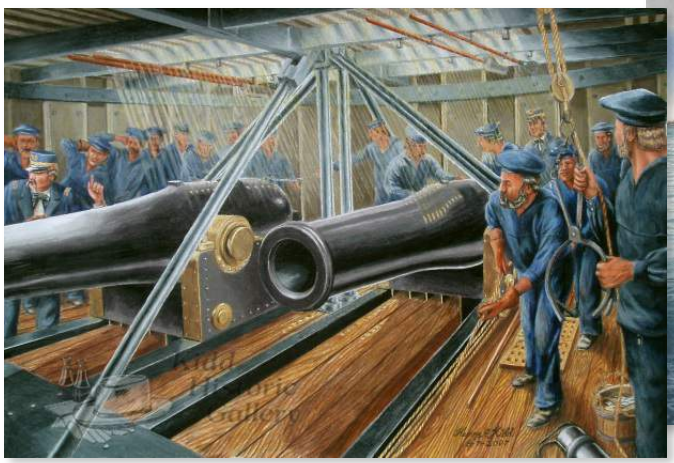
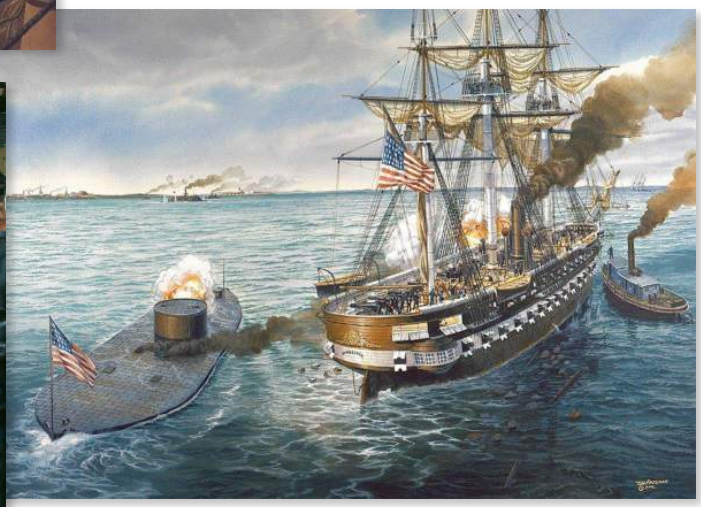
Civil War Innovations





Today you will be learning about Innovations from the American Civil War. This is a directed and self-directed, self-paced program, but if you need any help, we are here to assist!

Please keep your sheets with you; this will give you information and writing area for your projects. We have added a large amount of data which you may not want to read at this time, you can read it once you get home if you so desire. The experiments are at the end of each reading section.

All students are welcome to participate in all activities, if you need additional material, just ask! Have fun today!

Contact the National Museum of the U.S. Navy for Field Trip and School Visit opportunities!

*This packet is intended for middle schools, to be used in groups of three or fewer and/or individually.

National Museum of the United States Navy

History of American Civil War Technology

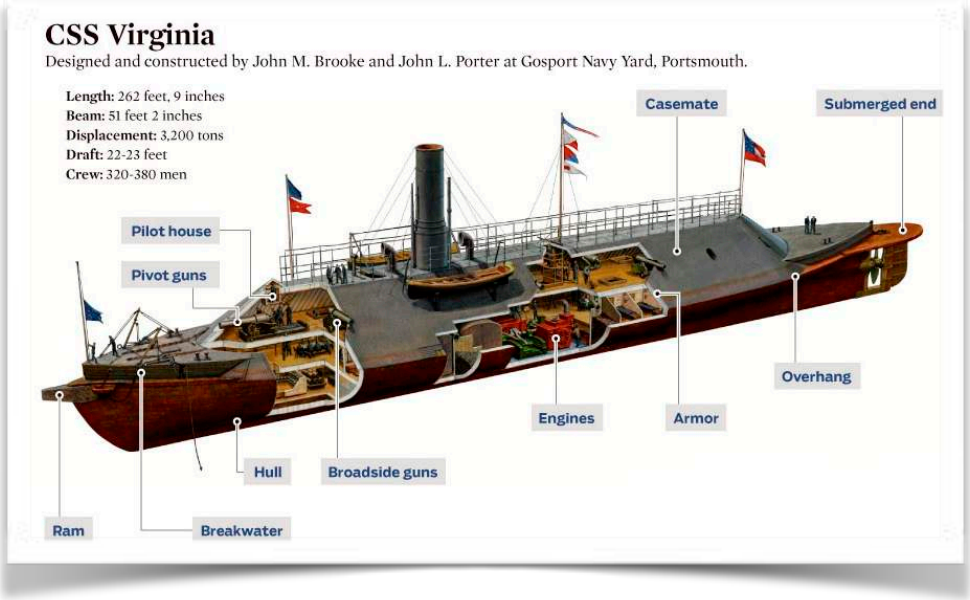
Remembered as the bloodiest conflict in American history, the Civil War was also one of the most innovative and influential. Things that would come to influence future wars, such as submarines and land mines, had their beginnings in the Civil War. Advancements in naval design and weapons manufacturing, as well as medical innovations, would set the groundwork for today's military and medical practices.

