# THE U.S. NAVAL NUCLEAR PROPULSION PROGRAM

# 2025

*More than 177 million miles safely steamed on nuclear power.*

The world's first nuclear-powered submarine, USS Nautilus (SSN 571), underway in June 1965.

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## MORE THAN 75 YEARS OF POWERING MARITIME DOMINANCE

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# Naval Nuclear Propulsion Program

For more than 75 years, the Naval Nuclear Propulsion Program has powered maritime dominance for the U.S. Navy and the Nation. America is a maritime nation. The seas are the lifeblood of our economy, our national security, and our way of life. With 90% of global commerce traveling by sea, the Navy safeguards the world's economy from hostile nations and organizations that threaten international waters. The Navy's track record of keeping America safe is so sound that most Americans cannot recall a time in their lives when they feared attack from another nation's naval force. We keep threats away from our shores by operating abroad. Today and every day you can find nearly 100 ships and submarines underway around the globe. There is no substitute for presence. Nuclear propulsion plays a critical role in national security by providing the mobility, flexibility, and endurance that today's Navy requires to meet a growing number of missions across the globe. Nearly half of the Navy's major combatants are nuclear-powered: 11 aircraft carriers, 48 attack submarines, 14 ballistic missile submarines, and 4 guided-missile submarines[1].

The vision of the Naval Nuclear Propulsion Program, also known as Naval Reactors, is a U.S. Navy fleet that dominates the maritime domain with unmatched power and propulsion. The mission is to harness the atom to safely, reliably, and affordably power a global fleet that enables unrivaled responsiveness, endurance, stealth, and warfighting capability. Meeting the mission requires the combination of fully trained U.S. Navy men and women with ships that excel in endurance, stealth, speed, and independence from logistics supply chains.

Naval Reactors' organic statute, at 50 U.S.C. §§ 2406, 2511, codifying Presidential Executive Order 12344, sets forth the total responsibility of Naval Reactors for all aspects of the Navy's nuclear propulsion, including research, design, construction, testing, operation, maintenance, and ultimate disposition of naval nuclear propulsion plants. The Program's responsibility includes all related facilities, radiological controls, environmental safety, and health matters, as well as selection, training, and assignment of personnel. All of this work is accomplished by a lean network of dedicated research laboratories, nuclear-capable shipyards, equipment contractors and suppliers, and training facilities that are centrally controlled by a small headquarters staff. The Director, Naval Reactors, is Adm. Bill Houston, who also serves as a Deputy Administrator in the National Nuclear Security Administration.

Naval Reactors maintains an outstanding record of over 177 million miles safely steamed on nuclear power. The Program currently operates 97 reactors and has accumulated over 7,600 reactor-years of operation. A leader in environmental protection, the Program has published annual environmental reports since the 1960s, proving that the Program has not had an adverse effect on human health or on the quality of the environment. Because of the Program's demonstrated reliability, U.S. nuclear-powered warships are welcomed in more than 150 ports of call in over 50 foreign countries and dependencies.

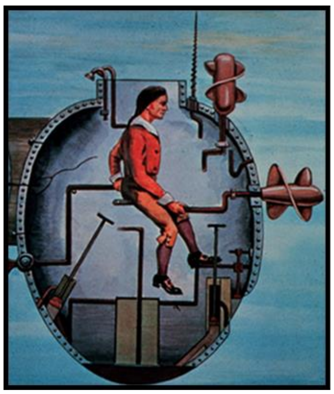
[1] Data throughout this book reflects status of the Naval Nuclear Propulsion Program as of December 2024.

Since USS Nautilus (SSN 571) first signaled "**UNDERWAY ON NUCLEAR POWER**" in 1955, our nuclear-powered ships and submarines have demonstrated their superiority in defending the country — from the Cold War to unconventional threats and today's strategic competition — to advances that will continue to power maritime dominance for the next 75 years.

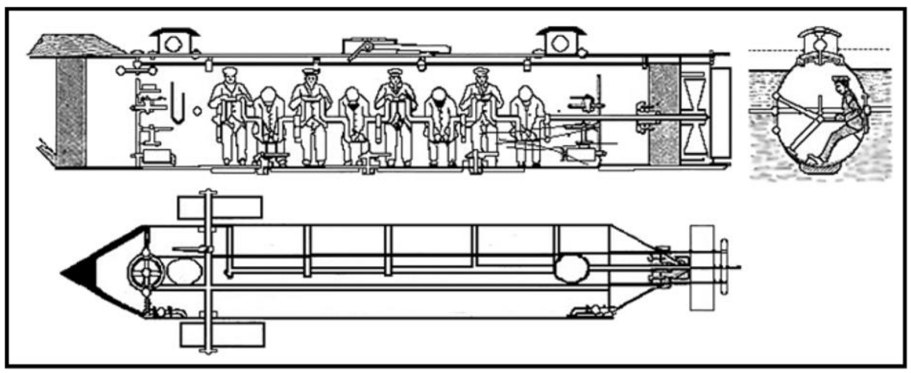
The Ohio-class guided-missile submarine USS Georgia (SSGN 729) begins to submerge near Naples, Italy.

# Advantages of Naval Nuclear Power

**Submarines:** Before the advent of nuclear power, the submarine was, in reality, a small surface ship that could submerge only for short periods of time. The earliest versions of the submarine, Bushnell's *Turtle* (ca. 1775) and the Confederate *CSS H. L. Hunley* (ca. 1864), were propelled by human effort and were limited by human endurance and the amount of oxygen within the vessel upon submergence. Later versions of the submarine required oxygen and fossil fuel to operate engines, which in turn required drawing air in and blowing combustion products out. This meant the submarine had to be either on or close enough to the surface to use a snorkel, which made the ship susceptible to detection. To avoid detection, the ship had to submerge and rely on electric batteries, which depleted within several hours. The ship would then have to surface or snorkel again to start the diesel and recharge the batteries.



Bushnell's Turtle



CSS H. L. Hunley

Although diesel submarines can be relatively quiet when submerged on batteries, they have very limited endurance and power. There are other forms of air-independent propulsion that allow submarines to be submerged for weeks at a time if they remain at very low speeds. Because of the large amount of oxygen that must be stored onboard, these propulsion systems are insufficient for warships contributing to global maritime influence.

By eliminating the need for oxygen for propulsion, nuclear power allows a submerged submarine to drive at high speeds without concern for fuel consumption, to operate fully-capable sensors and weapons systems, and to support a safe and comfortable living environment for the crew.  Only a nuclear-powered submarine can operate anywhere in the world's oceans, including under the polar ice, undetected and at maximum capability for extended periods. Further, nuclear power provides endurance at high speeds, allowing strategic changes of missions from one location to another.

The Seawolf-class fast-attack submarine USS Connecticut (SSN 22), left, Los Angeles-class fast-attack submarine USS Hartford (SSN 768), center, and the Royal Navy hunter killer submarine, HMS Trenchant (S-91) surface through the ice during a multinational maritime exercise in the Arctic Circle.

**Surface Ships:** With high-speed endurance to provide strategic flexibility; speed and responsiveness to provide tactical flexibility; and mobility while on-station, nuclear-powered aircraft carriers can respond to crises more quickly, arrive in a higher condition of readiness, and stay on-station longer with less logistics support than their fossil-fueled counterparts. Mobility and security of fuel supplies are among a fleet commander's greatest concerns. Nuclear propulsion dramatically reduces these concerns by providing the ship virtually unlimited high-speed propulsion endurance without dependence on fossil-fuel tankers or their escorts.

For example, USS Enterprise (CVN 65), USS Long Beach (CGN 9), and USS Bainbridge (CGN 25) left the Mediterranean on July 31, 1964, for a 65-day, 30,000-mile cruise around the world, which was carried out completely free from refueling or logistics support. More recently, USS John C. Stennis (CVN 74) and USS Abraham Lincoln (CVN 72) completed around-the-world deployments in support of national tasking, and in 2021, USS Nimitz (CVN 68) completed a 321-day deployment with no port calls.


Nuclear-powered warships, USS Enterprise (CVN 65), USS Long Beach (CGN 9), and USS Bainbridge (CGN 25) on their around-the-world cruise.

Moreover, the compact, energy-dense nature of a nuclear propulsion plant eliminates large-volume tankage requirements for propulsion fuel and reduces space devoted to combustion air and exhaust. This permits increased storage capacity for combat consumables (weapons, aircraft fuel, stores), which improves sustainability and reduces underway replenishment requirements.

# Today's Mission

The Naval Nuclear Propulsion Program exists to provide the United States with the most capable warships in the world.

## *Nuclear-Powered Submarines*

Since Nautilus, follow-on classes of ever more capable U.S. nuclear-powered attack submarines (SSNs) have ensured a warfighting edge over any potential adversary. Forward-deployed SSNs, either alone and unsupported or with strike groups, can exert influence throughout the world, safeguarding vital commercial sea-lanes, protecting aircraft carrier and expeditionary strike groups, and creating tactical uncertainty for an enemy who must tie up their own fleet units in defensive roles. Our SSNs operate virtually undetected in all the world's oceans, even under the Arctic ice. Cruise missiles launched from an unseen, submerged SSN can reach targets deep inland. Perhaps most important, SSNs guarantee access. Access to hostile areas for intelligence gathering, as well as "clearing the way" to ensure access for other U.S. naval forces. With fewer bases overseas, our SSNs represent a stealthy, far-reaching force that will be called upon to shoulder a large part of the defense burden, even in low-intensity conflicts. SSNs provide real-time, actionable intelligence to combatant commanders and can quickly strike with precision or deploy Special Operations Forces. Simply put, no other warfighting platform can match the stealth, endurance, mobility, and mix of capabilities that these apex predators bring to the battle.

Lt. Cmdr. Nicholas Biela stands maneuvering watch as surfaced officer of the deck aboard the Virginia-class attack submarine USS Delaware (SSN 791) while underway in the U.S. 4th Fleet area of operations.

Today's active SSN fleet comprises 24 Los Angeles-class SSNs, 3 Seawolf-class SSNs, and 22 Virginia-class SSNs.

The Virginia class is the replacement for the Los Angeles class, whose earliest boats were commissioned in the 1970s. The lead ship, USS Virginia (SSN 774), was commissioned Oct. 23, 2004. Virginia is the Navy's first major combatant designed with the post-Cold War security environment in mind. and is uniquely suited for dominance in both shallow and deep waters. Virginia-class submarines can carry out a variety of missions in shallow water near land, from anti-submarine warfare to precision strike, covert intelligence gathering, minefield mapping and mine delivery, and Special Operations Force delivery. These submarines have many innovations including integrated command, control, communications, and intelligence (C3I) systems; non-hull-penetrating photonics masts; and reconfigurable torpedo rooms to accommodate a large number of Special Operations Force personnel. Virginia-class submarines are equipped with a nine-person lockout chamber and can be equipped with a Dry Deck Shelter (DDS) for Special Operations Force support.

The number of non-allied countries that are seeking or have obtained diesel, air-independent propulsion (AIP), and nuclear-powered submarines is an increasing concern to national security and the military balance in critical regions of the world. The superior stealth, mobility, endurance, and firepower of our SSNs will enable the United States to successfully combat these threats, whether in deep or shallow waters.

The Virginia-class reactor plant is designed to last the entire planned 33-year life of the ship without refueling. This will help to reduce life-cycle cost while increasing the time the ship is available to perform missions.

The Virginia-class modular design gives each ship the flexibility to support future technology upgrades and advanced payloads. This flexibility will ensure that these submarines will maintain warfighting superiority over any adversary well into the future.

The Virginia-class fast attack submarine USS New Hampshire (SSN 778) transits the Thames River.

For over six decades, U.S. ballistic missile submarines (SSBNs) have provided strategic deterrence. These warships are virtually undetectable while submerged, forming the most survivable component of the U.S. strategic deterrent. This force is currently comprised of 14 Ohio-class SSBNs, each capable of carrying 20 Trident II missiles. At 560 feet in length and 18,700 tons displacement, Ohio-class SSBNs are the largest U.S. nuclear-powered submarines.

Ohio-class submarines are nearing the end of their service lives and will be replaced by the Columbia class. A new reactor core and propulsion plant design support this next-generation ballistic missile submarine, including electric-drive propulsion and a life-of-the-ship core that will provide the Columbia class with unprecedented stealth and a service life in excess of 40 years. Ultimately, this will allow Columbia-class SSBNs to cover the Nation's deterrent requirements with an expected savings of greater than $40 billion. Technology supporting the new reactor core and electric-drive were developed and tested over the last several decades. Construction is focused on both capability and affordability, drawing on existing technologies currently deployed on Virginia-class submarines, as well as new concepts for survivability, integration, automation, and modularity, addressing current and projected threats and reducing life-cycle costs. Lead ship construction commenced in fiscal year 2021 to support strategic deterrent patrols starting in 2031.

> *"As every ballistic-missile submarine has since the keel laying of USS George Washington (SSBN 598) here at Electric Boat in November 1958 – the District of Columbia, and all those in its class will continue to serve as the most survivable leg of the nuclear triad – standing constant watch far beneath the waves, as we have done for over 63 years – a stalwart deterrent against those would seek to do the unspeakable."*
> *– Adm. Daryl Caudle, Commander, U.S. Fleet Forces*

The Ohio-class ballistic missile submarine USS Louisiana (SSBN 743) transits Puget Sound.

Four SSBNs were converted into nuclear-powered-guided missile submarines (SSGNs). As the fleet's SSGNs, USS Ohio (SSGN 726), USS Michigan (SSGN 727), USS Florida (SSGN 728), and USS Georgia (SSGN 729) are providing significant capabilities to combatant commanders.

Each of an SSGN's 24 missile tubes has an inside diameter of over 7 feet and can be converted to launch multiple Tomahawk-guided missiles or to deploy a number of large payloads, such as unmanned underwater vehicles (UUVs) and special sensors.

Each SSGN can covertly enter a battlespace carrying unconventional payloads and up to 154 guided missiles, plus a large number of Special Operations Force personnel. This gives battlefield commanders more surprise strike options, covert information-gathering methods, and communication pathways.

The Ohio-class guided-missile submarine USS Florida (SSGN 728) and a CV-22 Osprey participate in a Special Operations Force interoperability exercise in the Mediterranean Sea.

# *Nuclear-Powered Aircraft Carriers*

In times of crisis around the world, one of the first questions the President asks is "where are the aircraft carriers?"  Each aircraft carrier provides the Nation 4.5 acres of highly mobile sovereign territory, unconstrained by local host-nation laws and politics, from which to project flexible, rapid, visible, and credible U.S. military power as needed to keep the peace, deter conflicts, protect American interests, or fight a war.  Nuclear-powered aircraft carriers (CVNs) can transit to the scene at sustained high speed (without the logistics support that would be needed for a fossil-fueled aircraft carrier) and arrive fully ready to launch the formidable firepower of the air wing.  They can sustain that presence and response without immediate replenishment of combat consumables, with tactical mobility and flexibility, free from the need for propulsion fuel replenishment.  CVNs have greater weapons and fuel-storage capacity to sustain both long-term flight operations and to refuel their conventionally-powered escorts, as the logistics dictate.

The Nimitz-class aircraft carrier USS John C. Stennis (CVN 74) leads a close formation.

Since 1967, when Congress authorized the construction of USS Nimitz (CVN 68), the Nation has moved toward an all nuclear-powered aircraft carrier force. Following the commissioning of USS Gerald R. Ford (CVN 78) in July 2017, our carrier fleet consists of 11 CVNs, with John F. Kennedy (CVN 79) and Enterprise (CVN 80) currently under construction. These are the largest warships of any navy in the world.  Nuclear propulsion provides unique tactical mobility and flexibility, responsiveness, and sustainability, all key attributes in sustaining the ability of our CVN force to meet the demands of forward presence and crisis response.

The Gerald R. Ford class represents the convergence of two paths: a dedication to current missions and innovation for future needs. Significant advances in this class's warfighting capabilities and technologies, including a 33% increase in sortie generation rate, a tripling of the electrical generating power, an increase in core energy, and a cost reduction in manpower and planned maintenance make the Gerald R. Ford class a key investment in 21st-century capability. The nuclear propulsion plant will increase operational availability, enhance survivability, and improve reliability. In addition to reducing acquisition and life-cycle costs by approximately $4 billion, these benefits will create a higher quality of life for the crew and improve the capability to incorporate future warfighting technology.


The world's largest aircraft carrier, USS Gerald R. Ford (CVN 78) transits the Strait of Gibraltar.

# What is the Naval Nuclear Propulsion Program?

The Naval Nuclear Propulsion Program comprises the military and civilian personnel who design, build, operate, maintain, and manage the nuclear-powered ships and the many facilities that support the U.S. nuclear-powered naval fleet. The Program has cradle-to-grave responsibility for all naval nuclear propulsion matters. Program responsibilities are delineated in 50 U.S.C. §§ 2406, 2511 (codifying Presidential Executive Order 12344 of Feb. 1, 1982).

