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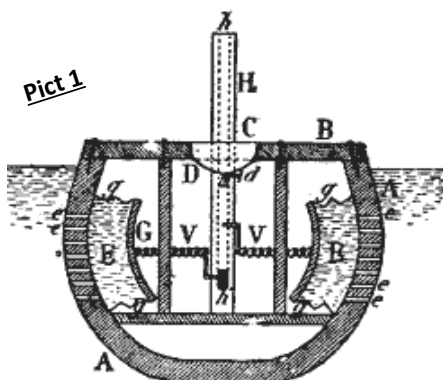
SUBMARINE HISTORY TIMELINE

1580

The first published prescription for a submarine came from the pen of **WILLIAM BOURNE**, an English innkeeper and scientific dilettante. Bourne first offered a lucid description of why a ship floats – by displacing its weight of water -- and then described a mechanism by which:

"It is possible to make a Ship or Boate that may goe under the water unto the bottome, and so to come up again at your pleasure. [If] Any magnitude of body that is in the water . . . having alwaies but one weight, may be made bigger or lesser, then it Shall swimme when you would, and sinke when you list"

In other words, decrease the volume to make the boat heavier than the weight of the water it displaces, and it will sink. Make it lighter, by increasing the volume, and it will rise. He wrote of watertight joints of leather, and a screw mechanism to wind the volume-changing "thing" in and out. Bourne was describing a principle, not a plan for a submarine, and offered no illustration.



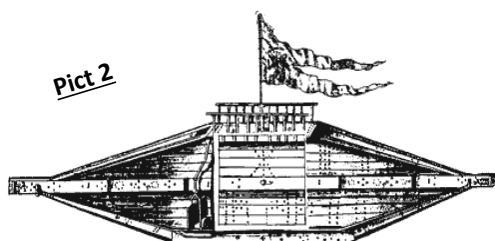
Some years later, this drawing purported to be Bourne's scheme: leather-wrapped pads which can be screwed in toward the centre-line to create a flooded chamber, and screwed out to expel the water and seal the opening.

However, Bourne wrote of expanding and contracting structures, not flooding chambers – and submarines built in England in 1729 and France in 1863 conformed with his idea exactly.

1623

Dutchman **CORNELIUS DREBBEL**, hired in 1603 as "court inventor" for James I of England, built what seems to have been the first working submarine. According to accounts, some of which may have been written by people who actually saw the submarine, it was a decked-over rowboat, propelled by twelve oarsmen, which made a submerged journey down the Thames River at a depth of about fifteen feet. There are no credible illustrations of Drebbel's boat, and no credible explanations of how it worked.

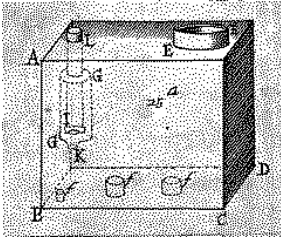
1654



The 72-foot-long "Rotterdam Boat," designed by a Frenchman (named **DE SON**) was probably the first underwater vessel specifically built (by the council of the Southern Netherlands) to attack an enemy (the English Navy). This almost submarine – a semi-submerged ram – was supposed to sneak up unobserved and punch a hole in an enemy ship. The designer boasted that it could cross the English Channel and back in a day, and sink a

hundred ships along the way.

1696

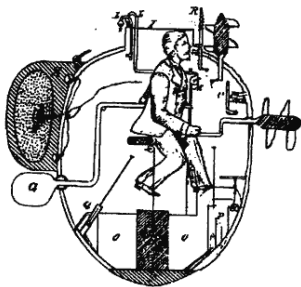


Pict 3

DENIS PAPIN, a professor of mathematics built two submarines. He used an air pump to balance internal pressure with external water pressure, thus controlling buoyancy through the in-and-out flow of water into the hull. Propulsion: sails on the surface, oars underwater. Papin featured "certain holes" through which the operator might "touch enemy vessels and ruin them in sundry ways."

