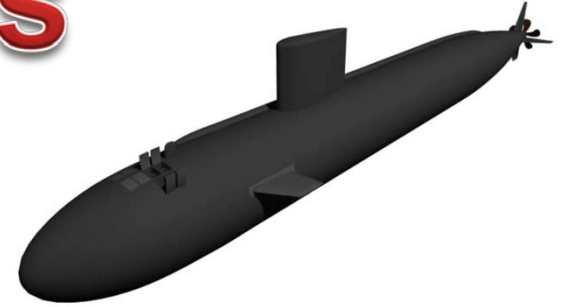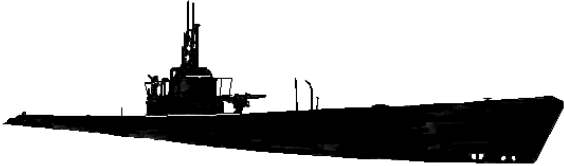# Submarines

List of submarine classes of the United States Navy

Sure, we all served on them but do we know ALL of them? This comprehensive list all the classes of U.S. submarines.

Submarines of the United States Navy are built in classes, using a single design for a number of boats. Minor variations occur as improvements are incorporated into the design, so later boats of a class may be more capable than earlier. Also, boats are modified, sometimes extensively, while in service, creating departures from the class standard. However, in general, all boats of a class are noticeably similar.

(continued)

Occasionally, a class will consist of a single ship as a prototype, or for experimental use; an example is USS Albacore (AGSS-569), which used an unprecedented hull design. In this list such single boat 'classes' are marked with '(unique)'.

The years in red indicate when the boats saw service or, in some cases, the year she was developed.

This is a self paced show. You must click your mouse for each bullet or page change.

The word "more" at the bottom indicates there is more information on the class on the following page.

USS Alligator (1862)
Unique (1861-1892)

❖ 30 ft (9 m) long and 6 ft (1.8 m) or 8 ft (2.4 m) in diameter.

❖ Made of iron, with the upper part pierced for small circular plates of glass, for light; several water tight compartments

❖ Propulsion: sixteen hand powered paddles protruding from the sides

❖ Later, paddles replaced by a hand-cranked propeller, which improved its speed up to seven knots.

❖ Air was to be supplied from the surface by two tubes with floats, connected to an air pump inside the submarine.

Alligator: The Forgotten Torchbearer of the U.S. Submarine Force

Painting by Jim Christley

USS Holland (SS-1)

Unique (1896-1900)

❖ **Only one in USN service, but there were others of the type made**

❖ **Included many features that submarines of the early 20th century would exhibit**

❖ **Had both an internal combustion engine for running on the surface, and an electric motor for submerged operation.**

❖ **Reloadable torpedo tube and a deck gun**

❖ **She had all the necessary ballast and trim tanks to make precise changes in depth and attitude underwater.**

USS Plunger (SS-2) class
(1900-1903)

❖ <u>7 in class.</u> This was one of the earliest submarines.

❖ She was the lead ship of the her class and was later renamed A-1 when she was designated an A-type submarine.

❖ Besides testing machinery, armament and tactics, the submarine torpedo boat also served as a training ship for the crews of new submersibles emerging from the builder's yard.

B-class (SS-10 to 12)
(1905-1907)

❖ There <u>were three "B class"</u> submarines

❖ Turning point in submarine design. Last of the *Holland*-class submarines.

❖ 250 hp gasoline engines, 150 hp electric motors

❖ Speed: 9 knots (surf) 8 knots (sub)

❖ Complement: 10 officers and enlisted

❖ Armament: 2 × 18" bow torpedo tubes

C-class (SS-9, 13 to 16)
(1905-1910)

❖ <u>5 in class</u>. Built between 1906–1909 by Craig Shipbuilding Co.

❖ In commission from 1908–1919 and all sold for scrap in 1920

❖ Propulsion: 250hp gasoline engine, 150 hp electric motor

❖ Speed:
10.5 knots (surf), 9 knots (sub), Test depth 200'

❖ Armament: 2 × 18" bow torpedo tubes (4 torpedoes)

Photo # NH 100941   Submarines C-5, C-2 & C-3 alongside USS Charleston in Panama Canal Zone waters

U.S. C-Submarine
Panama Canal
852-P
Pickard & Zell

D-class (SS-17 to 19)
(1908-1910)

- ❖ **<u>All three ships</u> served during WW I providing training for crews and officers**
- ❖ **Designed to survive one compartment flooding.**
- ❖ **Displacement:288 tons**
- ❖ **Length:134' 10" , Beam:13' 11"**
- ❖ **Speed:13 knots**
- ❖ **Complement:15 officers and men**
- ❖ **Armament:4 × 18" torpedo tubes**

E-class (SS-24 and 25)
(1909-1912)

❖ <u>**Two in class.**</u> **The first to have diesel engines.**

❖ **The class was decommissioned in 1922 to comply with the Washington naval treaty.**

❖ **Displacement:
287 tons (surf), 342 tons (sub)**

❖ **Propulsion: 700 hp diesel engines, 600 hp electric motors, twin propellers, 120 battery cells**
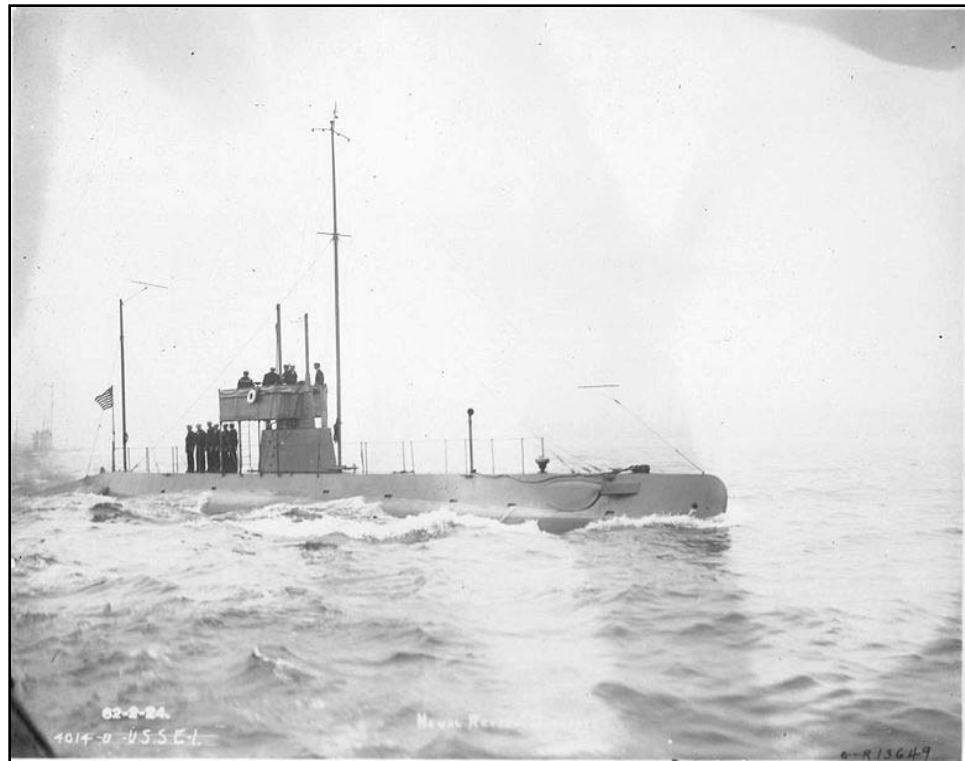
❖ **Speed:14 knots (surf), 9 knots (sub)**

❖ **Test depth: 200'**

❖ **Armament:4 × 18" torpedo tubes, 4 torpedoes**

F-class (SS-20 to 23)
(1909-1913)

❖ <u>Four boats</u>, similar to the C-class and D-class submarines built by Electric Boat.

❖ The E-class and the F-class submarines were the first from Electric Boat to have bow planes.

❖ The hull contained three compartments:
torpedo room with four 18" torpedo tubes, control room with ballast and hydroplane
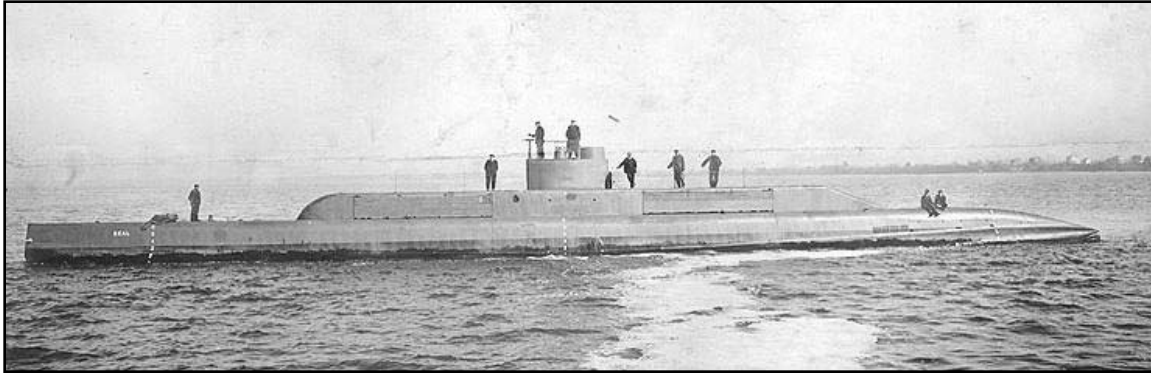controls and periscope, engine room with two diesel engines.
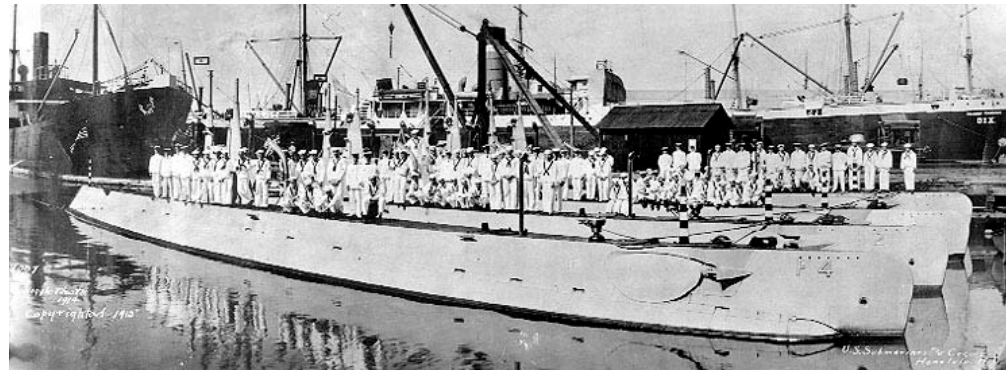
❖ The diesels were connected to a common shaft. The shaft turned motors that could act as generators for charging the batteries. The battery was an array of cells in rubber-lined, open-topped, steel jars.
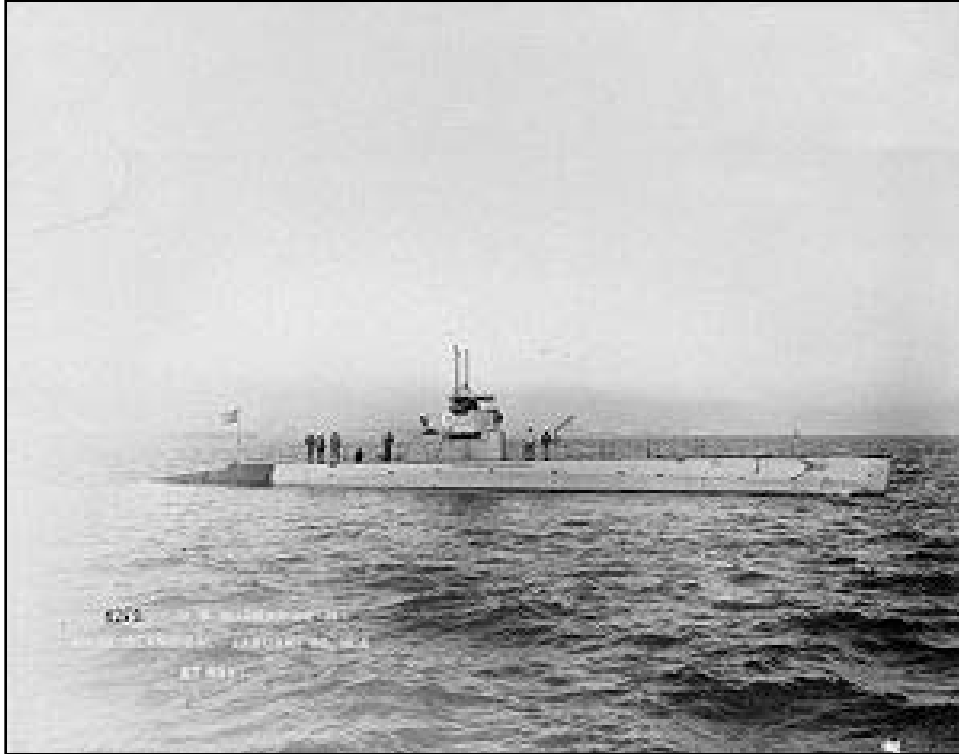
10

G-Class(SS-19½, 26, 27, 31)
(1909-1914)

❖ ***Four boats.** G-1* (SS-19½) was given the number 19½ because SS- numbers were given after her decommissioning; she was between SS-19 & SS-20.