Program elements include the following:

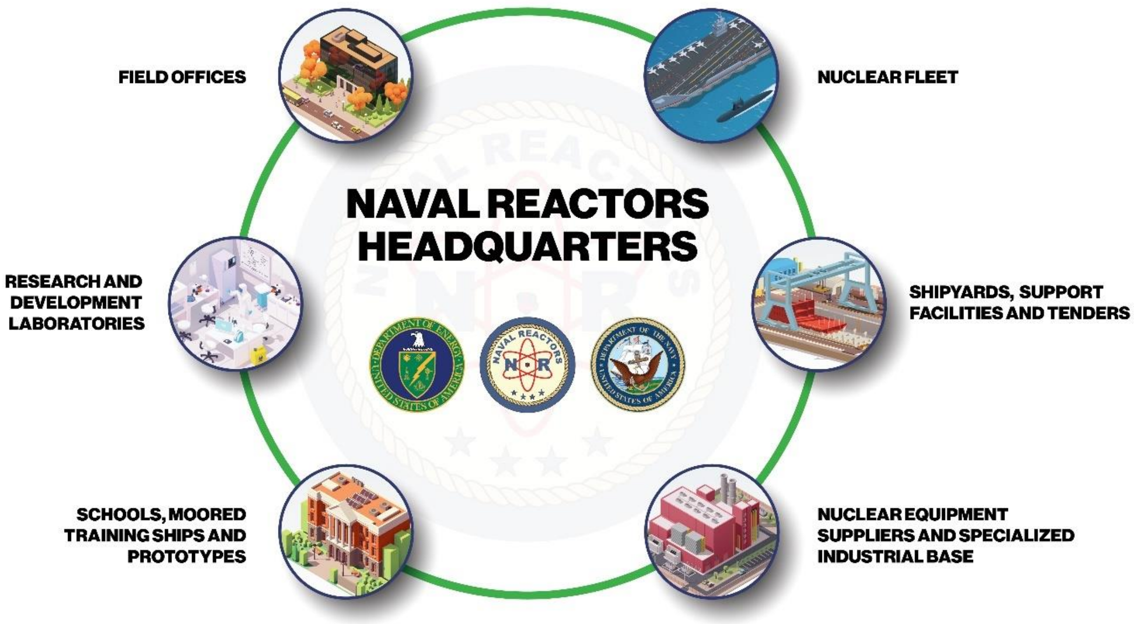
- Research, development, and support laboratories
- Contractors responsible for designing, procuring, and building propulsion plant equipment
- Shipyards that build, overhaul, and service the propulsion plants of nuclear-powered vessels
- Navy support facilities and tenders
- Nuclear power schools and Naval Reactors training facilities
- Naval Nuclear Propulsion Program Headquarters and Field Offices.

*"Naval Reactors, and our nuclear-powered warships will continue to be a centerpiece, an integral centerpiece, of our National Security Posture."*
*– Adm. Frank L. "Skip" Bowman, Director of Naval Reactors 1996-2004*

*"It's a unique Program in the sense that it has continued to be revolutionary and I think the Program it's as strong, it is as capable as it can be with so much more that it can do in the future. At the same time, I would say, it didn't get to this 75 years by accident, and the work that went into achieving that record of excellence was a day-by-day, hour-by-hour thing that has to continue in that fashion to go forward successfully."*
*– Adm. Kirkland Donald, Director of Naval Reactors 2004-2012*

# Naval Nuclear Propulsion Program

The Naval Nuclear Propulsion Program is responsible for the research, design, construction, testing, operation, maintenance, and ultimate disposition of naval nuclear propulsion plants.




## *Headquarters*

Naval Reactors Headquarters provides oversight and direction for all Program elements. Because of the highly complex nature of nuclear technology, all major technical decisions regarding design, procurement, operations, maintenance, training, and logistics are made by a Headquarters staff with expertise in nuclear technology.

Headquarters engineers set standards and specifications for all Program work, while onsite Headquarters representatives monitor the work at the laboratories, prototypes, shipyards, and prime contractors.

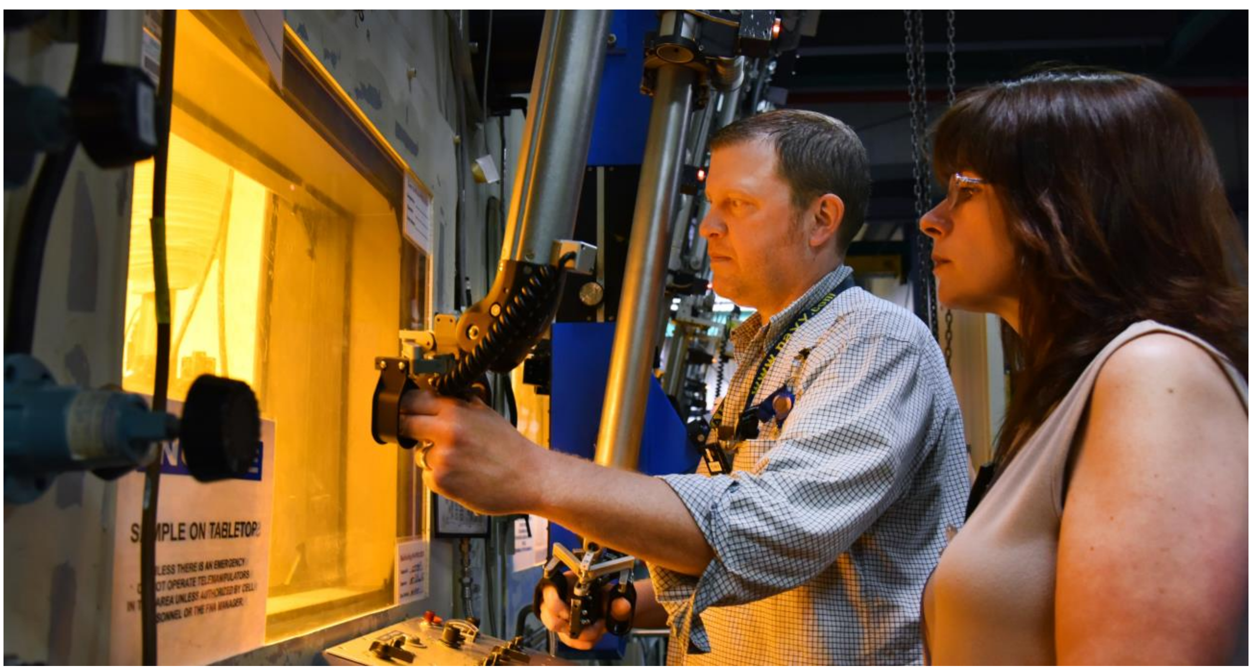
Based on more than 75 years of engineering experience in nuclear propulsion, the Headquarters organization exercises exacting control over all aspects of the Program, demanding unparalleled technical excellence and discipline.

## *Research, Development, and Support Laboratories*

The Naval Nuclear Laboratory (NNL) consists of four government-owned/contractor-operated sites supporting the Program: Bettis Atomic Power Laboratory (Bettis) in Pittsburgh, Pennsylvania; Knolls Atomic Power Laboratory (KAPL) in Schenectady, New York; Kenneth A. Kesselring (Kesselring) Site in West Milton, New York; and Naval Reactors Facility within the Idaho National Laboratory. Currently, the prime contractor is Fluor Marine Propulsion, LLC.

Bettis and KAPL are research and engineering facilities devoted solely to naval nuclear propulsion work. With combined staffs of nearly 8,000 engineers, scientists, technicians, and support personnel, their mission is to develop the most advanced naval nuclear propulsion technology and to provide technical support for the continued safe, reliable operation of all existing naval reactors. KAPL also operates a prototype nuclear propulsion plant at the Kesselring Site in New York for the operational testing of new designs and promising new technologies under typical operating conditions before introducing them into the fleet. Both Bettis and KAPL offer post-graduate research opportunities through the Rickover Fellowship in Nuclear Engineering.[2] The Naval Reactors Facility, located within the Idaho National Laboratory, examines naval spent nuclear fuel and irradiated test specimens. The data derived from these examinations are used to develop new technology and to improve the cost-effectiveness of existing designs.

The combined efforts of the Program's research, development, and support labs have led to tremendous advances in naval reactor technology. For example, the first submarine core endurance was about 62,000 miles; today, submarine and aircraft carrier cores have an endurance of over 1 million miles.



Personnel at Knolls Atomic Power Laboratory.

[2] For more information, visit the South Carolina Universities Research & Education Foundation website at http://scuref.org/rfp-01

## *Nuclear Component Procurement Organization*

Since the late 1950s, the Naval Nuclear Propulsion Program has had dedicated prime contractor support to provide engineering, procurement, and technical oversight of naval nuclear components. Currently, the prime contractor is Bechtel Plant Machinery, Inc. (BPMI), with locations in Pittsburgh, Pennsylvania and Schenectady, New York. BPMI is involved in the design, purchase, quality control, and delivery of major propulsion plant components for installation in nuclear-powered aircraft carriers, submarines, and prototype plants.

Bechtel Plant Machinery, Inc. (BPMI) Headquarters located in Pittsburgh, Pennsylvania.

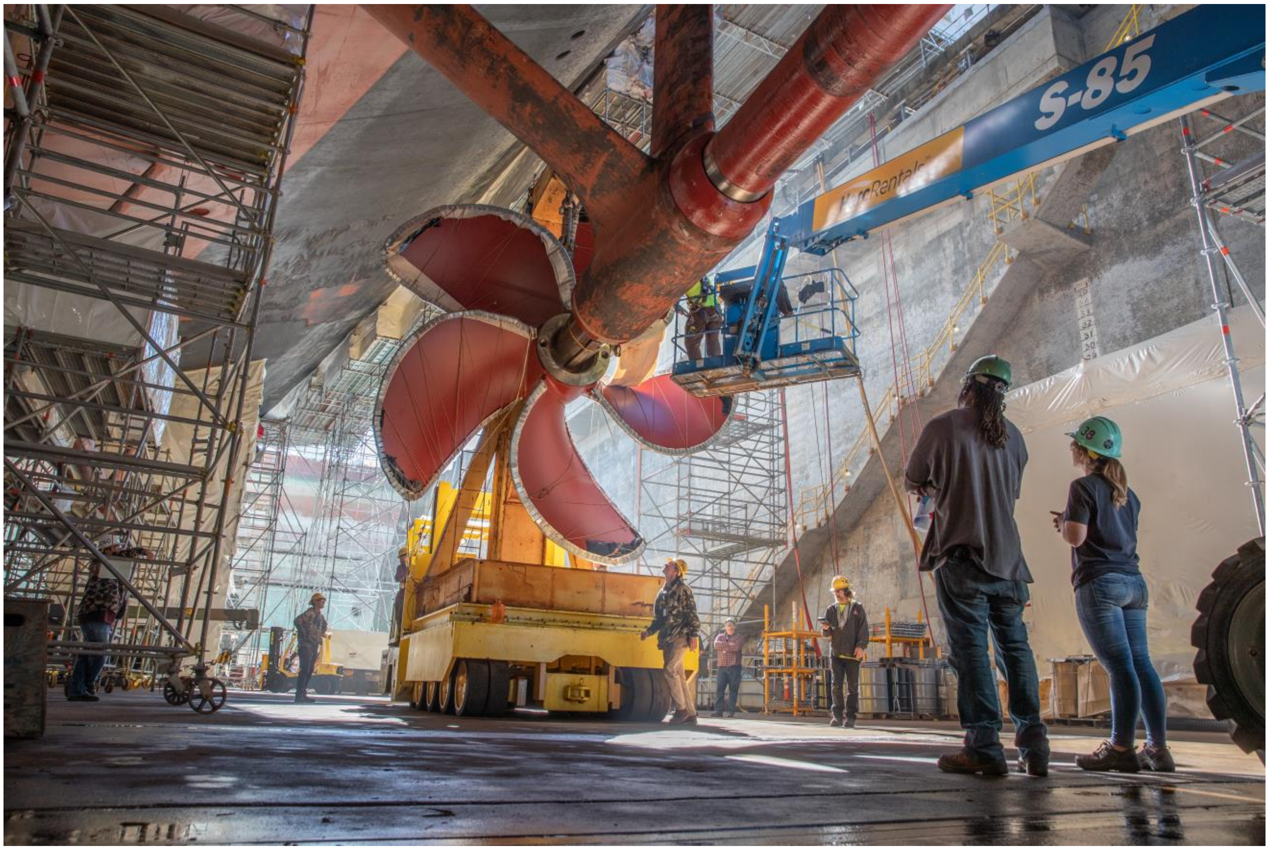
## *Nuclear Equipment Suppliers*

A number of privately-owned companies throughout the United States perform the actual design and fabrication of the major propulsion plant components. Manufacturing the heavy components used in naval nuclear propulsion plants requires 4-8 years of precision machining, welding, grinding, heat treatment, and nondestructive testing of large specialty metal forgings, under carefully-controlled conditions. Standards for naval applications are far more rigorous and stringent than those required for civilian nuclear reactors because components on warships must be designed and built to accommodate battle shock; radiated noise limits; crew proximity to the reactor; and frequent, rapid changes in reactor power. Many of these equipment manufacturers have been supplying the Program for several decades.

## *Shipyards*

Two private shipyards build all our nuclear-powered ships. These two shipyards, together with four public shipyards, provide the Nation's capability to overhaul, repair, refuel, and inactivate nuclear-powered ships. These complicated tasks require an experienced and skilled workforce specifically trained to do naval nuclear propulsion work. With approximately 70,000 employees, these six shipyards are unique industrial assets with capabilities found nowhere else in America.

| Shipyard | Sector | Location |
|---|---|---|
| General Dynamics Electric Boat | Private | Groton, Connecticut |
| Huntington Ingalls Industries – Newport News Shipbuilding | Private | Newport News, Virginia |
| Norfolk Naval Shipyard | Public | Portsmouth, Virginia |
| Pearl Harbor Naval Shipyard & Intermediate Maintenance Facility | Public | Pearl Harbor, Hawaii |
| Portsmouth Naval Shipyard | Public | Kittery, Maine |
| Puget Sound Naval Shipyard & Intermediate Maintenance Facility | Public | Bremerton, Washington |




Inside Dry Dock 6 at Puget Sound Naval Shipyard & Intermediate Maintenance Facility.

## *Support Facilities and Tenders*

Deployed tenders and support facilities at major bases perform maintenance and repair on nuclear-powered ships outside of major shipyard availability periods. Staffed by specially trained personnel, these facilities provide upkeep and resupply support for the fleet. The tenders are themselves seagoing naval vessels that routinely perform their missions while deployed all over the world. The ability of the nuclear-powered fleet to remain on-station is enhanced by the ability to forward-deploy repair and maintenance activities.


The submarine tender USS Emory S. Land (AS 39) arrives at His Majesty's Australian Ship (HMAS) Stirling in Western Australia in advance of the Submarine Tendered Maintenance Period where Royal Australian Navy sailors worked alongside their U.S. Navy counterparts to perform maintenance on a Virginia-class submarine.

# *Schools and Training Facilities*

The Naval Nuclear Propulsion Program's unique training requirements are met by special-purpose training facilities staffed by highly qualified instructors. The Program's schoolhouses include the Nuclear Field "A" School and the Nuclear Power School in Charleston, South Carolina. After successfully completing Nuclear Power School, hands-on operator training is provided at either Moored Training Ships in Charleston or a land-based prototype at the Kesselring Site in West Milton, New York. In-plant training is supplemented with an extensive suite of simulation products, including various task trainers and large Engine Room Team Trainers that replicate submarine engine rooms. This hands-on training ensures that all operators have qualified on an operating naval nuclear propulsion plant before their first sea tour.

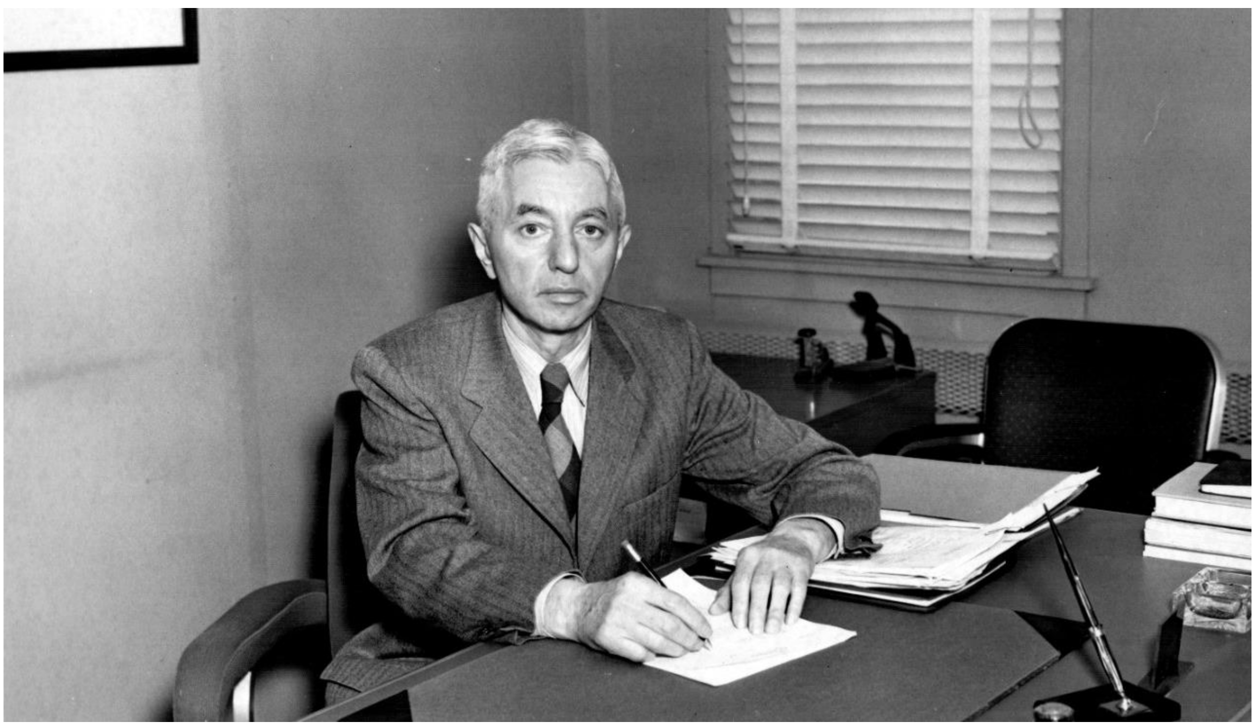
With the repeal of the Combat Exclusion Law in the 1994 Defense Authorization Act and the Navy's decision to open combatant ships to women, the Program began accepting women into the training pipeline to be propulsion plant operators aboard nuclear-powered surface warships. In 2011, women began training to serve aboard submarines. Today, women serve on a total of 33 submarines and all aircraft carriers.


