased long after the armies became experienced. Continued high casualty rates resulted because tactical developments failed to adapt to the new weapons technology. Few commanders understood how the rifle-musket strengthened the tactical defensive. However, some commanders made offensive innovations that met with varying success. When an increase in the speed of the advance did not overcome defending firepower (as Hardee suggested it would), some units tried advancing in more open order. But this sort of formation lacked the appropriate mass to assault and carry prepared positions and created command and control problems beyond the ability of Civil War leaders to resolve. Late in the war, when the difficulty of attacking field fortifications under heavy fire became apparent, other tactical expedients were employed. Attacking solidly entrenched defenders often required whole brigades and divisions moving in dense masses to rapidly cover intervening ground, seize the objective, and prepare for the inevitable counterattack. Seldom successful against alert and prepared defenses, these attacks were generally accompanied by tremendous casualties and foreshadowed the massed infantry assaults of World War I. Sometimes, large formations attempted mass charges over short distances without halting to fire. This tactic enjoyed limited success at Spotsylvania Court House in May 1864. At Spotsylvania, a Union

division attacked and captured an exposed portion of the Confederate line. The attack succeeded because the Union troops crossed the intervening ground quickly without artillery preparation and without stopping to fire their rifles. Once inside the Confederate defenses, the Union troops attempted to exploit their success by continuing their advance, but loss of command and control made them little better than a mob. Counterattacking Confederate units, in conventional formations, eventually forced the Federals to relinquish much of the ground gained.

As the war dragged on, tactical maneuver focused more on larger formations—brigade, division, and corps. In most of the major battles fought after 1861, brigades were employed as the primary maneuver formations. But brigade maneuver was at the upper limit of command and control for most Civil War commanders. Brigades might be able to retain coherent formations if the terrain were suitably open, but most often, brigade attacks degenerated into a series of poorly coordinated regimental lunges through broken and wooded terrain. Thus, brigade commanders were often on the main battle line trying to influence regimental fights. Typically, defending brigades stood in line of battle and blazed away at attackers as rapidly as possible. Volley fire usually did not continue beyond the first round. Most of the time, soldiers fired as soon as they were ready, and it was common for two soldiers to work together, one loading while the other fired. Brigades were generally invulnerable to attacks on their front and flanks if units to the left and right held their ground or if reinforcements came up to defeat the threat.

Two or more brigades constituted a division. When a division attacked, its brigades often advanced in sequence, from left to right or vice versa—depending on the terrain, suspected enemy location, and number of brigades available to attack. At times, divisions attacked with two or more brigades leading, followed by one or more brigades ready to reinforce the lead brigades or maneuver to the flanks. Two or more divisions constituted a corps that might conduct an attack as part of a larger plan controlled by the army commander. More often, groups of divisions attacked under the control of a corps-level commander. Division and corps commanders generally took a position to the rear of the main line in order to control the flow of reinforcements into the battle, but they often rode forward into the battle lines to influence the action personally.

Of the three basic branches, cavalry made the greatest adaptation during the war. It learned to use its horses for mobility, then dismount and fight on foot like infantry. Cavalry regained a useful battlefield role by employing this tactic, especially after repeating and breechloading rifles gave it the firepower to contend with enemy infantry. Cavalry also found a role off the battlefield, in long-range raids that interdicted enemy supply lines and diverted enemy troops, in a manner that foreshadowed air interdiction in the twentieth century. The campaign for Vicksburg included two excellent examples of this function. The first of these was a Confederate raid on the Union supply depot at Holly Springs, led by Major General Earl Van Dorn in December 1862, that effectively thwarted Grant's first offensive into Mississippi. The second was a Union raid from Tennessee to Baton Rouge, Louisiana, led by Colonel Benjamin H. Grierson, which diverted Confederate attention away from Grant's main effort in April 1863.

In contrast to the cavalry, which reasserted itself as an offensive arm, artillery found that it could best add its firepower to the rifle-musket and tip the balance even more in favor of the tactical defensive, but artillery never regained the importance to offensive maneuver that it held in Mexico. If artillery had developed an indirect firing system, as it did prior to World War I, it might have been able to contribute more to offensive tactics. Still, both sides employed artillery decisively in defensive situations throughout the war.

The most significant tactical innovation in the Civil War was the widespread use of field fortifications after armies realized the tactical offensive's heavy cost. It did not take long for the deadly firepower of the rifle-musket to convince soldiers to entrench every time they halted. Eventually, armies dug complete trenches within an hour of halting in a position. Within twenty-four hours, armies could create defensive works that were nearly impregnable to frontal assaults. In this respect, this development during the American Civil War was a clear forerunner of the kind of warfare that came to dominate World War I.

Summary

In the Civil War, the tactical defense dominated the tactical offense because assault formations proved inferior to the defender's firepower. The rifle-musket, in its many forms, provided this firepower and caused the following specific alterations in tactics during the war:

- It required the attacker, in his initial dispositions, to deploy farther away from the defender, thereby increasing the distance over which the attacker had to pass.
- It increased the number of defenders who could engage attackers (with the addition of effective enfilading fire.)
- It reduced the density of both attacking and defending formations.
- It created a shift of emphasis in infantry battles toward firefights rather than shock attacks.
- It caused battles to last longer because units could not close with each other for decisive shock action.
- It encouraged the widespread use of field fortifications. The habitual use of field fortifications by armies was a major American innovation in nineteenth-century warfare.
- It forced cavalry to the battlefield's fringes until cavalrymen acquired equivalent weapons and tactics.
- It forced artillery to abandon its basic offensive maneuver: that of moving forward to within canister range of defending infantry.

Tactics in the Vicksburg Campaign

The basic unit of operational maneuver for Union forces in the Vicksburg campaign was the corps. For the Confederates, it was the division (there being no corps echelon in Pemberton's order of battle). On the battlefield, the brigade was the basic tactical unit for both sides. (One obvious exception to this rule was the battle of Raymond, where the Confederate force was a single brigade, and the brigade commander deployed and maneuvered regiments.)

Union forces held the initiative at the operational level throughout the campaign. Not surprisingly, in most tactical encounters, Union forces were on the offensive. Union commanders relied heavily on frontal attacks—neither Grant nor his subordinates were noted for their tactical finesse. Frontal assaults in the Civil War were generally costly, but they sometimes worked, as the Vicksburg campaign demonstrates. At the battle of Port Gibson, the Union corps commander who ran the battle, Major General John A. McClernand, enjoyed a heavy numerical advantage over the Confederates, but rugged terrain and jungle-like vegetation greatly facilitated the defense. McClernand responded by packing his forces two, three, and four regiments deep, on whatever open ground was available—crowding out his artillery in the process.

Whether this was a conscious adaptation to circumstances or a blind urge on McClelland's part to gather more and more force is a matter of speculation. Although McClelland's men eventually drove the Confederates from the field in a series of frontal attacks, Port Gibson does not stand out as an example of effective offensive tactics.

