

TECHNOLOGIES OF WAR:  
THE CIVIL WAR AND WORLD WAR II

With government money going to research and development, wars can speed up technological innovations. Those innovations can be applied to civilian life as well. Take a look at the Civil War and World War II and investigate the inventions that those conflicts spurred.

Grades 8-12

Illinois State Goals covered: 1B, 1C, 3B, 16A, 16B, 16B, 16D, 18B



Fig.1:U.S. Navy's Polaris Fleet Ballistic Missile Now Well Along in Development.

**Section 1: Technological innovation in war: The Civil War and World War II**

*Important concepts to consider:*

- The change in the American government's role in developing technologies
- How these technologies have affected both war and civil society

The technology of war has always been a struggle over competitive edge. From the Roman Empire to today, militaries worldwide have worked to gain an advantage through technology. Each side desires to protect its soldiers, and to inflict damage on the enemy. However, research and development of the machines of war have often led to technological advances in other ways. Things that may have only seemed to be important on the battlefield

have also transitioned into effective civilian applications. In medicine, communications, and transportation, American wars have inspired many innovations.

These innovations have had severe consequences. As weapons have improved, more lives have been sacrificed on the battlefield. The Civil War is seen by many to be the first modern conflict to utilize the first generation of modern warfare equipment. A devastating number of American soldiers were either killed or wounded on the battlefield. This equipment would become common in the wars that followed. In the era of the World Wars, the results of military technological advances had even more dire consequences for not only soldiers, but civilians as well. From machine guns to tanks, to mines, rockets, nuclear bombs and chemical weapons, the technologies of war have expanded immensely in their destructive capabilities.

As we explore some of these advances in American military technology, focusing on two wars, keep in mind the necessity of these technologies as well as the negative or positive outcomes of their implementation.



Fig.2: Testing the Tools of War

## Section 2: The Civil War

### *Important concepts to consider:*

- The level of involvement the government has taken in technological research for the purposes of war, as well as how this has changed over time.
- The dangers of these technological advances

The American federal government hardly involved itself in technological research during the 19<sup>th</sup> century. This period in weapons and military research largely involved individual entrepreneurs. As a consequence, while inventors worked relentlessly to create weapons of war to sell to the government, few real advances in warfare would occur during the period as little investment was made by the government in military technologies. Out of necessity, The Civil War would change the government's role in weapons and technology, leaving a lasting impact on warfare and civilian society as well.

While the Civil War was still a conflict in which individual inventors and producers tried to persuade the government of the usefulness of their war products, the relationship between them grew closer. As an example, Samuel Colt was able to prove the reliability and effectiveness of his Colt revolvers - quick firing weapons with six bullets - which would become a standard weapon for officers in the field. Increasingly the government transitioned from muskets to more accurate rifles (so called because of the corkscrewed grooves in the barrel that imparted spin to the bullets, ensuring accuracy and power). With the use of rifles came a new emphasis on shell cartridges (bullets with the gunpowder already in them) as opposed to the time-consuming old method of loading a gun in many steps. At the same time, ironclad warships emerged as the new standard for navies, the machine gun was born, mines emerged as important tools in warfare, and the list goes on. With each investment made by both the Union and Confederate governments to equip their armies with the latest technology in weapons, the industry of weapons production received a boost that allowed it to expand as a whole.

The Union government also began massive projects installing telegraph wires for strategic purposes. The improved reach of communications was a precursor to future expansion in America, as well as a big boost to military intelligence and journalism. Railroads also expanded for the transport of troops and supplies. Growth of the railroads continued long after the war and drastically shifted how the American economy transported goods and people. Even errors committed in medicine's failed attempts to stem sickness and prevent death from wounds served as learning experiences for the still young and developing medical industry.

More soldiers on the battlefield with deadlier weapons in their hands proved to be a devastating combination. The Civil War's casualties were immense (at least 600,000 and likely more) and a sign of how technological advancement would affect wars in the future.

Invented in 1844, communication via telegraph was already well established when the Civil War began. However, the War Department understood the strategic importance of establishing a telegraph department to go along with its military campaigns. From maintaining communication between officers in the field and commanders in Washington, to intercepting Confederate messages, and even to allowing for a faster and more responsive news media network, the Telegraph Corps became integral to the war effort. By the time the war was over, the department, funded by the government, had laid down over 15,000 miles of telegraph cable. While this was all eventually turned back over to civilian private ownership after the war, the immense government expenditure in communications improved the speed of connectivity across the nation on a faster and grander scale than ever seen before.