Naval Nuclear Power Training Command in Charleston, South Carolina.

# Establishment of the Program

In 1946, shortly after the end of World War II, Congress passed the Atomic Energy Act, which established the Atomic Energy Commission (AEC) to succeed the wartime Manhattan Project, and gave it sole responsibility for developing atomic energy. At this time, then-Capt. Hyman G. Rickover was assigned to the Navy Bureau of Ships (BUSHIPS), the organization responsible for ship design. Rickover recognized the military implications of successfully harnessing atomic power for submarine propulsion and knew it would be necessary for the Navy to work with the AEC to develop such a program. He and several officers and civilians were sent to the AEC laboratory at Oak Ridge, Tennessee, to learn the fundamentals of nuclear reactor technology.

Although theories of nuclear power were understood, the technology to build and operate a shipboard nuclear propulsion plant did not exist. There were several reactor concepts; the real challenge was to develop this technology and transform the theoretical into the practical. New materials had to be developed, components designed, and fabrication techniques worked out. Furthermore, installing and operating a steam propulsion plant inside the confines of a submarine and under the unique deep-sea pressure conditions raised a number of technical difficulties. Faced with these obstacles, the team at Oak Ridge knew that to build a naval nuclear propulsion plant would require a substantial commitment of resources and a new level of government and industry commitment.



Adm. Hyman G. Rickover at his desk.

Rickover returned to Washington and used every opportunity from his post at Navy Bureau of Ships to argue the need to establish a Naval Nuclear Propulsion Program. On Aug. 4, 1948, the Navy created the new Nuclear Power Branch (Code 390) with Rickover as its head within the Bureau's Research Division.

By 1949, Rickover had forged an agreement between the AEC and the Navy, under which he would proceed with both projects. In 1949, Rickover's new organization contracted with Westinghouse to develop a facility (the Bettis Atomic Power Laboratory) to work on the pressurized-water design. In 1950, he contracted with General Electric to determine whether a liquid-metal reactor design, which it was developing at the AEC's Knolls Atomic Power Laboratory, could be applied to naval propulsion.

Rickover recruited a strong technical staff from those who studied at Oak Ridge, others from past service in the Navy, and top nuclear engineers right out of college. This core of engineers and naval officers oversaw every aspect of the development of nuclear propulsion, including the construction of full-sized prototypes of submarine nuclear propulsion plants.

USS Nautilus (SSN 571) was built, tested, commissioned, and put to sea in 1955 using the pressurized-water design, as was USS Seawolf (SSN 575) in 1957, using the liquid-metal design. Although Seawolf operated at sea successfully until the ship’s first refueling, experience showed that pressurized-water technology was preferable for naval applications. It thus became the basis for all subsequent U.S. nuclear-powered warship designs.

In less than seven years, Rickover obtained congressional support to develop an industrial base in a new technology; pioneered new materials; designed, built, and operated a prototype reactor; established a training program; and took a nuclear-powered submarine to sea.  The success and speed of this development revolutionized naval warfare and has ensured America's undersea and nuclear propulsion superiority ever since.

For more than 33 years, Rickover headed the Naval Nuclear Propulsion Program.  Upon retirement in 1982, he left behind a tradition of technical excellence and an organization staffed by experienced professionals dedicated to designing, building, and operating naval nuclear propulsion plants safely and in a manner that protects people and the environment. These traditions have been proudly furthered by his successors. The result is a fleet of nuclear-powered warships unparalleled in capability and a mature, highly disciplined infrastructure of government and private organizations that continue to build on Rickover's legacy.

In the 1970s, government restructuring moved the Naval Nuclear Propulsion Program from the AEC (which was disestablished) to what became the Department of Energy (DOE). In 2000, the Program became a part of the newly formed National Nuclear Security Administration within the DOE. During these transitions, the Program retained its dual agency responsibility and has maintained its basic organization, responsibilities, and technical discipline.[3]

[3] For a more detailed history of the Naval Nuclear Propulsion Program, see *Nuclear Navy, 1946-1962*, by Richard G. Hewlett and Francis Duncan, 1974, University of Chicago Press (http://energy.gov/management/downloads/hewlett-and-duncan-nuclear-navy-1946-1962), and *Rickover and the Nuclear Navy:  The Discipline of Technology*, by Francis Duncan, 1990, Naval Institute Press (http://energy.gov/management/downloads/duncan-rickover-and-nuclear-navy). For more information on Admiral Rickover, see *Rickover:  The Struggle for Excellence*, by Francis Duncan, 2001, Naval Institute Press.

# Technical and Management Philosophy

Naval nuclear propulsion plants must be militarily capable and reliable in combat, as well as safe for the environment, the public, and those who operate and service them.

The Program has stayed at the forefront of technology to improve tactical speed, silencing, and reliability, characteristics that ensure a commanding edge in warfighting. Naval nuclear propulsion plants are rugged enough to sustain battle shocks and keep operating safely; resilient enough to accommodate many years of frequent power changes; and designed to be operated and maintained by highly trained Navy crews, without onboard scientists and engineers.

The Program's small and relatively uncomplicated pressurized-water reactors are inherently stable and can respond to operational transients without the need for immediate operator action. Fission products are completely contained within high-integrity fuel elements that can withstand high shock loading. The reactors are so effectively shielded while at sea, typical propulsion plant operators receive less radiation exposure than they would have received from natural background radiation on shore in the same period.

Cmdr. Michael Kessler, commanding officer, left, and Lt. Cmdr. Chris Eggers, executive officer, right, demonstrate launching procedures aboard the Ohio-class ballistic missile submarine USS Louisiana (SSBN 743) during a Demonstration and Shakedown Operation in the Pacific Ocean.

The Naval Nuclear Propulsion Program's success is based on strong central technical leadership, thorough training, conservatism in design and operating practices, and an understanding that in every aspect of the Program, excellence must be the norm.[4] In addition, there is a recognition that individuals must accept responsibility for their actions to maintain these standards.

Rickover said it this way:

*"Responsibility is a unique concept: it can only reside and inhere in a single individual. You may share it with others, but your portion is not diminished. You may delegate it, but it is still with you. You may disclaim it, but you cannot divest yourself of it. Even if you do not recognize it or admit its presence, you cannot escape it. If responsibility is rightfully yours, no evasion, or ignorance or passing the blame can shift the burden to someone else. Unless you can point your finger at the person who is responsible when something goes wrong, then you have never had anyone really responsible."*

> *"I think Admiral Rickover was clear, and history has taught, that he had the people of our Program at the very front and center of everything that he did. So he built the Program and the principles of the Program such that even as we are maturing this incredible technology, harnessing this incredible power, we are going to do so in a way that keeps our operator at the center of all that, in terms of operating and certainly keeping them safe and I think that Admiral Rickover would be really happy to know that we continue to do that today."*
> *– Adm. John Richardson, Director of Naval Reactors from 2012-2015*

[4] For more on the Naval Nuclear Propulsion Program's technical and management philosophy, see *The Rickover Effect,* by Theodore Rockwell, 1992, Naval Institute Press.

# The Training Program

## *Over 158,000 Nuclear-Trained Personnel*

From the inception of the Naval Nuclear Propulsion Program, Rickover recognized that nuclear propulsion plant operators must know more than simply what to do in any given situation: they must understand why. Ever since the first crew of Nautilus reported to the Bettis Atomic Power Laboratory for nuclear training in July 1952, these operators have received in-depth technical training, both theoretical training and actual watchstanding experience under instruction. This training has been given at many different locations over the years, but the commitment to a thorough, detailed understanding of the basics of chemistry, physics, thermodynamics, and plant characteristics has remained its foundation. Currently, the number of Sailors, officers and civilians trained and qualified as nuclear propulsion plant operators is over 158,000.


Students at graduation from the Naval Nuclear Power Training Command.

Thorough training minimizes problems, results in quick and efficient responses to emergencies, and helps ensure safety. Prospective plant operators must meet tough selection standards and successfully complete extensive nuclear propulsion training and qualification before reporting aboard ship.

After selection for the Naval Nuclear Propulsion Program and completion of basic recruit training, enlisted personnel are assigned to Nuclear Field "A" School in Charleston, South Carolina, for initial in-rate instruction. In addition to a preparatory course in mathematics, each student receives extensive hands-on training in equipment laboratories specially designed to teach required technical skills. The 24-week Nuclear Power School training that follows provides the basic academic knowledge necessary to understand the theory and operation of a nuclear propulsion plant. The curriculum is presented at the first-year collegiate level and includes thermodynamics, reactor principles, radiological fundamentals, and other specialized subjects.


Students training at Naval Nuclear Power Training Command.

For officers, all of whom are college graduates with technical training, the first step is the 24-week graduate-level course at Nuclear Power School. Here, students receive highly technical instruction covering the prerequisite theory background before they begin hands-on training on an operating reactor plant. Subjects include those in the enlisted curriculum (but taught in greater depth), as well as electrical engineering, reactor dynamics, and other such courses.

After Nuclear Power School, hands-on operator training is provided for both officers and enlisted personnel. Twenty-four weeks of additional classroom training and actual watchstanding experience under instruction occurs at either Moored Training Ships in Charleston, South Carolina or a land-based prototype in Schenectady, New York. Each student qualifies as a propulsion plant operator, attaining extensive watchstanding experience and a thorough knowledge of all propulsion plant systems and their operating requirements. Under the guidance of experienced operator instructors, students learn how to operate a naval nuclear propulsion plant during normal and potential casualty situations. Before reporting aboard ship, they must qualify on their watchstation on an operating reactor.

## *Training Is a Way of Life in the Nuclear Navy*

Nuclear training onboard ship is every bit as demanding as it is at the schools. Newly reporting officers and enlisted personnel must completely requalify as watchstanders and demonstrate their propulsion plant knowledge and operator ability at their new assignments. Even after qualifying, shipboard operators participate in ongoing Engineering Department training lectures, plant operational evolutions, and extensive casualty drills.

Moored Training Ships at Nuclear Power Training Unit in Charleston, South Carolina.

To advance and assume greater responsibility, operators and officers must continue to demonstrate increasing proficiency and knowledge as they qualify and serve on more demanding watchstations. Shore training facilities provide operators advanced training in equipment repair and operation. All officers must qualify as an Engineering Officer by passing a comprehensive examination administered by Naval Reactors Headquarters. Additionally, a rigorous advanced training program in nuclear propulsion plant operations is conducted at Naval Reactors Headquarters for prospective commanding officers of nuclear-powered warships, prototypes, and Moored Training Ships.  The course must be completed by any officer taking command of a U.S. Navy nuclear-powered ship.

Cmdr. Isaac Pelt, left, is relieved by Cmdr. Jeffrey Cornielle, right of center, as commanding officer of the Virginia-class fast-attack submarine USS Minnesota (SSN 783) during a change of command ceremony held aboard U.S. Naval Base Guam.

# What It Means to Be a Sailor in the Naval Nuclear Propulsion Program

One of the most rewarding jobs in today's military is that of a Sailor in the Naval Nuclear Propulsion Program. Those accepted into this unique Program will face one of the most fulfilling and challenging career paths available. These individuals are intelligent, responsible, and motivated and the Program will accept no less. Since nearly half of the Navy's combatants are nuclear-powered, there are many opportunities available to those interested in joining this elite group.

Naval nuclear propulsion plant operators are carefully screened, selected, and trained, and the standards for selection are high. To qualify for the Program, applicants must have (among other prerequisites) a high school diploma or college degree, good academic scores, an interest in pursuing the challenge this highly technical field offers, and the capacity and motivation to work hard.

The training within the Program is respected worldwide; in fact, the quality of this training is recognized to such an extent that many colleges give credit, up to 77 hours, for Program training and experience. After completing initial training, operators continue to gain experience and technical expertise in the many job opportunities onboard nuclear-powered ships.  These jobs include operating, maintaining, and repairing equipment; component and system performance testing; standing watches to monitor propulsion plant performance; and eventually supervising and instructing junior personnel in propulsion plant operations.


Naval Nuclear Propulsion Program Sailor conducts training.

Many opportunities are available to Sailors who have completed their initial sea tour, such as returning to Nuclear Power School or one of the shore-based training facilities to teach new students; recruiting new Sailors for the Program; or working ashore in other commands supporting the Program. Whatever Sailors choose to do after their first sea tour, they can be assured that they will be highly sought after because of their training, competence, and professionalism.

Director, Naval Reactors Adm. Bill Houston, (left) presents a challenge coin to Machinist's Mate Petty Officer 3rd Class George Roman, from Olney, Maryland, during a visit of the Nimitz-class aircraft carrier USS John C. Stennis (CVN 74).

There are monetary benefits in being a part of the Naval Nuclear Propulsion Program. For example, those who are accepted in the Program can receive generous entry bonuses. After joining, Sailors typically advance rapidly and receive more income as a result. Sailors in the Program also receive special duty pay for their unique skills.

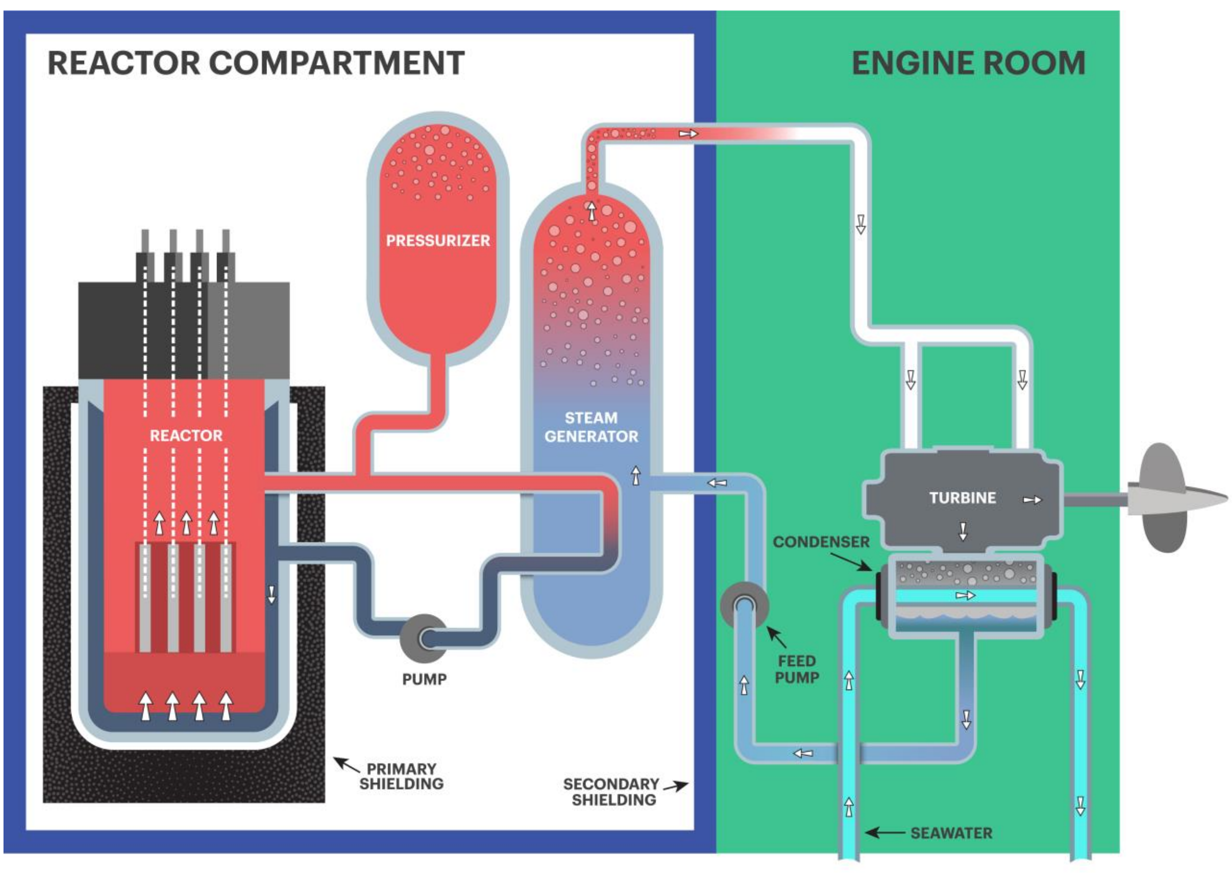
The Naval Nuclear Propulsion Program requires mature and dedicated people who are willing to work hard to achieve success. The Program ensures that those who qualify have a firm understanding of science and technology and the ability and confidence to operate the most advanced nuclear propulsion plants in the world. Sailors who choose this career develop into highly competent, talented, and knowledgeable individuals, and in doing so, provide an invaluable service to our country. If you want to be a part of the Naval Nuclear Propulsion Program, please see your local Navy recruiter, call 1-800-USA-NAVY, or go to www.navy.com/careers/nuclear-operations.

# Description of a Typical Naval Nuclear Propulsion Plant

In a naval nuclear propulsion plant, fissioning of uranium atoms in the reactor core produces heat. With the high-integrity fuel design, fission products inside the fuel are never released into the primary coolant. Because the fission process also produces radiation, shielding is placed around the reactor to protect the crew. Despite close proximity to a reactor core, a typical crew member receives less exposure to radiation than one who remains ashore and works in an office building.

