

# THE • BUSHNELL • TURTLE



## A • REVOLUTIONARY • SUBMARINE

AN INTERACTIVE EXHIBITION BY HANDSHOUSE STUDIO

*If you want to understand the world,  
you must look from many sides.  
If you look from many sides,  
you will see the three dimensions.  
If you map the three dimensions,  
you will begin to understand.  
Build it and you will learn.*



Handhouse Studio initiates adventurous hands-on projects as a way to explore history, understand science, and perpetuate the arts.

The Bushnell Turtle, A Revolutionary Submarine is an interactive exhibit that brings this hands-on experience to museums and educational institutions.

Find out more...

On a late summer night in 1776, in secret, Sergeant Ezra Lee piloted a tiny one-man submarine...







...through New York Harbor to attach a bomb to the underbelly of the British warship HMS Eagle. The mission failed; but the Turtle emerged as the first true submersible used in warfare. Its builder, a Connecticut farmer named David Bushnell, became an icon of Yankee ingenuity.









*Arrival of the Log*



During a January freeze in 2003; Handhouse Studio organized a team of craftspeople to build a working replica of the Turtle, using the materials, tools and methods available in the 1700s. Guided by his letter to Thomas Jefferson, the team constructed the “external shape of the Submarine Vessel” from a single log.









*Splitting the Sitka Spruce log and carving the 'Turtle' shells*



"The machine was composed of solid pieces oak scooped out and fitted together" *Ezra Lee*











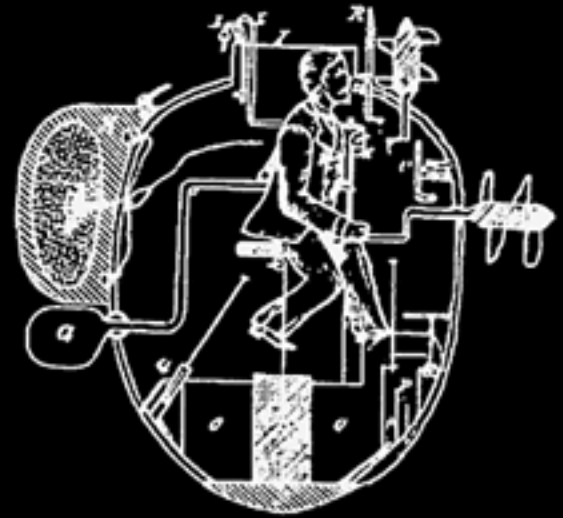


“The external shape of the submarine vessel bore some resemblance to two upper tortoise shells of equal sizes, joined together.” *David Bushnell*






*The 'Turtle' as drawn in 1875 by Lt. Francis Barber of the United States Navy*



“The inside was capable of containing the operator, and air, sufficient to supply him thirty minutes without receiving fresh air.” *David Bushnell*