Fig.3: Richmond, Va. Wagon train of Military Telegraph Corps. An integral strategic factor in the Union's successful invasion of the then capital of the Confederacy, this wagon train carried miles of wire and was accompanied by technicians tasked with ciphering and deciphering telegraph messages from both sides of the conflict.

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The Civil War marks a transition in the relationship between government and industry – one significant example being the relationship between the military and the railroad industry. Railroads were essential to the military efforts of both the North and the South. However, at the beginning of the war, the North had about 22,000 miles of track, as well as the bulk of the steel industry, while the South only had 9,000 miles of track. Understanding the importance of speedy transportation and the movement of equipment when it came to expanding this technology, the Union army would take an unprecedented role in determining which railroad projects were funded and for what purpose.

This enhanced role on the part of the military when it came to railroads would continue decades after the Civil War was over. In exchange for protection by the military, the railroad expansion westward would in large part be determined by military desires, needs and military civil engineers. The close relationship between the military and industry when it came to this technology dynamically changed American transportation and trade. Furthermore it set a precedent in which future military projects in partnership with private industry would develop with broad civilian applications as well as fulfilling military needs.

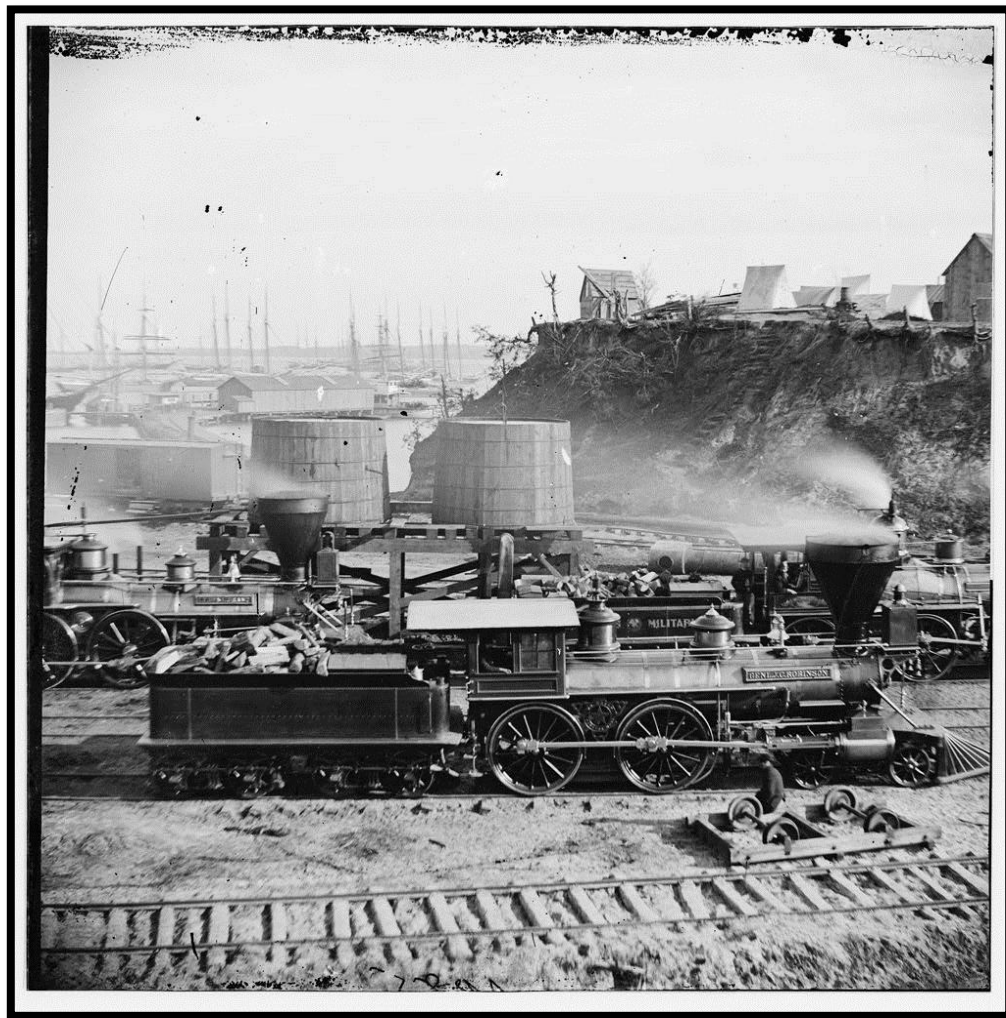


Fig. 4: City Point, Va. "Gen. J. C. Robinson" and other locomotives of the U.S. Military Railroad. This photo taken around the time of the siege of Petersburg in the Eastern Theater of war.