1776

Yale graduate **DAVID BUSHNELL** built the first submarine to actually make an attack on an enemy warship. Dubbed the "Turtle" because it resembled a sea-turtle floating vertically in the water, it was operated by Sergeant Ezra Lee. The scheme: be towed into the vicinity of the target; open a foot-operated valve to let in enough water to sink, close the valve; move in under the enemy by cranking the two propellers – one for forward and one for vertical movement – turned by foot treadle "like a spinning wheel;" drill into the hull to attach a 150-pound keg of gunpowder with a clock-work detonator; crank to get away; operate a foot-pump to get the water out of the hull and thus re-surface. In early-morning darkness on September 7, 1776, "Turtle" made an attack on a British ship in New York harbour, probably HMS Eagle. The drill may have hit an iron strap – it would not penetrate the hull. Lee became disoriented, soon bobbed to the surface and was spotted by a lookout. He managed to get away



Pict 4

1797

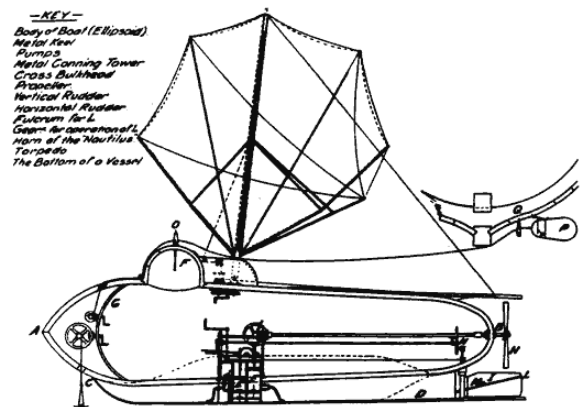
ROBERT FULTON, an American artist and successful inventor living in Paris, offered to build a submarine to be used against France's British enemy: "a Mechanical **Nautilus**. He would build and operate the machine at his own expense, and would expect payment for each British ship destroyed. He predicted that, "Should some vessels of war be destroyed by means so novel, so hidden and so incalculable the confidence of the seamen will vanish and the fleet rendered useless from the moment of the first terror."

1800

After protracted delays and several changes in government, **Fulton** was encouraged enough to build the submarine he called "Nautilus." He made a number of successful dives, to depths of 25 feet and for times as long as six hours (ventilation provided by a tube to the surface). "Nautilus" was essentially an elongated "Turtle" with a larger propeller and mast and sail for use on the surface. In trials, "Nautilus" achieved a maximum sustained underwater speed of four knots. Fulton (given the rank of rear admiral) made several attempts to attack English ships but his relationships with the French government deteriorated;

Fulton broke up "Nautilus" and sold it for scrap. The name "Nautilus" was immortalized by Jules Verne in his 1870 novel, "20,000 Leagues under the Sea" and was given to several U. S. Navy boats – including the world's first nuclear-powered submarine, the 1954 USS Nautilus.

Pict 5



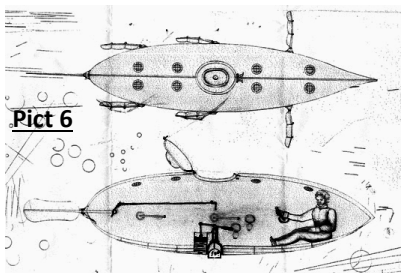
Fulton also attached the name "torpedo" to that maritime weapon we now call a mine. Fulton's torpedoes were meant to be towed into position, either by a submerged boat or a surface rowboat. When the French passed on the submarine, he offered to sell torpedoes to the English; he demonstrated their utility by sinking an anchored ship with a torpedo towed into place by a rowboat.

In 1867, English engineer **Robert Whitehead** developed a self-propelled mine, which he called the "automobile torpedo" -- the true ancestor of the modern submarine-launched torpedo.

1812-1815

There were at least two submersibles reported during the War of 1812, to one of which a British admiral attached the by then-generic name "Turtle."

1832



Frenchman **BRUTUS DE VILLEROI** demonstrated what he called *le bateau poisson* ("fish boat"), a submarine 10 feet 6 inches long, just over two feet diameter, with a crew of three. Propulsion: three pair of duck-paddles. Over several years, he demonstrated (and tried to sell) his submarine to the Dutch and the French, without success. He moved to Philadelphia in the late 1850s.

1852

Indiana shoemaker **LODNER D. PHILLIPS** built at least two submarines. The first collapsed at a depth of twenty feet. The second achieved hand-cranked underwater speeds of four knots and depths to 100 feet; Phillips offered to sell it to the U. S. Navy. The response: "No authority is known to this Bureau to purchase a submarine boat . . . the boats used by the Navy go on not under the water."

1855

WILHELM BAUER built the 52-foot "Diable Marin" or "**Seeteufel**" (Sea Devil) for Russia; this submarine made as many as 134 dives, the most spectacular of which was in celebration of the coronation of Tsar Alexander II. The boat took sixteen men underwater.