❖ Displacement: 360–400 tons (surf), 457–516 (sub)

❖ Length: 157'–161'; Beam: 13'–17'; Draft: 11'–12'

❖ Propulsion: Gas-electric (G-1, G-2, G-4), Diesel-electric (G-3)

❖ Speed: 14 knots (surf), 9.5–10.9 knots (sub)

❖ Complement: 24-26 officers and men

❖ Armament: 4-6 × 18" torpedo tubes

H-class (SS-28 through 30, 147 to 52)
(1911-1918)

❖   **Nine boats total. 8** originally ordered by the Imperial Russian Navy. But the shipment of the final six was held up by the Russian Revolution.

❖   Called "pig" boats due to foul living quarters and unusual hull shape.

❖   Displacement:
358 tons (surf), 467 tons (sub)

❖   Propulsion: Diesels 950 hp, electric motors 600 hp, 2 × shafts).

❖   Speed: 14 knots (surf), 10.5 knots (sub), Test depth:200 ft

❖   Armament:4 × 18" torpedo tubes (8 torpedoes

K-class (SS-31 to 39)
(1912)

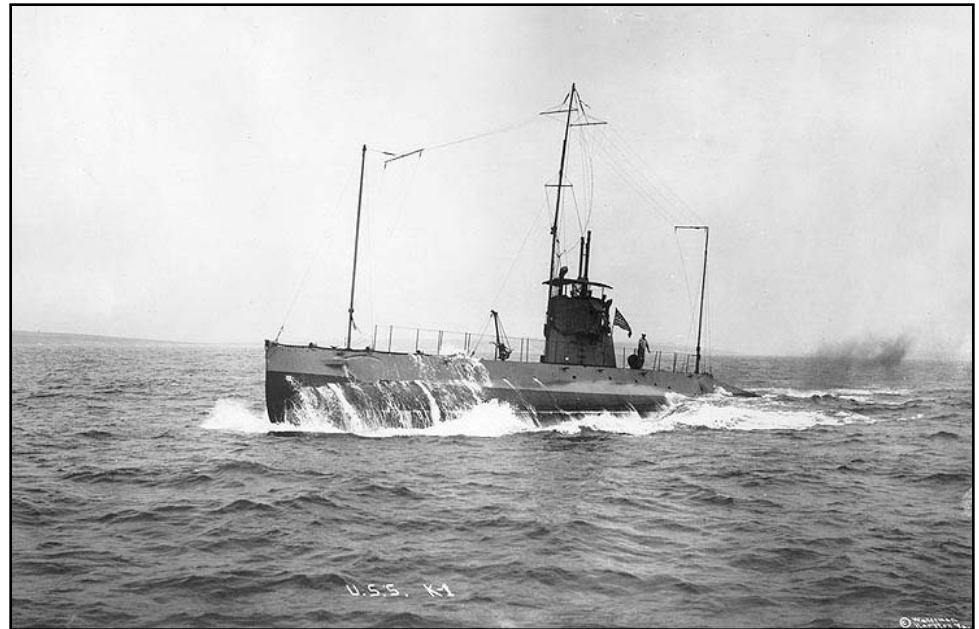❖ **Eight small submarines** of the United States Navy, serving between 1914 and 1923.

❖ Displacement:
392 tons (surf), 521 tons (sub)

❖ Length:153' 7 ",
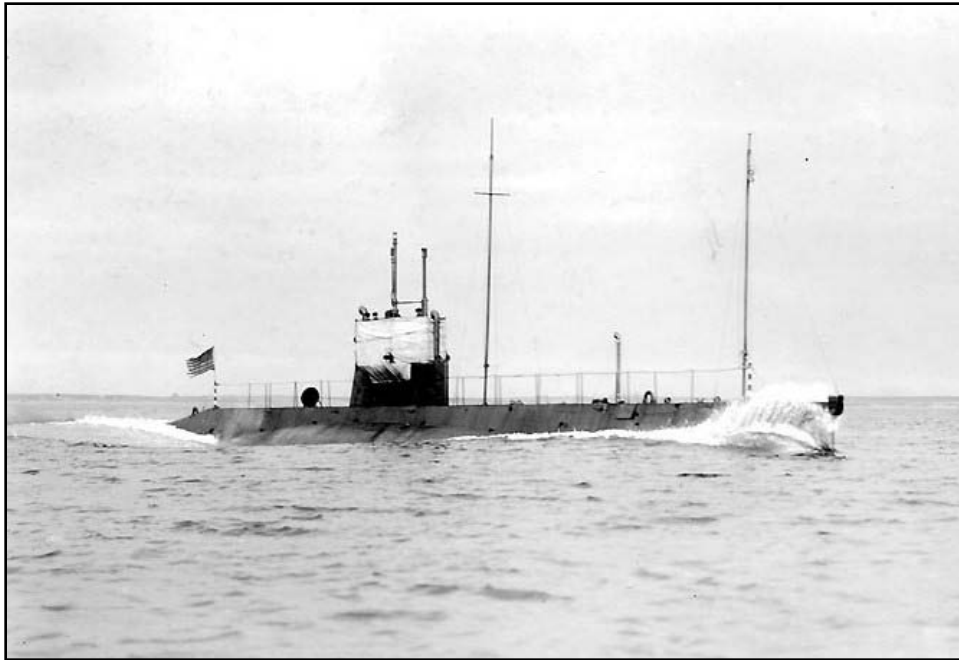Beam:16' 8", Draft:13'1"

❖ Speed:14 knots (surf),
10.5 knots (sub)

❖ Complement: 28 officers and men

❖ Armament: 4 × 18" torpedo tubes

L-class (SS-40 to 46, 48 to 51)
(1914-1918)

❖ Complement: 28 officers and men.

❖ Armament: 4 × 18" torpedo tubes, 8 torpedoes; 1 × 3"/23 caliber deck gun.

❖ The United States Navy's first attempt at designing and building ocean-going submarines.

❖ Built as two groups with slight differences between the two.

❖ Displacement: Group 1 = 450 tons, Group 2 = 456 tons.

❖ Propulsion: Diesel-electric Group 1 = 2 x 650 hp, Group 2 = 2 × 600 hp.

❖ Speed:14 knots (surf).

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USS M-1 (SS-47)
unique (1914-1918)

❖ M-1 was designed as a test bed for the newest technology but considered a failure.

❖ Was the world's first double-hulled design,.

❖ Displacement: 488 tons (surf); Length:196' 3"; Beam:19'; Draft:11'

❖ Propulsion: Diesel-electric (840 hp engine, 680 hp motors), 120 battery cells.

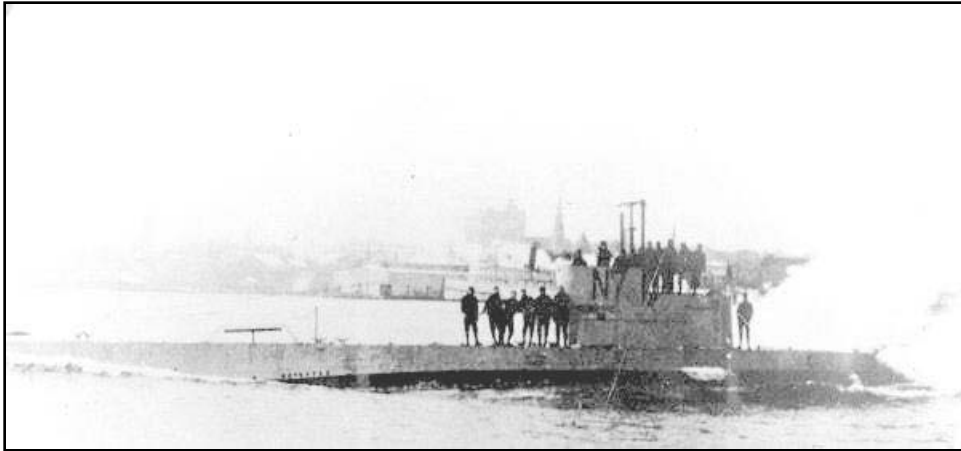❖ Speed: 14 knots (surf), 10.5 knots (sub); Test depth: 200 ft.

❖ Armament:•1 × 3"/23 cal deck gun; 4 × 18" torpedo tubes, 8 torpedoes.

N-class (SS-53 to 59)
(1915-1918)

❖ **A class of seven** coastal defense submarines of the United States Navy.

❖ The first submarines with reliable diesel engines, they were constructed by two companies to slightly different specifications; three by the Seattle Construction and Dry-dock and three by the Lake Torpedo Boat Company.

❖ Commissioned during World War I, they were assigned to the 1st Naval District and patrolled the New England coast.

❖ By 1922 the Seattle boats were assigned to the Submarine School, New London, while the Lake boats were all scrapped in that year.

O-class (SS-62 to 77)
## (1916-1918)

❖ <u>A class of 16,</u> created out of the lessons learned from the L class submarine and made in two groups.

❖ The O class were more robust with greater power and endurance for ocean patrols.

❖ They were much faster than previous classes but latter ones proved disappointing.