Undoubtedly, the most successful frontal attack of the campaign occurred during the battle of the Big Black River on 17 May. Brigadier General Michael K. Lawler, a Union brigade commander, perceived a weak spot in the Confederate fieldworks opposing him. He formed his brigade into a formation reminiscent of the assault columns used by Napoleon: two regiments leading, with a third following closely in support, a fourth in reserve, and two regiments on loan from another brigade to pin the enemy with fire and serve as an exploitation force. Lawler utilized natural cover to bring his brigade close to the enemy, and when the attack came, it was vigorous and impetuous. The unsteady Confederate regiment facing Lawler broke and ran when this assault force reached its breastworks.

The Napoleonic influence can be seen on a larger scale as well. During the Union march from Port Gibson to Jackson, and then to Champion Hill, Grant deployed his corps on separate routes to facilitate movement, but close enough to support each other should Confederates be encountered in force. Napoleon referred to this practice as the *bataillon carrée*, which can best be summarized by the adage, "march dispersed, fight massed." As he closed on the Confederates at Champion Hill on 16 May, Grant contrived to bring three converging corps-size columns to bear upon the enemy in a classic "concentric attack." The outnumbered Confederates could have been attacked from three directions and possibly destroyed, but Union command, control, and communications were inadequate to the task of coordinating the action. Only one of the three Union columns ever became fully engaged.

But if Union tactical art was mediocre on average, Confederate skill was generally lower still. The Confederate forces defending Mississippi constituted a "department" and never were formally designated as an "army." Prior to the campaign, units were dispersed, having spent the winter in garrison and in fortified positions. Regiments had little recent experience operating together as brigades and divisions. Not until Grant crossed the Mississippi and moved into the interior did a major portion of the department assemble as a field army. Not surprisingly, the assembled forces had difficulty even

forming up and marching as a unit, let alone fighting. At the battle of Champion Hill, the Confederate army was unresponsive and uncoordinated. Individual brigades and regiments fought hard and well, but higher-level command and control was lacking.

But at the lower echelons, some of the more imaginative and daring tactics of the Vicksburg campaign were executed, or at least attempted, by Confederates. Whereas Grant's forces relied almost exclusively on the frontal attack, on two occasions during the maneuver phase of the campaign, Confederate commanders attempted to attack their enemy in flank. During the battle of Port Gibson, Brigadier General John S. Bowen tried to thwart McClelland's steamroller tactics by leading a portion of Colonel Francis M. Cockrell's brigade in an attack against the Union right flank. But as was so often the case in the Civil War, by the time Cockrell's men reached their jump-off point, the enemy had begun to respond. After initial progress, Cockrell's men were stopped by Union reserves drawn up to oppose them. Later in the campaign, at the battle of Raymond, Confederate Brigadier General John Gregg attempted another flank attack. Unaware that his brigade confronted a Union corps, Gregg detached three of his five regiments and sent them off to attack the Union right. But when the flanking forces reached their jump-off position and realized the numerical odds against them, they opted not to attack.

When the campaign of maneuver ended and the siege of Vicksburg began, an entirely new set of tactics came into play. Whereas there was little formal doctrine for battlefield tactics in the Civil War (and none at all for operational maneuver), the sciences of fortification and siegecraft were well-established and understood by any military engineer trained at West Point. In keeping with the principles of fortification, the Confederates had erected strong earthwork fortifications that afforded interlocking fields of fire and commanded the approaches into Vicksburg. Trenches or "rifle pits" connected the major fortifications. After two failed assaults (by far the bloodiest frontal attacks of the campaign), the Union forces responded with a siege that was also the product of conventional doctrine. Grant established two separate forces, one to face outward and block any Confederate interference from outside, and the other to enclose Vicksburg and "reduce" its fortifications. Union troops crept up to the Confederate positions through zigzag trenches called "saps" or "approaches" and dug mines under some of the major fortifications.

But the siege ended before the last act of the doctrinal script was played out—there was no final assault.

Logistical Support

Victory on Civil War battlefields seldom hinged on the quality or quantity of tactical logistics. On the operational and strategic level, however, logistical capabilities and concerns always shaped the plans and sometimes the outcomes of campaigns. And as the war lengthened, the logistical advantage shifted inexorably to the North. The Federals controlled the majority of financial and industrial resources of the nation, and with their ability to import any needed materials, the Federals ultimately created the best-supplied army the world had yet seen. Despite suffering from shortages of raw materials, the Confederates, on their part, generated adequate ordnance, but they faltered gradually in their ability to acquire other war matériel. The food supply for Southern armies, moreover, was often on the verge of collapse, largely because limitations of the transportation network were compounded by political-military mismanagement. Still, the state of supply within field armies on both sides depended more on the caliber of the people managing resources than on the constraints of available matériel.

One of the most pressing needs at the start of the war was for sufficient infantry and artillery weapons. Large quantities of outmoded muskets were on hand for both sides, either in arsenals or private hands, but the Federals initially had only 35,000 modern rifle-muskets, while the Confederates had seized about 10,000. Purchasing agents rushed to Europe to buy existing stocks or contract for future production. This led to an influx of outmoded weapons, which resulted in many soldiers going into battle with Mexican War-era smoothbore muskets. As late as the fall of 1863, soldiers on both sides in the western theater were armed with muskets; several of Grant's regiments in the Vicksburg campaign noted exchanging their muskets for captured Confederate Enfields. Modern artillery pieces were generally available in adequate quantities, though the Confederates usually were outgunned. Although breechloading technology was available and the Confederates had imported some Whitworths from England, muzzleloading smoothbore or rifled cannon were the standard pieces used by both armies.

With most of the government arsenals and private manufacturing capability located in the North, the Federals ultimately produced

sufficient modern firearms for their armies, but the Confederates also accumulated adequate quantities—either from battlefield captures or through the blockade. In addition, exceptional management within the Confederate Ordnance Bureau led to the creation of a series of arsenals throughout the South that produced large quantities of munitions and weapons.

The Northern manufacturing capability permitted the Federals eventually to produce and outfit their forces with repeating arms, the best of which had been patented before 1861. Initially, however, the North's conservative Ordnance Bureau would not risk switching to a new, unproved standard weapon that could lead to soldiers wasting huge quantities of ammunition in the midst of an expanding war. By 1864, after the retirement of Chief of Ordnance James Ripley and with President Lincoln's urging, Federal cavalry received seven-shot Spencer repeating carbines, which greatly increased its battle capabilities.

Both sides initially relied on the states and local districts to provide some equipment, supplies, animals, and foodstuffs. As the war progressed, more centralized control over production and purchasing emerged under both governments. Still, embezzlement and fraud were common problems for both sides throughout the war. The North, with its preponderance of railroads and developed waterways, had ample supply and adequate distribution systems. The South's major supply problem was subsistence. Arguably, the south produced enough food during the war to provide for both military and civilian needs, but mismanagement, parochial local interests, and the relatively underdeveloped transportation network often created havoc with distribution.

In both armies, the Quartermaster, Ordnance, Subsistence, and Medical Bureaus procured and distributed equipment, food, and supplies. The items for which these bureaus were responsible are not dissimilar to the classes of supply used today. Some needs overlapped, such as the Quartermaster Bureau's procurement of wagons for medical ambulances, but conflicts of interest usually were manageable. Department and army commanders requested needed resources directly from the bureaus, and bureau chiefs wielded considerable power as they parceled out occasionally limited resources.