The Civil War is considered to be one of the first modern wars, where new and updated technology was used, ultimately affecting the outcome of the war. It is important to understand the impact some of these innovations had during the war, as well as the impact they continue to have to this day, both in warfare and everyday life.

The Fate of the USS *Merrimack*

The federal screw steamer the USS *Merrimack* had been docked at the Norfolk Navy Yard in April, 1861 when Virginia declared its secession from the Union. Federal personnel, being forced to abandon their positions, burned the yard and attempted to burn and sink the *Merrimack*. The Confederates salvaged the vessel, finding the lower hull and machinery to be undamaged.

The Secretary of the Navy ordered her to be converted into the Confederacy's first casemate **ironclad**, the CSS *Virginia*. Her forward and aft main deck was covered in 2 layers of 4-inch thick iron plate in order to be submerged. The casemate, which remained above the water, was built of wood and covered with 2 layers of 2-inch thick iron plating, angled to deflect shells. The vessel was fitted with fourteen gunports, some of which had iron shutters meant to protect the canons, though they were not yet installed during Virginia's first battle. aged the vessel, finding the lower hull and machinery to be undamaged. The Secretary of the Navy ordered her to be converted into the Confederacy's first casemate ironclad, the CSS *Virginia*.



The *Merrimack's* engines, which the Union had condemned before attempting to destroy her, would only allow the vessel to go four knots (just over 4.5 miles per hour). The *Virginia* was also difficult to maneuver, taking nearly an hour to complete a full circle. Regardless, the ironclad was nearly impenetrable and ready to face United States forces.

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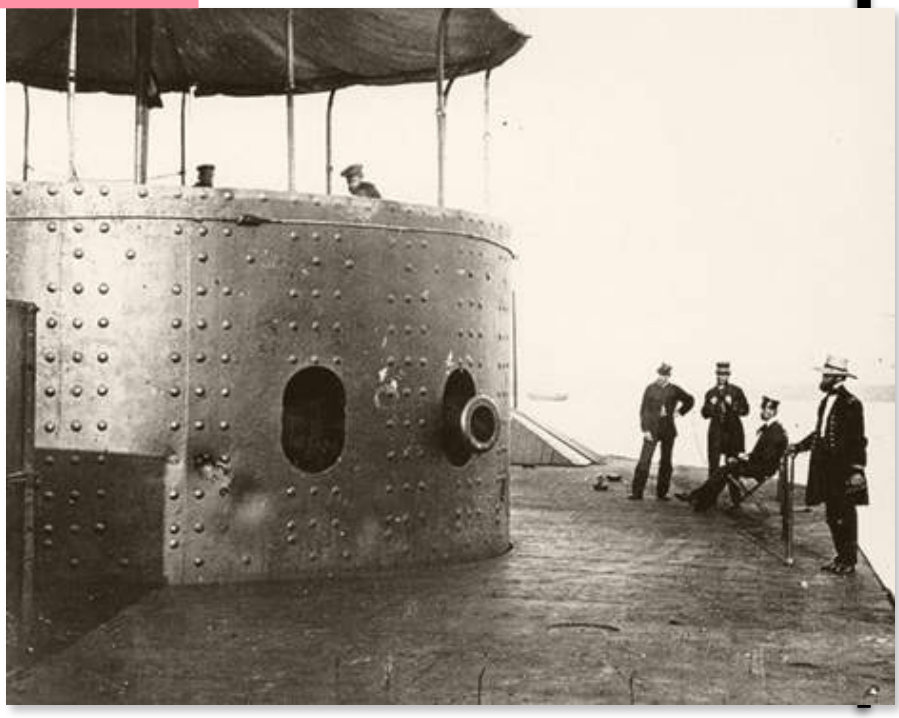
USS *Monitor*



If you look through American naval history, you will not find many ships so innovative as USS *Monitor*, a vessel that transformed naval warfare with its revolving turret. When Monitor, armed with only two cannons, fought the much more heavily armed CSS *Virginia* to a draw on March 9, 1862, the world took note. Decades later, in 1937, Winston Churchill wrote, "The combat of the *Merrimac* and the Monitor made the greatest change in the sea-fighting since cannon fire by gunpowder had been mounted on ships about four hundred years before."