❖ The second group of these boats entered service just before the end of WW I.
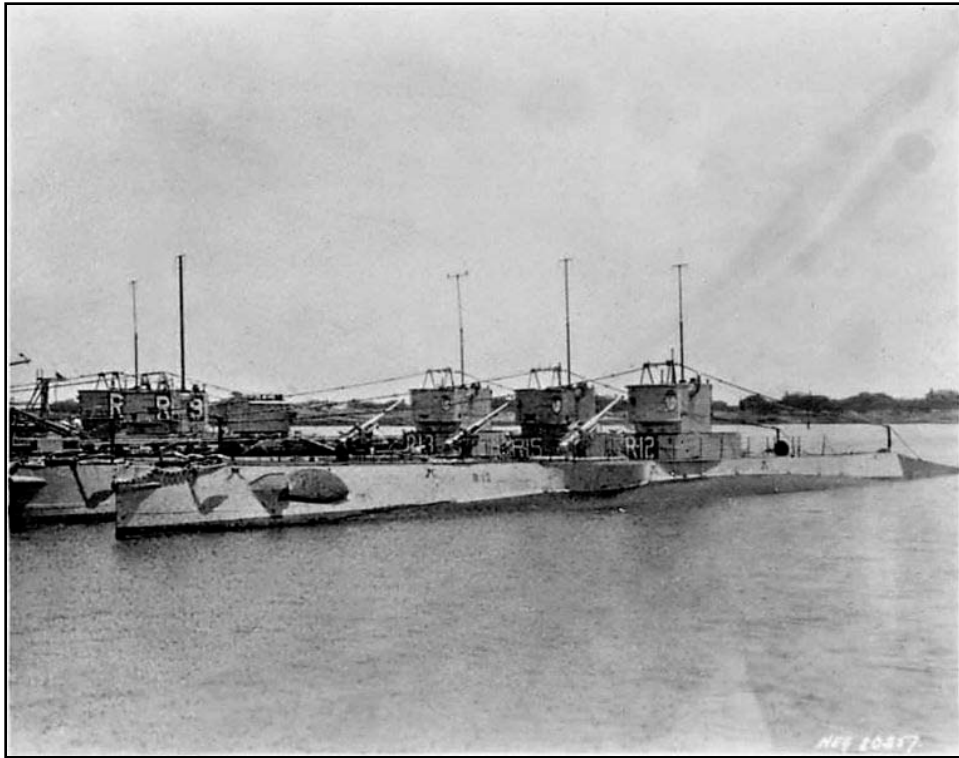

Photo # NH 103193 "O" type submarines of Submarine Division 8 at Boston, 16 August 1921
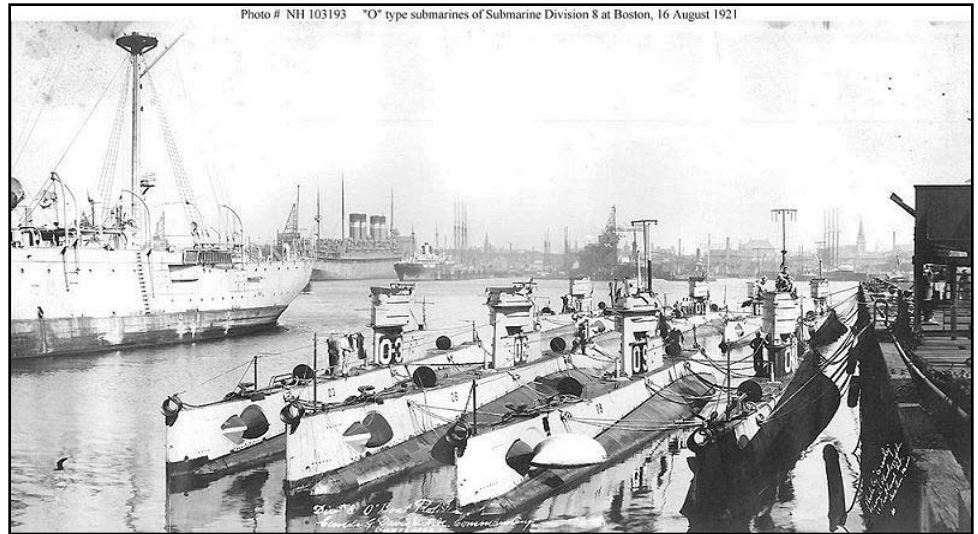
❖ Eight of the first group survived to serve in World War II as training boats when they were recommissioned in 1941.

R-class (SS-78 to 104)
(1914-1918)

- ❖ **A class 20** United States Navy submarines active from 1918 until 1945.

- ❖ **Displacement:** 569 tons (surf), 680 tons (sub)

- ❖ **Length:**186' 2"; **Beam:**18'; **Draft:**14'6".
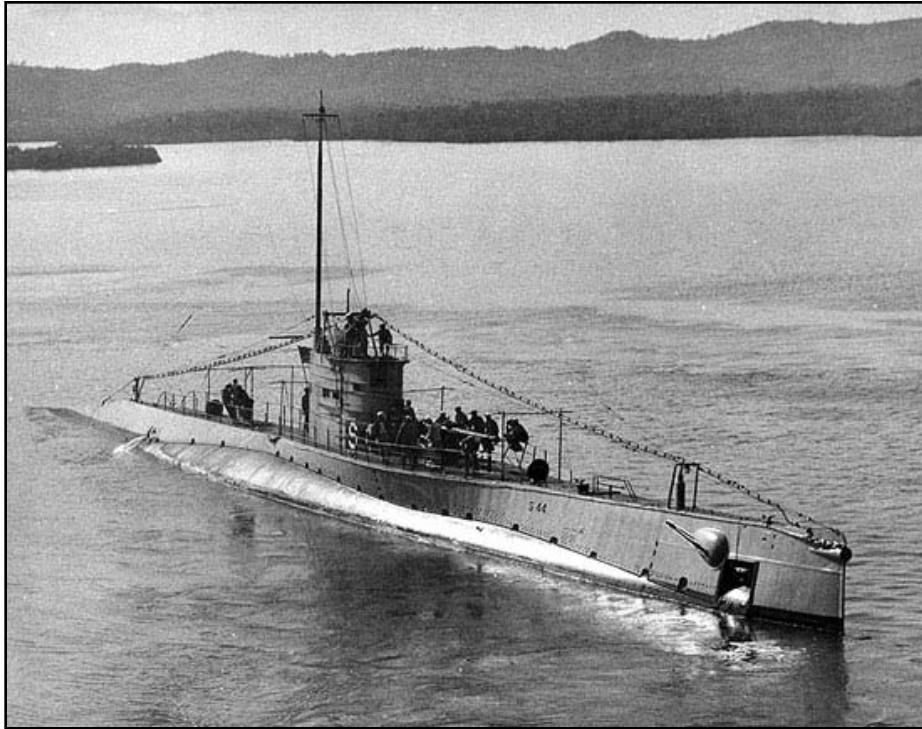
- ❖ **Propulsion: Diesel-electric.**

- ❖ **Speed:**13.5 knots (surf), 10.5 knots (sub).

- ❖ **Complement: 30 officers and men.**

- ❖ **Armament: 4 × 21" torpedo tubes; 1 × 3"/50 caliber deck gun.**

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S-class (SS-105 to 107, 109 to 146, 153 to 162)
Generally divided into four groups (1917-1922)

❖ <u>**51 total boats**</u>**. Group I (S-1 class, or "Holland" type):S-1 and S-18–S-41, built in Quincy, MA and in San Francisco, CA, as subcontractor for Electric Boat Company**

❖ **Group II (S-3 class, or "Navy Yard" type):S-3-S-17, built at the Portsmouth Navy Yard and Bridgeport, CT.**

❖ **Group III (S-42 class): S-42-S-47, built at Fore River**

❖ **Group IV (S-48 class): S-48-S-51, built by Lake.**

(more)

❖   **The S-boats were improvements over the O- and R-boats. They were substantially larger. This allowed for greater range, larger engines and higher speed, and more torpedo reloads, though the number of forward torpedo tubes was still four.**

❖   **Seven of the Group II and all the Group IV boats had an additional stern tube. Group IV was also longer and had less draft. USS S-1 (SS-105) experimented with a seaplane (an idea the Japanese would adopt**).

AA-1 (SS-52/SF-1) class
(1916-1922)

❖ **This class <u>was three experimental submarines</u> built toward the end of World War I, between 1916 and 1919.**

❖ **The design was not a success and none of the submarines saw active service.**

❖ **However, the lessons learned were applied to the design of the later V-boats.**
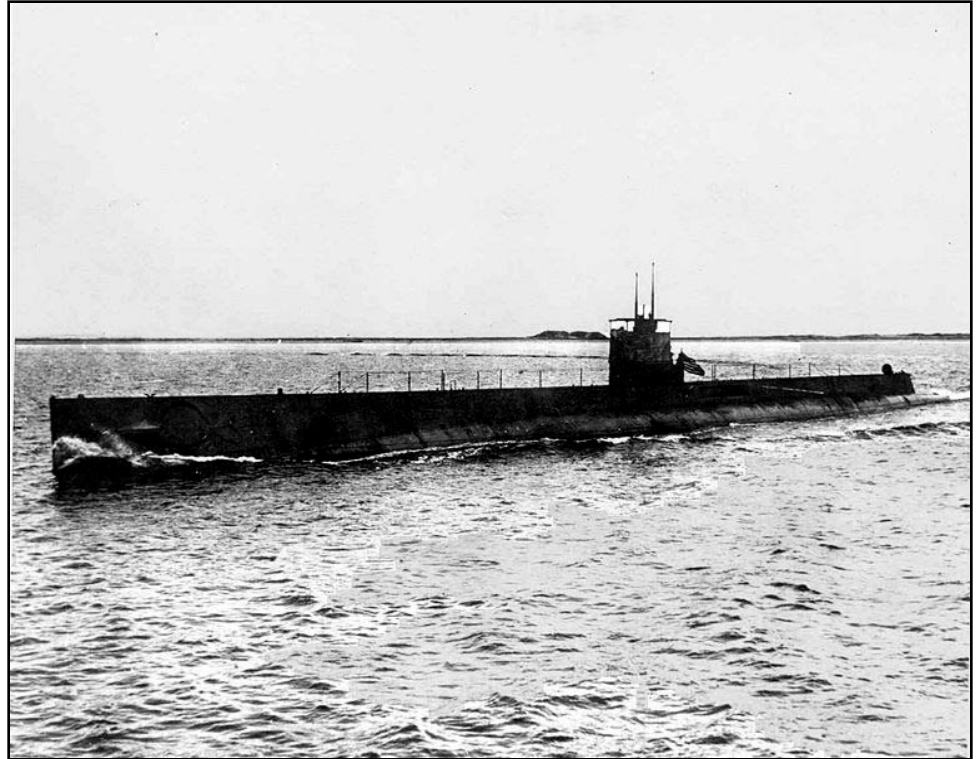
V-Boats
Barracuda Type: (SS-163, 164, 165)
(built 1921-1926)
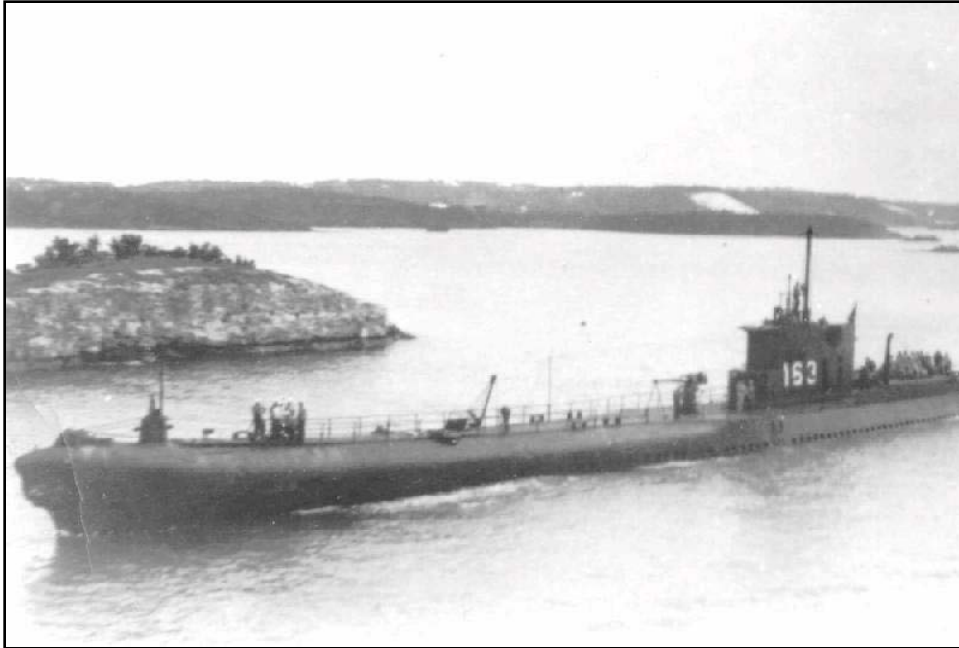
❖ **The V-boats (Barracuda-class) <u>were a group of three</u> United States Navy submarines built between World War I and World War II from 1919 to 1934.**

❖ **Not a ship class of nearly-identical ships built from the same design, they shared authorization under the "fleet boat" program. The term "V-boats" is used to includes five separate classes of submarines.**

(more)

❖   Originally USS V-1 through V-9 (SS-163 through SS-171), these were renamed in 1931 as Barracuda, Bass, Bonita, Argonaut, Narwhal, Nautilus, Dolphin, Cachalot, and Cuttlefish, respectively.

❖   All served in World War II, six of them on war patrols in the central Pacific. Argonaut was lost to enemy action.