When essential equipment and supplies could not be obtained through normal channels, some commanders used their own resources to procure them. One example of this practice was Colonel John T. Wilder, who personally contracted for Spencer rifles for his mounted brigade in the Army of the Cumberland. Wilder obtained an unsecured personal loan to purchase the weapons, and his men reimbursed him from their pay. The Federal government picked up the cost after the rifles' worth was demonstrated in the Tullahoma and Chickamauga campaigns.

Typically, matériel flowed from the factory to base depots as directed by the responsible bureaus. Supplies were then shipped to advanced depots, generally a city on a major transportation artery safely within the rear area of a department. During campaigns, the armies established temporary advance depots served by rail or river transportation. From these points, wagons carried the supplies forward to the field units. This principle is somewhat similar to the modern theater sustainment organization.

The management of this logistical system was complex and crucial. A corps wagon train, if drawn by standard six-mule teams, would be spread out from five to eight miles, based on the difficulty of terrain, weather, and road conditions. The wagons, which were capable of hauling 4,000 pounds in optimal conditions, could carry only half that load in difficult terrain. Sustenance for the animals was a major

Table 6. Sample of Federal Logistical Data

<i>Item</i>	<i>Packing</i>	<i>Weight (lbs.)</i>
<i>Bulk ammunition:</i>		
.58 caliber, expanding ball (500-grain bullet)	1,000 rounds per case	98
12-pounder Napoleon canister (14.8 lbs. per round)	8 rounds per box	161
<i>"Marching" ration (per man per day):</i>		
1 lb. hard bread (hardtack)		2
¾ lb. salt pork or ¼ lb. fresh meat		
1 oz. coffee		
3 oz. sugar and salt		
<i>Forage (per horse per day):</i>		
14 lbs. hay and 12 lbs. grain		26
<i>Personal equipment:</i>		
Includes rifle, bayonet, 60 rounds of ammunition, haversack, 3 days' rations, blanket, shelter half, canteen, personal items		50—60

restriction, because each animal required up to twenty-six pounds of hay and grain a day to stay healthy and productive. Bulky and hard to handle, this forage was a major consideration in campaign planning. Wagons delivering supplies more than one day's distance from the depot could be forced to carry excessive amounts of animal forage. If full animal forage was to be carried, the required numbers of wagons to support a corps increased dramatically with each subsequent day's distance from the forward depot. Another problem was created by herds of beef that often accompanied the trains or were appropriated en route. This provided fresh (though tough) meat for the troops but slowed and complicated movement.

The bulk-supply problems were alleviated somewhat by the practice of foraging, which, in the proper season, supplied much of the food for animals and men of both sides. Foraging was practiced with and without command sanction wherever an army went, and it became command policy during Grant's Vicksburg campaign.

Logistics in the Vicksburg Campaign

When Major General Earl Van Dorn's cavalry destroyed Grant's advance depot at Holly Springs in December 1862, it wrecked Grant's plan for an overland, railroad-centered attack to support Sherman's Chickasaw Bayou expedition. Although the outcome of that expedition would probably not have been altered, this episode illustrates how closely operational planning relied on a fixed logistical base for overland operations. Grant, in his memoirs, however, credits the Holly Springs raid with providing him the key to a less-conventional strategy. Forced to rely upon foraging and requisition in the surrounding countryside to feed his army in the weeks following Van Dorn's raid, Grant came to realize that the Mississippi valley, though relatively underpopulated, was indeed a rich agricultural area, abounding in beef, hogs, and grain. Thus, Grant credited Van Dorn with showing him the solution to his supply dilemma should he choose to operate far from any secure logistical pipeline. War matériel (weapons, ammunition, medical supplies, etc.) would still have to be hauled by wagons, along with some limited food items such as coffee and bread. The countryside, however, could sustain his army with bulky animal forage, meat, and other provisions.

In January 1863, Grant established an impressive logistics system running from his depots at Cairo, Illinois, and Memphis to advance bases established along the levees at Lake Providence, Milliken's

Bend, and Young's Point—the latter being just ten river miles from Vicksburg. Supplies as well as troops moved down river on a sizeable fleet of army-contracted riverboats. These transports varied considerably in size, but many were capable of carrying 300,000 pounds of supplies—the equivalent of 150 wagonloads. At the end of March, when Grant decided to move his army south of Vicksburg on the Louisiana side of the river, he hoped to have water transport most or all of the way. Union engineers, augmented by details from McClelland's and Sherman's corps, dug a canal at Duckport linking the Mississippi to the network of bayous paralleling the army's route of march. The canal was completed successfully, but falling water levels made it useless before it could do any good. As a last resort, Union logisticians pushed wagon trains along the sixty-three-mile route that McClelland's and McPherson's corps traveled, from Milliken's Bend to Bruinsburg. Some supplies were hauled by wagon from Milliken's Bend to Perkins' Plantation, just below New Carthage. There, they were loaded on riverboats that had run by the Vicksburg batteries, for delivery to the army downstream. About 11 May, over a week after the bulk of the army had crossed to the east bank, Sherman's men completed a new road from Young's Point to Bowers' Landing, across the base of De Soto point. This road shortened the wagon haul to twelve miles—still a two-day haul over the rough roads. From Bower's Landing, steamers carried supplies down the river to the newly won logistical base at Grand Gulf.

The net effect of these efforts was to give Grant two sets of well-stocked advance depots, one below Vicksburg and several just above the city. After Grant moved away from his new base at Grand Gulf, his army had only to reestablish links with the river and its supply problems would essentially disappear. The Confederates knew this, and expected Grant to stay close to the river during his advance toward Vicksburg. Thus, his movement inland came as a surprise.

In his postwar memoirs, Grant stated that he "cut loose" from his supply lines when he pushed inland from Grand Gulf. Many historians have taken those words at face value, asserting that Grant's men relied entirely upon food and forage gathered from the countryside. Grant, however, never cut completely loose from his supply lines, nor did he intend his words to convey that. As his army maneuvered east of the river, a steady stream of wagons carried supplies from Young's Point to Bower's Landing, where the supplies were loaded on steamboats and carried to Grand Gulf. From Grand Gulf, huge wagon trains,

escorted by brigades hurrying forward to join the main force, carried supplies to the army. No "line of supply" existed only in the sense that Union troops did not occupy and garrison the supply route. An aggressive Confederate thrust into the area between Grand Gulf and Grant's army might have thwarted the Union campaign—Grant's men could forage for food, but only so long as they moved forward. Moreover, the barns and fields of Mississippi did not provide any ammunition to the foragers. One of the ironies of the campaign is that Pemberton's single offensive action, the attempt to strike south from Edwards toward Dillon's Plantation on 15 May, would probably have led him to Grant's ammunition train. However, heavy rains, confusion, and indecision led instead to the battle at Champion Hill.

During the campaign of maneuver, Grant was well served by his logistical staff in the rear and by the aggressive support of Rear Admiral David Porter. As Grant's army neared Vicksburg, Porter sensed the opportunity to establish a logistic base just north of Vicksburg on the Yazoo River at Johnson's Plantation (the site of Sherman's landing in the abortive Chickasaw Bayou expedition). The Navy's initiative led to supplies being on the ground by 18 May when Grant's army reached the outer works around the city. That, and efficient construction of roads from the plantation by Federal engineers, enabled Grant to fulfill a promise to provide hardtack for his troops by 21 May. At the same time, Porter's gunboats reduced the Warrenton batteries just a few miles below the city and enabled Grant's logisticians to move the lower supply base from Grand Gulf to Warrenton. These two bases cut the overland wagon haul to a maximum of six miles for units manning the siege lines. Thus, as Grant closed on Vicksburg, his supply situation changed dramatically, almost overnight, whereas the Confederates then had to rely almost completely on whatever stores had been placed in the city in advance.