In response to the news of CSS *Virginia* being built, Lincoln recommended the construction of "one or more ironclad steamers or floating batteries, and to select a proper and competent board to inquire into and report in regard to a measure so important."

Swedish-born engineer John Ericsson was one of those who came forward with a design. He believed he could show what he could do to revolutionize naval construction and help the Union win the war. He was convinced that "victory will rest upon the side which holds possession of the seas, and I will offer my services to the Federal Government to assure that its navy will dominate."

Full of confidence, he submitted his plan for a "subaquatic ironclad vessel with a gun turret" directly to the president.

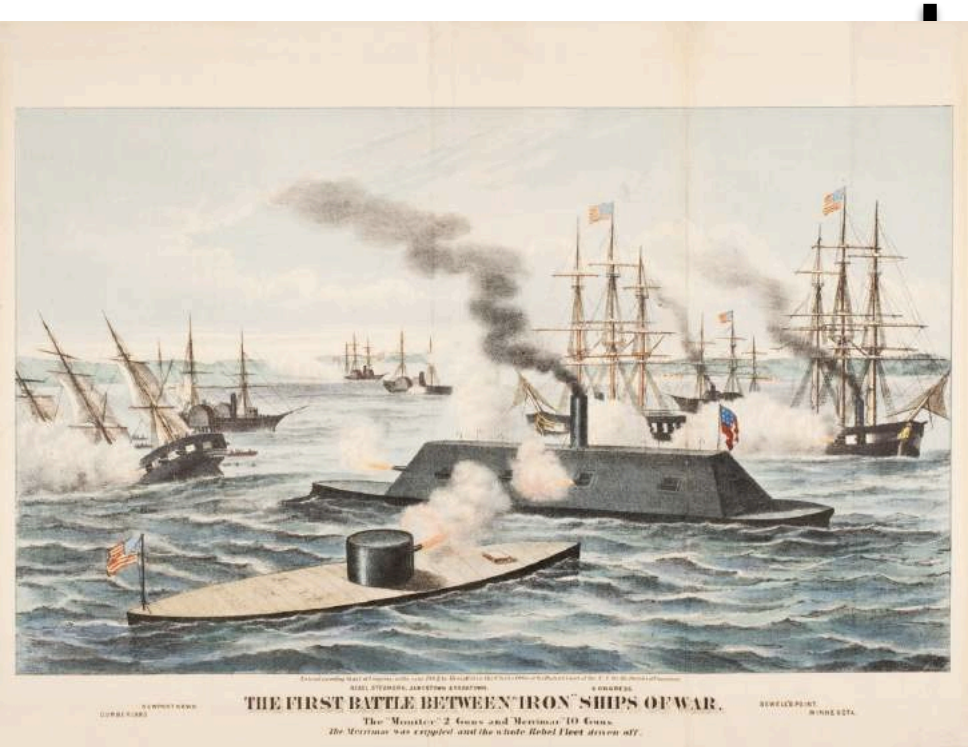
The ship looked simple enough, a raft with a gun turret in the middle. Ericsson boasted that it could withstand the heaviest shot and designed for action in shallow coastal waters like Hampton Roads and southern rivers. Even in narrow rivers it could operate its guns in battle, since only the turret needed to be turned.

The unique features of Ericsson's raft-like design and turret impressed the president, and he took it to the Navy Department, where he openly backed it. As he was looking at the designs he remarked: "All I have to say is what the girl said when she stuck her foot in the stocking. It strikes me there's something in it." After some initial disagreements, the Navy finally accepted the design.

Monitor was built in an amazingly short amount of time; some claim it took 98 days. All across the north there was a scramble to provide the necessary iron plate, and foundries worked overtime to cast the boat's complex machinery. The remarkable vessel contained 40 patentable inventions.