V-Boats (con't.)
USS Argonaut (SM-1, later APS-1)
(1928)

❖ **V-4 (USS Argonaut) was the first of the second generation of V-boats commissioned in the late 1920s, which remain the largest non-nuclear submarines ever built by the U.S.**

❖ **Exempted by special agreement from the armament and tonnage limitations of the Washington Treaty, V-4 and her sister ships V-5 (Narwhal) and V-6 (Nautilus) were designed with special diesel engines than those which had proved to be failures on the earlier series of V-boats.**

(more)

❖   **Unfortunately, the specially-built engines failed to produce their design power and some developed dangerous crankshaft explosions. V-4 and her sisters were slow in diving and, when submerged, were unwieldy and slower than designed. They also presented an excellent target to surface ship sonar and had a large turning radius.**

❖   **Designed primarily as a minelayer, her arrangements were highly ingenious but extremely complicated, filling two aft compartments.**

V-Boats (con't.)
Narwhal Class {USS Narwhal (SS-167), USS Nautilus (SS-168)}
(1930)

❖ **Two boats**, in appearance and dimensions, Narwhal and Nautilus were similar to Argonaut and constituted "submarine cruiser" partially inspired by German success with long-range submarine in World War I.

❖ Endurance, sea-keeping, increased torpedo capacity, and large deck guns were emphasized at the cost of high speed.

❖ Originally, a small scouting seaplane was to be carried in a water-tight hangar abaft the conning tower.

V-Boats (con't)
USS Dolphin (SS-169)
unique (1932)

❖　In 1933 the Dolphin tested a unique feature to submarines of having a motor boat stored in a water proof unit which could be brought out when needed.

❖　At that time most navies thought that in wartime submarines would cruise and have to board and inspect merchant vessels before they could sink them.

❖　Speed:17 knots (surf), 8 knots (sub), Range: 4,900 nautical miles, Test depth: 250'.
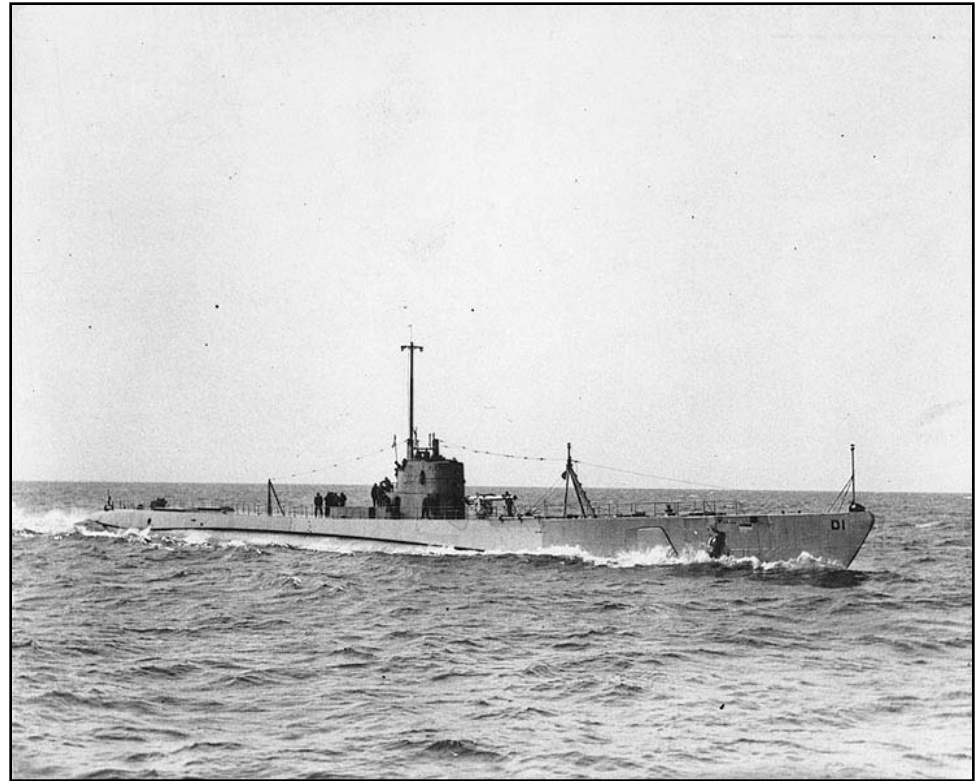
❖　Armament: 6 × 21" torpedo tubes (four forward, two aft), 18 torpedoes, 1 × 4"/50 cal deck gun.

V-Boats (con't.)
USS Cachalot (SS-170) class
(1934)

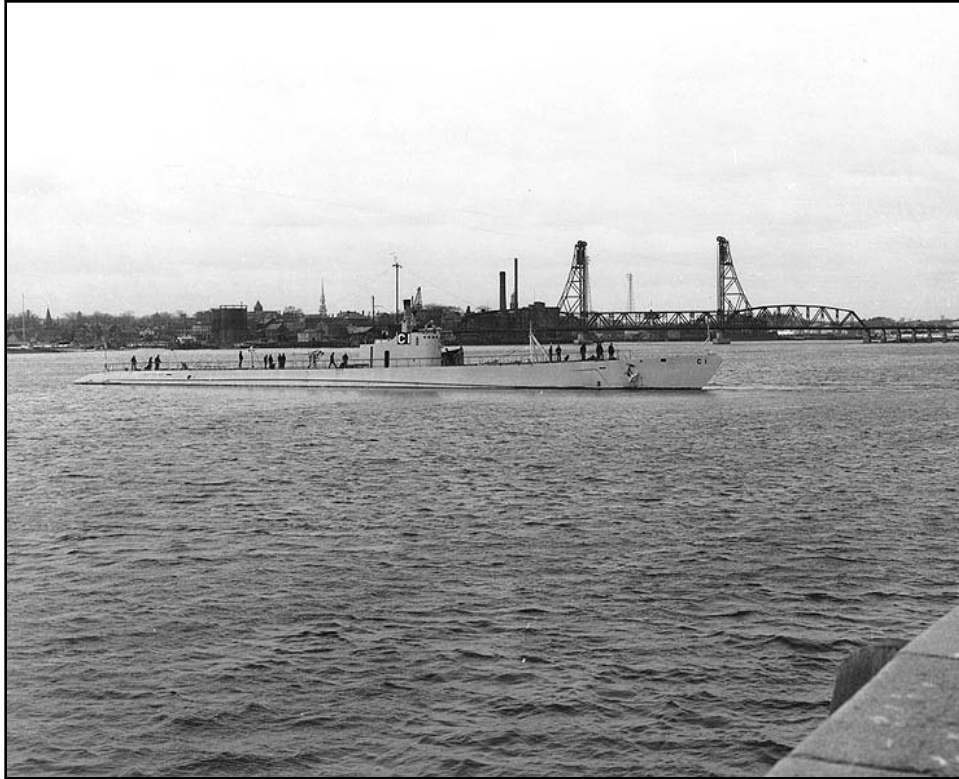❖ <u>**This was a pair**</u> **of medium-sized submarines built under the tonnage limits of the London Naval Treaty of 1930.**

❖ **Although externally much like the later "fleet submarines," internally the Cachalots were quite different.**

❖ **They featured full double hulls adapted from the Kaiserliche Marine's U-135, direct-drive diesel propulsion systems, a separate crew's mess and considerable space around the conning tower within the large bridge fairwater (which was drastically cut down in World War II when the three-inch (76 mm) gun was relocated forward of the bridge.)**

USS Porpoise (SS-172) class
(1937)

❖ <u>Ten boats,</u> built in the late 1930s, these incorporated a number of modern features that would make them the basis for subsequent classes.

❖ Based on the Cachalots, they were enlarged to incorporate additional main diesels and generators.

❖ Displacement: 1,310 long tons (surf), 1,934 tons (sub), Length: 301', Beam:24'11¾ ", Draft: 13 ft'10".

❖ Speed:19 kn (surf) 8 kn (sub); Range: 6,000 nm at 10 kn (22,000 nm @ 8 kn); Test depth: 250 ft.

❖ Armament:6 × 21" torpedo tubes (four forward, two aft; 16 torpedoes), (two external bow tubes added 1942), 1×3"/50 deck gun, 2 × 30 cal machineguns.

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USS Salmon (SS-182) class
(1938)

❖ **Six boats** that were an important developmental step in the design of the "Fleet Submarine" concept during the 1930's.and an incremental improvement over the previous Porpoise-class.

❖ Propulsion: 9-cylinder diesel engines, hydraulic-drive, two electrical generators, 2 × 120-cell batteries, 4 x high-speed electric motors with reduction gears, two shafts.
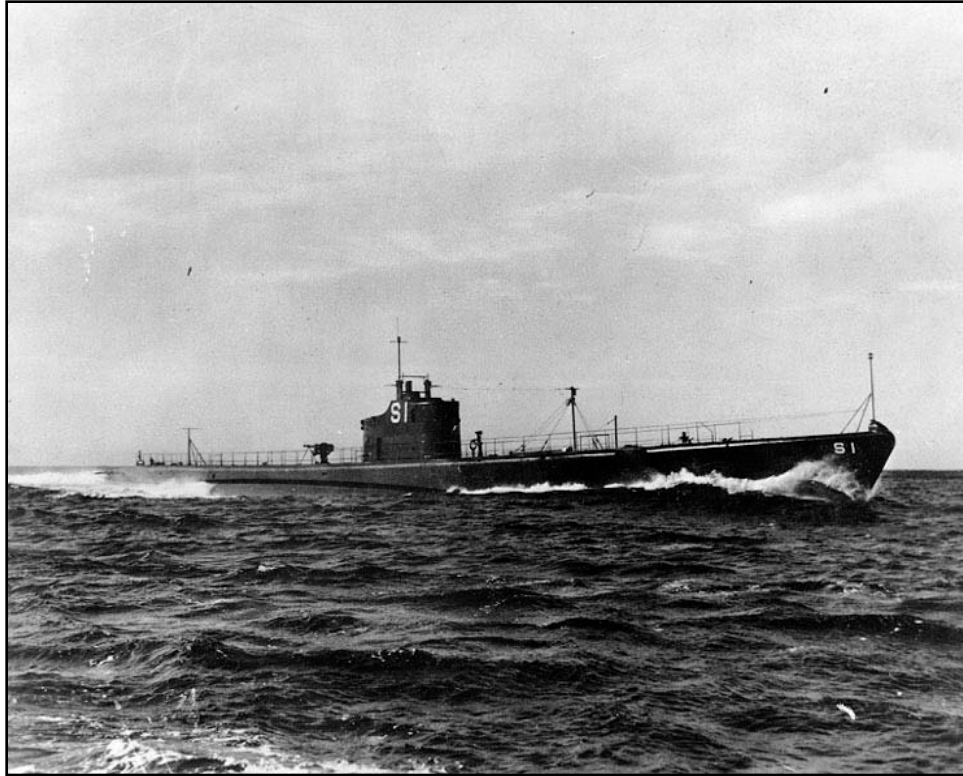
❖ Armament: 8 × 21" torpedo tubes (four forward, four aft), 24 torpedoes, 1 × 3"/ 50 caliber deck gun, four machine guns.

USS Sargo (SS-188) class
(1937-1939)

❖ This <u>class of 10 submarines</u> were the first US boats to be sent into action after the Japanese attack on Pearl Harbor, starting war patrols the day after the attack. They were built between 1937 and 1939.

❖ After the Second World War, boats of this class were moved into a training role before being scrapped.

❖ Complement: 5 officers, 54 enlisted men.

❖ Armament: 8 × 21" torpedo tubes, 24 torpedoes, 1 × 3"/ 50 caliber deck gun, four machine guns

❖ Displacement: 1,450 tons (surf), 2,350 tons (sub), Length:310' 6", Beam:26'10", Draft:16'7½ ".

USS Tambor (SS-198) class
(1941)

❖ **These 12 boats** were the USN's first practical fleet submarine and formed the core of the United States Pacific submarine fleet at the time of the US entry into World War II.