Curiously, the Confederate logistical situation in the Vicksburg campaign was almost uniformly worse than that of the Union forces. The fact that the Confederates were conducting defensive operations within their own territory resulted in as many logistical problems as advantages. The bountiful forage discovered by Grant's troops was generally not available to the Confederate army, due in large part to the farmers' reluctance to part with their produce. In March, Pemberton complained of a shortage of beef, yet one of his staff officers noted an abundance of cattle in the region between Vicksburg and Jackson. Federal surgeons found apothecary shelves in Jackson well stocked

with drugs, yet Confederate surgeons were critically short of medical supplies. The explanation, however, is simple: the invading Federals could take what they needed, whereas the defending Confederates could not so easily requisition from their own people.

Thus, the Confederates had to rely upon their established logistical systems and procedures. Confederate logistical doctrine in the Civil War called for armies to supply themselves, as far as possible, from the resources of the area in which they were stationed. There was no shortage of basic supplies in the Vicksburg region. The Mississippi Delta (the area between the Mississippi and Yazoo Rivers) and farmlands to the east produced large quantities of food for man and beast. The transportation net, with the main rail line running from Vicksburg to the major rail nexus at Jackson, and the numerous navigable waterways, offered the Confederates the ability to stockpile or shift supplies quickly. The telegraph network provided communications that could support the management of logistical resources. Depots and manufacturing centers in Jackson, Enterprise, and Columbus, Mississippi, helped support a variety of Confederate needs.

Three major factors, however, limited Pemberton's ability to optimize his logistical support. The first problem was the inefficiency of, and competing priorities between, the Confederate quartermaster and commissary departments. Many of the supplies from Pemberton's area were needed to support other military departments. Even so, the management of these resources was inefficient, and not enough funds were available for local purchase of food. Pemberton also had concerns about his own staff—officials in Richmond had received civilian complaints about Pemberton's Quartermaster. This problem, however vexing, did not prove insurmountable.

The second problem was largely beyond Pemberton's control—Union naval superiority. Prior to the war, most bulk commodities were moved by water. But in the course of the Vicksburg campaign, Porter's gunboats denied the Confederates the use of the Mississippi and its tributaries, thus throwing heavier demands on the overtaxed road and rail transport systems. Even before Grant's army crossed to the east bank of the Mississippi, Pemberton found it difficult to gather and distribute supplies.

The third and greatest problem hampering Confederate logistical efforts was Pemberton's lack of overall vision for the campaign. In the

absence of a campaign plan, the Confederate logisticians, like Pemberton himself, could only react to Union initiatives. Supplies could not be positioned to support any particular scheme of maneuver.

After Grant seized and destroyed Jackson, all supplies became critical for Pemberton. With Porter on the Mississippi and with the eastward rail lines interdicted, Pemberton was effectively cut off from any resources beyond the immediate vicinity of his army. Fortunately, his largest supply depots were in Vicksburg, a fact that helps explain Pemberton's reluctance to risk the loss of the city. Rations that could be stretched out for perhaps two full months were stockpiled inside Vicksburg before 18 May. Ordnance officers had managed to gather significant quantities of small arms and ammunition as well. The main shortages in the city after the siege began were artillery, medical supplies, engineer tools, and percussion caps for rifle-muskets. The latter shortage was eased when couriers penetrated the Union siege lines with several hundred thousand caps.

As the siege progressed, the contrast between Union and Confederate logistics became increasingly pronounced. Confederate stockpiles dwindled, rations were cut, and ammunition expenditure curtailed. But the Union forces, situated as they were on North America's greatest transportation artery, received reinforcements and supplies in seemingly limitless quantities. Predictably, Confederate morale deteriorated until Pemberton felt that his troops had lost the ability and will to fight. Finally, logistics played a role in determining the final surrender terms. An important factor influencing Grant's decision to parole the entire Vicksburg garrison of over 29,000 men was the simple fact that the Confederate government, not the Federal army, would then have to deal with transporting and feeding those troops.

Engineer Support

Engineers on both sides performed many tasks essential to every campaign. Engineers trained at West Point were at a premium; thus, many civil engineers, commissioned as volunteers, supplemented the work being done by engineer officers. The Confederates, in particular, relied on civilian expertise because many of their trained engineer officers sought line duties. State or even local civil engineers planned and supervised much of the work done on local fortifications.

In the prewar U.S. Army, the Corps of Engineers contained a handful of staff officers and one company of trained engineer troops. This cadre expanded to a four-company Regular engineer battalion. Congress also created a single company of topographic engineers, which joined the Regular battalion when the engineer bureaus merged in 1863. In addition, several volunteer pioneer regiments, some containing up to 2,000 men, supported the various field armies. The Corps of Engineers also initially controlled the fledgling Balloon Corps, which provided aerial reconnaissance. The Confederate Corps of Engineers, formed as a small staff and one company of sappers, miners, and pontoniers in 1861, grew more slowly and generally relied on details and contract labor rather than established units with trained engineers and craftsmen.

Engineer missions for both sides included construction of fortifications; repair and construction of roads, bridges, and, in some cases, railroads; demolition; limited construction of obstacles; and construction or reduction-of-siege works. The Federal Topographic Engineers, a separate prewar bureau, performed reconnaissance and produced maps. The Confederates, however, never separated these functions in creating their Corps of Engineers. Experience during the first year of the war convinced the Federals that all engineer functions should be merged under a single corps because qualified engineer officers tended to perform all related functions. As a result, the Federals also merged the Topographic Engineers into their Corps of Engineers in March 1863.

Bridging assets included wagon-mounted pontoon trains that carried either wooden, canvas-covered, or inflatable rubber pontoon boats. Using this equipment, trained engineer troops could bridge even large rivers in a matter of hours. The most remarkable pontoon bridge of the war was the 2,200-foot bridge built by Army of the Potomac engineers in 1864 over the James River—one of over three dozen pontoon bridges built in support of campaigns in the east that year. In 1862, the Confederates began developing pontoon trains after they had observed their effectiveness. In fact, during the Atlanta campaign of 1864, General Joseph Johnston had four pontoon trains available to support his army.

Both armies in every campaign of the war traveled over roads and bridges built or repaired by their engineers. Federal engineers also helped clear waterways by dredging, removing trees, or digging canals. Fixed fortifications laid out under engineer supervision played

critical roles in the Vicksburg campaign and in actions around Richmond and Petersburg. Engineers also supervised the siege works to reduce those fortifications.