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## Discussion and Analysis: Section 1

Instructions: The following are some questions that ask you to brainstorm and discuss the implications of increased government support for the purposes of war. Some of these answers may not be found in this lesson; some independent research using your textbooks, the internet, or the resources of the Pritzker Military Library listed at the end of this lesson may help you figure out the answers.

1. An important reason why the Civil War was fought was the debate over how much influence, control, and power would be centralized within the federal government as opposed to being left to each state. How do you think this factor might have also been related to how the government did or did not get involved in broad military projects or national expansions prior to the Civil War? What lasting consequences could you assume would remain after the war?
  
2. In looking at the Telegraph Corps, the railroad expansion, and the increased roles of military civil engineers in nationwide projects, what do you think are the implications of such broad federal involvement within civil society? What kind of change does this show in not only the military but also in the federal government's reach to American society? (Remember to consider the broader context of this time period in American history.)

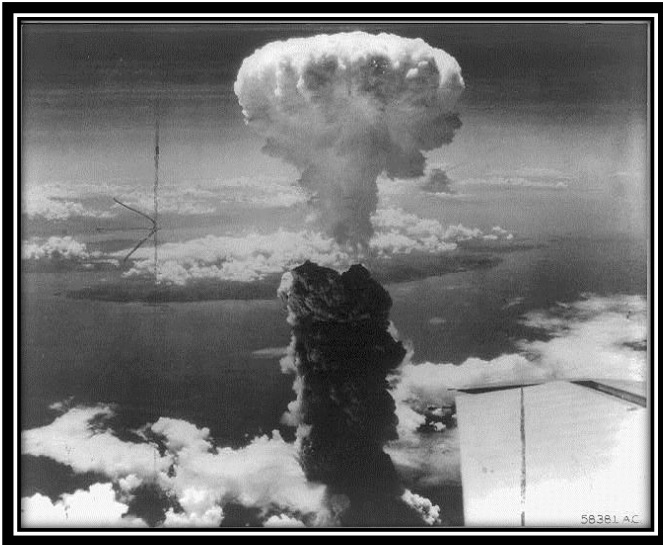


Fig.5: Second atomic bombing of Nagasaki, Japan. On August 9, 1945, this plutonium bomb, nicknamed “Fat Man,” was dropped on Nagasaki. One day later Japan began taking steps towards formally surrendering.

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### Section 3: World War II

#### *Important concepts to consider:*

- Evolution of war and technology’s role in it
- Global implications of technological advancement

Whereas the Civil War marked a drastic turning point in the way people would come to view the role of the federal government in areas such as war production and innovation, World War II would revolutionize the way they would become intertwined and inseparable.

From ballistic to cruise missiles pioneered by German rocket scientists, to early developments in digital computers and fully networked digital communications, World War II is marked with great innovations that advanced military efficiency and led to countless civilian applications that we use today. The nation’s rapid transition to a war economy led to innovation as well as vast government funding and support of the sciences. Those German rocket scientists would later help NASA build rockets for space flight after the war. And military-funded research in the applications of radar would not only revolutionize mass aviation systems but eventually lead to systems like the Global Positioning System (GPS) which we now use on a daily basis.

Penicillin, blood transfusion methods, uses of X-ray machines, new understandings of human dietary needs, and various medicines all became improved and mass-produced during this period. Wartime rationing led to the need for industry to replace common materials with newly developed plastics and polymers, many of which are still in common use.

World War II is a precursor of what science, physics, and mathematics would become in the rest of the century. The amazing success of government-supported research and development meant to reach a common end became the norm in the rest of the century. Large scale research, operations, and development projects, substantially funded by either private or military money, became common practice after World War II. This research is the seed for modern conveniences such as cell phones, computers, and satellite TV.

As warfare and the technology of war have evolved, new threats have also evolved. The spread of nuclear technology has remained a concern in the United States since its development during World War II. As research and development merge with the military structure, weapons' destructive power continues to increase.