The ship was launched on January 30, 1862, from Continental Iron Works in Greenpoint, Brooklyn, N.Y., and was fitted out with two massive 11-inch Dahlgren guns. Its crew spent the next several weeks working out the brand-new boat's kinks. Its unique appearance earned the vessel the nickname 'cheesebox on a raft.'

USS *Monitor* vs CSS *Virginia*
The Battle of Hampton Roads



On the morning of March 9, *Virginia* sortied into Hampton Roads, steamed towards *Minnesota*, and found *Monitor* on guard. The first battle between ironclad steam powered warships was so on. For four hours, Virginia and *Monitor* exchanged shots, neither able to do any significant damage to other. Both ships withdrew, expecting to fight again. The second battle never occurred, but the advantages of steam and iron over sail driven, wooden warships had been proven. The U.S. Navy contracted for more ships like *Monitor* and many of them fought during the Civil War. *Monitor* served in the U.S. Navy for nine more months before sinking off the coast of North Carolina on New Year's Day, 1863.

Battle of Hampton Roads

Strange But True!

On September 5, 1861, Franklin Buchanan joined the C.S. Navy and was given a captain's commission. On February 24, 1862, the Confederate States Secretary of the Navy, Stephen Mallory appointed Buchanan to the office of C.S. Navy James River Squadron Flag Officer and he then selected the newly built ironclad CSS Virginia to be his flag ship.

Buchanan was the captain of the CSS Virginia (formerly the USS *Merrimack*) during the Battle of Hampton Roads in Virginia. He climbed to the top deck of Virginia and began furiously firing toward shore with a carbine as the USS Congress was shelled. He soon was brought down by a sharpshooter's minie ball to the thigh. He would eventually recover from his leg wound. He never did get to command Virginia against the USS Monitor. That honor went to Catesby ap Roger Jones.

But, strangely, before the war, from 1859–1861, Captain Buchanan was in the U.S. Navy and the Commandant of the Washington Navy Yard! His office was located right next to where the National Museum of the U.S. Navy is today.

What year did the Battle of Hampton Roads take place?

_____

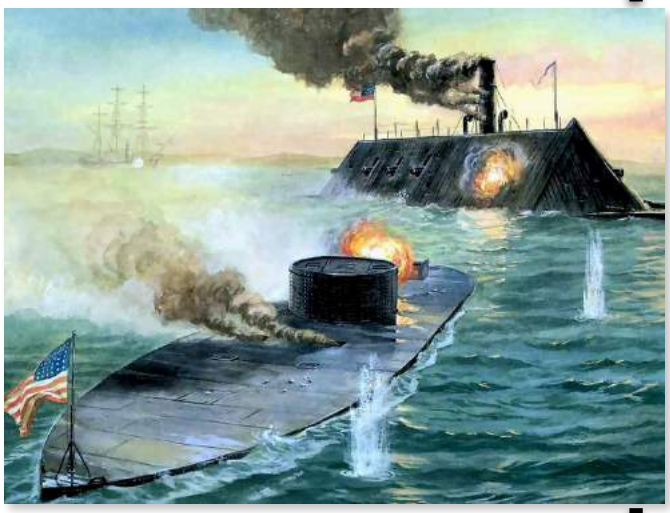
What ship was the USS *Monitor* charged to protect?

_____

The Battle of Hampton Roads

The battle received worldwide attention, and it had immediate effects on navies around the world. The preeminent naval powers, Great Britain and France, halted further construction of wooden-hulled ships, and others followed suit.

On May 10, 1862, advancing Union troops occupied Norfolk. Virginia was also unable to retreat further up the James River due to her deep draft. Unable to run, she was blown up in order to keep the ironclad from being captured. While the design of *Monitor* was well-suited for river combat, her low freeboard and heavy turret made her unseaworthy in rough waters. On 31 December, Monitor was under tow from USS *Rhode Island*, when a heavy storm developed off Cape Hatteras, North Carolina. The storm proved to be too much for the ship and she sunk and was lost at sea.



Test your Knowledge!

What advantages did the Confederacy's *Virginia* have at the beginning of the Battle of Hampton Roads?

What disadvantages did *Virginia* have?