U.S. naval nuclear propulsion plants use a pressurized-water reactor design that has two basic systems: the primary system and the secondary system. The primary system circulates water in an all-welded, closed loop consisting of the reactor vessel, piping, pumps, and steam generators. The heat produced in the reactor core is transferred to the water, which is kept under pressure to prevent boiling. The heated water passes through the steam generators where it gives up its energy. The primary water is then pumped back to the reactor to be heated.

Inside the steam generators, the heat from the primary system is transferred across a watertight boundary to the water in the secondary system, which is also a closed loop. The secondary water (which is at relatively low pressure) boils, creating steam. Isolation of the secondary system from the primary system prevents water in the two systems from intermixing, keeping radioactivity from activation of corrosion and wear products out of the secondary water.



In the secondary system, steam flows from the steam generators to drive the main propulsion turbines (which turn the ship's propellers) and the turbine generators (which supply the ship with electricity). After passing through the turbines, the steam condenses back into water, and feed pumps return it to the steam generators for reuse. Thus, the primary and secondary systems are separate, closed systems in which continuously circulating water transforms the heat produced by the nuclear reaction into useful work (such as propulsion or electricity).

No step in this power production process requires the presence of air or oxygen. This, combined with the ship's ability to produce oxygen and purified water from seawater for crew needs, allows the ship to operate completely independent of the Earth's atmosphere for extended periods of time. In fact, the length of a submerged submarine patrol is limited primarily by the amount of food the ship can carry for the crew.

The Ohio-class ballistic missile submarine USS Louisiana (SSBN 743) transits Puget Sound.

# Protection of People

The policy of the U.S. Naval Nuclear Propulsion Program is to reduce personnel exposure to ionizing radiation associated with naval nuclear propulsion plants to the lowest level reasonably achievable. In carrying out this policy, the Program has consistently maintained personnel radiation exposure standards more stringent than those in the civilian nuclear power industry or in other Government nuclear programs.

No civilian or military personnel in the Naval Nuclear Propulsion Program have ever exceeded the Federal lifetime radiation exposure limit or the Federal annual limit in effect at the time. Since 1968, no personnel have exceeded 5 rem per year, which was the Program's self-imposed limit until it became the Federal limit in 1994.

In recent years, the average annual radiation exposure for operators has dropped to less than one-tenth of the average annual exposure a member of the American public receives from natural background radiation and medical sources. In 1987, the Yale University School of Medicine conducted an independent study of about 76,000 personnel assigned to submarine duty. New York University updated and expanded the Yale study in 2001 to include over 85,000 submariners. In 1991, Johns Hopkins University conducted an independent study of over 70,000 shipyard personnel assigned to work on nuclear-powered ships. In 2022, Johns Hopkins University expanded their study to include over 370,000 shipyard workers. None of these studies showed any cancer risks linked to radiation exposure. The conclusion from these and other studies is that the risks from radiation exposure associated with naval nuclear propulsion plants is low compared to risks normally accepted in work and everyday life.

The principles of personal responsibility, technical knowledge, rigorous training, and auditing are vital to achieving the Program's strong nuclear safety record. These same principles are also applied to Occupational Safety, Health, and Occupational Medical (OSHOM) programs. Workers are provided comprehensive safety and health training, carefully engineered procedures, close supervision, and work-team backup. Oversight and feedback mechanisms provide a safer working environment, as witnessed at the Program's laboratories and prototype training facilities, where injury and illness incidence rates and lost workdays rates are about one-fourth the rates of general industry.

# Concern for the Environment

Long before protection of the environment became a prevalent endeavor, it was a high priority in the Naval Nuclear Propulsion Program. From the beginning, the Program recognized that the environmental safety of operating U.S. nuclear-powered ships would be key to their acceptance at home and abroad. The Program maintains the same rigorous attitude toward the control of radioactivity and protection of the environment as it does toward reactor design, testing, operation, and servicing. As a result, the Program has a well-documented record showing the absence of any adverse environmental effects from the operation of U.S. nuclear-powered warships. Because of this record, these ships are welcome in over 150 ports in over 50 countries and dependencies.

Environmental releases, both airborne and waterborne, are strictly controlled. As a result, the annual releases of long-lived gamma radioactivity from *all* Program activities are comparable to the annual releases from a typical U.S. commercial nuclear reactor operating in accordance with its Nuclear Regulatory Commission license. Throughout the Program's entire history of more than 7,600 reactor years of operation and over 177 million miles steamed on nuclear power there has never been a reactor accident, nor any release of radioactivity that has had an adverse effect on human health or the quality of the environment. The Program's standards and record surpass those of any other national or international nuclear program.

While providing warfighting advantages compared to conventionally-powered ships, the operation of a nuclear-powered ship also avoids releasing significant amounts of greenhouse gases to the environment. A Government Accountability Office report regarding the cost-effectiveness of conventionally and nuclear-powered aircraft carriers estimated that an aircraft carrier powered by fossil fuel burns approximately 500,000 barrels of oil per year. This, in turn, generates approximately 240,000 metric tons of carbon dioxide, equivalent to the amount of carbon dioxide generated annually by almost 40,000 passenger vehicles. Since the U.S. Navy has 11 nuclear-powered aircraft carriers and 68 submarines, the amount of carbon dioxide avoided annually by naval nuclear-powered warships is equivalent to approximately 800,000 passenger vehicles.

The Program has a comprehensive environmental monitoring program at each of its major installations and facilities, including nuclear-capable shipyards and the homeports of nuclear-powered ships. This monitoring program consists of analyzing water, sediment, air, and marine samples for radioactivity to verify that Program operations have not had an adverse effect on the environment. Independent surveys conducted by the U.S. Environmental Protection Agency (EPA) and by state and local governments confirm that U.S. naval nuclear-powered ships and support facilities have had no discernible effect on the quality of the environment.

Ensuring proper environmental performance has also been a priority at Program DOE facilities, which are responsible for non-nuclear as well as nuclear environmental matters. Regular inspection of the Program's laboratory and prototype sites by the EPA and state officials in accordance with the Clean Air Act, the Resource Conservation and Recovery Act (RCRA), and the Clean Water Act, has shown no significant problems.

The Program's stewardship of the environment does not end when a facility ceases operations. For example, the Program has successfully released three former shipyards for unrestricted future use with respect to Program radioactivity: Ingalls Shipbuilding's radiological facilities in Pascagoula, Mississippi (1982), and the Charleston and Mare Island Naval Shipyards in South Carolina and California (1996). The respective states and the EPA independently verified and agreed with these facilities' unrestricted releases from Program radiological controls. The successful inactivation and closure of these radiological facilities demonstrates that the stringent control exercised by the Program since its inception has been successful in protecting human health and the environment.

In October 2006, the U.S. Naval Nuclear Propulsion Program commemorated the first-ever unrestricted release of a U.S. nuclear power reactor site, based on the absence of both chemical and radiological constituents. After operating for 34 years and training over 14,000 Sailors, the DOE S1C Prototype Reactor Site in Windsor, Connecticut, was returned to "green-field" conditions. Naval Nuclear Propulsion Program personnel and contractors worked in cooperation with the Connecticut Department of Environmental Protection, the U.S. EPA, the town of Windsor, and the public to complete this project. These agencies also provided independent oversight of the project. The current Windsor Site condition makes it suitable for any future use, without restriction, from economic development to recreation.

Former DOE S1C Prototype Reactor Site in Windsor, Connecticut.

Finally, the Program maintains its environmental responsibilities from cradle-to-grave, from nuclear-powered warship design to ultimate disposal. The U.S. Navy's program to safely dispose of decommissioned nuclear-powered submarines and cruisers is an example. It involves defueling the reactor(s), inactivating the ship, removing the reactor compartment for land disposal, recycling the remainder of the vessel to the maximum extent practical, and disposing of the remaining non-recyclable materials.

The spent nuclear fuel removed from nuclear-powered warships constitutes about 0.05% of all spent nuclear fuel in the United States today. Also, it is ruggedly designed to withstand combat conditions and can be safely stored pending ultimate placement in a geologic repository.

The Program has safely made 924 container shipments of naval spent nuclear fuel since 1957 using specially designed, rugged containers, such as the M-290.


Robust shipping containers such as the M-290 are used to safely ship spent nuclear fuel.

To date, 135 nuclear-powered warships have been recycled with 144 defueled reactor compartments sent to the DOE's Hanford Site.

Reactor Compartment Disposal packages at the Department of Energy Hanford Site.

# Naval Nuclear Propulsion Program Emergency Preparedness

U.S. nuclear-powered warships are designed to the most exacting and rigorous standards. They are built to survive wartime attack, include redundant systems, and are operated by highly-trained crews using rigorously applied procedures. These features enhance both safety and the ability of the ship to survive attack in time of war.

Naval reactors are designed and operated in such a way as to protect the crew, the public, and the environment. It is important to note that the crew lives in very close proximity to the reactor and is dependent on the energy generated by the reactor for air, water, heat, and propulsion. Thus, it is imperative to both the Navy and the crew that the reactor be well designed and safely operated. Another important part of ensuring safety is developing, exercising, and evaluating the ability to respond to any emergency in the highly unlikely event one does occur.

Planning for emergencies is based on extensive Naval Nuclear Propulsion Program technical analysis, as well as recommendations and guidance provided by numerous agencies experienced in emergency planning, including the Department of Homeland Security, Federal Emergency Management Agency, the Navy, the DOE, the Nuclear Regulatory Commission, the EPA, the National Council on Radiation Protection and Measurements, and the International Atomic Energy Agency.

All Naval Nuclear Propulsion Program activities, both shipboard and ashore, have plans in place that define Program responses to a wide range of emergency situations. These plans are regularly exercised to ensure that proficiency is maintained. These exercises consistently demonstrate that Program personnel are well prepared to respond to emergencies regardless of location. Actions are taken to continually evaluate and improve emergency preparedness at all Program activities.

## *Naval Spent Nuclear Fuel Transportation Exercises*

In 2024, the Naval Nuclear Propulsion Program completed the 13$^{th}$ full-scale naval spent nuclear fuel transportation accident exercise in Pocatello, Idaho. The scenario simulated the collision of a truck with a spent nuclear fuel container railcar at a railroad crossing. Navy personnel escorting the shipment practiced verifying that the container was still intact and assisting the local incident commander and emergency responders in their response to the accident. More than 200 people observed and participated in the exercise, representing tribal, federal, state, and local government agencies and a commercial rail carrier. These exercises are extremely effective in promoting public knowledge of the safety of the Program's naval spent nuclear fuel shipments, increasing first responder confidence in their ability to respond to accidents involving these shipments, and providing stakeholders with the opportunity to interact and learn from one another.

To date, 924 spent fuel containers have been safely shipped. These robust containers have traveled more than 1.7 million miles with spent nuclear fuel sealed inside, which is greater than the distance of 60 trips around the earth.

## *Partnership with State and Local Officials*

If a radiological emergency ever occurred, civil authorities would be promptly notified and kept fully informed of the situation. With the support of Naval Nuclear Propulsion Program personnel, local civil authorities would determine appropriate public actions, if any, and transmit this information via their normal emergency communication methods.

The Naval Nuclear Propulsion Program maintains close relationships with civil authorities to ensure that communications and emergency responses are coordinated, if ever needed. Periodic exercises are conducted with all States and Guam where U.S. nuclear-powered warships are homeported and Naval Nuclear Propulsion Program facilities are located, demonstrating the Navy's commitment to work as a team in response to emergency situations.

Due to the unique design and operating conditions of U.S. nuclear-powered ships, civil emergency response plans that are sufficient for protecting the public from industrial and natural events (for example, chemical spills or earthquakes) are also sufficient to protect the public in the highly unlikely event of an emergency onboard a nuclear-powered ship or at a Naval Nuclear Propulsion Program facility.

Members of the public who live near nuclear-powered ships or support facilities can be confident that in the event of an emergency, extensive resources are readily available to quickly respond to the situation.


Battalion Chief Frank Diego, Guam Fire Department, left, and Capt. Michael Thompson, commanding officer of the Emory S. Land-class submarine tender USS Frank Cable (AS 40), communicate during a joint exercise between the U.S. Navy and Government of Guam onboard Naval Base Guam. The joint exercise tested the efforts of the Transportation Emergency Response Team (TERT) and several Government of Guam agencies response to a simulated transportation accident involving a shipment of material.

# International Partnerships

## *United Kingdom*

The Naval Nuclear Propulsion Program's partnership with the Royal Navy dates back to Adm. Hyman G. Rickover and Lord Louis Mountbatten and the 1958 Agreement between the Government of the United States of America and the Government of the United Kingdom of Great Britain and Northern Ireland (U.K.) for Cooperation on the Uses of Atomic Energy for Mutual Defense Purposes.


The United Kingdom Chief of Defence Nuclear Maddy McTernan visited Naval Reactors in January 2024.

The U.S.–U.K. Mutual Defense Agreement has underpinned the U.S.–U.K. nuclear relationship for more than 65 years, enabling cooperation in the uses of atomic energy for mutual defense purposes, including the exchange of Naval Nuclear Propulsion Information, materials, and equipment. It was under this agreement that Naval Reactors first shared naval nuclear propulsion technology with another country in the late 1950s.

The bilateral relationship facilitates knowledge sharing, access, force multiplication, and shared responsibility for a common mission across the globe, and particularly, in the undersea domain. The U.S. works closely with the U.K. on all nuclear matters, including nuclear policy, operations and technology. In recent years, this technology exchange has expanded with the goal of mutually advancing the state of the art in submarine naval nuclear propulsion technology. There is no stronger relationship between two submarine forces in the world than the U.S. Navy and the Royal Navy. Our partnership with the U.K. as responsible nuclear powers is an important part of the long history of defense cooperation, enhancing Euro-Atlantic security and is a strong enabler for delivering both U.S. and U.K. nuclear deterrents.

## *Japan*

The U.S. Navy's only forward-deployed aircraft carrier is based out of Yokosuka, Japan and has resulted in a unique and special relationship with the Naval Nuclear Propulsion Program and the government and people of Japan. USS George Washington (CVN 73) first arrived Sept. 25, 2008, and served as the Forward-Deployed Naval Forces Japan aircraft carrier until 2015 when the ship was relieved by USS Ronald Reagan (CVN 76). George Washington returned to U.S. 7th Fleet and replaced Ronald Reagan as the Forward-Deployed Naval Forces Japan aircraft carrier in late 2024.

A welcome event was held on the pier for the arrival of USS Ronald Reagan (CVN 76) in 2015.

December 2023 marked the 16th successful completion of the Joint Drill, a yearly exercise that reflects a realistic response ensuring the U.S. Navy and the government of Japan are proficient and able to work together seamlessly during an emergency. The drills are unique to the location and not performed elsewhere. During the 16th annual Joint Drill, American and Japanese personnel participated in a large-scale training drill led by Commander, Submarine Group 7 and Commander, Fleet Activities Yokosuka simulating an earthquake and an emergency response.

Mayor of Yokosuka, Japan, the Honorable KAMIJI, Katsuaki visited Naval Reactors Headquarters in October 2023.

The 16th annual Joint Drill not only demonstrated the strength of the U.S.–Japan alliance but also highlighted the shared dedication to ensuring peace and safety in the region. The lessons learned and the relationships strengthened each year play a critical role in shaping the future of emergency response and cooperation between the two nations.

## *AUKUS*

In September 2021, leaders of Australia, the United Kingdom, and the United States announced the trilateral security partnership AUKUS. The first major initiative of AUKUS was the historic trilateral decision to support Australia in acquiring conventionally armed, nuclear-powered submarines (SSNs). AUKUS is built on the bedrock of decades of close defense, capability, and technology cooperation between our three nations and is a natural progression of our partnership.

Vice Adm. Jonathan Mead, Royal Australian Navy, watches as USS North Carolina (SSN 777) moors at HMAS Stirling in Western Australia.

On March 13, 2023, the leaders of the three AUKUS partners, following an intensive 18-month consultation period, announced the Optimal Pathway to provide a conventionally armed, nuclear-powered submarine capability to Australia at the earliest possible date while ensuring all three partners maintain the highest nuclear non-proliferation standards.

*"AUKUS allows us to capitalize on one of our greatest advantages in the Pacific, namely, the strength and capabilities of our submarine fleet, which is second to none in the world. Sharing this technology with Australia will be a force multiplier."*
*– U.S. Senator Richard Blumenthal*

The first three Royal Australian Navy officers graduated from Nuclear Power Training Unit – Charleston, South Carolina in January 2024.

Naval Reactors, as the center of naval nuclear propulsion technology and stewardship within the United States, has an essential role to play in all three phases of the Optimal Pathway:

- **Phase One:** Involves establishing Submarine Rotational Force–West (SRF-W) through increased SSN visits to Australia designed to expand Australia's knowledge of SSNs and the development of an Intermediate Level (I-Level) Maintenance capability. Naval Reactors will assist the Australians in developing the infrastructure, workforce, stewardship, and regulatory capabilities required to safely support nuclear-powered submarines.

- **Phase Two:** In the early 2030s, the U.S. will begin to sell at least three Virginia-class submarines to Australia. These submarines will be sovereign Australian warships and will be operated and maintained by Australia, using knowledge and experience gained from working with the U.S. Navy and Naval Reactors. Royal Australian Navy sailors will be trained to operate and maintain the reactor plants of their Virginia-class submarines by completing the U.S. naval nuclear propulsion training pipeline and serving aboard U.S. SSNs. U.S. nuclear-capable shipyards will train Australian industry personnel to execute the highly complex overhauls required to keep SSNs operating. The Naval Nuclear Propulsion Program will also train Australian technical personnel to support operating SSNs and take on over 75 years of technical expertise in naval nuclear propulsion.