❖ Displacement:1,475 tons (surf), 2,370 tons (sub); Length:307'2", Beam:27'3" Draft:14"7½ ".

❖ Propulsion: 4 × diesels driving electrical generators; 2 x 126-cell batteries, 4 × high-speed electric motors with reduction gears, two shafts.

USS TAMBOR   CONFIDENTIAL

(more)

❖   **Complement: 6 officers, 54 enlisted men.**

❖   **Armament: 10 × 21" torpedo tubes
(six forward, four aft), 24 torpedoes, 1 × 3" / 50 caliber deck gun, Bofors 40 mm and Oerlikon 20 mm cannon.**

USS Mackerel (SS-204) class
(1941)

❖ This <u>was a two ship class</u> intended to prototype small submarines for wartime use due to the (false) belief that larger submarines could not be mass produced.

❖ Propulsion: direct-drive diesel engines, 2 × 60-cell Sargo batteries, 2 × electric motors.

❖ Speed: 16 knots (surf), 11 knots (sub), Range: 6,500 nautical miles.

❖ Complement: 4 officers, 33 enlisted men.

❖ Armament: 6 x 21" torpedo tubes (four forward, two aft), 12 torpedoes, 1 × 3"/ 50 caliber gun.

USS Gato (SS-212) class
(1940-1944)

❖ **This class of 77 boats** was the "standard" attack submarine of WWII.

❖ **Displacement:** 1,525 tons (surf), 2,424 tons (sub), Length: 311'8", Beam: 27'3", Draft: 17'

❖ **Propulsion:** 4 × diesels driving electrical generators, 2 × 126-cell Sargo batteries, 4 x high peed electric motors with reduction gears.

❖ **Speed:** 21 knots (surf), 9 knots (sub), Range: 11,000 nautical miles.
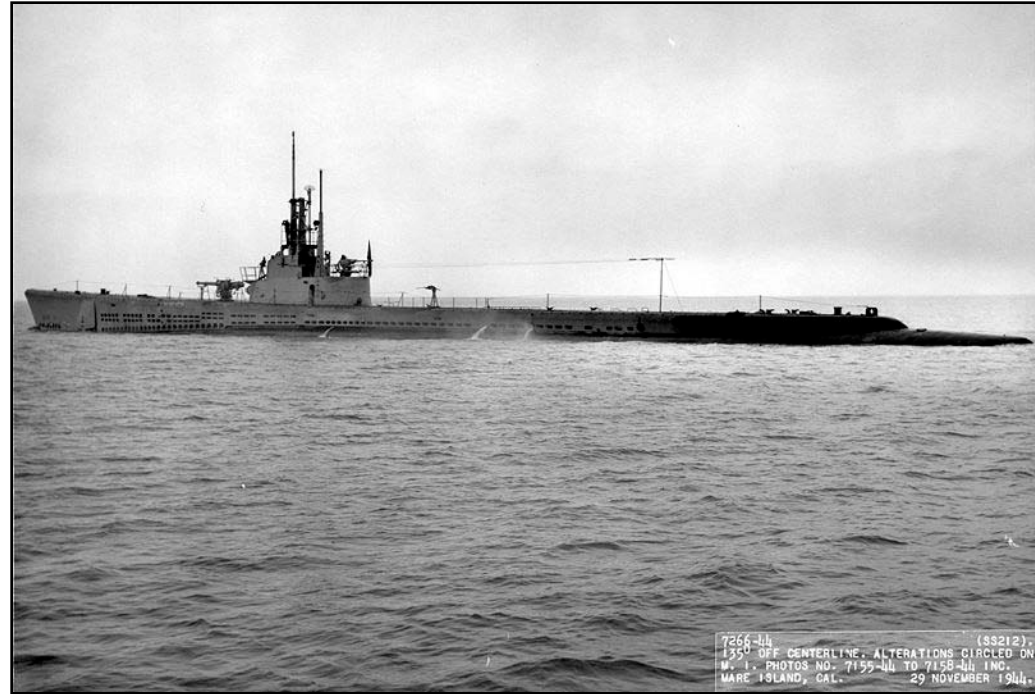
(more)

❖ **Test depth:300', Complement: 6 officers, 54 enlisted men.**

❖ **Armament:10 × 21" torpedo tubes, (six forward, four aft), 24 torpedoes, 1 × 3"/ 50 caliber deck gun, Bofors 40 mm and Oerlikon 20 mm cannon.**

USS Balao (SS-285) class
(1942-1948)
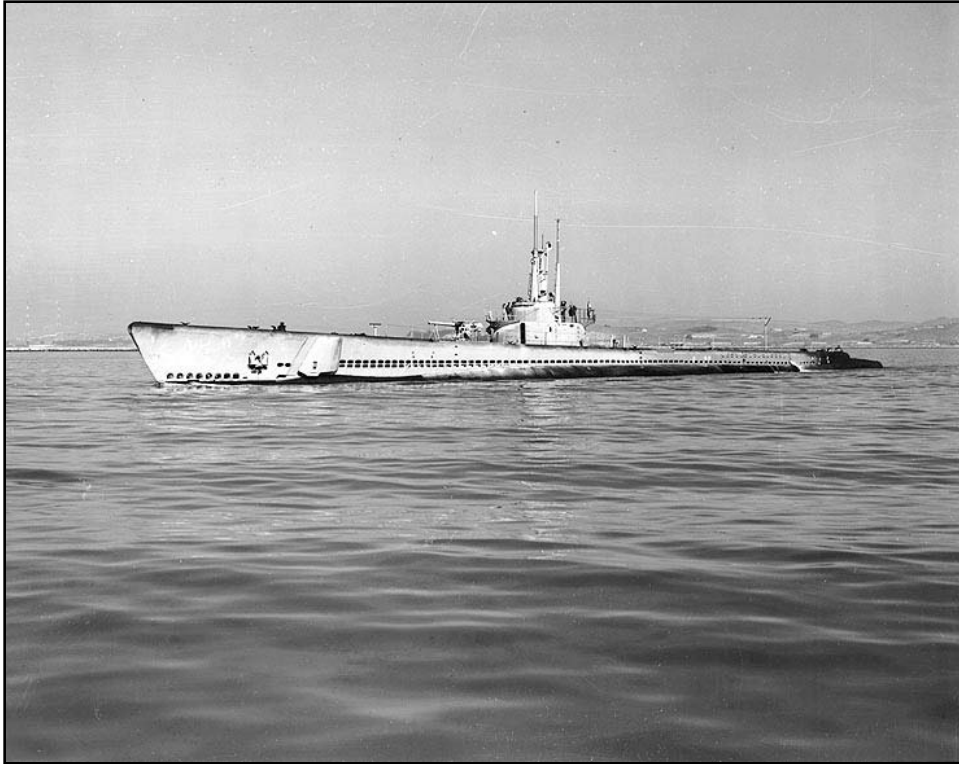
❖ **The Balao-class was a mainstay submarine design used during World War II, and <u>with 122 units built</u>, the largest class of submarines in the United States Navy.**

❖ **An improvement on the earlier Gato-class, the boats had slight internal differences. The most significant improvement was the use of thicker, higher yield strength steel in the pressure hull skins and frames, which increased their test depth to 400 feet.**

(more)

❖   **The propulsion of the Balao-class submarines was generally similar to that of the preceding Gato-class. Like their predecessors, they were true diesel-electric submarines: their four diesel engines powered electrical generators, and electric motors drove the shafts. There was no direct connection between the main engines and the shafts.**

USS Tench (SS-417) class
(1944-1951)

❖ <u>**The 29 Tench class**</u> **boats were built between 1944 and 1951. They were evolutionary improvement over the Gato and Balao classes, only about 35 to 40 tons larger, but more strongly built and with a slightly improved internal layout.**

(shown as a post WWII GUPPY conversion.)

❖ **Initial plans called for 146 to be built, but 115 were cancelled when it became apparent that they would not be needed to defeat Japan.**

❖ **Some of the class were updated through the GUPPY (The Greater Underwater Propulsion Power Program). The difference is noticeable by the level foredeck and the rounded nose.**

USS Barracuda (SS-550) class
(1949-1952)
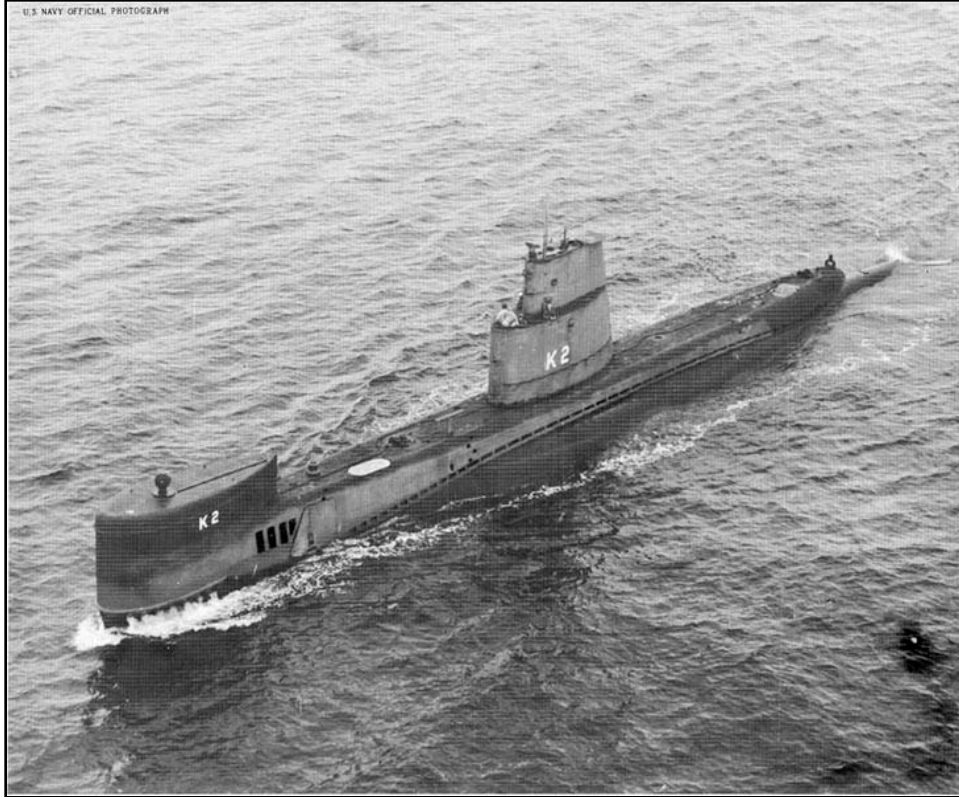
❖ **<u>The three SSK boats</u>**, Barracuda (SSK-1), Bass (SSK-2), and Bonita (SSK-3), were built around the large BQR-4 bow-mounted sonar array as part of Project Kayo, which experimented the use of passive acoustics with low-frequency, bow sonar arrays.

❖ The SSKs themselves were limited in their anti-submarine warfare abilities by their low speed and their need to snorkel periodically, but the advances in sonar technology they pioneered were invaluable to later nuclear-powered submarines.

(more)

❖ **Displacement: 765 tons (surf),1,160 tons (sub); Length: 196"1"; Beam: 24'7"; Draft:14'5".**

❖ **Propulsion: 3 × GM diesel engines, 2 × GE electric motors, two screws; Speed: 13 knots (surf), 8.5 knots (sub); Test depth: 400'.**

❖ **Complement: 37 officers and men; Armament: 4 × 21" torpedo tubes.**

USS Dolphin (AGSS-555)
Unique (1968)

❖ **USS Dolphin (AGSS-555) was the United States Navy's only operational diesel-electric, deep-diving, research and development submarine.**

❖ **The single most significant technical achievement in her development is the pressure hull, a constant diameter cylinder, closed at its ends with hemispherical heads, and deep frames instead of bulkheads.**

❖ **The submarine had no snorkel mast; her one hatch must be open while her diesels are running.**

(more)

❖ **Displacement: 861 tons; Length: 151'11"; Beam: 19' 8"; Draft: 15'9".**

❖ **Propulsion: 2 × GM 12-cylinder diesels, 2 × electric main motors, 330-cell silver-oxide battery; Speed: 10 knots (surf), 7.5 knots (sub).**

❖ **Test depth: 1,500 ft (operating), 3,000 ft (test - unclassified).**

❖ **Armament: .45 pistol, M14 rifle and shotgun for port defense.**

USS Tang (SS-563) class
(1949-1952)

❖ **Seven boats** designed and built (as opposed to modified) under the Greater Underwater Propulsion Power Program (GUPPY) for underwater performance rather than surfaced speed and handling.