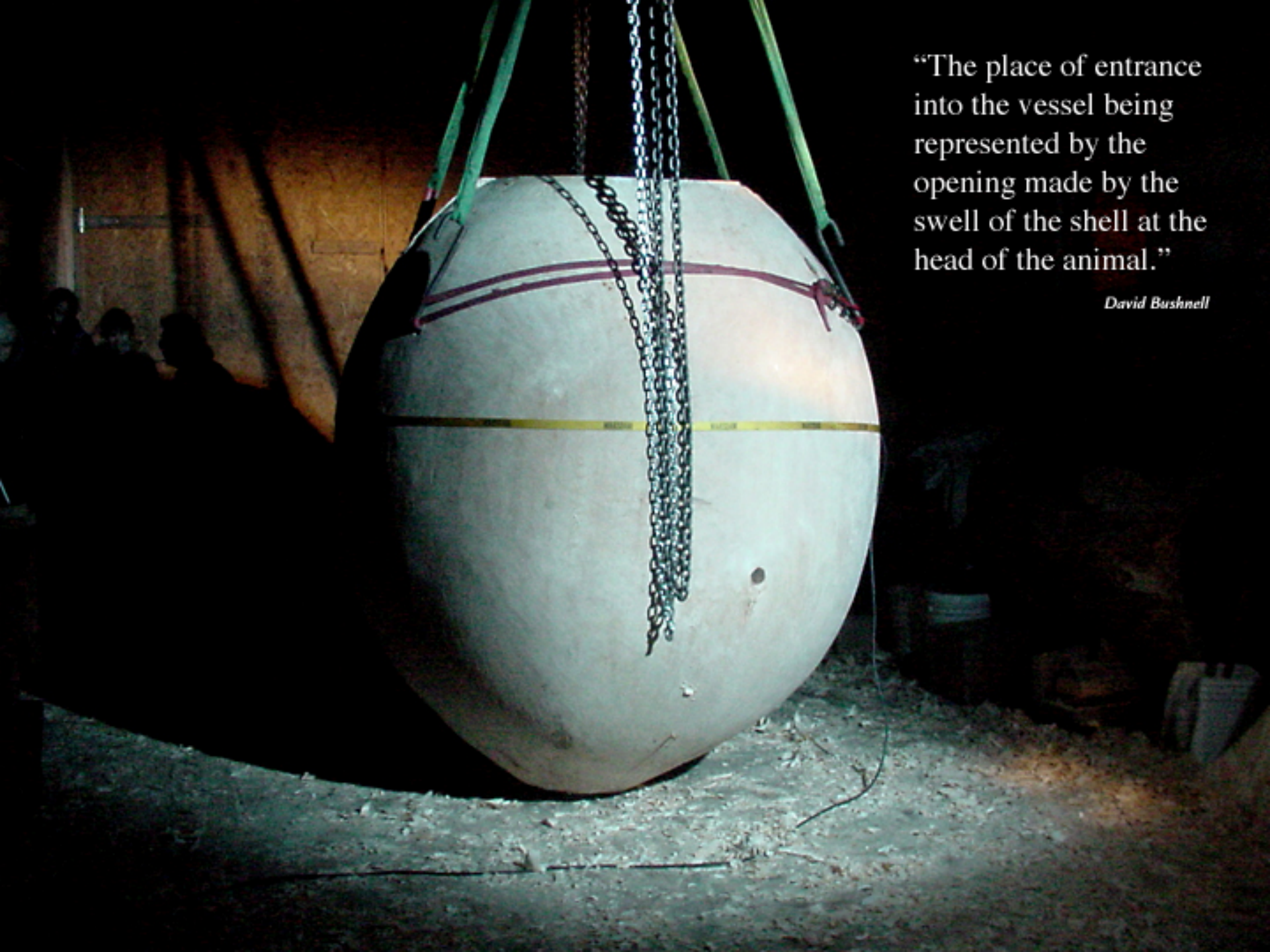


“The machine  
was built of oak  
in the strongest  
possible manner,  
corked and  
tarred.” *Ezra Lee*



“The place of entrance  
into the vessel being  
represented by the  
opening made by the  
swell of the shell at the  
head of the animal.”

*David Bushnell*



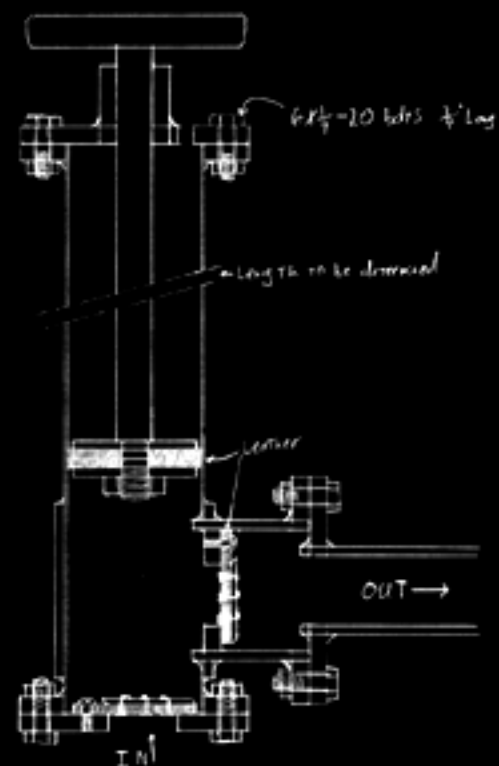




“The entrance into the vessel was elliptical, and so small as barely to admit a person.” *David Bushnell*

“It was bound around thoroughly with iron band.” *Ezra Lee*





“He ejected water by the two brass forcing pumps which were placed at each hand.” *David Bushnell*





“The top or head was made of a metallic composition, exactly suited to its body....” *Ezra Lee*









“There was a brass crown or cover, resembling a hat with its crown and brim, which shut water tight upon the iron band.” *David Bushnell*





*Molds and brass window parts*



"There were three round doors, one directly in front, and one on each side, large enough to put the hand through..."





