

= Turtle (submersible) =

Turtle (also called American Turtle) was the world 's first submersible with a documented record of use in combat . She was built in Old Saybrook , Connecticut in 1775 by American David Bushnell as a means of attaching explosive charges to ships in a harbor . Bushnell designed her for use against British Royal Navy vessels occupying North American harbors during the American Revolutionary War . Connecticut Governor Jonathan Trumbull recommended the invention to George Washington ; although the commander @-@ in @-@ chief had doubts , he provided funds and support for the development and testing of the machine .

Several attempts were made using Turtle to affix explosives to the undersides of British warships in New York Harbor in 1776 . All failed , and her transport ship was sunk later that year by the British with the submarine aboard . Bushnell claimed eventually to have recovered the machine , but its final fate is unknown . Modern replicas of Turtle have been constructed ; the Connecticut River Museum , the U.S. Navy 's Submarine Force Library and Museum , the Royal Navy Submarine Museum and the Oceanographic Museum (Monaco) have them on display .

= = Development = =

In the early 1770s , David Bushnell , a Yale College freshman and Patriot , began experimenting with underwater explosives . By 1775 , with tensions on the rise between the Thirteen Colonies and Great Britain , Bushnell had practically perfected these explosives . That year he also began work near Old Saybrook , Connecticut on a small manned submersible craft capable of affixing such a charge to the hull of a ship . The charge would then be detonated by a clockwork mechanism that released a musket firing mechanism , probably a flintlock , adapted for the purpose . According to Dr. Benjamin Gale , a doctor who taught at Yale , the firing mechanism and other mechanical parts of the submarine were manufactured by a New Haven clockmaker named Isaac Doolittle .

Named for its shape , Turtle resembled a large clam as much as a turtle ; it was about 10 feet (3 @. @ 0 m) long (according to the original specifications) , 6 feet (1 @. @ 8 m) tall , and about 3 feet (0 @. @ 9 m) wide , and consisted of two wooden shells covered with tar and reinforced with steel bands . It dived by allowing water into a bilge tank at the bottom of the vessel and ascended by pushing water out through a hand pump . It was propelled vertically and horizontally by hand @-@ cranked propellers . It also had 200 pounds (91 kg) of lead aboard , which could be released in a moment to increase buoyancy . Manned and operated by one person , the vessel contained enough air for about thirty minutes and had a speed in calm water of about 3 mph (2 @. @ 6 kn ; 4 @. @ 8 km / h) .

Six small pieces of thick glass in the top of the submarine provided natural light . The internal instruments had small pieces of bioluminescent foxfire affixed to the needles to indicate their position in the dark . During trials in November 1775 , Bushnell discovered that this illumination failed when the temperature dropped too low . Although repeated requests were made to Benjamin Franklin for possible alternatives , none was forthcoming , and Turtle was sidelined for the winter .

Bushnell 's basic design included some elements present in earlier experimental submersibles . The method of raising and lowering the vessel was similar to that developed by Nathaniel Simons in 1729 , and the gaskets used to make watertight connections around the connections between the internal and external controls also may have come from Simons , who constructed a submersible based on a 17th @-@ century Italian design by Giovanni Alfonso Borelli .

= = Preparation for use = =

Bushnell 's work began to receive more attention in August 1775 , when Franklin was informed of it . Despite Bushnell 's insistence on secrecy surrounding his work , news of it quickly made its way to the British , abetted by a Loyalist spy working for New York Congressman James Duane . On November 16 , 1775 , a coded message to William Tryon , the last royal governor of the Province of New York , brought Bushnell 's work to British attention . The details of the report were highly

inaccurate , implying Turtle was nearly ready to be deployed in Boston harbor against the fleet that was part of the British siege effort there . In fact , Bushnell and his brother Ezra were still testing the machine in the Connecticut River . In the spring of 1776 , after the British withdrew from Boston , Bushnell offered the submarine to General George Washington for use in the defense of New York City . Washington agreed , and provided some funding to the inventor to prepare the vessel for deployment .