❖ Displacement: 1,616 tons (surf), 2,100 tons (sub), Length: 287', Beam: 27', Draft: 17'.

❖ Speed: 16.3 knots (surf), 17.4 knots (sub).
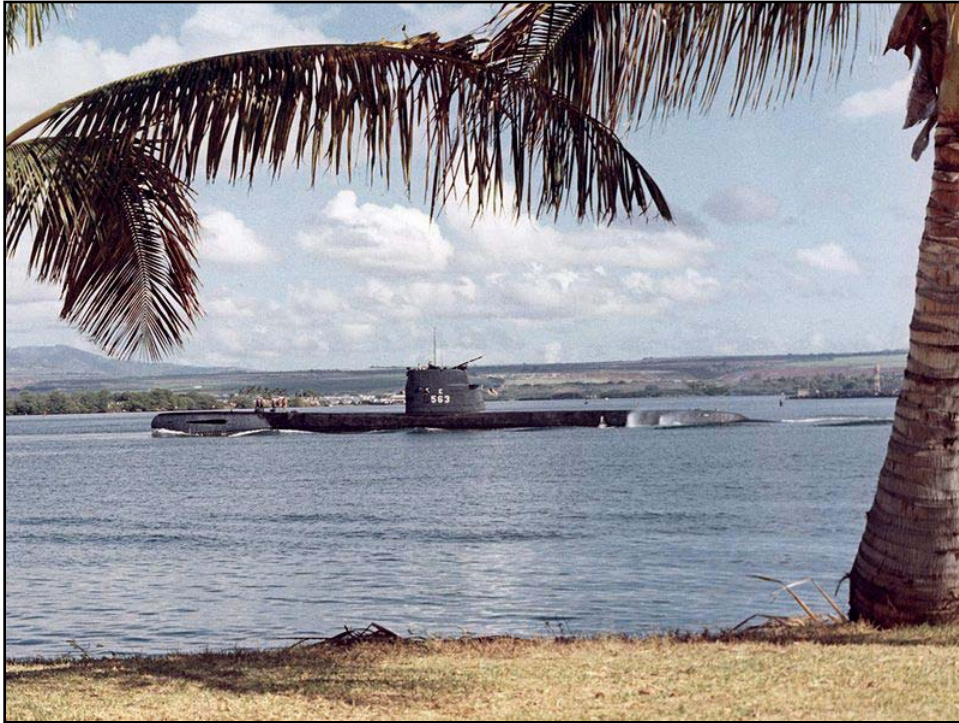
❖ Complement: 87 officers and men.

❖ Armament: 8 × 21" torpedo tubes (6 forward, 2 aft); 40 × Mk 49/57 mines.

USS Albacore (AGSS-569)
unique (1953)

Photo # 80-G-K-22262   USS Albacore off Newport, R.I., March 1957

❖ **Built primarily to test the streamlined hull form that is now standard, she later served as a research and development test bed.**

❖ **Displacement:
1,240 tons light, 1540 tons full.**

❖ **Length: 204"; Beam: 27';
Draft: 22'.**

❖ **Propulsion: Two Diesels,
one electric motor.**

❖ **Speed: 25 knots (surf), 33 knots (sub).**

❖ **Range: varied with configuration.**

❖ **Complement: 5 officers, 49 men.**

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USS T-1 (later USS Mackerel SST-1)
(1953 - 1972)

❖ **Two submarines** built in the early 1950s for use in training submarine personnel and testing submarine equipment.

❖ SST-1 was the Mackerel and SST-2 was the Marlin.

❖ Both submarines of the class served in these roles for over 19 years.

❖ Endurance: 90 minutes at full speed, 102 hours at 3 knots.

❖ Test depth: 712'(operating) 1,050' .

❖ Complement: 2 officers, 12 enlisted men.

❖ Armament: 1 × 21 in (533 mm) torpedo tube.
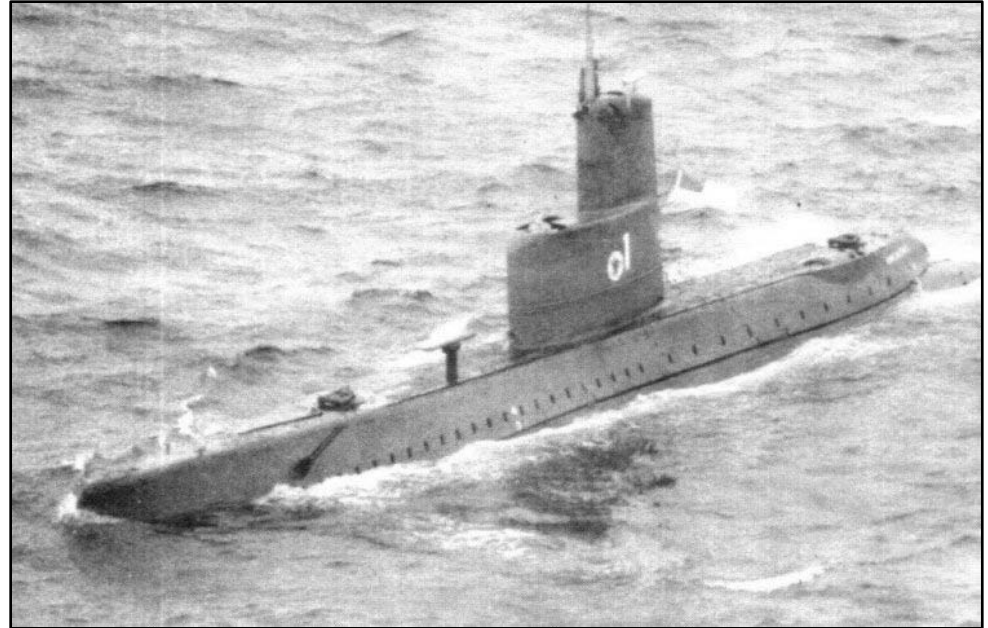
USS Nautilus (SSN-571)
unique (1954)

❖ The USN's – and the world's -- first nuclear powered submarine, her hull form was based on that of a fleet boat.

❖ Displacement: 2,980 tons light, 3,520 tons full.

❖ Length: 320 ft'; Beam: 28' ft; Draft: 26'.

❖ Propulsion: STR nuclear reactor (later re-designated S2W) 13,400 horsepower (10.0 MW)

❖ Speed: 23 knots.

❖ Complement: 13 officers, 92 enlisted men.

❖ Armament: 6 torpedo tubes.

USS Sailfish (SSR-572) class
(1953-1956)

❖ <u>Two ships</u>. **Sailfish was the first submarine built expressly for radar picket service. She and sister ship, Salmon, were the largest conventionally powered submarines in the United States Navy.**

❖ **On 3 February 1961, Sailfish was reclassified an attack submarine and given hull classification symbol SS-572.**

❖ **Length: 350', Beam: 29'1", Draft: 16' 4".**
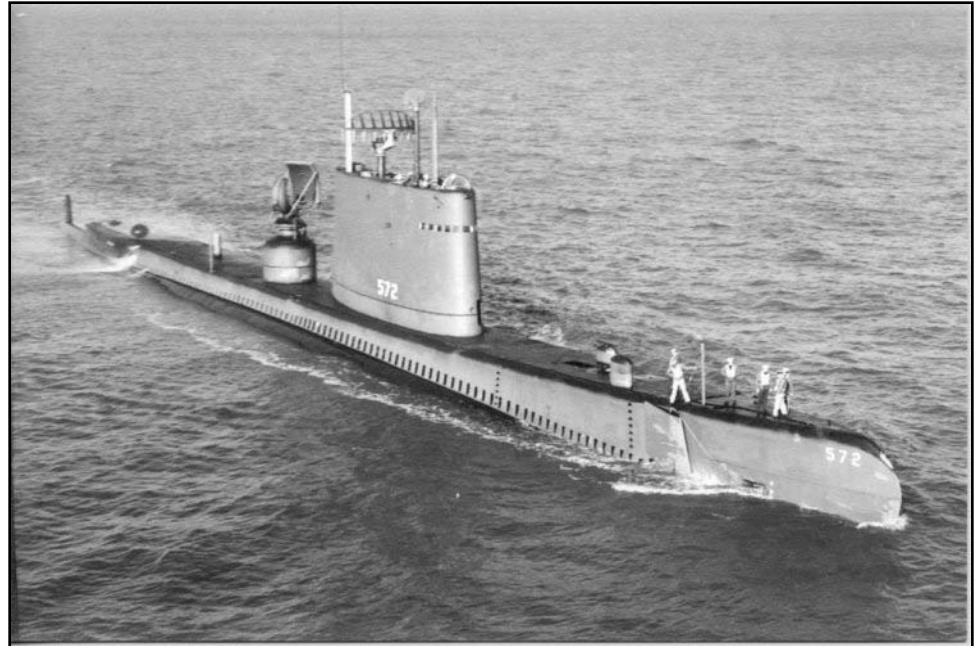
❖ **Propulsion: Diesel-electric, 2 screws; Speed: 20.5 knots (surf), 15 knots (sub).**

❖ **Complement: 95 officers and men.**

❖ **Armament: 6 × 21" torpedo tubes.**

USS Grayback (SSG-574) class
(1954-1958)

❖ **She and her sister ship** Growler were the first of the Navy's guided missile submarines to carry the Regulus II sea-to surface missiles.

❖ She conducted t nine deterrent missile strike missions.

❖ The Regulus missile program ended in 1964 and Grayback was withdrawn from active service.

❖ She was re-classified from a guided missile submarine to an amphibious transport submarine with hull classification symbol LPSS on 30 August 1968.

(more)

❖ **In June 1972, the Grayback carried a team of Navy seals into the coastal waters of North Vietnam as part of Operation Thunderhead. This was the last attempt during the Vietnam War to rescue American POWs held in North Vietnam**.

USS Seawolf (SSN-575)
unique (1957)

❖ Seawolf was technologically more advanced than her predecessor, Nautilus

❖ Her liquid-sodium cooled reactor was more efficient than a water-cooled one, and quieter, but posed several safety hazards for the ship and crew and was replace with a S2Wa PWR.

(more)

❖ **Although fully armed, Seawolf, like the first nuclear submarine, was primarily an experimental vessel.**

❖ **On 8 January 1971 she began overhaul and conversion to a special project platform.**

❖ **The euphemistic 'special project platform' description is explained by carefully examining photos of the ships from before and after the yard period. The extended hull forward of the sail held intelligence gathering equipment that supported covert operations.**

USS Darter (SS-576)
unique (1956-1989)

❖ **Based on the Tang-class, but incorporating many improvements.**

❖ **Darter was used to experiment with numerous innovations including a three-man helmsman-planesman station using aircraft-style stick controls. Speed: 15.5 kn (surf), 16 kn (sub).**

❖ **Test depth: 700'.**

❖ **Complement: 10 officers, 75 men.**

❖ **Armament: 8 × 21" torpedo tubes, (six forward, two aft).**

USS Skate (SSN-578) class
(1955-1959)

❖ **<u>The four Skate-class</u>** **submarines were the United States Navy's first production run of nuclear powered submarines.**

❖ **They were an evolution of the Tang class in everything but their propulsion plants.**

❖ **The four Skate class boats re-introduced stern torpedo tubes.**

❖ **Skate and Sargo were built with the S3W reactor.**

❖ **Swordfish and Seadragon also had the S3W reactor in the S4W reactor plant (same machinery in an alternate arrangement).**

USS Barbel (SS-580) class
(1956-1959)

❖ <u>The three Barbel-class</u> submarines, the last diesel-electric propelled attack submarines and the first production warships built with the teardrop-shape hull first tested on Albacore (SS-569)

❖ They also were the first to use an "attack center" within the hull rather than a conning tower in the sail.