- **Phase Three:** Sees the combination of U.K. submarine design and advanced U.S. technology in the delivery of SSN AUKUS, the future attack submarine for both Australia and the United Kingdom. Australia plans to deliver the first sovereign-built SSN AUKUS in the early 2040s, with construction starting this decade. The U.K. will begin construction of SSN AUKUS ahead of Australia and deliver its first boat in the late 2030s. Naval Reactors will provide key advanced naval nuclear propulsion plant technologies to the U.K. for use in the trilaterally-enabled SSN AUKUS.

# Naval Nuclear Propulsion Program Accomplishments

In addition to the military applications of nuclear power, technology developed by the Naval Nuclear Propulsion Program is the basis for civilian nuclear power around the world. Significant contributions include:

- The uranium-dioxide fuel system, now the most widely used system in nuclear power
- The design for large pressurized-water reactor components and the cladding for large pressure vessels
- Safety standards, containment concepts, and refueling techniques for power reactors
- A system for preventing damage to a reactor core even if failures occur in the cooling system
- The first successful method of radioactive decontamination of reactor plants
- Zirconium, zirconium alloys, and hafnium materials for cladding and reactor control use
- Numerous computer programs widely used for design safety, research, and testing
- The first chemical cleaning process for nuclear plant steam generators
- Ultrasonic inspection methods for evaluating the material status of the reactor vessel and major components
- Nuclear fabrication standards, quality control requirements, and equipment specifications
- Development and publication of the Chart of the Nuclides, used worldwide for nuclear research and development work
- Extensive use of solid-state electronics for instrumentation, control, and power distribution.

The Program also provides the nuclear industry with information from its research in a variety of areas, including corrosion and wear technology for components operating in high-temperature, high-pressure water; pressurized-water reactor heat transfer and fluid flow technology; methods for predicting performance of reactors in accident scenarios; and numerical analyses of reactor designs using digital computers. This has resulted in over 5,000 technical reports which have been made available to industry and the public.

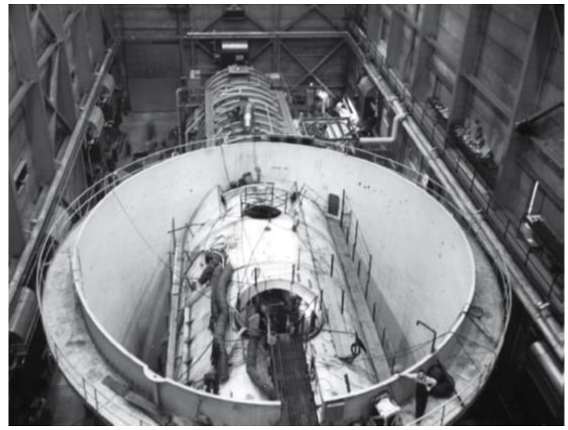
Perhaps the most substantial contribution to the civilian sector is the thousands of highly-trained Program graduates who now play key roles in operating and managing civilian nuclear power reactors.

# Appendix

# The First Naval Nuclear Propulsion Plants

## *The First Prototype (S1W)*

**December 1948** Westinghouse is contracted by the Atomic Energy Commission (AEC) to design, build, operate, and test a prototype pressurized-water naval nuclear propulsion plant (known alternatively as Submarine Thermal Reactor, Mark 1, or simply S1W).



S1W Prototype shown from above.

**1950–1953** S1W is constructed at the AEC's National Reactor Testing Station (now DOE's Idaho National Laboratory) inside a submarine hull surrounded by a 300,000-gallon tank of water simulating the ocean.

**March 30, 1953** S1W reaches criticality at 11:17 p.m., making the first practical quantities of nuclear power in the world.

**June 25, 1953** S1W achieves full design power and begins a successful 96-hour sustained full-power run, simulating a submerged crossing of the Atlantic Ocean.

**Late 1955** Following nearly 2 years of continuous operation and testing and a refueling, S1W completes a 66-day continuous full-power run, the equivalent of propelling a submarine at high speed twice around the globe.

**October 1989** DOE permanently shuts down S1W after 36 years of safe operation. The last 22 years of operation used the same reactor core, setting a longevity record. Over 13,000 U.S. Navy officer and enlisted operators trained at S1W.

**1990** All defueling and inactivation operations were completed.

**2019** Naval Reactors entered into an agreement with the DOE Office of Environmental Management to carry out the decommissioning and disposal of three prototypes at the Naval Reactors Facility in Idaho.

**2022** Naval Reactors turned over the S1W prototype to DOE Office of Environmental Management and disposal is ongoing.

## *USS Nautilus (SSN 571)*

With the endurance and stealth only nuclear propulsion could provide, Nautilus revolutionized undersea warfare by becoming the world's first *true* submarine, limited only by the amount of supplies the ship could carry.

**August 1949** The Chief of Naval Operations establishes a January 1955 "ready-for-sea" date for development of a submarine nuclear propulsion plant.

**August 1950** President Harry S Truman signs Public Law 674, authorizing construction of Nautilus.

**August 1951** Electric Boat begins construction of the first nuclear-powered submarine in Groton, Connecticut.

**June 14, 1952** President Truman lays the keel of Nautilus.

**September 30, 1954** Nautilus is commissioned at Electric Boat in Groton, Connecticut.

**January 17, 1955** Under the command of Commander Eugene P. Wilkinson, Nautilus puts to sea for the first time less than 4 years after construction began and signals the historic message, "UNDERWAY ON NUCLEAR POWER."

**February 1955** In 84 hours, Nautilus steams 1,300 submerged miles from New London, Connecticut, to San Juan, Puerto Rico, 10 times farther than previously traveled by a submerged submarine. This is the first time that a submarine maintains a high speed (about 16 knots average) for longer than an hour.

**1957** Nautilus is refueled after steaming over 62,000 miles on the first core. The submarine was submerged for more than half that distance.

**August 3, 1958** During an 1,800-mile, 96-hour historic transpolar voyage from Point Barrow, Alaska, to the Greenland Sea, Nautilus becomes the first ship to reach the geographic North Pole. President Eisenhower awards Nautilus the Presidential Unit Citation (the first such award in peacetime), and Commanding Officer, Commander William R. Anderson, the Legion of Merit, for demonstrating the Arctic's strategic potential.

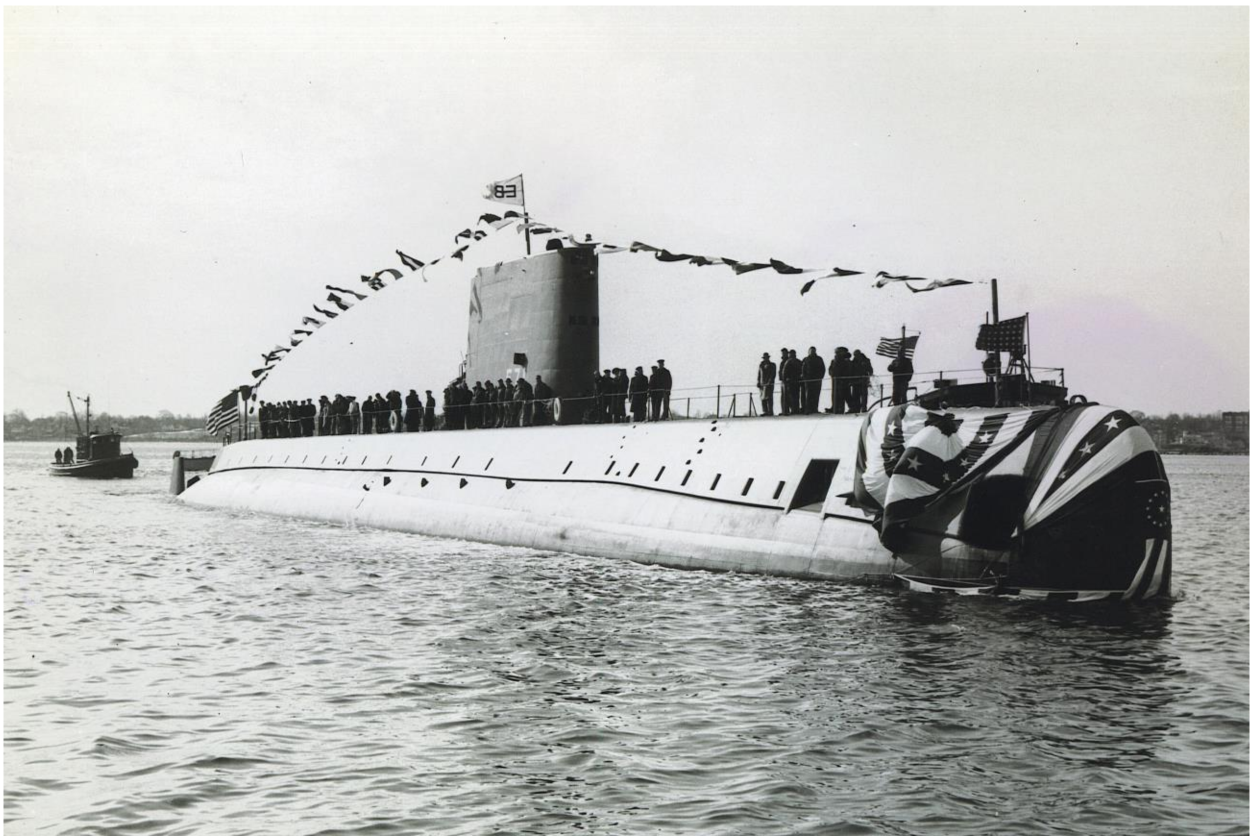

New York Harbor welcomes USS Nautilus (SSN 571) after the submarine's successful voyage under the North Pole.

**1960** Nautilus deploys to the Mediterranean and becomes the first nuclear-powered submarine assigned to the 6th Fleet.

**1960-1979** Nautilus participates in numerous defense missions, including the naval blockade on all offensive military equipment under shipment to Cuba during the 1962 Cuban Missile Crisis, and demonstrates U.S. technical capability through high-visibility calls in numerous foreign ports in the Atlantic and the Mediterranean.

**April 1979** Nautilus departs Groton enroute to California for the ship's final voyage and completes the 2,500th dive and 510,000 miles safely steamed on nuclear power.

**May 1979** Nautilus enters Mare Island Naval Shipyard for inactivation and conversion as a historic ship for public display. Following this, Nautilus leaves California under tow for the Naval Submarine Base in Groton, Connecticut.



USS Nautilus (SSN 571) in the Thames River following its Christening Ceremony.

USS Nautilus (SSN 571)

Length — 320 feet

Beam — 28 feet

Displacement — Surfaced: 3,533 tons
Submerged: 4,092 tons

**Today:** Nautilus is currently a National Historic Landmark, open to the public as part of the Nautilus Memorial and Submarine Force Library and Museum in Groton, Connecticut.

(For additional information, visit the Nautilus Museum website at *http://ussnautilus.org*).

# *USS Seawolf (SSN 575)*

**April 1950** General Electric begins design work on a liquid-sodium naval nuclear propulsion plant as an alternative to pressurized water for a second nuclear-powered submarine.

**September 1953** Seawolf's keel is laid at Electric Boat in Groton, Connecticut.

**June 1956** Seawolf's reactor reaches criticality.

**October 1958** While operating as an active unit of the Atlantic Fleet, Seawolf completes a record-breaking 60-day submerged run, traveling over 13,000 miles.


USS Seawolf (SSN 575) underway.

**December 1958** Although operating satisfactorily for almost 2 years, Seawolf's sodium-cooled plant is significantly less attractive for naval warships than pressurized-water alternatives. Therefore, the Seawolf plant is replaced with a pressurized-water plant (S2W) similar to that installed in Nautilus. Seawolf's sodium plant had steamed over 71,000 miles, submerged for over three-quarters of that distance.

**March 1987** Seawolf is decommissioned after 30 years of operation and over 473,000 miles safely steamed on nuclear power.

# Classes of Nuclear-Powered Ships

## *Submarines*

**Early SSNs:** With the success of Nautilus, the U.S. Navy launched a series of nuclear-powered attack submarine classes (Skate, Skipjack, and Permit) that introduced different warfighting and design features.


USS Skipjack (SSN 585) underway.

USS Skipjack (SSN 585)
*(Skipjack class)*

Length — 249 feet

Beam — 32 feet

Displacement — Surfaced: 3,075 tons
Submerged: 3,500 tons

**Fleet Ballistic Missile (FBM) Submarines:** With Nautilus still in operational testing, the U.S. Navy began developing a submarine ballistic missile system, which it brought from inception to deployment in 5 years. In the first class of FBMs (George Washington), the Navy extended SSN hulls to add a missile compartment amidships. In the 1960s, subsequent FBM classes (Ethan Allen, Lafayette, James Madison, and Benjamin Franklin) were designed from the keel up as missile submarines. Each carried 16 Polaris missiles, but were later backfitted with the more powerful and accurate Poseidon missiles. A few of the James Madison- and Benjamin Franklin-class submarines were also backfitted with the early Trident I ballistic missiles. All submarines of these classes have now been retired from strategic service and replaced by the more advanced Ohio-class ballistic missile submarines which carry Trident II missiles. The newest Columbia-class ballistic missile submarine, currently being developed to replace the Ohio class, will also carry Trident II missiles.


USS Lafayette (SSBN 616) underway.

USS Lafayette (SSBN 616)
*(Lafayette class)*

Length — 425 feet

Beam — 33 feet

Displacement — Surfaced: 7,250 tons
Submerged: 8,250 tons

**Sturgeon class:** After deployment of Permit-class submarines, the U.S. Navy began building Sturgeon-class submarines, which combined the most advantageous warfighting elements of the early SSN classes. With well-tested, quiet, and dependable propulsion plants, the 37 Sturgeon-class submarines were the mainstay of our nuclear fleet into the 1980s.


USS Pogy (SSN 647) underway.

USS Pogy (SSN 647)
*(Sturgeon class)*

Length — 292 feet

Beam — 32 feet

Displacement — Surfaced: 4,250 tons
Submerged: 4,780 tons

**Single-ship Designs:** The Navy built several single-ship class submarines, USS Triton (SSN 586), USS Halibut (SSN 587), USS Tullibee (SSN 597), USS Narwhal (SSN 671), and USS Glenard P. Lipscomb (SSN 685), each to explore alternate propulsion plant concepts (for example, turbine electric drive and different reactor and propulsion turbine designs). Technology developed in these efforts became the basis for later classes.

**Los Angeles class:** With a high-power propulsion plant, advanced sonar, and improved torpedo fire control systems, Los Angeles-class submarines provide high-speed escort, anti-submarine and anti-surface warfare roles with a minimum underwater noise signature.

Beginning with USS San Juan (SSN 751), Los Angeles-class submarines incorporate technological advances, including cruise missile vertical launch capability, a new combat system, and retractable bow planes. Additionally, these later boats do not need to be refueled over the entire life of the ship.

USS Columbia (SSN 771) gets underway from Joint Base Pearl Harbor-Hickam.

USS Columbia (SSN 771)
*(Los Angeles class)*

Length — 362 feet

Beam — 33 feet

Displacement — Surfaced: 6,000 tons
Submerged: 6,927 tons

**Ohio-class Ballistic Missile Submarines (SSBN):** Virtually undetectable in the open ocean, Ohio-class submarines are quieter, better equipped, and have greater missile range than their predecessors. With an advanced design, a long-life reactor plant, and a unique, comprehensive program to ensure equipment reliability and material availability, the Ohio class operates for long periods between maintenance periods. Ohio's 560-foot length provides room to incorporate modifications and technological developments. Large hatches and a carefully planned equipment arrangement facilitate component servicing and replacement. This class comprises 14 ships.

**Ohio-class Guided-Missile Submarines (SSGN):** Four ballistic missile submarines have been converted into SSGNs. Each SSGN is capable of covertly entering a battlespace carrying unconventional payloads and up to 154 guided missiles, plus a large number of Special Operations Force personnel. This capacity gives battlefield commanders more surprise strike options, clandestine information-gathering methods, and communication pathways.

USS Wyoming (SSBN 742) prepares to return to port.

USS Wyoming (SSBN 742)
*(Ohio class)*

Length — 560 feet

Beam — 42 feet

Displacement — Surfaced: 16,600 tons
Submerged: 18,700 tons

**Seawolf class:** The Seawolf class goes faster, dives deeper, and carries significantly more weapons than its predecessors. The technology developed for Seawolf, enabling a high power-density propulsion plant that can operate quietly over the ship's entire speed range, is being applied to future generations of nuclear-powered warships.

The newest and last of the Seawolf class, USS Jimmy Carter (SSN 23), has the same capabilities as its sister ships, plus a unique, 100-foot multimission platform (MMP). The MMP provides unprecedented payload access to the ocean, offering more flexibility and capability than conventional torpedo or vertical launch tubes in the shape or size of weapons, auxiliary vehicles, and sensors.

USS Seawolf (SSN 21) makes a brief stop for personnel in the Norwegian Sea.

USS Seawolf (SSN 21)
*(Seawolf class)*

Length — 353 feet (453 feet for SSN 23)

Beam — 40 feet

Displacement — Surfaced: 7,460 tons (10,860 tons for SSN 23)
Submerged: 9,150 tons (12,150 tons for SSN 23)

**Virginia class:** USS Virginia (SSN 774), the lead ship of this planned 55-ship class, was commissioned Oct. 23, 2004, meeting the schedule established by the original Acquisition Program Baseline over a decade before. The Navy commissioned the 22nd Virginia-class submarine, USS Hyman G. Rickover (SSN 795) in October 2023. It's the second submarine to be named for the father of the nuclear navy. Most recently, in September 2024, USS New Jersey (SSN 796) was commissioned.