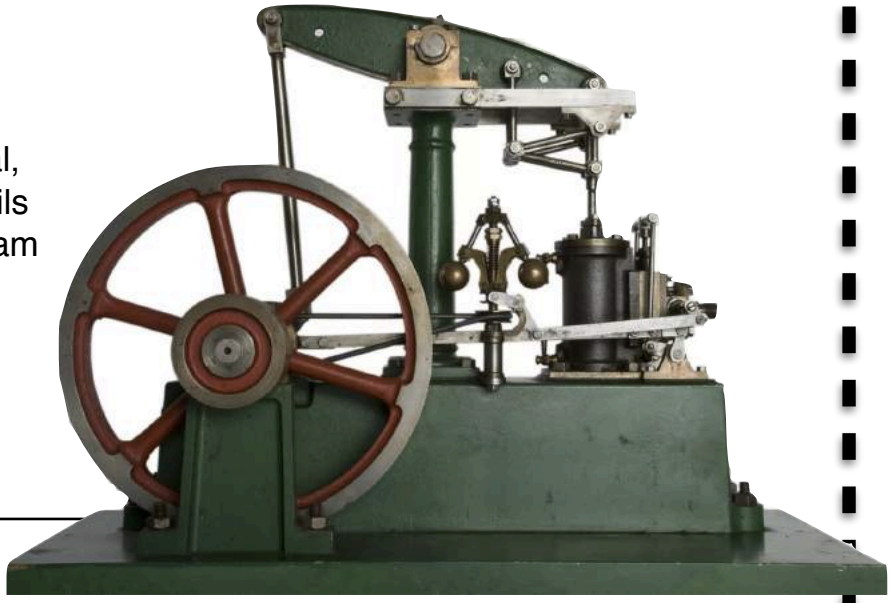
What advantages did the *Monitor* have over the *Virginia?*

What disadvantages did the *Monitor* have?

Steam Engines

Along with powering the trains that were rolling through the country in the early nineteenth century, steam engines were also moving ships though the sea. By the time of the Civil War, advancements in marine steam engines allowed for ships to go farther and faster than ever before. Steam engines powered both the CSS *Virginia* and the USS *Monitor*. Let's learn how these engines work!

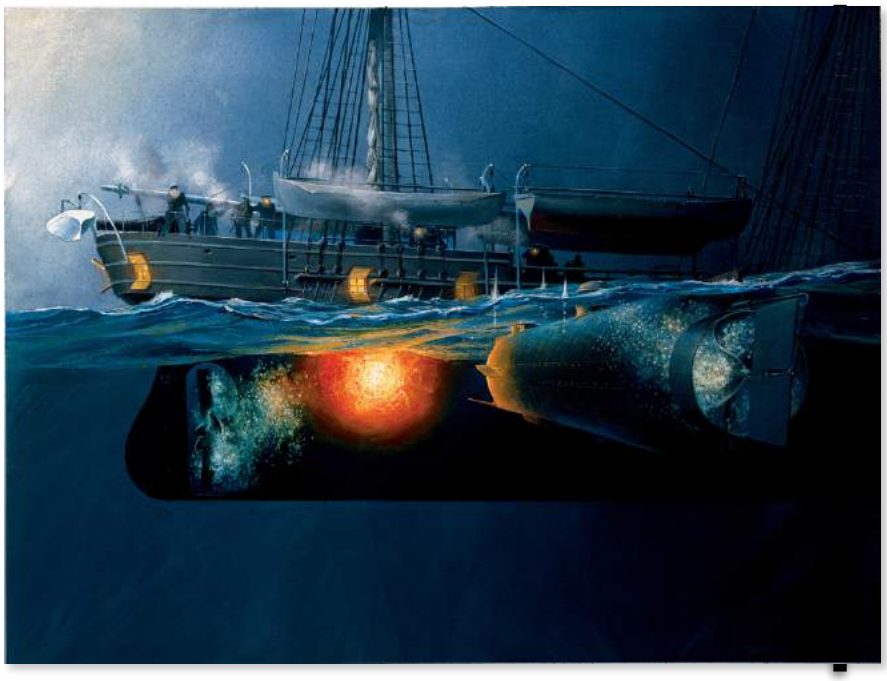
How do steam engines work?
In a nutshell: Steam engines burn coal, which releases heat energy, which boils water, which releases steam. The steam is trapped and piped into a cylinder which moves a piston back-and-forth that drives the propellers.



It is now time to design your own ironclad ship. Imagine you were building your own ironclad. Taking what you've learned from the *Monitor* and *Merrimack*, how would you design it? Use the space below to draw your design.