❖ This class of submarine was taken out of service between 1988 and 1990, leaving the Navy with an entirely nuclear-powered submarine fleet.
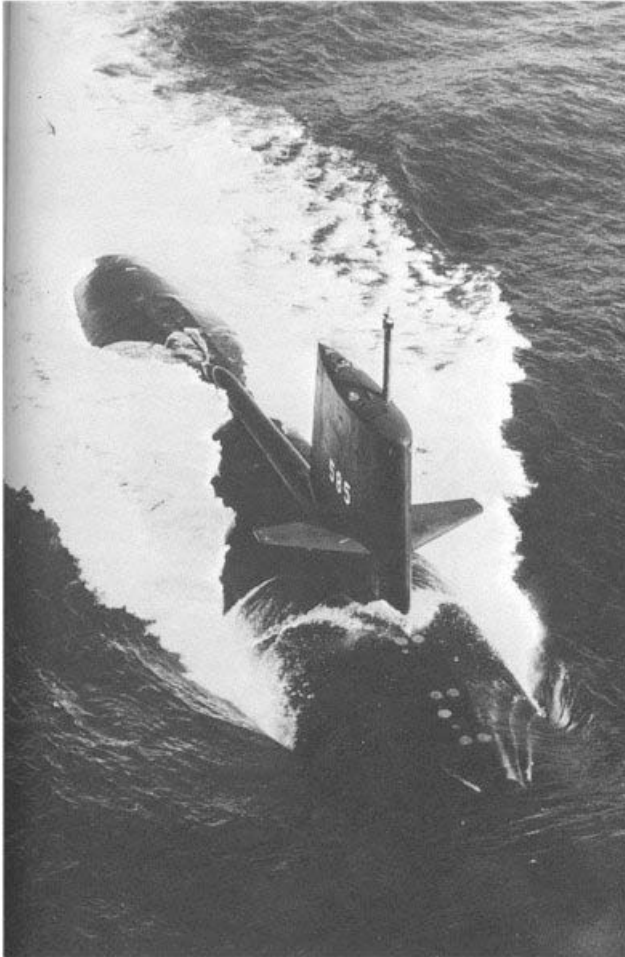

❖ The Barbel class' design is considered to be very effective and is comparable to the Soviet Kilo class submarine,.

USS Skipjack (SSN-585) class
(1956-1961)

❖   The <u>six boats</u> of Skipjack's design was based off of the successful Barbel class submarines that were based on the USS Albacore design.

❖   This required that the single screw was aft of the rudders and dive planes. The bow planes were moved to the massive sail to cut down on flow-induced noise near the bow sonar array.

❖   The Skipjacks also introduced the S5W reactor to U.S. nuclear submarines. The S5W was used on 98 U.S. nuclear submarines and the first British nuclear submarine, the HMS Dreadnought (S101).

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❖ **The George Washington class submarines were based off of the Skipjack design. The hull of USS Scorpion (SSN-589) was laid down twice as the original hull was redesigned to become the first US ballistic missile submarine USS George Washington (SSBN-598).**

USS Triton (SSRN/SSN-586)
unique (1959)

❖ At the time of her construction, Triton was the largest submarine ever built.

❖ She was the last submarine to have a conning tower, as well as the last American submarine to have twin screws or a stern torpedo room. Her sail was the largest ever aboard an American submarine.

❖ She also had a compartment solely for crew berthing, with 96 bunks, and two separate CPOs' quarters.

(more)

❖ **Propulsion: Two S4G pressurized-water nuclear reactors (PWR), two five-blade propellers.**

❖ **Speed: 30+ knots (surf), 27+ knots (sub).**

USS Halibut (SSGN/SSN-587)
unique (1960)
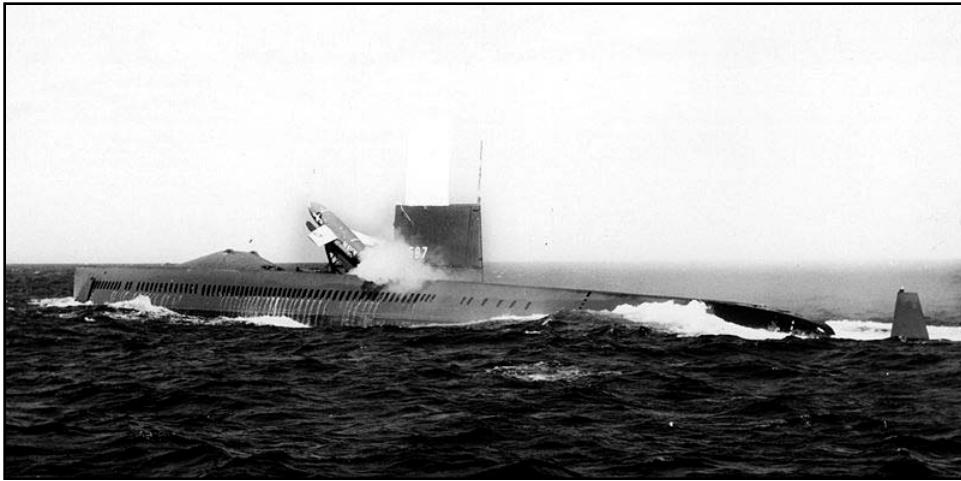
❖ **Begun as a diesel-electric submarine but completed with nuclear power, Halibut was the first submarine designed to launch guided missiles.**

❖ **Intended to carry the Regulus missile, her main deck was high above the waterline to provide a dry "flight deck." Her missile system was completely automated, with hydraulic machinery controlled from a central control station.**

(more)

❖   **Type: SSGN 1960-1965, Attack submarine 1965-1976.**

❖   **Propulsion: S3W reactor, two shafts.**

❖   **Armament: 1 Regulus missile launcher (five missiles); 6 × 21" torpedo tubes (four forward, two aft).**

USS Thresher/Permit (SSN-594) class
(1958-1968)

(more)

❖ The <u>14 Thresher/Permit</u> class boats were the replacement for the Skipjack class.

❖ They kept the proven S5W reactor plant from the Skipjack's, but were a radical change in many other ways.

❖ They had the large bow-mounted sonar and angled, amidships torpedo tubes pioneered by the Tullibee.

❖ Their pressure hulls were made using an improved process that extended test depth to 1,300 ft.

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❖   The engineering spaces were also redesigned, with the turbines supported on "rafts" that were suspended from the hull on sound damping isolation mounts. Their hulls were more effectively streamlined and had smaller sails.

❖   However, the increased displacement over the Skipjacks lead to top speed of around 28kts, five knots slower than the Skipjacks.

USS Tullibee (SSKN/SSN-597)
unique (1960)

❖ The Tullibee was a prototype "hunter-killer" (SSKN) submarine, the nuclear powered equivalent of the Barracuda class.

❖ Length: 273'; Displ: 2,300 tons (smallest US nuclear-powered attack submarine.)

❖ Initial crew size: 7 officers and 60 enlisted men. At inactivation: 13 officers and over 100 enlisted men.

❖ She was built to test the new bow sonar and amidships torpedo room configuration that is now standard for US submarines.

USS George Washington (SSBN-598) class
(1958-1961)

❖ <u>**Five boats in the class.**</u>

❖ **Originally laid down as the attack submarine Scorpion.**

❖ **During construction, she was lengthened by the insertion of a 130-foot- (40-meter)-long ballistic missile section and renamed George Washington.**

❖ **Because the ballistic missile compartment design of George Washington would be reused in later ship classes, the section inserted into George Washington was designed with a deeper test depth rating than the rest of the submarine.**

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❖	**Complement: Two crews (Blue/Gold) of 12 officers and 100 men.**

❖	**Armament: 16 Polaris A1/A3 missiles, 6 × 21" torpedo tubes (Mark 16, Mark 37, or Mark 48 torpedoes).**

USS Ethan Allen (SSBN-608) class
(1959-1963)

❖ **Ethan Allen was the first submarine designed as a ballistic missile launch platform. There <u>were five boats in her class</u>.**

❖ **She was constructed from HY80 steel (high yield, 80,000 psi yield strength), and was fitted with the Mark 2 Mod 3 Ships Inertial Navigation System (SINS).**

❖ **On 6 May 1962, Ethan Allen launched a nuclear-armed Polaris missile that detonated at 11,000 feet (3.4 km) over the South Pacific.**

❖ **That test (Frigate Bird), part of Operation Dominic I, was the only complete operational test of an American strategic missile. The warhead hit "right in the pickle barrel."**

USS Lafayette (SSBN-616) class
(1961-1964)

❖ **The nine Lafayette-class submarines were an evolutionary development from the Ethan Allen class of fleet ballistic missile submarine, slightly larger and generally improved.**

❖ **The first eight of the class initially had the Polaris A-2 missile, later being refitted with the longer ranged Polaris A-3. The USS Daniel Webster had A-3 missiles from the start.**

❖ **In the mid-1970s all of the class were upgraded to carry the Poseidon C3 missile.**
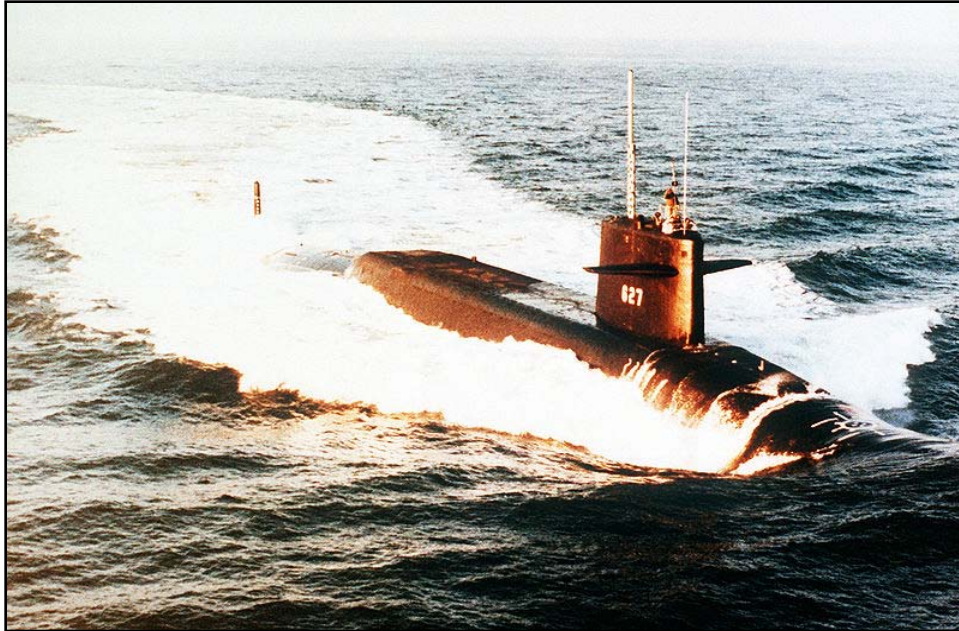
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❖　Unlike the similar James Madison and Benjamin Franklin classes, none of the Lafayette class submarines were refitted with Trident missiles. They were decommissioned between 1986 and 1992, with two, ex-Daniel Webster (MTS-626) and ex-Sam Rayburn (MTS-635) remaining in use as Moored Training Ship.

