German strategist General Helmuth von Moltke once described the American Civil War as "two armed mobs chasing each other around the country, from which nothing could be learned." Despite Moltke's disdain for America's military efforts during the Civil War, the U.S. Army can learn a great deal about how advances in technology can change the nature of war. The conduct of war changed as a result of three technological advances during the Civil War: the rifled musket, the electric telegraph, and the railroad.

The Rifled Musket

During the mid-19th century, the use of the rifled musket dramatically changed how the war was conducted. Before the rifled musket came into use, Napoleonic tactics of linear frontal assault of massed forces, supported by direct-fire artillery and quick cavalry charges, was the recipe for battlefield success. European and American military leaders replicated Napoleon's tactics because he optimized the weapons he had at that time—smoothbore muskets with a nominal effective range of 100 yards and canister artillery with a maximum range of 400 yards. In contrast, the Civil War rifle had an effective range of over 500 yards when firing the conical Minie ball bullet. The rifled musket's increased range and lethality had several adverse effects on Napoleonic tactics. For example, an infantryman with a rifled musket was a greater threat to artillerymen and cavalrymen. Napoleon massed his artillery and used canister fire to decimate an advancing infantry line. The Civil War infantryman, using a rifled musket could target artillerymen before they were within range of canister fire, which forced the artillery to operate further from the enemy than was optimal.

Using the rifled musket also allowed the infantryman to attack cavalry soldiers from a much greater distance, which reduced the cavalry's shock affect and made a cavalry charge more costly to the attacker. As a result, the long-range firepower of the rifle relegated the artillery and cavalry to lesser roles than they had during the Napoleonic wars.

The change in infantry firepower shifted the tactical strength of armies from offense to defense by making frontal infantry assaults too costly, which posed a serious problem for tacticians. Napoleonic-style warfare, as espoused by General Antoine Henri Jomini, emphasized a strong offense for a decisive victory. The problem soon became how to execute an offensive plan when the tactical defense was much stronger. Given the state of
technology, the best answer was to avoid massed frontal assaults. One obvious method was to attack an enemy's flanks. (5) During the battle of Gettysburg, Confederate forces attempted to attack the Union flank at the Little Round Top. They found, however, that attacking flanks using linear Napoleonic tactics resulted in disproportionately high casualties for the offense.

Toward the end of the war, units were changing their offensive tactics from massed lines to small groups. While some men provided cover, others advanced. Both sides used cover as available and sought to reinforce the skirmish line. Union forces successfully used open-order skirmish tactics to limit offensive losses during Union General William Tecumseh Sherman's Georgia Campaign and Union General Ulysses S. Grant's Petersburg Campaign in late 1864. (6) To further confound the doctrine, soldiers were turning to field trenches and hastily constructed earthworks to protect themselves from increasingly deadly firepower. Both forces used earth and logs to fortify their defensive fighting positions while fighting the 1864 Overland Campaign. During the Battle of the Wilderness at Brock Road on 6 May 1864 and Laurel Hill on 8 May 1864, both sides found that prepared defensive positions allowed them to repel attacks. The key to tactical victory then became attacking an opponent before he had time to establish a defense. In the end, the tactical advantage still lay with the defender because of the rifle's firepower. (7)

**The Electric Telegraph**

The electric telegraph significantly changed the military leader's ability to command and control fielded forces. Before the Civil War, the Army used couriers to transmit messages. Civil War commanders used telegrams to transmit messages instantly to each other over distances of a thousand or more miles. (8) The government installed its first telegraph line between Washington, D.C., and Baltimore in May 1844. By 1860, a network of telegraph wires "crisscrossed the country east of the Mississippi [River]." (9) The War Department, recognizing the telegraph's value, co-opted the existing civil telegraph structure for military use at the beginning of the Civil War, and established the U.S. Military Telegraph Corps (USMTC), in May 1861. Telegraph operators supplied the Union Army with technical expertise to transmit and receive messages; in return, the Union Army provided rations and helped operators construct, repair, and protect telegraph lines. In 1862, the Union Army constructed nearly 4,000 miles of telegraph lines that transmitted over one million military dispatches. (10) More important than the volume of messages was the Union Army's use of the telegraph as a communication tool. Before the Civil War, information from distant battles took hours
or days to reach headquarters. The telegraph permitted Civil War governments to "affect the conduct of campaigns through near-real time communications with commanders in the field." (11) President Abraham Lincoln sent 10 to 12 telegrams each day to his generals, routinely soliciting specific, tactical information. The telegraph allowed Lincoln to order his Union Armies' strategic repositioning, reinforcement, and pursuit tactics, allowing him to truly act as Commander-In-Chief of the Union Army and Navy. (12)

Union generals used the telegraph for rapid communications; including issuing orders; reporting dispositions of enemy and friendly forces; reporting progress and results of battles; and requesting reinforcements. In 1864 and 1865, Grant went a step further when he used the telegraph to coordinate the movement of all Union forces into one comprehensive plan. He received daily reports from his armies and issued orders to integrate their efforts. Lincoln and Grant used the telegraph to develop a strategic view of the entire theater east of the Mississippi River, allowing them faster, synchronized direction of fielded forces. (13)

**The Railroad**

The use of the nascent railroad system significantly changed how men and materiel were transported to the battlefield. Before 1830, armies relied on foot and animal transport, limiting to 10 days the amount of supplies they could carry, which decided how quickly and how far armies could maneuver. The rapid movement of men and materiel by rail increased the Army's logistical capacity tenfold. Troops and supplies arrived at their destinations quicker with less fatigue, and supplies arrived in better condition. The geographical scale of military operations also increased, allowing armies to become larger but still remain combat affective. (14) Previous wagon-haul logistics and local foraging limited the size of armies to about 30,000 men. The advent of railroad resupply permitted armies to operate effectively hundreds of miles from their supply bases. During his 1864 Atlanta Campaign, Sherman's 473-mile railroad resupply line from Louisville, Kentucky, to Atlanta, Georgia, allowed him to wage an offensive campaign with an army of 100,000 men. (15) Other affects of railroad use included prolonging the war by making decisive operations more difficult to achieve; improving logistics, which made it more difficult for armies to annihilate their opponents; providing escape for forces by rail or by receiving reinforcements before being completely destroyed. For example, during the First Battle of Bull Run, Confederate General Joseph Eggleston Johnston's army used the Manassas Gap Railroad to reinforce General P.G.T. Beauregard's forces, preventing
their destruction at the hands of Union General Irvin McDowell. (16)

Recognizing the need to co-opt the civilian railroad for military use, in January 1862, Congress authorized Lincoln to seize control of the railroads for the war effort. The U.S. Military Rail Roads (USMRR), a subordinate agency to the War Department, was responsible for operating the rail lines. The USMRR and the USMTC provided leadership and organizational skills that helped military leaders rapidly assimilate the new capabilities in the conduct of war. (17) Military efforts in the Civil War demonstrate how new technologies can affect the conduct of war. (18) Modern military forces must be able to adapt quickly to evolving technologies and use new techniques in the pursuit of war to effect peace. MR