While the Federal engineer effort expanded in both men and materiel as the war progressed, the Confederate efforts continued to be hampered by major problems. The relatively small number of organized engineer units available forced Confederate engineers to rely heavily on details or contract labor. Finding adequate manpower, however, was often difficult because of competing demands for it. Local slave owners were reluctant to provide labor details when labor was crucial to their economic survival. Despite congressional authorization to conscript 20,000 slaves as a labor force, state and local opposition continually hindered efforts to draft slave labor. Another related problem concerned the value of Confederate currency. Engineer efforts required huge sums for men and materiel, yet initial authorizations were small, and although congressional appropriations grew later in the war, inflation greatly reduced effective purchasing power. A final problem was the simple shortage of iron resources, which severely limited the Confederates' ability to increase railroad mileage or even produce iron tools.

In 1861, maps for both sides were also in short supply; for many areas in the interior, they were nonexistent. As the war progressed, the Federals developed a highly sophisticated mapping capability. Federal topographic engineers performed personal reconnaissance to develop base maps, reproduced them by several processes, and distributed them to field commanders. Photography, lithographic presses, and eventually photochemical processes gave the Federals the ability to reproduce maps quickly. Western armies, which usually operated far from base cities, carried equipment to reproduce maps on campaigns with their army headquarters. By 1864, annual map production exceeded 21,000 copies. Confederate topographic work never approached the Federal effort in quantity or quality. Confederate topographers initially used tracing paper to reproduce maps. Not until 1864 did the use of photographic methods become widespread in the South.

Engineers in the Vicksburg Campaign

The engineering operations conducted in support of the Vicksburg campaign were perhaps the most diverse and complex of the war. For much of the campaign, Federal engineers focused on mobility

operations, while Confederate engineers emphasized countermobility, particularly in denying the Federals the use of streams and bayous in the swamps north of the city. Confederate engineers also supervised the construction and repair of the fortifications around the city. During the siege phase of the campaign, Grant's engineers focused on the reduction of those works, utilizing procedures such as sapping, mining, and other related tasks, as well as the improvement of roads and landings to enhance logistical support. This wide range of activities, which required engineers on both sides to construct roads, emplace or construct bridges, clear or obstruct waterways, construct field works, emplace batteries, divert the flow of rivers, and numerous other tasks, is made even more remarkable by the limited numbers of trained engineers available to accomplish them.

Grant's Army of the Tennessee contained three formally organized engineer units. The largest was the Missouri Engineer Regiment of the West. Organized initially in July 1861, its ranks held skilled railroad men, engineers, and ironworkers recruited from St. Louis and surrounding areas. By the time of the Vicksburg campaign, it had extensive experience in a variety of construction operations and had been involved in some minor skirmishing. The regiment, with a strength of roughly 900 men, constructed roads around Young's Point in February 1863 and in March cut levees on the west side of the river and constructed casemated battery positions opposite Vicksburg. In April, six companies of the regiment returned to Memphis to begin the repair of the Memphis and Charleston Railroad. Companies A, D, F, and I, which were designated the 2d Battalion, remained with Grant's main force during the decisive phases of the campaign. The other two formally organized engineer units were the Kentucky Company of Engineers and Mechanics and Company I of the 35th Missouri, which was designated as the army's pontoon company. Since Grant then had barely 500 "trained" engineers at his disposal for his operations below Vicksburg, most of his divisions detailed men for engineer tasks or designated one of their infantry companies as engineer troops. Known as "pioneer" companies and detachments, or as the "pioneer corps" of their parent divisions, these ad hoc units generally undertook missions requiring higher degrees of skill than those assigned to normal labor details.

The most strenuous engineer labors of the campaign took place between January and April 1863, as Grant sought ways to bypass the strong Confederate position at Vicksburg by creating flanking routes

though the bayou country. Several of these efforts involved alternate water routes around the city. One scheme involved digging a canal that would divert the Mississippi through the peninsula directly opposite Vicksburg, a project initiated during Farragut's expedition in June 1862. Beginning in January 1863, details of infantry under engineer supervision labored the better part of two months before the rising river flooded them out. A month later, labor details working under engineer supervision cut the levee at Yazoo Pass to divert Mississippi River water into the Delta region in hopes that gunboats and transports could find a way to Vicksburg from the north. In March, the 1st Missouri Engineers used black powder to blow a gap in the western levee along the Mississippi River at Lake Providence. The plan was to flood enough of the countryside to link the bayous and rivers west of the Mississippi and thus provide an alternate route for steamboats all the way to the Red River. Once the levees were broken, the engineers used man-powered underwater saws, which swung pendulum-like from barge-mounted trestles, to cut off trees and stumps and allow passage of vessels. This backbreaking work required the men to spend much of their time in the water untangling the saws. It took the Missouri Engineers eight days to clear a two-mile stretch of bayou. Unfortunately, falling water levels led to the abandonment of the project.

Grant's subsequent march from Milliken's Bend to Hard Times, a distance of sixty-three miles through the swampy floodplain, entailed a vast amount of engineering work. Much of the roadbed had to be corduroyed (paved with logs laid side-by-side); stretches of quicksand required layers of planking to create sufficient buoyancy for wagons; and numerous water courses had to be bridged using materials found on site. Engineers and infantry details constructed eight major bridges, totaling more than 1,700 feet, along the road to Hard Times. Again, the shortage of qualified engineer troops meant that most of the actual labor involved details of infantry, under the supervision of engineer-trained officers. This road-building effort continued on the west bank even after Grant crossed the river at Bruinsburg and pushed inland.

During the campaign of maneuver on the east side of the river, Union bridge builders demonstrated their ingenuity to the fullest. Twenty-two trestle, suspension, pontoon, and raft bridges were employed in the campaign. Engineers used all available materials in their bridges, including boards pulled from buildings, cotton bales,

telegraph wire, vines, cane, and flatboats, in addition to the supplies forwarded from engineer depots upriver. The pontoon company of Sherman's corps ultimately brought along its inflatable rubber pontoons, which were employed in the crossing of the Big Black River.

Once Grant decided to initiate a formal siege to reduce Vicksburg, he was faced with a critical shortage of trained engineer officers. Grant ordered all officers with West Point training or civil engineer experience to assist chief engineer Captain Frederick E. Prime and the other three engineer officers on Grant's staff. These men supervised infantry details at the different approaches, while the trained engineer units worked in the saps and trenches. Captain Andrew Hickenlooper, Major General John A. Logan's chief engineer, was able to procure experienced coal miners, drawn from the ranks, to construct the mine undertaken by Logan's division.

On the Confederate side, the engineering effort in this campaign came under the general authority of chief engineer Major Samuel H. Lockett, who arrived at Vicksburg in June 1862. At that time, Vicksburg's only fortifications consisted of a few batteries along the river. Union naval bombardments on 27-28 July 1862 persuaded the Confederate command to fortify the city on both the landward and river fronts. Lockett spent the month of August surveying the rough terrain and planning on how best to utilize it for defensive purposes. On 1 September 1862, the actual construction began, using hired or impressed slave labor. Lockett's fortified line extended nine miles, from the river above Vicksburg to the river below. Thirteen river batteries studded the bluffs overlooking the Mississippi. Snyder's (Haynes') Bluff to the north and Warrenton to the south were also fortified. In addition, the Confederates also constructed a set of floating barriers called "rafts" across the Yazoo River to block incursions by Union gunboats.

When Pemberton assumed command of the department on 1 November 1862, Lockett's responsibilities increased. He exercised authority over the entire area from Holly Springs to Port Hudson and from Vicksburg to Jackson. As part of his duties, Lockett surveyed defensive positions around Jackson and Edwards Station. In May 1863, after Grant had crossed the river, Lockett laid out defensive bridgeheads at several crossing sites along the Big Black River.