USS James Madison (SSBN-627) class
(1962-1964)

❖ **The James Madison <u>class of 10 submarines</u> were an evolutionary development from the Lafayette class of fleet ballistic missile submarine. They were identical to the Lafayettes except for being designed to carry the Polaris A-3 missile instead of the earlier A-2.**

❖ **Improvements in the James Madison class included the ballistic missile, guidance, fire control, navigation, and launcher systems. Significantly, in the A3, the number of reentry systems was increased from 1 to 3, making this the first multiple reentry vehicle missile.**

❖ **The guidance, fire control, and navigation systems were improved to account for the longer range of the A3 missile.**

USS Sturgeon (SSN-637) class
(1963-1975)

❖ **The Sturgeon-class (the 637 class) <u>of 37 attack submarine</u> were the "work horses" of the submarine attack fleet throughout much of the Cold War.**

❖ **They were phased out in the 1990s and early 21st century, as their successors, the Los Angeles, followed by the Seawolf and Virginia class boats, entered service.**

❖ **The Sturgeons were essentially lengthened and improved variants of the Thresher/Permit class that directly preceded them.**

(more)

❖ **The biggest difference was the much larger sail, which permitted the return of intelligence gathering masts to U.S. nuclear submarines. The fairwater planes mounted on the sail could rotate 90 degrees, allowing the submarine to surface through thin ice.**

❖ **The last nine Sturgeons were lengthened 10 feet to provide more space for intelligence-gathering equipment and to facilitate the use of dry dock shelters.**

USS Benjamin Franklin (SSBN-640) class
(1963-1967)

❖ **These <u>10 submarines</u> were an evolutionary development from the James Madison class.**

❖ **The Benjamin Franklin-class submarines were built with the Polaris A-3 ballistic missile, and later converted to carry the Poseidon C-3. During the late 1970s and early 1980s, selected units were further modified to carry Trident-I (C-4) ballistic missiles.**

❖ **Two submarines of this class were converted for delivery of special warfare units ashore. In the early 1990s, to make room for the Ohio-class ballistic missile submarines within the limits set by treaty.**

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❖ **The missile tubes of USS Kamehameha (SSBN-642) and USS James K. Polk SSBN-645) were disabled. Those boats were re-designated special operations attack submarines and given attack submarine (SSN) hull numbers.**

❖ **USS Kamehameha was decommissioned on 2 April 2002, the last ship of the Benjamin Franklin class to be decommissioned.**

USS Narwhal (SSN-671)
unique (1969)

❖ No other submarine has used all of Narwhal's innovations. These included a natural circulation reactor plant, scoop seawater injection (which was not repeated), the ability to cross connect main and auxiliary seawater systems, main air ejectors, and a directly-coupled main engine turbine. Her small reactor coolant pumps had two speeds: On and Off.

❖ She was the quietest submarine of her era, equaled only by the Ohio class and finally surpassed by the Seawolf-class.

❖ **Narwhal was fitted with a "turtleback" structure just forward of her rudder that may have been used for remote-controlled underwater vehicles, or for housing an experimental towed sonar array.**

USS Glenard P. Lipscomb (SSN-685)
unique (1974)

❖ She was the Navy's second design using a turbo-electric power plant similar to USS Tullibee (SSN-597).

❖ Intended to test the potential advantages of this propulsion system for providing quieter submarine operations, it was heavier and larger than similar vessels with conventional drive trains, which resulted in slower speeds.

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❖ **Those disadvantages, along with reliability issues, led to the decision not to use the design for the follow-on Los Angeles-class submarines. Other than the engine room, Glenard P. Lipscomb was generally similar to the Sturgeon-class, and although serving as a test platform, she was a fully combat-capable attack submarine.**

USS Los Angeles (SSN-688) class
(1972-1996)

❖ **This class of 62 boats** (also called 688 class,) of fast attack submarines (SSN) forms the backbone of the United States submarine fleet. It is the most numerous nuclear powered submarine class in the world.

❖ Except for USS Hyman G. Rickover (SSN-709), submarines of this class are named after U.S. cities, breaking a long-standing Navy tradition of naming attack submarines after sea creatures.

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❖ **The final 23 boats in the series, referred to as "688i" boats, are quieter than their predecessors and incorporate a more advanced combat system. These 688i boats are also designed for under-ice operations: their diving planes are on the bow rather than on the sail, and they have reinforced sails.**

USS Ohio (SSBN-726) class
(1976-1997)

❖ **The 14 Ohio class, also called Trident II SSBNs, carry approximately fifty percent of the total US strategic warhead inventory.**

❖ **The missiles have no pre-set targets when the submarine goes on patrol. Instead, they are capable of rapid targeting using secure and constant at-sea communications links.**

❖ **The Ohio class is the largest type of submarine ever constructed for the U.S. Navy.**

(more)

❖   To decrease the time for replenishment, three large logistics hatches are fitted to provide large diameter resupply and repair openings.

❖   The class design allows the vessel to operate for over fifteen years between major overhauls.

USS Ohio (SSGN-726) class
(2002-2010)

❖   After the end of the Cold War, <u>four Ohio-class</u> (*Ohio*, *Michigan*, *Florida* and *Georgia)* were modified to remain in service carrying conventionally-armed guided missiles, and were designated SSGNs.
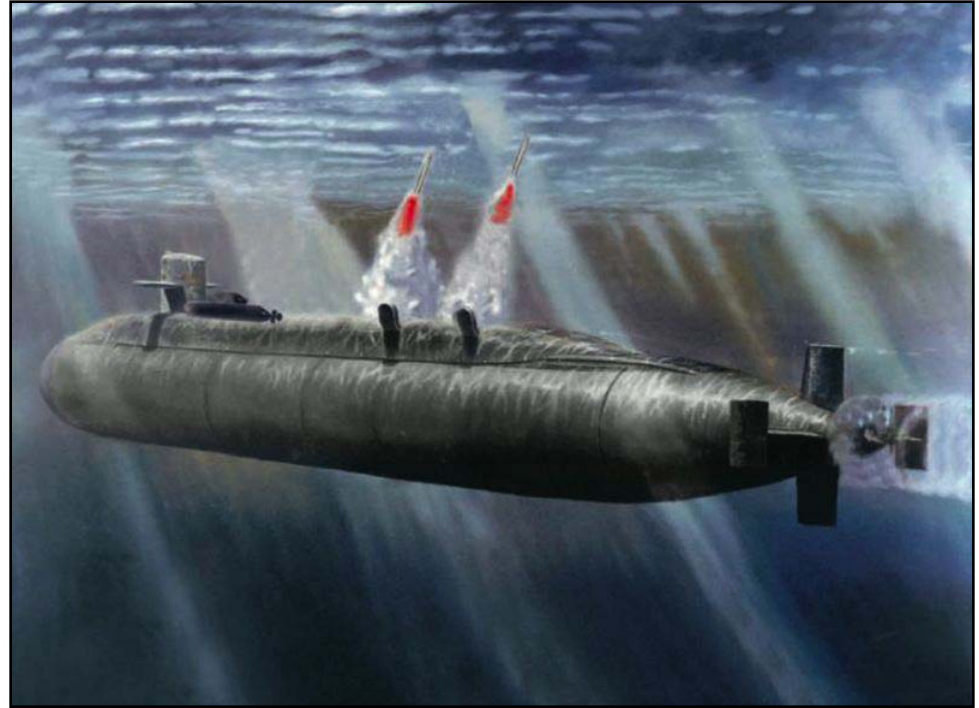
❖   22 of the 24 Trident missile tubes were modified to contain large vertical launch systems (VLS), one configuration of which may be a cluster of seven Tomahawk cruise missiles. In this configuration, the number of cruise missiles carried could be a maximum of 154.

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❖   **The missile tubes also have room for stowage canisters that can extend the forward deployment time for special forces. The other two Trident tubes are converted to swimmer lockout chambers. For special operations, the Advanced SEAL Delivery System and the Dry Deck Shelter can be mounted on the lockout chamber and the boat will be able to host up to 66 special operations sailors or Marines.**

USS Seawolf (SSN-21) class
(1989-2005)

❖   The Seawolf class attack submarine (SSN) was the intended successor to the Los Angeles class, ordered at the end of the Cold War in 1989. A total of 29 submarines was to be built over a ten-year period. It was later reduced to twelve submarines.

❖   The end of the Cold War and budget constraints led to the cancellation of any further additions to the fleet, leaving the just <u>three boats in the class.</u>

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❖	Compared to previous Los Angeles class submarines, Seawolf subs are larger, faster, and significantly quieter; they also carry more weapons and have twice as many torpedo tubes, for a total of 8.

❖	The boats also have extensive equipment for shallow-water operations, including a floodable silo capable of simultaneously deploying eight combat swimmers and their equipment. The boats carry up to 50 UGM-109 Tomahawk cruise missiles for attacking land and sea surface targets.

USS Virginia (SSN-774) class
(2000-?)

❖ The Virginia class (or SSN-774 class) are designed for a broad spectrum of open-ocean and littoral missions. <u>30 ships are planned</u>.

❖ They're a less expensive alternative to the Cold War-era designed Seawolf class attack submarines, and they are slated to replace the aging Los Angeles class submarines.
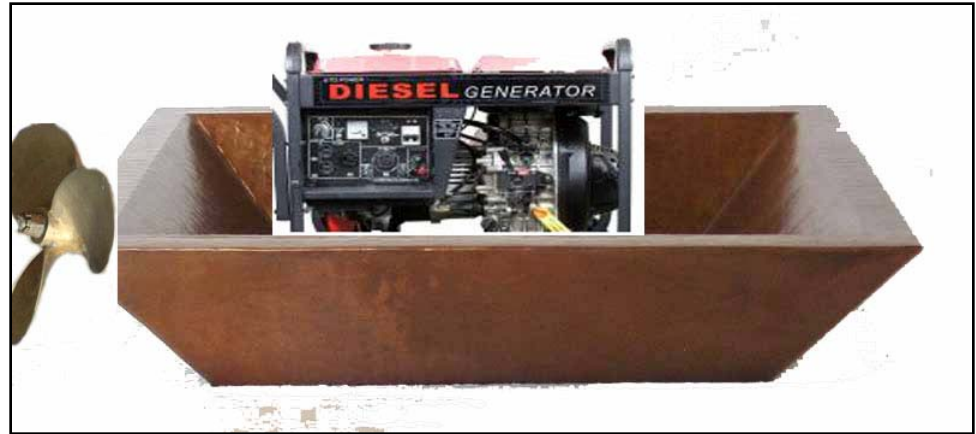
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❖ **For the first time, instead of a traditional periscope, the class utilizes a pair of telescoping photonics masts located outside the pressure hull. Each mast contains high-resolution cameras, along with light-intensification and infrared sensors, an infrared laser rangefinder, and an integrated Electronic Support Measures (ESM) array.**

❖ **The class also makes use of pump-jet propulsors, which significantly reduces the risks of cavitation, allowing for quieter and faster operations.**
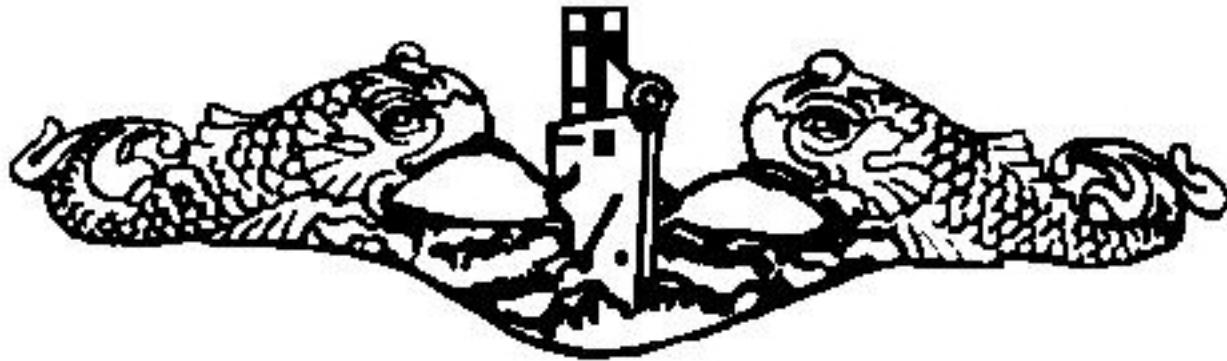
USS Oldtimer (SS-69-4-U) class
(2 weeks)

❖ **This class of boat was developed to calm the nerves of all the old-time submarine sailors.**

❖ **It is probably not sea-worthy, has a top speed of about 25 feet per hour and a range of about 100 feet.**

❖ **But, <u>by God</u>, it has a diesel engine.**

❖ **Crew size is related to rub-a-dub, dub (three men in a tub?**

The End