Pict 7

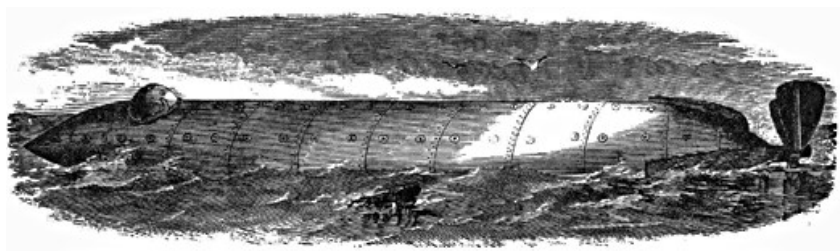


1859

French designer **BRUTUS DE VILLEROI** built a 33-foot-long treasure-hunting submarine for a Philadelphia financier. The target: the 1780 wreck of the British warship De Braak, lost near the mouth of the Delaware River. The boat made at least one three-hour dive to twenty feet.

1861-1862

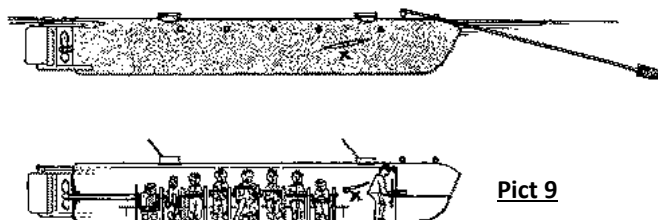
VILLEROI obtained a contract from the U. S. Navy for a larger submarine: the 46-foot-long "**Alligator**". Alligator" was placed in service on June 13, 1862 – the first submarine in the U. S. Navy. It sank in a storm, 1863, while being towed to a potential operating area off South Carolina.



Pict 8

1863

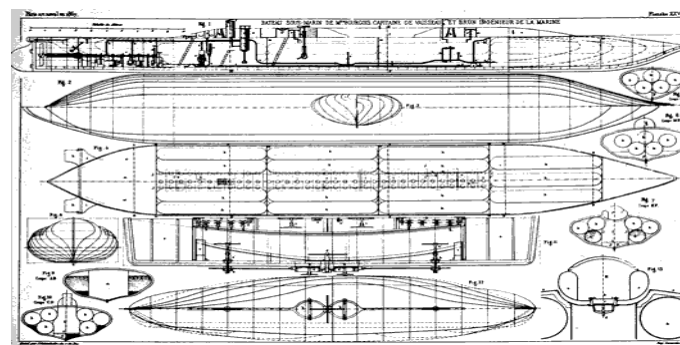
Hunley's consortium built a large submarine -- about 40 feet long. Crew: possibly nine, eight to crank the propeller and at least one to steer and operate the sea cocks and hand-pumps to control water level in the ballast tanks. This submarine was sent to Charleston to try to break the Federal blockade. Almost immediately, it sank.



Pict 9

1863

French team of **CHARLES BURN** and **SIMON BOURGEOIS** launched "Le Plongeur" (The Diver) – 140 feet long, 20 feet wide, displacing 400 tons. Power: engines run by 180 psi compressed air stored in tanks throughout the boat. The boat was too unstable



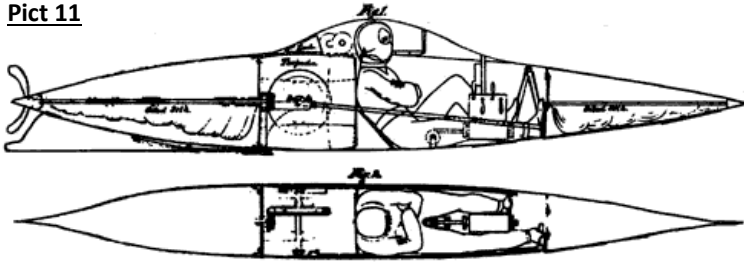
Pict 10

1864

WILHELM BAUER proposed that submarines be powered by a visionary – but not yet practical – internal combustion engine. Overall, he was to spend twenty-five years developing (or at least, proposing) submarines on behalf of six nations – Germany, Austria, England, the United States, Russia, France . hero in the Nazi era. Essentially ignored by his native Germany in his lifetime, Bauer became a posthumous hero in the Nazi era.

1874

Pict 11



Recent Irish émigré **JOHN PHILLIP HOLLAND** submitted a submarine design to the Secretary of the Navy, who passed the paperwork to a subordinate. No one would willingly go underwater in such a craft, that officer suggested.

1878

HOLLAND found sponsorship with the Fenians, a group of Irish revolutionaries, looking for a way to harass the British Navy. He built a small prototype submarine, "Holland No. 1" to test out his theories – including the use of a gasoline engine. The trial was successful enough to encourage building a larger, more warlike, boat.