In August 1776 , Bushnell asked General Samuel Holden Parsons for volunteers to operate Turtle , because his brother Ezra , who had been its operator during earlier trials , was taken ill . Three men were chosen , and the submersible was taken to Long Island Sound for training and further trials . While these trials went on , the British gained control of western Long Island in the August 27 Battle of Long Island . Since the British now controlled the harbor , Turtle was transported overland from New Rochelle to the Hudson River .

= = Attack on Eagle = =

General Washington then authorized an expedition by Turtle in New York Harbor . At 11 : 00 PM on September 6 , one of the volunteers , Sergeant Ezra Lee , took the Turtle out to attempt an attack on Admiral Richard Howe 's flagship , HMS Eagle , then moored off Governors Island .

According to Lee 's account , Turtle was towed by rowboats as close as was felt safe to the British fleet . He then navigated for more than two hours before slack tide made it possible to reach Eagle . His first attempt to attach the explosive failed because the screw struck a metal impediment . Lee tried and tried to turn the drill , but could not achieve penetration . A popular story held that he failed due to the copper lining covering the ship 's hull . The Royal Navy had recently begun installing copper sheathing on the bottoms of their warships to protect from damage by woodworms and other marine life , however the lining was paper @-@ thin and could not have stopped Lee from drilling through it . Bushnell believed Lee 's failure was probably due to an iron plate connected to the ship 's rudder hinge . When Lee attempted another spot in the hull , he was unable to stay beneath the ship , and eventually abandoned the attempt . It seems more likely that he was suffering from fatigue and carbon dioxide inhalation , which made him confused and unable to properly carry out the process of drilling through the Eagle 's hull . Lee reported British soldiers on Governors Island spotted the submersible and rowed out to investigate . He then released the charge (which he called a " torpedo ") , " expecting that they would seize that likewise , and thus all would be blown to atoms . " Suspicious of the drifting charge , the British retreated back to the island . Lee reported that the charge drifted into the East River , where it exploded " with tremendous violence , throwing large columns of water and pieces of wood that composed it high into the air . " It was the first recorded use of a submarine to attack a ship ; however , the only records documenting it are American . British records contain no accounts of an attack by a submarine or any reports of explosions on the night of the supposed attack on HMS Eagle .

According to British naval historian Richard Compton @-@ Hall , the problems of achieving neutral buoyancy would have rendered the vertical propeller useless . The route Turtle would have had to take to attack Eagle was slightly across the tidal stream which would , in all probability , have resulted in Lee becoming exhausted . In the face of these and other problems , Compton @-@ Hall suggests the entire story was fabricated as disinformation and morale @-@ boosting propaganda , and if Lee did carry out an attack it was in a covered rowing boat rather than Turtle .

= = Aftermath = =

On October 5 , Sergeant Lee again went out in an attempt to attach the charge to a frigate anchored off Manhattan . He reported the ship 's watch spotted him , so he abandoned the attempt . The submarine was sunk some days later by the British aboard its tender vessel near Fort Lee , New Jersey . Bushnell reported salvaging Turtle , but its final fate is unknown . Washington called the attempt " an effort of genius " , but " a combination of too many things was requisite " for such an attempt to succeed .

= = Replicas = =

Functional replicas of the Turtle have been created and tested , as well as non @-@ functioning cutaway ones for museum displays .

In 1976 , a replica of Turtle was designed by Joseph Leary and constructed by Fred Frese as a project marking the United States Bicentennial . It was christened by Connecticut 's governor , Ella Grasso , and later tested in the Connecticut River . This replica is owned by the Connecticut River Museum .

On August 3 , 2007 three men were stopped by police while escorting and piloting a replica of Turtle within 200 feet (61 m) of RMS Queen Mary 2 , then docked at the cruise ship terminal in Red Hook , Brooklyn . The replica was created by New York artist Philip " Duke " Riley and two residents of Rhode Island , one of whom claimed to be a descendant of David Bushnell . The Coast Guard issued Riley a citation for having an unsafe vessel , and for violating the security zone around Queen Mary 2 .

In 2015 , replicas of the exterior and interior of Turtle were used in the television series TURN : Washington ? s Spies .

= = Image gallery = =