One other Confederate engineering effort is worthy of note. Brigadier General John S. Bowen, given command of Grand Gulf in

March 1863, used slave labor to shave the cliffs overlooking the mouth of the Big Black River and built a series of batteries and rifle pits that would withstand over one hundred tons of ordnance fired by Porter's gunboats during their unsuccessful bombardment of the position on 29 April.

As the campaign unfolded, Lockett continued to support the Confederate army, often on his own initiative. It was Lockett who found and repaired the washed-out bridge over Baker's Creek that gave Pemberton a withdrawal route after the battle of Champion Hill on 16 May. Lockett later prepared the railroad bridge over the Big Black for demolition and fired it on 17 May just before the Federals reached it after their destruction of the Confederate bridgehead. Following that disastrous engagement, Lockett rushed back to Vicksburg to supervise the repair of fortifications damaged by the winter rains. Once the siege began, Lockett was busy supervising the repair of fortifications damaged by Union artillery. When the Federals began mining efforts, Lockett responded with at least fifteen countermines, three of which he exploded.

Lockett operated with even fewer engineer assets than the meager number available to Grant. Although Lockett and his three-man staff equaled the number of engineers assigned to Grant's staff, and although he did have four other trained engineers as assistants, his troop assets included only one company of sappers and miners that numbered less than three dozen men. Most of the entrenching work had been done by a relatively small number of hired or impressed slave laborers. Apparently, Confederate infantrymen were less willing than their Union counterparts to dig and maintain earthworks. When Lockett reached Vicksburg on 18 May, he had only twenty-six sappers and miners, eight detailed mechanics, four overseers, and seventy-two slaves (twenty of whom were sick) to quickly repair nine miles of fortified lines. Lockett noted having only 500 shovels available.

Although the Confederate army at Vicksburg was obviously blessed with an engineer staff officer of talent and initiative, not all of Lockett's countrymen appreciated his efforts. General Joseph E. Johnston, when he toured the works around Vicksburg in December 1862, felt that "[t]he usual error of Confederate engineering had been committed there. An immense, entrenched camp, requiring an army to hold it, had been made instead of a fort requiring only a small garrison." This defect, however, was not Lockett's fault. He received

little command guidance; therefore, he planned his defenses to suit the best engineering aspects of the terrain.

Topographical engineering played little role in this campaign for either side. Grant's topographic engineers became fully involved in the more crucial field engineering missions, and the speed of movements in May precluded useful mapping work. The Confederates, as was typical in most of the western theater, paid almost no attention to mapping or even detailed reconnaissance of their area of operations. As a result, Pemberton did not know the topography of his own department any better than Grant did during the campaign of maneuver.

Communications Support

Communications systems used during the Civil War consisted of line-of-sight signaling, telegraphic systems, and various forms of the time-honored courier methods. The telegraph mainly offered viable strategic and operational communications, line-of-sight signaling provided operational and limited tactical possibilities, and couriers were most heavily used for tactical communications.

The Federal Signal Corps was in its infancy during the Civil War, Major Albert C. Myer having been appointed the first signal chief in 1860. His organization grew slowly and became officially recognized as the Signal Corps in March 1863. It achieved bureau status by November of that year. Throughout the war, the Federal Signal Corps remained small, its maximum strength reaching just 1,500 officers and men, most of whom were on detached service with the corps. Myer also indirectly influenced the formation of the Confederate Signal Service. Among the men who assisted Myer in prewar testing of his wigwag signaling system was Lieutenant E. P. Alexander. (Myer's wigwag system, patented in 1858, used five separate, numbered movements of a single flag. Four-number groups represented letters of the alphabet and a few simple words and phrases. The system could also be employed at night by using kerosene torches.) Alexander used wigwag signals to the Confederates' advantage during the First Battle of Bull Run and later organized the Confederate Signal Corps. Officially established in April 1862, the Confederate Signal Corps was attached to the Adjutant and Inspector General Department. It attained the same size as its Federal counterpart, with nearly 1,500 men ultimately being detailed for service.

Myer also fought hard to develop a Federal field telegraph service. This field service utilized the Beardslee device, a magneto-powered machine operated by turning a wheel to a specific point. This sent an electrical impulse that keyed the machine at the other end to the same letter. Although less reliable than the standard Morse code telegraph key, the Beardslee could be used by an operator with only several hours' training and did not require bulky batteries for a power source. Myer's field telegraph units carried equipment on wagons that enabled its operators to establish lines between field headquarters. The insulated wire used could also be hooked into existing trunk lines, thus offering the potential to extend the reach of the civilian telegraph network. Control over the existing fixed telegraph system, however, remained with the U.S. Military Telegraph Service. Myer lost his struggle to keep the field telegraph service under the Signal Corps when Secretary of War Edwin M. Stanton relieved Myer as the signal chief in November 1863 and placed all telegraph activity under the Military Telegraph Service.

Although the Confederate Signal Corps' visual communications capabilities were roughly equal to those of the Federals, Confederate field telegraph operations remained too limited to be of operational significance. The Confederates' existing telegraph lines provided strategic communications capabilities similar to those of the Federals, but lack of resources and factories in the South for producing wire precluded their extending the prewar telegraph networks.

The courier system, using mounted staff officers or detailed soldiers to deliver orders and messages, remained the most viable tactical communications option, short of commanders meeting face to face. Although often effective, this system was fraught with difficulties, as couriers often were captured, killed, or delayed in route. Commanders sometimes misinterpreted or ignored messages, and situations often changed by the time messages were delivered. The weaknesses of the courier system, though not always critical in themselves, tended to compound commanders' errors or misjudgments during campaigns and battles.

Communications in the Vicksburg Campaign

Operating along river lines of communication meant that Grant's army often would leave behind its excellent strategic telegraph network. Memphis, two days by steamboat from Vicksburg, was the nearest telegraph station upriver, and the telegraph lines running north

from Memphis often were cut by guerrillas. For much of the campaign, Cairo, Illinois, was the closest point that had reliable telegraph links with the East. Once Grant began operations south of Vicksburg, he essentially broke off his communications with Washington. President Lincoln, on 22 May 1863 (the day Grant launched his deliberate assault against Vicksburg), telegraphed Major General Stephen Hurlbutt at Memphis with a situation update based upon information gleaned from Confederate newspapers smuggled out of Richmond. The next day, Lincoln, who had not yet heard from Grant about his landing at Bruinsburg, finally received a telegraphic report. Grant's message, describing his operations since 30 April, had been sent upriver by courier on a steamer only after the Federal army had closed on the city on 18 May.

As for Federal tactical communications, Grant's signal corps detachment struggled to fill its ranks with detailed officers and men, but the full complement of forty-five officers was not assigned until late in the campaign. Signal officers operating with the field army probably provided their best service as scouts, since they usually advanced ahead of the main force, reconnoitering potential signal sites. The nature of the terrain generally precluded communications by flag, but stations set up along the riverbanks and at key areas along the line of march offered some limited local communications. Interestingly, Admiral Porter early saw the value of the army signal system. He detailed seven Navy officers to work with the signal corps. Thus Porter, on the river, could maintain a link with the army as long as the gunboats operated within visual range of army signal stations on shore.