The Virginia class is designed to excel in near-land ("littoral") operations while maintaining the Navy's superiority in open-ocean operations. By applying the technology developed for the Seawolf program, the Virginia class is as quiet and stealthy as the Seawolf class. The Virginia class has a reconfigurable torpedo room that can be optimized for a variety of missions, including antisubmarine warfare, *Tomahawk* missile strikes, and Special Operations Forces delivery. Technological advances have allowed significant improvements in mine detection and avoidance, sensors and surveillance, and communications.


USS Hyman G. Rickover (SSN 795) during its Commissioning Ceremony in October 2023.

USS Hyman G. Rickover (SSN 795) DATA
*(Virginia class)*

Length — 377 feet

Beam — 34 feet

Displacement — Surfaced: 6,970 tons
Submerged: 7,800 tons

**Columbia class:** District of Columbia is the lead ship of the newest class of ballistic missile submarines, the most survivable leg of the Nation's nuclear triad. Columbia's next-generation nuclear propulsion plant will have electric drive propulsion and a life-of-the-ship reactor core making the ship more cost-effective to operate and maximizing its time in deployment. Columbia will share a Common Missile Compartment (CMC) design with the United Kingdom's Dreadnought-class ballistic missile submarine. Construction of the lead ship commenced in fiscal year 2021 to support strategic deterrent patrols starting in 2031. The Columbia class remains the Navy's number one acquisition priority. The Columbia class will be comprised of at least 12 ships.

Artist rendering of the future Columbia class.

District of Columbia (SSBN 826)
*(Columbia class)*

Length — 560 feet

Beam — 43 feet

Displacement — Surfaced: 18,500 tons
Submerged: 20,800 tons

# *Aircraft Carriers*

**The First Aircraft Carrier Prototype:** As early as 1950, the U.S. Navy identified a need for a nuclear reactor to power a ship as large as an aircraft carrier. In 1952, scientists began researching a suitable reactor system at Westinghouse Electric's Bettis Atomic Power Laboratory in Pennsylvania. In 1956, construction crews broke ground at the National Reactor Testing Station, which later became the Idaho National Laboratory, in southeastern Idaho, on the Aircraft Carrier First Design by Westinghouse (A1W) prototype reactor. The A1W featured two reactors, which achieved criticality in 1958 and 1959, respectively. The A1W prototype became the world's first surface-ship nuclear reactor prototype. Given the size and weight of a carrier, the design required two pressurized water reactors to power a single propeller shaft. The A1W prototype sat in a steel hull that simulated the engine room of an aircraft carrier. The A1W prototype plant was permanently shut down on Jan. 26, 1994, after more than 34 years of safe operation. Over 14,500 Navy officers and enlisted operators trained at A1W.


The Naval Reactors Facility turned over the A1W prototype to the DOE Office of Environmental Management for demolition in a ceremony Nov. 2, 2023. An estimated 150 participants attended the A1W prototype turnover ceremony, including the local Mayors of Idaho Falls and Arco, as well as Congressional staff members and members of the Shoshone-Bannock Tribes. The event centered around a symbolic plaque exchange, signifying the handover of responsibilities from the Naval Reactors Facility to the DOE Office Idaho Cleanup Project. In 2019, Naval Reactors entered into an agreement with the Office of Environmental Management to carry out the demolition of the A1W facility and other deactivation and decommissioning efforts, including two additional prototypes at the Naval Reactors Facility.

**USS Enterprise (CVN 65):** The world's first nuclear-powered aircraft carrier put to sea in 1961 with eight reactors capable of propelling the ship to speeds in excess of 30 knots. The original cores lasted three years; the final Enterprise cores had a life of nearly 20 years. Enterprise was as tall as a 23-story building (keel to mast top), had 4.5 acres of flight deck, and carried a crew (including the air wing) of over 5,000. Enterprise was inactivated December 1, 2012 after 50 years of decorated naval service and safely steaming more than one million miles.

USS Enterprise (CVN 65) underway.

USS Enterprise (CVN 65)
*(Enterprise class)*

Length — 1,123 feet

Overall Width — 257 feet

Combat Load Displacement — 93,000 tons

In 2012, the Navy issued an Environmental Assessment which evaluated the disposal of defueled reactor plants from Enterprise as eight individual reactor compartment packages. In 2019, the Navy issued a Notice of Intent to prepare an Environmental Impact Statement (EIS) that would consider a broader range of alternatives for disposal of the defueled reactor plants from Enterprise. A draft EIS was issued for public review in 2022, and the final EIS was issued in June 2023. In September 2023, the Navy issued a Record of Decision selecting commercial dismantlement of Enterprise, including its defueled naval reactor plants.

**Nimitz class:** The success of Enterprise led to the larger Nimitz class. Nimitz-class aircraft carriers' two reactors produce more power than Enterprise's eight. With larger displacement made possible by a wider hull, Nimitz can store 50% more ammunition, carry almost twice as much aviation fuel as a conventionally-powered aircraft carrier, and go more than 20 years without refueling, thereby requiring only one refueling in the life of the ship. Nimitz-class aircraft carriers are over 18 stories tall, have 4.5 acres of flight deck, and carry crews (including the air wings) of over 5,500. Further, Nimitz is not the same aircraft carrier that was commissioned in 1975. The carriers undergo continuous modernization of aircraft, weapons, and ship systems to ensure that the most capable and current ships and air wings are available for every deployment.

USS Ronald Reagan (CVN 76) transits Pearl Harbor.

USS Ronald Reagan (CVN 76)
*(Nimitz class)*

Length — 1,092 feet

Overall Width — 257 feet

Combat Load Displacement — 97,500 tons

**Gerald R. Ford class:** USS Gerald R. Ford (CVN 78) is the lead ship of the newest class of aircraft carriers. Commissioned on July 22, 2017, Gerald R. Ford is the largest and most modern aircraft carrier in the world. Taking advantage of the efficiencies of the Nimitz-class hull form, this new carrier features an array of advanced technologies designed to improve upon the capabilities of the Nimitz class and, at the same time, allow significant manpower, maintenance, and cost reductions at a savings of nearly $100 million per year per ship. Gerald R. Ford is a large-deck nuclear-powered aircraft carrier that maintains the core capabilities of naval aviation while improving affordability of the carrier force. The carrier's design incorporates flexibility into the platform to accommodate future systems and technologies throughout her expected 50-year service life. Gerald R. Ford completed its inaugural deployment in 2022.

USS Gerald R. Ford (CVN 78) in Hampton Roads.

USS Gerald R. Ford (CVN 78)
*(Gerald R. Ford class)*

Length — 1,092 feet

Overall Width — 256 feet

Combat Load Displacement — 99,500 tons

## *Cruisers*

Beginning with the 17,000-ton USS Long Beach (CGN 9) and the 9,600-ton USS Bainbridge (CGN 25), the U.S. Navy built several types of nuclear-powered cruisers. Nuclear power and multi-mission capability (anti-air, anti-surface, and anti-submarine) made these cruisers some of the most versatile ships afloat and an effective component of the U.S. Navy's Cold War force. Having served proudly, nuclear-powered cruisers have been decommissioned as part of the post-Cold War downsizing of the fleet.

USS Bainbridge (CGN 25) transiting the Suez Canal.

USS Bainbridge (CGN 25)
*(Only ship in class)*

Length — 565 feet

Beam — 57 feet

Displacement — 9,600 tons

# Operations

Today, U.S. Navy ships and their dedicated crews are forward deployed around the globe, protecting the interests of the U.S. and its allies. Their forward presence gives the Nation the cornerstone on which to build peacetime engagement, deterrence, and crisis prevention, and conflict resolution. Sustaining and effectively using this forward presence requires agility, mobility, flexibility, and technology. Time and again, nuclear power proves itself as the power plant technology for fast response, self-sufficiency, and endurance.

Specific details of most naval nuclear-powered warship operations are classified. They cover a wide variety of activities, including thousands of ballistic missile submarine deterrent patrols, offensive and defensive exercises with other U.S. Navy and allied units, intelligence gathering, amphibious support, escort service, Special Operations Forces support, and task force deployments to trouble spots around the world. The following examples are a matter of public record and illustrate the versatility and the endurance of nuclear-powered warships.

In August 1990, Iraq invaded Kuwait, resulting in an unprecedented military buildup in the Persian Gulf region to support Operation Desert Shield. Within days of the Iraqi invasion, the USS Dwight D. Eisenhower (CVN 69) battle group transited the Suez Canal from the Mediterranean to the Red Sea, representing some of the first U.S. military assets to arrive on scene. Over a dozen U.S. attack submarines conducted surveillance, reconnaissance, and other missions before and during the hostilities. As Desert Shield became Desert Storm, at least two submarines and two nuclear-powered cruisers launched Tomahawk cruise missiles against Iraq. Warplanes from USS Theodore Roosevelt (CVN 71) participated in the air attack.

As tensions in the Persian Gulf fluctuated throughout the 1990s, aircraft carriers and submarines responded to add strength to our diplomacy efforts and monitor military activities.

Subsequent operations 19 years ago showcased the speed, independence from refueling supply chains, and on-station endurance of America's nuclear-powered warships. On Sept. 11, 2001, USS Enterprise (CVN 65) was headed home from a 6-month deployment when the Commanding Officer learned of the terrorist attacks on the U.S. via satellite TV. In anticipation of orders to do so, Enterprise executed a right full rudder and was within striking distance of Afghanistan in just under 11 hours. USS George Washington (CVN 73) and USS John C. Stennis (CVN 74) quickly led battle groups to provide protection for both coasts of America. USS Carl Vinson (CVN 70) and USS Theodore Roosevelt (CVN 71) aircraft carrier battle groups helped take the fight to the enemy, with nuclear-powered attack submarines assisting. Over the first several months of Operation Enduring Freedom, over 70% of all precision strike missions flown into landlocked Afghanistan were launched from U.S. Navy CVNs, and about a third of all Tomahawk precision missile strikes were launched from nuclear-powered submarines.

On March 19, 2003, USS Cheyenne (SSN 773) began the second chapter in the Global War on Terrorism, Operation Iraqi Freedom, by launching Tomahawk missiles against the regime of Saddam Hussein. When over 70% of the fleet surged to the theater, they arrived to a well-prepared battlespace based on intelligence and surveillance gathered by submarines, such as USS Pittsburgh (SSN 720), and others that had been on-station weeks and months before the first missiles were fired. At the end of major combat operations, nuclear-powered submarines accounted for about a third of the more than 800 Tomahawk missiles launched against Saddam Hussein's regime, and nearly 8,000 combat and support sorties had been flown from CVNs.

At the end of 2008, USS Ohio (SSGN 726) returned to Naval Base Kitsap-Bangor after its first deployment as an SSGN. During the 14 months away from home, the ship successfully completed three national taskings, earned two Navy Expeditionary medals, and hosted a Joint Special Operations Task Force while visiting Busan, Republic of Korea to demonstrate the joint command and control capability of the new SSGN platform.

In March 2011, USS Florida (SSGN 728) demonstrated the SSGN capabilities by launching 93 Tomahawk missiles in support of Operation Odyssey Dawn. Florida launched more than one-third of the initial salvo on the first night as the Joint Force enforced U.N. resolutions against Libya. Nearly a year into deployment, Florida was still able to take center stage in the operation.

With its maiden deployment in April 2018, USS John Warner (SSN 785) became the first Virginia-class submarine to fire on an enemy target when the ship launched six Tomahawk missiles, successfully striking Syrian chemical weapons facilities.

In November 2023, the U.S. deployed USS Florida (SSGN 728) to the Middle East to provide additional deterrence and support to the two carrier strike groups already on-station. Florida's ability to carry and launch Tomahawk missiles while submerged and virtually undetectable provides combatant commanders substantial strategic advantage.

U.S. Central Command published a photo of USS Florida (SSGN 728) in the Suez Canal, passing under the Al Salam Bridge northeast of Cairo in November 2023.

Aircraft carriers are a formidable military force that clearly and undeniably represent our nation's power by their mere presence, symbols of military strength that immediately reassures allies and disquiets potential adversaries. The strategic message provided by three CVNs, USS Nimitz (CVN 68), USS Theodore Roosevelt (CVN 71), and USS Ronald Reagan (CVN 76), operating with our South Korean and Japanese allies in 2017, provided an unambiguous signal of our nation's commitment to the continued security and stability of that region.

Nimitz-class aircraft carriers USS Carl Vinson (CVN 70) and USS Ronald Reagan (CVN 76) transit the Philippine Sea in November 2023.

That agility was also evident as the USS Harry S Truman (CVN 75) executed a direct display of the Secretary of Defense's Dynamic Force Employment concept in 2019, returning to the European Theater after an unscheduled short homeport period. Today, more than ever, our nation needs its aircraft carriers to defend national interests in this age of strategic competition.

In January 2024, the world's largest aircraft carrier, USS Gerald R. Ford (CVN 78), completed a historic 8-month deployment to the U.S. Naval Forces Europe area of operations. While in the Mediterranean, the carrier strike group participated in and supported numerous multinational exercises and vigilance activities to increase NATO capability and deter aggression in the region. The carrier visited ports in Croatia, Greece, Italy, Norway and Turkey. Following the outbreak of conflict in Israel, the Gerald R. Ford Carrier Strike Group was extended 76 days and operated in the Mediterranean Sea to deter further escalation and support Israel in its right to self-defense. In 239 days underway, the ship's crew conducted 43 underway replenishments, logged more than 17,826 flight hours and 10,396 sorties, and sailed more than 83,476 nautical miles safely.


USS Gerald R. Ford returns from an extended 8-month deployment in January 2024.

CVNs demonstrate great versatility during humanitarian assistance and disaster relief operations.  Once on-station, carriers provide much needed supplies, including pure drinking water produced by nuclear power.  USS Harry S Truman (CVN 75) provided humanitarian assistance to the Gulf Coast following Hurricane Katrina in 2005 and USS Carl Vinson (CVN 70) was immediately dispatched to assist the people of Haiti following a devastating earthquake in 2010.  In March 2011, USS Ronald Reagan (CVN 76) provided disaster relief to Japan in support of Operation Tomodachi, following a devastating earthquake and tsunami that struck the island of Honshu.  USS George Washington (CVN 73) provided similar rapid assistance to the people of the Philippines following Typhoon Haiyan in November 2013.

## *Arctic Operations*

From both a strategic and scientific standpoint, the Arctic Ocean is an important region. Strategically, the Arctic ice can be used as cover to approach the shores of bordering nations, including our own. Scientifically, Arctic ice and water hold information that can be used to better understand the world's ever-changing environment.

At the same time, the Arctic is one of the most challenging environments on the planet; perhaps nowhere else is the tactical flexibility provided by nuclear power more evident than in under-ice operations. A submarine operating under the ice must maneuver carefully, using special sonar equipment to avoid shifting ice packs, and keep track of clearances, not only below the ship, because the Arctic Ocean is quite shallow in many places, but also above the ship, where thick ice extends downward. In addition, under-ice operations prevent submarine crews from relying on navigation satellites (commonly used in open waters to keep track of position), requiring instead the use of shipboard inertial navigation systems and computers which must be constantly updated through calculations based on the movement of the ship. Communication, if necessary in the Arctic, requires a submarine to locate an area of thin ice and then carefully break through to the surface.

The first U.S. submarine Arctic operations were conducted in 1946 when the diesel-powered submarine, USS Atule (SS 403), conducted a brief excursion under the ice, limited by the need to recharge batteries. In 1957, USS Nautilus (SSN 571) became the first nuclear-powered submarine to operate under the ice. In 1958, Nautilus conducted the first submerged transpolar crossing, reaching the geographic North Pole on Aug. 3, 1958. In 1959, USS Skate (SSN 578) became the first ship to surface at the North Pole. In subsequent years, many U.S. nuclear-powered submarines have operated under and surfaced through the polar ice cap.

The Virginia-class fast attack submarine USS Indiana (SSN 789) surfaced in the Beaufort Sea during Operation Ice Camp 2024.

While conducting operations in the Arctic, U.S. submarines often collect data and samples for scientific study. Scientists will also embark on submarines to carry out more sophisticated tests and experiments. In the spring of 1999, USS Hawkbill (SSN 666) conducted an extensive mission to the Arctic to support numerous scientific studies and mapping. This mission successfully concluded a series of five Arctic expeditions conducted as a joint venture between the U.S. Navy and the National Science Foundation.

Biannually, the U.S. Navy conducts Ice Camp, a three-week operation that allows the Navy to assess its operational readiness in the Arctic, increase experience in the region, advance understanding of the Arctic environment, and continue to develop relationships with other services, allies, and partner organizations. Previously known as Ice Exercise (ICEX), the operation partners with the Arctic Submarine Laboratory and was elevated to an operation to better reflect the Navy's priority in the Arctic region. Ice Camp will meet national security objectives, as outlined in the Department of Defense and the Department of the Navy Arctic Strategy, to maintain an enhanced Arctic presence, strengthen alliances and partnerships, and build a more capable Arctic naval force. The first iteration of this event took place in 1946. Ice Camp 2024 included personnel from the U.S. Navy, Army, Air Force, Marine Corps, and Space Force and personnel from the Royal Canadian Air Force, Royal Canadian Navy, the French Navy, the United Kingdom Royal Navy, and the Royal Australian Navy.