...when open they admitted the fresh air.” *David Bushnell*





*Top view of the bomb and rudder*



“Behind the submarine vessel, was a place, above the rudder, for carrying a large powder magazine; this was made of two pieces of oak timber, large enough, when hollowed out, to contain one hundred and fifty pounds of powder...” *David Bushnell*



“The whole machine may be transported  
in a cart.” *Benjamin Gale to Benjamin Franklin, August 1775*







*First manned water test in Duxbury Harbor,  
January 2003*

“I took care to prove its strength  
to sustain the great pressure of  
the incumbent water, when sunk  
deep, before I trusted any person  
to descend much below the  
surface...” *David Bushnell*





*First manned water test in Duxbury Harbor, January 2003*

“...and I never suffered any person to go under water, without having a strong piece of rigging made safe to it, until I found him well acquainted with the operations necessary for his safety.” *David Bushnell*



“They therefore had the machine conveyed by land across from New Rochelle to the Hudson river, and afterwards arrived with it at New York.” *Ezra Lee*





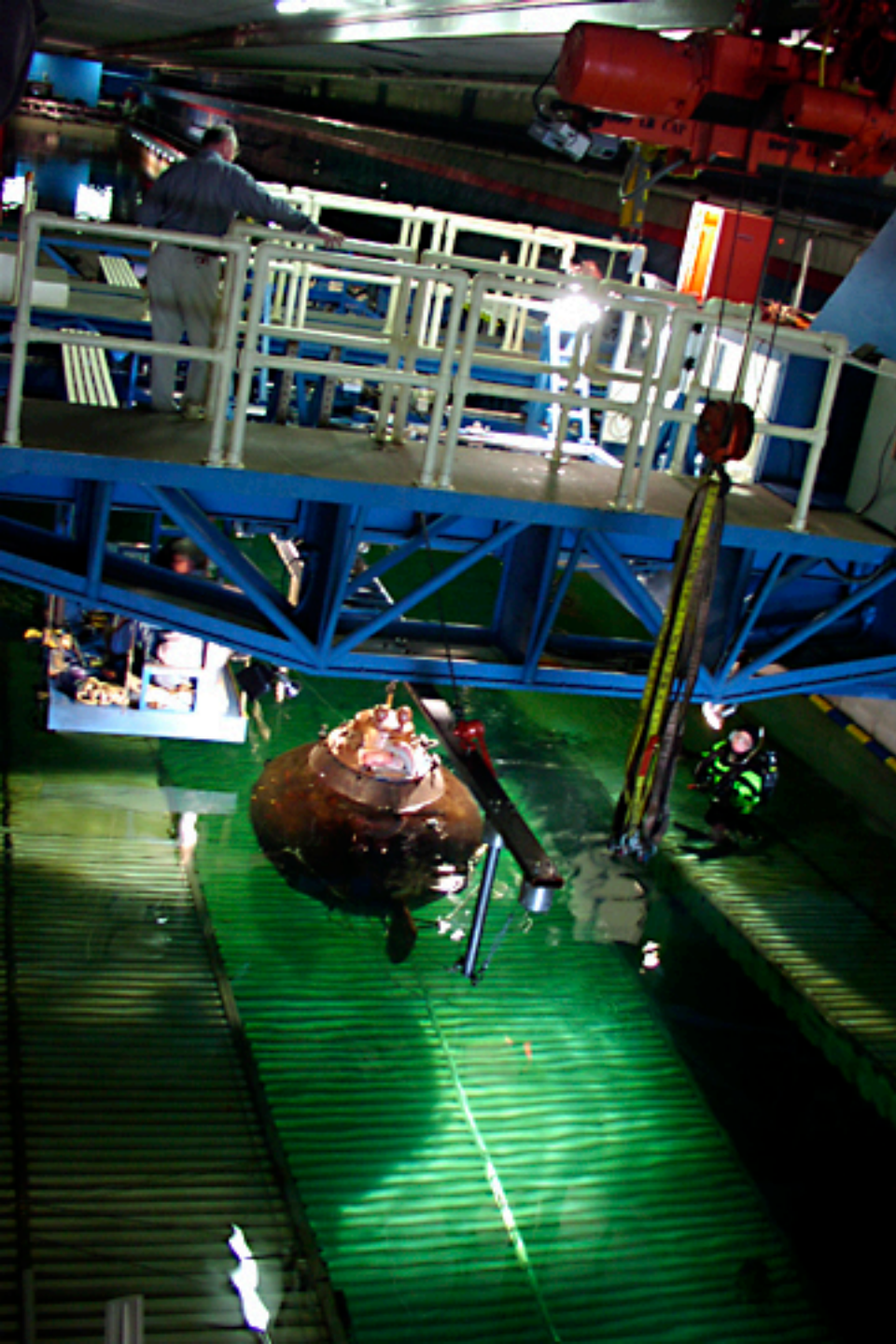


*Preparing to test the Turtle in the United States Naval Academy Hydromechanics Laboratory*



“The vessel was chiefly ballasted with lead, fixed to its bottom when this was not sufficient, a quantity was placed within, more or less, according to the weight of the operator: its ballast made it so stiff, that there was no danger of oversetting.” *David Bushnell*