1881

HOLLAND launched the "Fenian Ram" – 31 feet long, armed with a ram bow and an air-power cannon. Tests continued for two years, to depths of sixty feet for as long as one hour. Surface and submerged speeds were about the same, 9 knots.

1883

HOLLAND and several investors formed the Nautilus Submarine Boat Company, hoping to sell a submarine to the French, then at war in Indochina. Too heavy for the launching ways, the boat smashed into some pilings and was badly damaged.

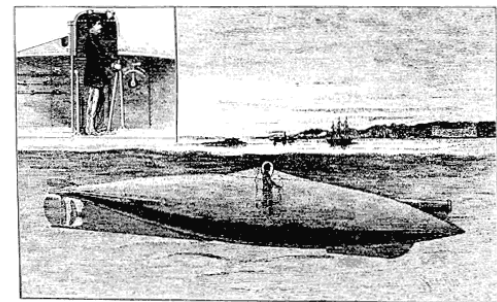


FIG. 1.—HOLLAND'S NEW SUBMARINE TORPEDO BOAT.

1898

Pict 12

Spanish-American War : **Holland** offered to go to Cuba and sink the Spanish fleet .

1898

The French fielded the 148-foot, 266-ton "**Gustav Zede**". On maneuvers, the submarine "torpedoed" an anchored battleship. The success of "Zede" prompted an international competition for a submarine with a surface range of 100 miles and a submerged range of 10 miles.

1900

On April 11, the U. S. Navy bought "**Holland VI**" for \$150,000 and changed the name to **USS Holland**. The boat had cost \$236,615 to build, but the company viewed it as a loss-leader. The Navy ordered another submarine.

Pict 13



1901

President of France **Emil Loubet** became the first chief executive to go for a submerged ride, aboard "**Gustav Zede**." He did so in full formal dress, frock coat and all. Three months later, on maneuvers three hundred miles from her base, "Zede" put a practice torpedo into the side of the moving battleship "Charles Martel" to the reported "general stupefaction" of those aboard the battleship. Submarines had become so popular in France that the newspaper Le Matin had launched a public fund-raising drive to build submarines for the Navy: "Francais" launched in 1901 and "Algerien" launched in 1902.

1904



Pict 14:

The British Holland "No. 3," in service from 1902 to 1912

1905

Theodore Roosevelt became the first U. S. president to take a submerged ride – in the A-1 "Plunger".

1906

U-1, the first German "**U-Boat**" (for unterzeeboot), was launched. It was 139 feet long, displaced 239 tons, had a surface speed of 11 knots, a submerged speed of 9 knots, and a range of two thousand miles. It was joined in 1908 by a twin, U-2. By this time, the French had a submarine force of sixty boats, the British almost as many.

1912

Germany began to get serious about submarines with the "30s" series – **U-31 to U-41**. These diesel-powered boats displaced 685 tons, carried six torpedoes and one 88mm deck gun, had a surface speed of 16.4 knots, submerged 9.7 knots – and a maximum range of 7,800 miles at 8 knots.

1914

On the eve of World War I, the art of submarine warfare was barely a dozen years old, and no nation had submarine-qualified officers serving at the senior staff level. Ancient prejudice against submarines remained: they represented an unethical form of warfare, and they did not "fit" in the classic, balanced structure of a navy – where battleships were king. No nation had developed any method for detecting submarines, or attacking them if found. Great Britain had the world's largest submarine fleet; Germany, with a late start, had the most capable.

Great Britain: seventy-four in service, thirty-one under construction, fourteen projected.

France: sixty-two boats in service, nine under construction.

Russia, forty-eight boats.

Germany: twenty-eight in service, seventeen under construction.

United States, thirty in service, ten under construction;

Italy, twenty-one in service, seven under construction; J

Japan, thirteen and three;

Austria, six and two.

On September 5, **U-21** sank the British cruiser "Pathfinder" with one torpedo. From weapon launch to sunk took three minutes. There were nine survivors of a crew of 268. A week later, the British had their turn when **E.9** sank the German light cruiser "Hela" with two torpedoes.

Then, on September 22, 1914, one virtually prehistoric German submarine, **U-9**, sank three British cruisers. On the same day. Within slightly more than 90 minutes. A month later, **U-17** became the first submarine to sink a merchantman. A month after that, **U-18** penetrated the British fleet anchorage at Scapa Flow; although she did no direct damage and was captured, the effect upon the British Navy was electric. The face of naval warfare was, indeed, changed forever.

Source: Prepared for NOVA by Captain Brayton Harris, USN

Author, *The Navy Times Book of Submarines: A Political, Social and Military History*

(adapted)