As these trips under the polar ice demonstrate, nuclear power has significantly augmented our ability to explore the far reaches of our planet.

# Special Projects

## *Shippingport*

Because of the Program's success with nuclear reactors, President Dwight D. Eisenhower made the Program responsible for developing the Shippingport Atomic Power Station in Shippingport, Pennsylvania, the world's first full-scale atomic powerplant built solely for the production of electricity. Operated by the Duquesne Light Company, Shippingport's pressurized-water reactor (PWR) design and original cores became prototypes for the majority of commercial nuclear power stations. Other Shippingport achievements include the following:

- Provided power to Duquesne Light Company customers from 1957 –1974 with PWR design cores.
- Was available for operation about 65% of its life — higher than most other commercial plants at the time — despite numerous planned shutdowns for research and development purposes.
- Issued the first safeguards report for a nuclear power station.

## *Light Water Breeder Reactor (LWBR)*

In the early 1960s, the Atomic Energy Commission focused research and development efforts on liquid-metal breeder reactors that would generate more fissionable material than they would consume while producing power. Conventional wisdom was that breeding would not be possible in a pressurized water reactor plant. The Program's successful development of an LWBR core at Shippingport dispelled that notion:

- In 1965, LWBR development began with uranium-233 as the "fissile" material; and thorium, the "fertile" material. Successful use of thorium, a plentiful resource, would provide a source of energy many times greater than the known fossil fuel reserves.
- In 1977, the LWBR began operation at Shippingport, generating electricity for Duquesne Light Company for five years.
- The LWBR core was very reliable, achieving a level of online operation similar to its PWR predecessor.
- Extensive end-of-life testing confirmed that the LWBR had operated as designed. In fact, breeding occurred at a rate higher than predicted. The performance of the core material was excellent.
- LWBR technical reports were made available to the commercial nuclear power industry.

The Program remained responsible for Shippingport through end-of-life testing and defueling. DOE decommissioned Shippingport in 1989, removed all radioactive components, and returned the site to "green-field" condition.

# *NR-1*

In 1965, the Program began development of a nuclear-powered deep-submergence research and ocean engineering vehicle, designated NR-1. The capability of this manned vehicle was far greater than any other research vessel planned or developed at that time because of the vastly increased endurance and independence from surface support made possible by nuclear power. Launched in January 1969 at Electric Boat, Groton, Connecticut and decommissioned in November 2008, NR-1 provided valuable service to the U.S. Navy, other Government agencies, and research and educational institutions. In addition to its small nuclear propulsion plant, which provided virtually limitless submerged endurance, NR-1's characteristics included the following:

- A 400-ton submerged displacement, 150-foot length, and 12-foot diameter
- A speed of approximately 4 knots with two external electric motors.
- A 3,000-foot operating depth.
- Retractable bottoming wheels.
- Viewing ports and exterior lighting, as well as color television and still cameras for photographic studies.
- An object recovery claw and manipulator with gripping and cutting capability.

NR-1 transiting the Thames River.

NR-1 was equipped with sophisticated electronics and computers to aid navigation, communications, and object location and identification. The submarine could maneuver or hold a steady position on or close to the seabed or underwater ridges to detect and identify objects at a considerable distance and to lift objects off the ocean floor.

NR-1 had a crew of 5–10 specially trained U.S. Navy volunteers and two scientists. Able to remain submerged and move at maximum speed for extended periods of time, the vessel performed detailed studies and mapping of the ocean bottom, including temperature, currents, and other oceanographic data for military and scientific uses.

The unique capabilities of NR-1 put the ship in high demand in both the military and the scientific communities. NR-1 could remain submerged for up to a month, facilitating the survey of large areas even in inclement weather. The following are a few of NR-1's past scientific missions:

- Participating in the search, identification, and recovery of critical parts of the space shuttle Challenger and Egypt Air Flight 990 wreckages.

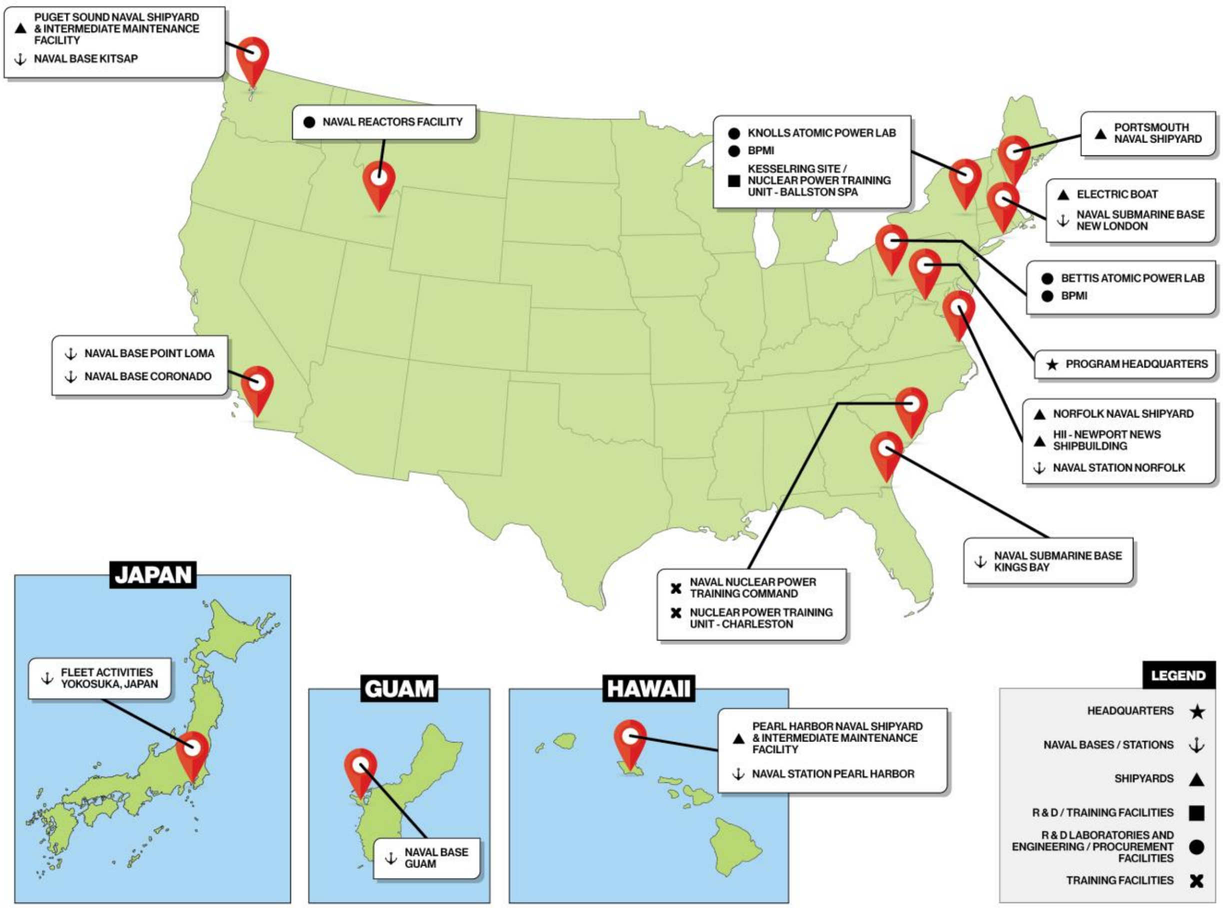
- Exploring the wreckage of HMHS Britannic (RMS Titanic's sister ship), lost in the Mediterranean during World War II under mysterious circumstances.

- Locating and surveying ancient Roman shipwrecks lost while on trading voyages between Rome and Carthage.

- Participating in Jason Project VII, a joint scientific and educational effort with an overall mission of engaging students in science and technology through the use of interactive telecommunications.

# Program Locations

As shown on the map below, Naval Nuclear Propulsion Program activities can be found throughout the United States and the world. Program interests crisscross the Nation from Portsmouth Naval Shipyard in Kittery, Maine, to the submarine base at Pearl Harbor, Hawaii; from the training center in Charleston, South Carolina, to Naval Base Kitsap in Bangor, Washington. With submarines based in Guam, an aircraft carrier forward deployed in Yokosuka, Japan, and U.S. nuclear-powered vessels welcome in numerous ports throughout the world, the Naval Nuclear Propulsion Program is truly global in scope.



# Program Directors – Past and Present

## *Admiral Hyman G. Rickover*
## *U.S. Navy*

**DIRECTOR**
**AUGUST 4, 1948 – JANUARY 31, 1982**

Adm. Hyman G. Rickover, the Father of the Nuclear Navy, was born in Makow, Russia, Jan. 27, 1900. At the age of 6, he came to the United States, settling in Chicago, Illinois. Rickover entered the U.S. Naval Academy in 1918 and was commissioned an ensign in June 1922.

Following sea duty aboard the destroyer USS La Vallette (DD 315) and the battleship USS Nevada (BB 36), Rickover attended Columbia University, where he earned a Master of Science in Electrical Engineering. From 1929 to 1933, he qualified for submarine duty and command aboard the submarines USS S 9 (SS 114) and USS S 48 (SS 159). In June 1937, he assumed command of the minesweeper USS Finch (AM 9). Later that year, he was selected as an Engineering Duty Officer and spent the remainder of his career serving in that specialty.

During World War II Rickover served as Head of the Electrical Section of the Bureau of Ships and later as Commanding Officer of the Naval Repair Base, Okinawa. In 1946, he was assigned to the U.S. Atomic Energy Commission (AEC) Laboratory at Oak Ridge, Tennessee, and, in early 1949, to the Division of Reactor Development, AEC.

As director of the Naval Reactors Branch, Rickover developed the world's first nuclear-powered submarine, USS Nautilus (SSN 571), which went to sea in 1955. In the years that followed, Rickover directed all aspects of building and operating the nuclear fleet.

Rickover's numerous medals and decorations include the Distinguished Service Medal, Legion of Merit, Navy Commendation Medal, and the World War II Victory Medal. In recognition of his wartime service, he was made Honorary Commander of the Military Division of the Most Excellent Order of the British Empire. Rickover was twice awarded the Congressional Gold Medal for exceptional public service. In 1980, President Jimmy Carter presented Rickover with the Presidential Medal of Freedom, the Nation's highest non-military honor, for his contributions to world peace.

Rickover retired from the U.S. Navy on 31, 1982, after over 63 years of service to his country and to 13 presidents. His name is memorialized in Rickover Hall at the Naval Academy, and two attack submarines, the now-decommissioned USS Hyman G. Rickover (SSN 709) and the recently commissioned Virginia-class USS Hyman G. Rickover (SSN 795). Rickover died July 8, 1986, and is buried at Arlington National Cemetery. The Engineering Honor Society Tau Beta Pi named Rickover as one of the Top Ten Engineers of the Twentieth Century in December 1999.

# *Admiral Kinnaird R. McKee*
# *U.S. Navy*

**DIRECTOR**
**FEBRUARY 1, 1982 – OCTOBER 21, 1988**

Adm. Kinnaird R. McKee was born in Louisville, Kentucky, Aug. 14, 1929, and graduated from the U.S. Naval Academy in 1951. He served aboard the Pacific fleet destroyer USS Marshall (DD 676) during the Korean War and in eight submarines of the Atlantic fleet . After completion of submarine training in 1953, he served on three diesel-powered submarines: USS Picuda (SS 382), USS Sea Cat (SS 399), and USS Marlin (SST 2). In 1956, McKee was ordered to command USS X-1, a small experimental submarine. He graduated from nuclear power training in 1958 and joined the commissioning crew of USS Skipjack (SSN 585), the U.S. Navy's first high-performance nuclear-powered attack submarine. Assignment as Executive Officer, USS Nautilus (SSN 571), followed in 1961; then of USS Sam Houston (SSBN 609) in late 1962. After three deterrent patrols aboard Sam Houston, he served in the Naval Reactors Division of the U.S. Atomic Energy Commission from 1964 to 1966.

McKee served as Commanding Officer of the nuclear-powered attack submarine USS Dace (SSN 607) from 1966 through 1969. The ship was twice awarded the Navy Unit Commendation and three times the Battle Efficiency Pennant for operations during that period. Following command of Dace, McKee served in the office of the Director, Navy Program Planning, where his responsibilities included strategic warfare, research and development, and submarine and antisubmarine warfare systems. In 1970, he was assigned to the immediate staff of the Chief of Naval Operations, where he established the CNO Executive Panel. As Commander, Submarine Group Eight, McKee served as the NATO and U.S. Submarine Commander in the Mediterranean from 1973 to 1975. On Aug. 1, 1975, he became the 48th Superintendent of the U.S. Naval Academy. Promoted to three-star rank in March 1978, McKee served as Commander, Third Fleet with headquarters in Pearl Harbor. He was then assigned as Director, Naval Warfare, Office of the Chief of Naval Operations, concurrent with the expansion of the directorate from its original concentration on antisubmarine warfare to responsibility for all aspects of naval warfare. He developed and implemented the new organization.

He relieved Rickover as Director, Naval Nuclear Propulsion Feb. 1, 1982. He was confirmed by the U.S. Senate for promotion to four-star rank March 2, 1982.

McKee's decorations include the Distinguished Service Medal, five awards of the Legion of Merit, and three awards of the Navy Unit Commendation.

McKee retired on Oct. 31, 1988, after 41 years of service to his country. McKee died Dec. 30, 2013, and is buried at the U.S. Naval Academy Cemetery.

# *Admiral Bruce DeMars*
# *U.S. Navy*

**DIRECTOR**
**OCTOBER 22, 1988 – SEPTEMBER 26, 1996**

Adm. Bruce DeMars was born in Chicago, Illinois, on June 3, 1935, and graduated from the U.S. Naval Academy in 1957. Following commissioning, he served in the attack transports USS Telfair (APA 210) and USS Okanogan (APA 220) and, after Submarine School, the diesel-electric submarine USS Capitaine (SS 336). Following nuclear power training, he served in the nuclear-powered submarines USS George Washington (SSBN 598), USS Snook (SSN 592), and USS Sturgeon (SSN 637) before reporting for duty as Commanding Officer, USS Cavalla (SSN 684).

Shore duty tours included instructor duty at Nuclear Power School and Submarine School and attendance at the Armed Forces Staff College. After staff duty with Submarine Squadron Ten, DeMars served as Senior Member of the Nuclear Propulsion Examining Board, U.S. Atlantic Fleet. He commanded Submarine Development Squadron Twelve in New London, Connecticut and then served as Deputy Director, Attack Submarine Division in the Office of the Chief of Naval Operations, until selected for promotion to Rear Admiral in 1981.

As a Flag Officer, DeMars served as Commander, U.S. Naval Forces Marianas; Commander, U.S. Naval Base Guam; as Commander in Chief, Pacific Representative for Guam and the Trust Territory of the Pacific Islands; and as Deputy Assistant Chief and then Deputy Chief of Naval Operations for Submarine Warfare.

He was confirmed by the U.S. Senate for promotion to four-star rank Sept. 30, 1988, and he relieved Admiral McKee as Director, Naval Nuclear Propulsion Oct. 22, 1988.

DeMars' decorations include the Distinguished Service Medal, four awards of the Legion of Merit, two awards of the Meritorious Service Medal, two awards of the Navy Commendation Medal, the Navy Achievement Medal, and the Navy Unit Commendation.

DeMars retired Oct. 1, 1996, after 43 years of service to his country. DeMars died Feb. 3, 2024.

# *Admiral Frank L. "Skip" Bowman*
# *U.S. Navy*

**DIRECTOR**
**SEPTEMBER 27, 1996 – NOVEMBER 4, 2004**

Adm. Skip Bowman was born and grew up in Chattanooga, Tennessee. He was commissioned following graduation from Duke University. In 1973, he completed a dual master's program in nuclear engineering, naval architecture, and marine engineering at the Massachusetts Institute of Technology and was elected to the Society of Sigma Xi. He has served on two visiting committees at MIT (Ocean Engineering and Nuclear Engineering), the Engineering Board of Visitors at Duke University, and the Nuclear Engineering Department Advisory Committee at the University of Tennessee.

His early assignments included tours in USS Simon Bolivar (SSBN 641), USS Pogy (SSN 647), USS Daniel Boone (SSBN 629), and USS Bremerton (SSN 698). In 1983, Bowman took command of USS City of Corpus Christi (SSN 705), which completed a seven-month circumnavigation of the globe and two special classified missions during his command tour. His crew earned three consecutive Battle Efficiency "E" awards. Bowman later commanded the tender USS Holland (AS 32) from August 1988 to April 1990. During this period, the Holland crew was awarded two Battle Efficiency "E" awards.

Ashore, Bowman has served on the staff of Commander, Submarine Squadron Fifteen, in Guam; twice in the Bureau of Naval Personnel in the Submarine Policy and Assignment Division; as the SSN 21 Attack Submarine Program Coordinator on the staff of the Chief of Naval Operations; on the Chief of Naval Operations' Strategic Studies Group; and as Executive Assistant to the Deputy Chief of Naval Operations (Naval Warfare). In December 1991, he was promoted to flag rank and assigned as Deputy Director of Operations on the Joint Staff (J-3) until June 1992, and then as Director for Political-Military Affairs (J-5) until July 1994. Bowman served as Chief of Naval Personnel from July 1994 to September 1996.

Bowman assumed duties as Director, Naval Nuclear Propulsion, Sept. 27,1996 and was promoted to the four-star rank Oct. 1, 1996.