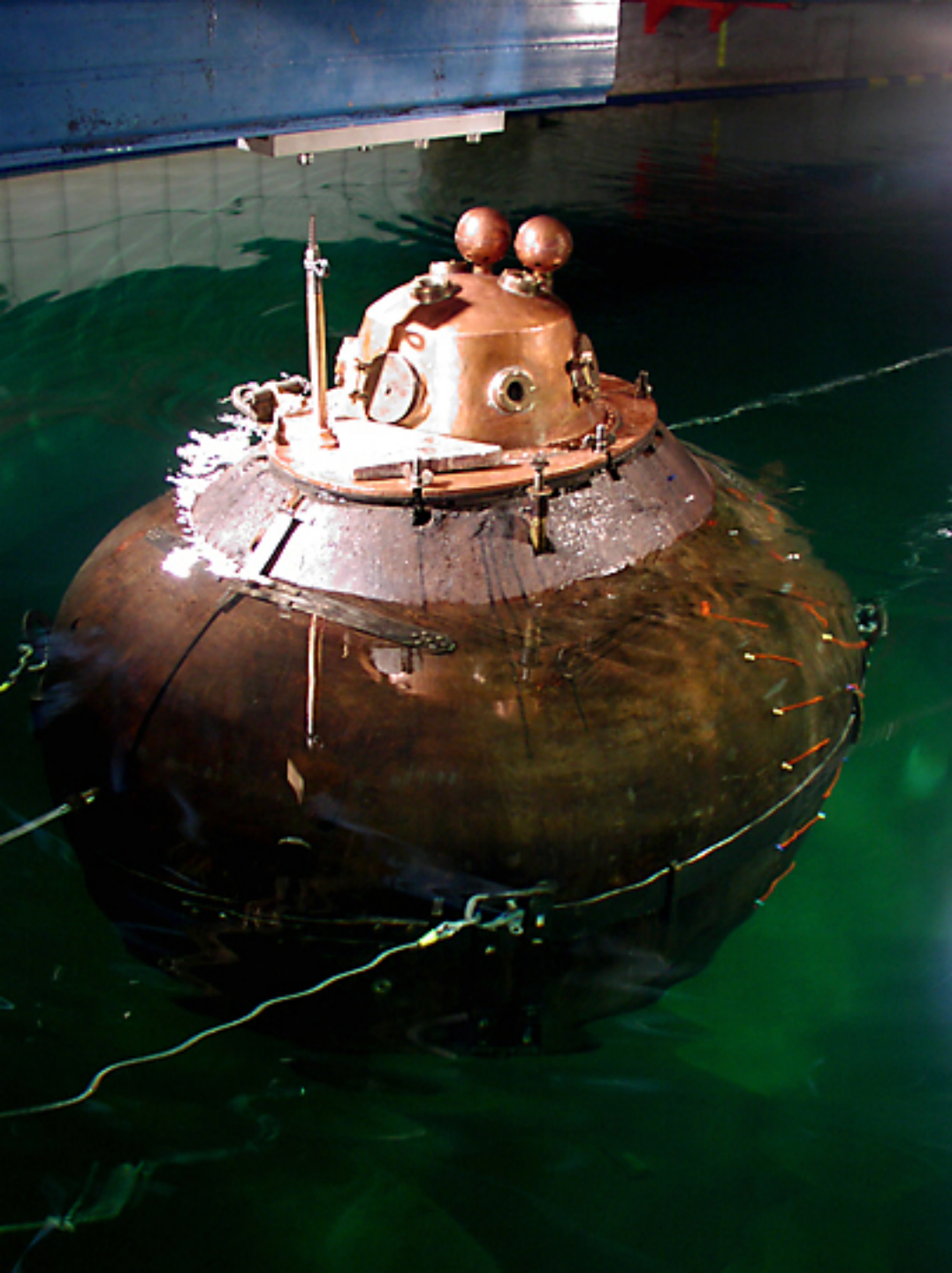


*Tests in the United States Naval Academy  
Hydromechanics Laboratory*



“I found, agreeable with my expectations that it required many trials to make a person of common ingenuity, a skillful operator.” *David Bushnell*





*Wooden balls used inside the snorkels to prevent the loss of air*

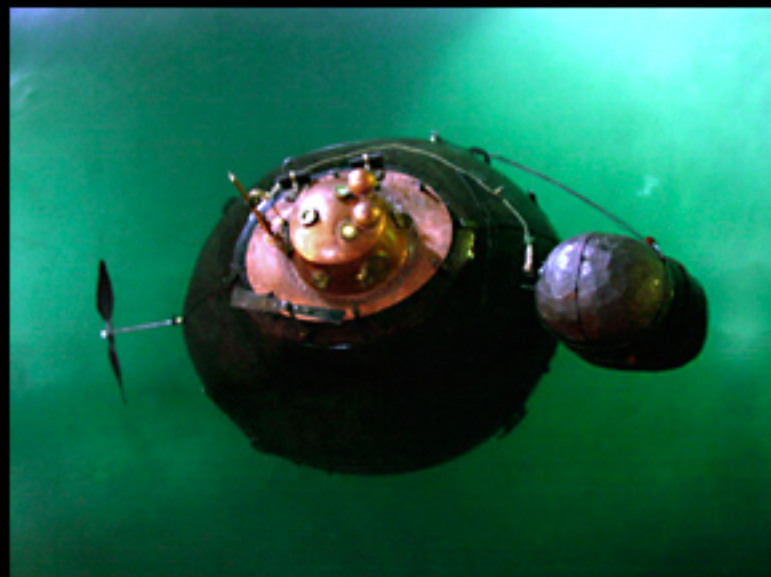


“There were two air pipes in the crown, so constructed that they shut themselves whenever the water rose near their tops... and opened themselves immediately after they rose above the water.” *David Bushnell*





*The horizontal propeller and smaller vertical propeller*



“An oar, formed upon the principle of the screw, was fixed in the forepart of the vessel, whose axis entered the vessel, which being turned one way rowed the vessel forward, and being rowed the other way rowed it backward: it was made to be turned by hand or foot.” *Ezra Lee*



“It had a screw that pierced  
through the top of the machine  
which was so very sharp that it  
would enter the wood with very  
little force.” *Ezra Lee*















The Bushnell Turtle replica was built by world-class, traditional craftspeople with no prior experience with submarines, and tested by world-class submarine experts with no experience in traditional crafts. The intersection of time and knowledge, collaboration between ageless crafts and cutting edge technologies, proved to be a rich educational experience for all.

The Turtle was made possible, in part, by funds provided by Windfall Films for the production of the documentary “The First Submarine.” The film is part of the series “Ancient Arsenal” by Windfall Films/Alliance Atlantis Production for the Discovery Channel, Channel Four Television, History TV and France5.

Handhouse Studio directed the making of the Bushnell Turtle replica through research, design and project development. Massachusetts College of Art faculty, students and alumnae and members of The Timber Framers Guild formed the team that constructed the Turtle.

Handhouse Studio, a 501c3 non-profit organization, is dedicated to the education of the public and the perpetuation of the arts, history, and science while emphasizing a hands-on approach. In its few years of operation, Handhouse Studio has hosted educational workshops, collaborated with a wide range of educational institutions and has worked with public media organizations such as National Geographic Magazine, National Geographic Today, WGBH public television, and PBS’s NOVA.



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