Submarines

The first submarine used in the Civil War was the Confederate H.L *Hunley*. Named for its inventor, Horace Lawson Hunley, this submarine was never officially commissioned into service after it was seized by the Confederate militia. The *Hunley* was able to submerge using ballast tanks on either side that were flooded by valves and pumped dry by hand. The tanks had no tops so that the crew could see in; however, this caused issues when water spilled out and flooded the compartment. The majority of the eight person crew manned the hand cranked propeller, while one person steered the vessel. The *Hunley* became the first combat submarine to sink a warship, the Federal sloop *Housatonic*, on February 17, 1864. The *Hunley* torpedoed the *Housatonic*, going down with the sloop as well.
This was the third and final time the *Hunley* would sink, the first being during a test run in August, 1863. The second occurrence of the *Hunley's* sinking took place in October, 1863 with her inventor, Horace *Hunley* aboard. Overall, 21 crewmen were killed in the *Hunley's* lifespan (which was less than seven months). The *Hunley* was discovered and salvaged in 1995, and is now on display in South Carolina.

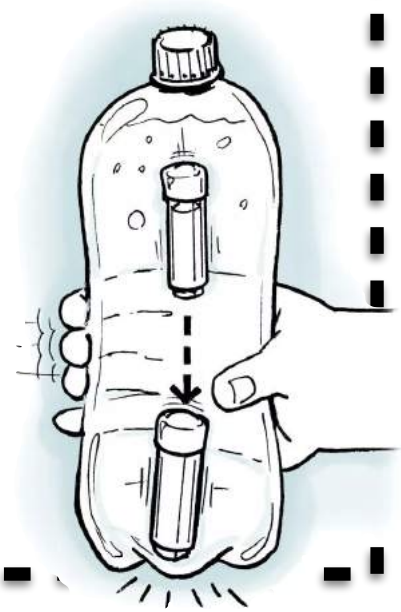


Cartesian Divers

Materials Needed:

1. 16 oz water bottle with lid
2. Pipette
3. Hex nut
4. Scissors
5. Buckets or cups filled with water

1. Fill water bottles so they are ¾ full.
2. Slide hex nut onto pipette.
3. Cut the pipette just below the nut (this is your submarine)
4. Have the students squeeze the pipettes in the buckets or cups to fill them partially with water. (They are filling their ballast tanks with some water)
5. Have them drop the pipette into the bucket or cup. The pipette should not sink, nor should it "bob" in the water.
6. Once the pipette floats properly, remove it from the cup and put it in the filled water bottle, replace the cap, tightly!
7. The pipette should be floating in the bottle, as it did in the bucket.
8. Squeeze the sides of the water bottle.
9. If the pipette did not sink, there may be too little or too much water in the bottle, or too little water in the pipette.



Morse Code and the Telegraph

The electrical telegraph is the first form of electrical telecommunications. In a matter of decades after their creation in the 1830s, electrical telegraph networks permitted people to transmit messages across both continents and oceans almost instantly!

The electrical telegraph was created and patented in the United States in 1837 by Samuel Morse, pictured here. Abraham Lincoln was the first president who was able to communicate on the spot with his officers on the battlefield. The White House telegraph office enabled him to monitor battlefield reports, lead real-time strategy meetings and deliver orders to his men. Here, as well, the Confederate army was at a disadvantage: They lacked the technological and industrial ability to conduct such a large-scale communication campaign.