With America's entry into World War II, the peace-time economy made a rapid and efficient transition into a war-time economy. Massive amounts of government contracts went into private firms tasked with equipping the U.S. military with the latest fighting equipment. Factories once designed to make automobiles or other consumer goods were quickly transformed into well-oiled war-making units. This process became a standard for how American mass production would be handled going forward. The structures, organization, and carefully scientifically crafted methods of production pioneered by military civil engineers in this period greatly aided American industry for the next half century. These methods and products were tested and evaluated for their combat effectiveness and usefulness at a scale and rigor that was unprecedented. The whole concept of research and development was the hallmark of the federal government's wartime production methods, leaving a lasting effect on the American economy - from the drawing board to the assembly line in record speeds.



Fig.6: A Nation's Effort to the Spirit of Patriotism and Production

It is crucial to address the destructive side of these wartime developments. On August 6, 1945, the United States dropped the first atomic bomb to be used in wartime over Hiroshima, Japan, killing 140,000 people and devastating the entire area. This act, which brought World War II to a close, also marked the beginning of the nuclear arms race which marked the Cold War during the second half of the 20<sup>th</sup> century.



Fig.7: General panoramic view of Hiroshima after the bomb ... shows the devastation ... about 0.4 miles ... / official U.S. Army photo.

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## Independent Research Activity

The history of U.S. military technology and weaponry is full of amazing inventors, scientists, physicists, and engineers. In groups or individually, pick a military technology from the Civil War or World War II that has also had significant impacts outside of the military. A few have been mentioned here but try to explore a bit more and see what interesting things you find. To help you begin thinking about it here are some areas of focus to begin your research:

- Many medicines and medical procedures were developed and expanded during World War II  
Examples: antibiotics, x-ray technology
- Aviation saw big breakthroughs during World War II  
Examples: jet propelled airplanes, radar
- The Civil War saw major developments in naval technology  
Examples: Ironclad battleships, submarines
- Photography in the Civil War experienced important advances

As you begin your research after you have made a decision on your topic, try to answer these questions about that technology:

- What were the military uses and advantages of the technology?
- Look into the inventor or creator of the technology and see if you can understand his/her motivations for their invention. What did he/she want to accomplish?
- How did this technology borrow from previous technologies or enhance existing ones? Or perhaps it was a brand new idea?
- Describe the civilian applications of the technology. Are there any negatives to the technology? If so, weigh the pros and cons of it and give your opinion on whether the technology was positive or negative. Why do you think so?

## Bibliography

### Images

Figure 1: "U.S. Navy's Polaris Fleet Ballistic Missile Now Well Along in Development," Pritzker Military Library Historic Photographs and Negatives Collection, Pritzker Military Library, Chicago, IL.

Figure 2: *Testing the Tools of War*, Pritzker Military Library Prints and Posters Collection, Pritzker Military Library, Chicago, IL.

Figure 3: "[Richmond, Va. Wagon train of Military Telegraph Corps.]" Photograph. 1865. From Library of Congress, *Civil War Glass Negatives and Related Prints*. <http://hdl.loc.gov/loc.pnp/cwpb.03735> (accessed December 23, 2010).

Figure 4: "[City Point, Va. "Gen. J. C. Robinson" and other locomotives of the U.S. Military Railroad]" Photograph. [Between 1860 and 1865]. From Library of Congress, *Civil War Glass Negatives and Related Prints*. <http://hdl.loc.gov/loc.pnp/cwpb.01859> (accessed January 3, 2011).

Figure 5: "[Second atomic bombing of Nagasaki, Japan]." Photograph. [1945 August]. From Library of Congress, *Miscellaneous Items in High Demand*. <http://hdl.loc.gov/loc.pnp/cph.3a36860> (accessed January 3, 2011).

Figure 6: "[A Nation's Effort to the Spirit of Patriotism and Production]" Pritzker Military Library Historic Photographs and Negatives Collection, Pritzker Military Library, Chicago, IL.

Figure 7: "General panoramic view of Hiroshima after the bomb ... shows the devastation ... about 0.4 miles ... / official U.S. Army photo." Photograph. [1945]. From Library of Congress, *Miscellaneous Items in High Demand*. <http://hdl.loc.gov/loc.pnp/cph.3c34192> (accessed January 3, 2011).

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