Telegraph played no tactical role in the Vicksburg campaign. Although six field telegraph units were assigned to Grant's army, they did not arrive in Memphis until late June and did not reach Vicksburg until after the surrender. During the campaign of maneuver, Grant's most reliable means of tactical communication was the courier, and this method was fraught with problems. On 16 May, as the Federal army advanced on multiple routes toward Champion Hill, the courier system failed badly. When the northernmost of the three Union columns became fully engaged with the enemy, Grant, accompanying that column, sent a message to McClelland, three miles away, to bring the other two columns into action. But the courier carrying the message chose to take a twelve-mile route by road rather than riding three miles across country. As a result, four hours elapsed before McClelland's divisions pushed the enemy, and part of his force never attacked at all.

Another problem arose during the deliberate assault of the Vicksburg works on 22 May, when Grant's inability to communicate directly with McClernand led to confusion about the need to support a supposed success in McClernand's sector.

The Confederates, on the other hand, operated with an excellent network of fixed telegraphic communications until Grant cut the lines into Vicksburg as he advanced from the south and east. The existence of a civilian telegraph net allowed Pemberton to get by with a signal corps detachment of only three officers. Virtually every significant town was linked by telegraph line; thus, Pemberton initially had excellent operational as well as strategic communications. In December 1862, Confederate telegraphers, using a line running along the west bank of the Mississippi, alerted Pemberton to the approach of Sherman's Chickasaw Bayou expedition, enabling the Confederates to bring in reinforcements from other parts of the department.

Ironically, the effectiveness of his telegraph communications may have worked to Pemberton's disadvantage as the campaign progressed because the telegraph system also allowed him to receive contradictory advice from two key subordinates, Bowen and Stevenson. Bowen argued that the main Federal effort was coming from below Vicksburg, while Stevenson argued that it was coming above Vicksburg. The telegraph also provided Pemberton with conflicting instructions from Joseph Johnston and Jefferson Davis about whether he should defend or evacuate Vicksburg as Grant advanced on the city. Most important, the allure of the telegraph may well have been a factor in keeping Pemberton tied to his headquarters long after he should have taken the field in person.

After 4 May, when advancing Federals began to cut telegraph wires, the Confederates relied increasingly on couriers. This system also had its problems. One of the three couriers Johnston sent out on 13 May with an order directing Pemberton to join him at Clinton was actually a Federal spy, who instead delivered the message to the Federals. Thus Grant learned of the order before the other two couriers reached Pemberton!

Once Pemberton withdrew behind the works at Vicksburg, couriers became his only means of communication with the outside world. Although a few men were able to slip through Federal lines early in the siege, couriers ultimately were forced to use the river, clinging to floating logs or pieces of debris in order to enter and leave the city.

Messages conveyed by this dangerous route took from five to ten days to pass between Johnston and Pemberton, and often couriers destroyed their messages if capture seemed imminent. The last message Pemberton received from outside the city came in by courier on 23 June.

Medical Support

Federal and Confederate medical systems followed a similar pattern. Surgeons general and medical directors for both sides had served many years in the prewar Medical Department but were hindered by an initial lack of administrative experience in handling large numbers of casualties, as well as by the state of medical science in the midnineteenth century. Administrative procedures improved with experience, but throughout the war, the simple lack of knowledge about the true causes of disease and infection led to many more deaths than direct battlefield action.

After the disaster at the Battle of First Bull Run, the Federal Medical Department established an evacuation and treatment system developed by Surgeon Jonathan Letterman. At the heart of the system were three precepts: consolidation of field hospitals at division level, decentralization of medical supplies down to regimental level, and centralization of medical control of ambulances at all levels. A battle casualty evacuated from the front line normally received treatment at a regimental holding area immediately to the rear. From this point, wagons or ambulances carried wounded men to a division field hospital, normally within a mile of the battle lines. Seriously wounded men could then be further evacuated by wagon, rail, or watercraft to general hospitals, located usually in towns along the lines of communication in the armies' rear areas.

Although the Confederate system followed the same general principles, Confederate field hospitals were often consolidated at brigade rather than division level. A second difference lay in the established span of control of medical activities. Unlike their Federal counterparts, who had control over all medical activities within an army area, a Confederate army medical director had no control of activities beyond his own brigade or division field hospitals. A separate medical director for large hospitals was responsible for evacuation and control. In practice, both sets of medical directors resolved potential problems through close cooperation. By 1863, the

Confederacy had also introduced rear area “wayside hospitals,” which were intended to handle convalescents en route home on furloughs.

Procedures, medical techniques, and medical problems for both sides were virtually identical. Commanders discouraged soldiers from leaving the battle lines to escort wounded back to the rear, but such practice was common, especially in less-disciplined units. The established technique for casualty evacuation was to detail men for litter and ambulance duty. Both armies used bandsmen, among others, for this task. Casualties would move or be assisted back from the battle line, where litter bearers evacuated them to field hospitals using ambulances or supply wagons. Ambulances were specially designed, two- or four-wheel carts with springs to limit jolts, but rough roads made even short trips agonizing for wounded men. Brigade and division surgeons staffed consolidated field hospitals. Hospital site considerations were the availability of water, potential buildings to supplement the hospital tents, and security from enemy cannon and rifle fire. The majority of operations performed at field hospitals in the aftermath of battle were amputations. Approximately 70 per cent of Civil War wounds occurred in the extremities, and the soft Minié ball shattered any bones that it hit. Amputation was the best technique then available to limit the chance of serious infection. The Federals were generally well supplied with chloroform, morphine, and other drugs, though shortages did occur on the battlefield. Confederate surgeons often lacked critical drugs and medical supplies.

Medical Support in the Vicksburg Campaign

Grant’s Army of the Tennessee had adopted most of the Letterman system by March 1863. Thus, field hospitals were consolidated at the division echelon, and medical supplies were distributed down to regimental level. Ambulances were under positive medical control, with commissioned or noncommissioned officers in charge at division and brigade and ambulance drivers and assistants assigned to each regiment. When Regular army surgeon Madison Mills became Grant’s medical director in March 1863, he inherited a growing field hospital established at Milliken’s Bend. Mills established convalescent camps and opened more field hospitals there to support Grant’s guidance that ill troops be kept with the command insofar as possible to enable them to rejoin their units upon recovery.

Federal surgeons were able to stockpile a significant amount of medical supplies in the depot established at Young’s Point. Most were

kept on the steamer *Des Arc*, which could move supplies to any secure drop-off point along the river. By May, Mills estimated that six months of medical supplies had been stockpiled. He was assisted in this by Grant's standing order that any steamer with space that moved down river from Memphis was to bring additional medical supplies. The medical department also received invaluable assistance from the U.S. Sanitary Commission in the form of supplies and evacuation of sick and wounded.

The river constituted an excellent evacuation as well as supply route. In addition to the 1,000-bed general hospital and convalescent camps established just north of Vicksburg, thousands of beds were available in general hospitals up river. Memphis alone had 5,000 available beds, with many more available in general hospitals in Cairo, Mound City, Paducah, Evansville, and St. Louis. Three steamers, *R. C. Wood*, *D. A. January*, and *City of Memphis*, served as hospital ships for evacuation to these upriver hospitals. A round trip to Memphis took four to five days.