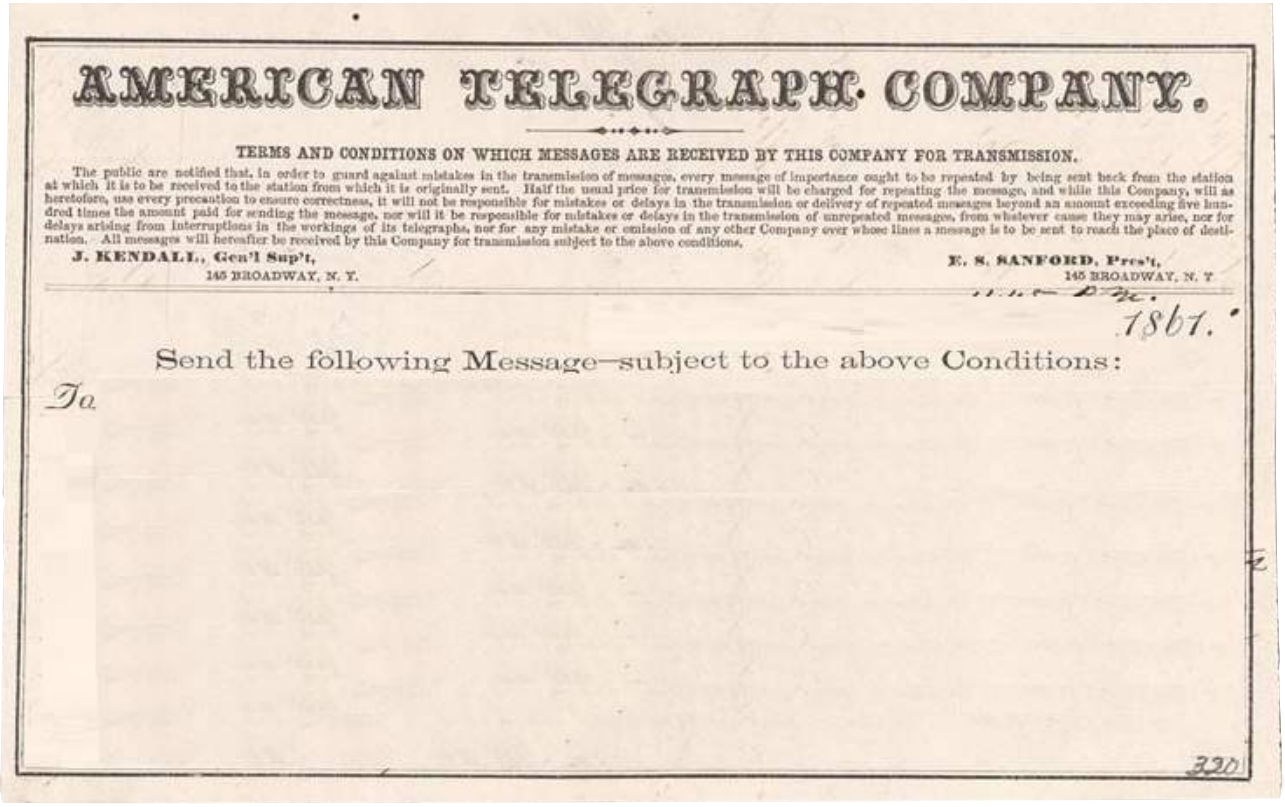
In 1861, the Union Army established the U.S. Military Telegraph Corps, led by a young railroad man named Andrew Carnegie. The next year alone, the U.S.M.T.C. trained 1,200 operators, strung 4,000 miles of telegraph wire and sent more than a million messages to and from the battlefield.

Send a Telegram!

Each Morse code symbol represents either a text character on number and is represented by a unique sequence of dots and dashes.

- The duration of a dash is three times the duration of a dot.
- Each dot or dash is followed by a short silence, equal to the dot duration.
- The letters of a word are separated by a space equal to three dots (one dash), and the words are separated by a space equal to seven dots.

A •–	J •–––	S •••
B –•••	K –•–	T –
C –•–•	L •–••	U ••–
D –••	M ––	V •••–
E •	N –•	W •––
F ••–•	O –––	X –••–
G ––•	P •––•	Y –•––
H ••••	Q ––•–	Z ––••
I ••	R •–•	



AMERICAN TELEGRAPH COMPANY.

TERMS AND CONDITIONS ON WHICH MESSAGES ARE RECEIVED BY THIS COMPANY FOR TRANSMISSION.

The public are notified that, in order to guard against mistakes in the transmission of messages, every message of importance ought to be repeated by being sent back from the station at which it is to be received to the station from which it is originally sent. Half the usual price for transmission will be charged for repeating the message, and while this Company, will as heretofore, use every precaution to ensure correctness, it will not be responsible for mistakes or delays in the transmission or delivery of repeated messages beyond an amount exceeding five hundred times the amount paid for sending the message, nor will it be responsible for mistakes or delays in the transmission of unrepeated messages, from whatever cause they may arise, nor for delays arising from interruptions in the workings of its telegraphs, nor for any mistake or omission of any other Company over whose lines a message is to be sent to reach the place of destination. All messages will hereafter be received by this Company for transmission subject to the above conditions.

J. KENDALL, Gen'l Sup't, 145 BROADWAY, N. Y.

E. S. SANFORD, Pres't, 145 BROADWAY, N. Y.

1861.

Send the following Message—subject to the above Conditions:

To