The most severe medical problem facing Grant's army between January and July 1863 was disease, a problem severely exacerbated early in the campaign when the army occupied swampy encampments along the river. From January to March, high water forced the troops to crowd together on the tops of the levees. Unfortunately, the levees also served as roads, latrines, and graves. Thus, Grant's army experienced over 170,000 cases of serious illness during this encampment. One should be skeptical of historians' assertions that work on projects such as the canal helped put Grant's men in excellent shape for the campaigning to come. Reports from regiments engaged in these projects routinely list more men on the sick lists than were present for duty. Once Grant began to maneuver, however, the combination of continual movement and healthier terrain led to dramatic decreases in serious disease.

During the campaign of maneuver, surgeons were forced by the nature of operations to carry sick and wounded soldiers along with the marching columns or leave them behind to be captured. By the time Grant began the siege of Vicksburg, over 2,000 Federal wounded from the battles of Raymond, Jackson, and Champion Hill had been left under Confederate control. Nineteen Federal surgeons stayed behind to attend these men. Four additional Federal surgeons stayed to help attend the Confederate wounded from those battles, which indicates the critical shortage of doctors serving Pemberton's army. On 20 May,

five wagons displaying a flag of truce and loaded with medical supplies rolled east from the Federal siege lines into Confederate territory to support the wounded from those earlier battles. After the surrender of Vicksburg on 4 July, fifty ambulances moved to Raymond under a flag of truce to recover many of these wounded.

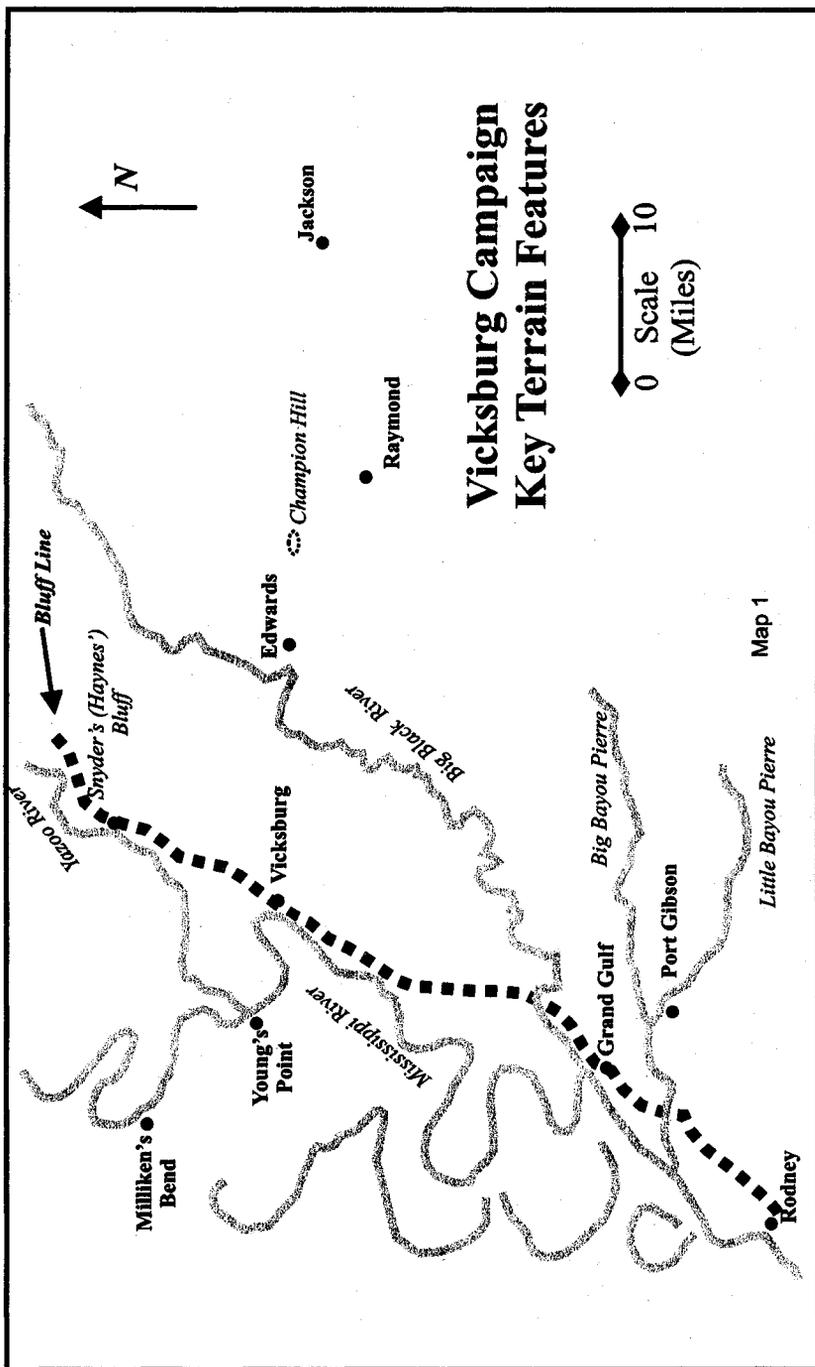
Although the Federal corps commanders' emphasis on medical support varied, medical officers had adequate supplies throughout the campaign. Sherman's corps allocated enough wagons for medical needs. McClelland, on the other hand, accorded low priority to medical requirements, thus Surgeon Mills had to scramble to support his XIII Corps surgeons. Shortages of medical supplies were partly made up in Jackson and other towns as surgeons raided the stocks of local drug stores. There also seemed to be no shortage of food for the wounded. Surgeons reported an abundance of beef for making soup and an adequate supply of hard bread and vegetables. After the supply line to the river was fully reestablished on 21 May, even ice became available.

After Grant initiated the siege of Vicksburg, division hospitals were established a mile behind the lines, using combinations of buildings and tents. Water often came from cisterns because of a shortage of wells and springs. The policy of keeping wounded and sick soldiers close to their commands, whenever practicable, was maintained. A consolidated evacuation hospital near Johnson's plantation on the Yazoo River housed the seriously ill and wounded until medical steamers could move them up the Mississippi to general hospitals.

Except for the assaults of 19 and 22 May, when more than 3,000 Union soldiers were wounded, battle casualties averaged close to a hundred per week, numbers that the medical staffs could manage effectively. Upon the Confederate surrender on 4 July, however, the Federal surgeons were confronted with over 6,000 Confederate sick and wounded from the city. The well-established Federal hospital, supply, and evacuation network proved adequate to meet this new demand.

Relatively little specific information is available concerning Confederate medical efforts during the campaign. However, it is safe to assume that problems with sickness and disease, particularly for those units posted in the Delta, were of similar magnitude to those encountered by Union troops when they, too, camped on the floodplain. It is clear that the Confederate army suffered from supply

shortages and from an inadequate number of trained surgeons. Since Federal surgeons reported finding large stocks of medical supplies in Jackson, it would seem that some of Pemberton's logistical problems hindered his medical staff as well. Reports on the medical condition of the army at the time of the surrender reveal that, within the city, the Confederates were "almost destitute" of medical supplies.



Map 1