Under his command, his crews have earned the Meritorious Unit Commendation (three awards), the Navy Battle Efficiency "E" Ribbon (five awards), the Navy Expeditionary Medal (two awards), the Humanitarian Service Medal (two awards), the Sea Service Deployment Ribbon (three awards), and the Navy Arctic Service Ribbon. His personal awards include the Defense Distinguished Service Medal, the Navy Distinguished Service Medal, the Legion of Merit (with three gold stars), and the Officier de l'Ordre National du Mérite from the Government of France.

Bowman retired Jan. 1, 2005, after more than 38 years of service.

# *Admiral Kirkland H. Donald U.S. Navy*

**DIRECTOR**
**NOVEMBER 5, 2004 – NOVEMBER 2, 2012**

Originally from Norlina, North Carolina, Adm. Kirkland Donald graduated from the U.S. Naval Academy in 1975 with a bachelor of science in ocean engineering. He also holds a master's degree in business administration from the University of Phoenix and is a graduate of Harvard University's John F. Kennedy School of Government Senior Executive Fellows Program.

After nuclear power and submarine training, he served in USS Batfish (SSN 681), USS Mariano G. Vallejo (SSBN 658), and USS Seahorse (SSN 669).

Donald was Commanding Officer, USS Key West (SSN 722), from October 1990 to February 1993. He served as Commander, Submarine Development Squadron 12 from August 1995 to July 1997. From June 2002 to July 2003, he was assigned as Commander, Submarine Group 8; Commander, Submarine Force 6th Fleet (CTF 69); Commander, Submarines Allied Naval Forces South; and Commander, Fleet Ballistic Missile Submarine Force (CTF 164) in Naples, Italy. He served as Commander, Naval Submarine Forces; Commander, Submarine Force, U.S. Atlantic Fleet; Commander, Allied Submarine Command; and Commander, Task Forces 84 and 144, in Norfolk, Virginia.

His shore assignments include the Pacific Fleet Nuclear Propulsion Examining Board and the staff of the Director, Naval Nuclear Propulsion. He also served at the Bureau of Naval Personnel, on the Joint Staff, and as Deputy Chief of Staff for C4I, Resources, Requirements and Assessments, U.S. Pacific Fleet.

Donald was confirmed by the Senate to receive a fourth star on Sept. 30, 2004 and assumed duties as Director, Naval Nuclear Propulsion, Nov. 5, 2004.

Donald is authorized to wear the Navy Distinguished Service Medal (three awards), Defense Superior Service Medal, Legion of Merit with four gold stars, and the Meritorious Service Medal with one gold star, in addition to other personal and unit awards.

Donald retired in December 2012 after more than 37 years of service.

# *Admiral John M. Richardson*
# *U.S. Navy*

**DIRECTOR**
**NOVEMBER 2, 2012 – AUGUST 14, 2015**

Adm. John Richardson graduated from the U.S. Naval Academy in 1982 with a Bachelor of Science in Physics. He also holds master's degrees in electrical engineering from the Massachusetts Institute of Technology and Woods Hole Oceanographic Institution, and National Security Strategy from the National War College.

At sea, Richardson served on USS Parche (SSN 683), USS George C. Marshall (SSBN 654), and USS Salt Lake City (SSN 716). He commanded USS Honolulu (SSN 718) in Pearl Harbor, Hawaii.

Richardson also served as Commodore of Submarine Development Squadron (DEVRON) 12; Commander, Submarine Group 8; Commander, Submarine Allied Naval Forces South; Deputy Commander, U.S. 6$^{th}$ Fleet; Chief of Staff, U.S. Naval Forces Europe and U.S. Naval Forces Africa; Commander, Naval Submarine Forces; and Director of Naval Reactors.

His staff assignments include duty in the Attack Submarine Division on the Chief of Naval Operations staff; Naval Aide to the President; prospective commanding officer instructor for Commander, Submarine Forces, U.S. Pacific Fleet; Assistant Deputy Director for Regional Operations on the Joint Staff; and Director of Strategy and Policy at U.S. Joint Forces Command.

Richardson served on teams that have been awarded the Presidential Unit Citation, the Joint Meritorious Unit Award, the Navy Unit Commendation, and the Navy "E" Ribbon. He was awarded the Vice Admiral Stockdale Award for his time in command of Honolulu.

Richardson assumed duties as Director, Naval Nuclear Propulsion, Nov. 2, 2012. He served as the 31$^{st}$ Chief of Naval Operations from September 2015 to August 2019.

Richardson retired in August 2019 after 37 years of service.

# *Admiral James F. Caldwell, Jr.*
# *U.S. Navy*

**DIRECTOR**
**AUGUST 14, 2015 – JANUARY 12, 2024**

Adm. Frank Caldwell received his commission graduating with distinction from the U.S. Naval Academy in 1981 with a Bachelor of Science in Marine Engineering. He also holds Master of Science in Operations Research from the Naval Postgraduate School.

Caldwell commanded USS Jacksonville (SSN 699) homeported in Norfolk, Virginia; Submarine Development Squadron (DEVRON) Twelve in New London, Connecticut; Submarine Group Nine in Bangor, Washington; and the Submarine Force, U.S. Pacific Fleet in Hawaii. His sea tours include service in both the Atlantic and Pacific Fleets. His operational assignments include duty as division officer on USS Boston (SSN 703), engineer officer on USS Alabama (SSBN 731) (GOLD), and executive officer on USS Buffalo (SSN 715).

Ashore, Caldwell served on the Pacific Fleet Nuclear Propulsion Examining Board and later as Undersea Warfare (USW) Requirements officer on the staff of Commander in Chief, U.S. Pacific Fleet. He also served as senior member of the Naval Submarine Force's Tactical Readiness Evaluation Team, and on the Joint Staff as deputy director for Politico-Military Affairs for Europe, the North Atlantic Treaty Organization, Russia and Africa. His flag tours ashore include deputy commander for U.S. Strategic Command's Joint Functional Component Command for Global Strike in Omaha, Nebraska; the Naval Inspector General, Washington Navy Yard, D.C.; and most recently on the Office of Naval Operations (OPNAV) Staff as the Director, Navy Staff.

Caldwell assumed his duties as Director, Naval Nuclear Propulsion, Aug. 14, 2015.

Caldwell's awards include the Distinguished Service Medal, Defense Superior Service Medal, Legion of Merit, Meritorious Service Medal, Navy Commendation Medal, Navy and Marine Corps Achievement Medal, and the Naval Submarine League's Charles A. Lockwood Award.

Caldwell retired after 42 years of service in January 2024.

## *Admiral William J. Houston*
## *U.S. Navy*

**DIRECTOR**
**JANUARY 12, 2024 – PRESENT**

Adm. Bill Houston is a native of Buffalo, New York and graduate of the University of Notre Dame with a degree in Electrical Engineering. He was commissioned via the Navy Reserve Officer Training Corps (NROTC) program. He also holds a Master's of Business Administration degree from the College of William and Mary's Mason School of Business.

His sea tours include division officer assignments on USS Phoenix (SSN 702), Engineer Officer onboard USS Hampton (SSN 767), and Executive Officer onboard USS Tennessee (SSBN 734) (Blue). He commanded USS Hampton (SSN 767) in San Diego and was commodore of Submarine Squadron 20 in Kings Bay, Georgia.

His shore assignments include Flag Lieutenant for Commander Submarine Force, U.S. Atlantic Fleet; the Atlantic Fleet Nuclear Propulsion Examining Board; Special Assistant to the Director of Naval Reactors for Personnel and Policy; Deputy Commander for Submarine Squadron 20; the Principal Director for Nuclear Matters within the Office of the Secretary of Defense; the Submarine and Nuclear Community Manager, Military Personnel Plans and Policy (N133) and Division Director of Submarine and Nuclear Propulsion Distribution, Navy Personnel Command (PERS-42).

His flag assignments include Deputy Director for Strategic Targeting and Nuclear Mission Planning (J5N) United States Strategic Command, Director of Operations, Naval Forces Europe-Africa Deputy Commander, U.S. 6th Fleet, and Commander, Submarine Group 8, Director, Undersea Warfare Division, Office of Chief of Naval Operations (N97), Commander, Naval Submarine Forces, Commander, Submarine Force, U.S. Atlantic Fleet, and Commander, Allied Submarine Command.

Houston assumed his duties as Director, Naval Nuclear Propulsion Program Jan. 10, 2024.

# Program Statistics

(As of December 2024)

| | |
|---|---|
| Active nuclear-powered combat submarines | 66 |
| Active nuclear-powered aircraft carriers | 11 |
| **Total active nuclear-powered ships** | **77** |
| **Total nuclear-powered ships built** | **230** |
| Number of miles steamed on nuclear power | >177,000,000 |
| Number of reactor-years of operation | >7,600 |
| Number of officers trained or in training | >28,155 |
| Number of enlisted personnel trained or in training | >127,495 |
| Number of civilians trained or in training | >2,357 |
| **Total number of cores taken critical (including refuelings)** | **457** |
| Number of reactors currently in operation | 97 |

# U.S. Nuclear-Powered Ship Program Summary

(As of December 2024)

| ***Class*** | ***Authorized by Congress*** | ***Under Construction*** | ***In Commission*** | ***Decommissioned*** |
|---|---|---|---|---|
| **SUBMARINES** | | | | |
| Virginia class | 38 | 15 | 23 | 0 |
| Seawolf class | 3 | 0 | 3 | 0 |
| Los Angeles class | 62 | 0 | 22 | 40 |
| Other SSNs (fast attack submarines) | 68[1] | 0 | 0 | 78[1] |
| ***TOTAL SSNs*** | ***161*** | ***15*** | ***48*** | ***106*** |
| Columbia class | 12 | 2 | 0 | 0 |
| Ohio class | 18[2] | 0 | 18[2] | 0 |
| *Polaris / Poseidon* SSBNs (ballistic missile submarines) | 41[1] | 0 | 0 | 31[1] |
| ***TOTAL SSBNs*** | ***59*** | ***2*** | ***14*** | ***31*** |
| ***TOTAL SSGNs*** | ***0*** | ***0*** | ***4***240+78+ | ***0*** |
| ***TOTAL*** | ***220*** | ***17*** | ***66*** | ***137*** |

| **NUCLEAR-POWERED SURFACE SHIPS** | | | | |
|---|---|---|---|---|
| Enterprise (CVN 65) | 1 | 0 | 0 | 1 |
| Nimitz (CVN 68) | 10 | 0 | 10 | 0 |
| Gerald R. Ford (CVN 78) | 4 | 3 | 1 | 0 |
| CGNs (Guided Missile Cruisers) | 9 | 0 | 0 | 9 |
| ***TOTAL*** | ***24*** | ***20*** | ***11*** | ***10*** |

| | | | | |
|---|---|---|---|---|
| ***TOTAL NUCLEAR-POWERED SHIPS*** | ***244*** | ***20*** | ***77*** | ***147*** |

[1] Ten ships originally authorized by Congress as fleet ballistic missile submarines were converted to fast-attack submarines.
[2] Four SSBNs were removed from strategic service and designated SSGNs.

# U.S. Nuclear-Powered Submarines

## NUCLEAR-POWERED ATTACK SUBMARINES (SSN)

| Name | Hull Number | Class | Builder | Shipbuilding Program FY | Keel Laid | Launched | Commissioned | Decommissioned |
|---|---|---|---|---|---|---|---|---|
| ***Nautilus*** | **SSN 571** | **571** | Electric Boat | 1952 | 06/14/52 | 01/21/54 | 09/30/54 | 03/03/80 |
| ***Seawolf*** | **SSN 575** | **575** | Electric Boat | 1953 | 09/07/53 | 07/21/55 | 03/30/57 | 03/31/87 |
| ***Skate*** | **SSN 578** | **578** | Electric Boat | 1955 | 07/21/55 | 05/16/57 | 12/23/57 | 09/12/86 |
| *Swordfish* | SSN 579 | 578 | Portsmouth | 1955 | 01/25/56 | 08/27/57 | 09/15/58 | 06/02/89 |
| *Sargo* | SSN 583 | 578 | Mare Island | 1956 | 02/21/56 | 10/10/57 | 10/01/58 | 02/26/88 |
| *Seadragon* | SSN 584 | 578 | Portsmouth | 1956 | 06/20/56 | 08/16/58 | 12/05/59 | 06/12/84 |
| ***Skipjack*** | **SSN 585** | **585** | Electric Boat | 1956 | 05/29/56 | 05/26/58 | 04/15/59 | 04/19/90 |
| ***Triton*** | **SSN 586** | **586** | Electric Boat | 1956 | 05/29/56 | 08/19/58 | 11/10/59 | 04/30/86 |
| ***Halibut*** | **SSN 587** | **587** | Mare Island | 1956 | 04/11/57 | 01/09/59 | 01/04/60 | 06/30/76 |
| *Scamp* | SSN 588 | 585 | Mare Island | 1957 | 01/23/59 | 10/08/60 | 06/05/61 | 04/28/88 |
| *Scorpion* | SSN 589 | 585 | Electric Boat | 1957 | 08/20/58 | 12/19/59 | 07/29/60 | 05/22/68[1] |
| *Sculpin* | SSN 590 | 585 | Ingalls | 1957 | 02/03/58 | 03/31/60 | 06/01/61 | 08/03/90 |
| *Shark* | SSN 591 | 585 | Newport News | 1957 | 02/24/58 | 03/16/60 | 02/09/61 | 09/15/90 |
| *Snook* | SSN 592 | 585 | Ingalls | 1957 | 04/07/58 | 10/31/60 | 10/24/61 | 10/16/86 |
| ***Permit*** | **SSN 594** | **594** | Mare Island | 1958 | 05/01/59 | 07/01/61 | 05/29/62 | 07/23/91 |
| *Thresher* | SSN 593 | 594 | Portsmouth | 1957 | 05/28/58 | 07/09/60 | 08/03/61 | 04/10/63[1] |
| *Plunger* | SSN 595 | 594 | Mare Island | 1958 | 03/02/60 | 12/09/61 | 11/21/62 | 02/02/90 |
| *Barb* | SSN 596 | 594 | Ingalls | 1958 | 11/09/59 | 02/12/62 | 08/24/63 | 12/20/89 |
| *Pollack* | SSN 603 | 594 | NY Shipbuilding | 1959 | 03/14/60 | 03/17/62 | 05/26/64 | 03/01/89 |
| *Haddo* | SSN 604 | 594 | NY Shipbuilding | 1959 | 09/09/60 | 08/18/62 | 12/16/64 | 06/12/91 |
| *Jack* | SSN 605 | 594 | Portsmouth | 1959 | 09/16/60 | 04/24/63 | 03/31/67 | 07/11/90 |
| *Tinosa* | SSN 606 | 594 | Portsmouth | 1959 | 11/24/59 | 12/09/61 | 11/17/64 | 01/15/92 |
| *Dace* | SSN 607 | 594 | Ingalls | 1959 | 06/06/60 | 08/18/62 | 04/04/64 | 12/02/88 |
| *Guardfish* | SSN 612 | 594 | NY Shipbuilding | 1960 | 02/28/61 | 05/15/65 | 12/20/66 | 02/04/92 |
| *Flasher* | SSN 613 | 594 | Electric Boat | 1960 | 04/14/61 | 06/22/63 | 07/22/66 | 09/14/92 |
| *Greenling* | SSN 614 | 594 | Quincy | 1960 | 08/15/61 | 04/04/64 | 11/03/67 | 04/18/94 |
| *Gato* | SSN 615 | 594 | Quincy | 1960 | 12/15/61 | 05/14/64 | 01/25/68 | 04/25/96 |
| *Haddock* | SSN 621 | 594 | Ingalls | 1961 | 04/24/61 | 05/21/66 | 12/22/67 | 04/07/93 |
| ***Tullibee*** | **SSN 597** | **597** | Electric Boat | 1958 | 05/26/58 | 04/27/60 | 11/09/60 | 06/18/88 |
| ***Sturgeon*** | **SSN 637** | **637** | Electric Boat | 1962 | 08/10/63 | 02/26/66 | 03/03/67 | 08/01/94 |
| *Whale* | SSN 638 | 637 | Quincy | 1962 | 05/27/64 | 10/14/66 | 10/12/68 | 06/25/96 |
| *Tautog* | SSN 639 | 637 | Ingalls | 1962 | 01/27/64 | 04/15/67 | 08/17/68 | 03/31/97 |
| *Grayling* | SSN 646 | 637 | Portsmouth | 1963 | 05/12/64 | 06/22/67 | 10/11/69 | 07/18/97 |
| *Pogy* | SSN 647 | 637 | NY Ship / Ingalls | 1963 | 05/05/64 | 06/03/67 | 05/15/71 | 06/11/99 |
| *Aspro* | SSN 648 | 637 | Ingalls | 1963 | 11/23/64 | 11/29/67 | 02/20/69 | 03/31/95 |
| *Sunfish* | SSN 649 | 637 | Quincy | 1963 | 01/15/65 | 10/14/66 | 03/15/69 | 03/31/97 |
| *Pargo* | SSN 650 | 637 | Electric Boat | 1963 | 06/03/64 | 09/17/66 | 01/05/68 | 04/14/95 |
| *Queenfish* | SSN 651 | 637 | Newport News | 1963 | 05/11/64 | 02/25/66 | 12/06/66 | 04/14/92 |
| *Puffer* | SSN 652 | 637 | Ingalls | 1963 | 02/08/65 | 03/30/68 | 08/09/69 | 07/12/96 |
| *Ray* | SSN 653 | 637 | Newport News | 1963 | 01/04/65 | 06/21/66 | 04/12/67 | 03/16/93 |
| *Sand Lance* | SSN 660 | 637 | Portsmouth | 1964 | 01/15/65 | 11/11/69 | 09/25/71 | 08/07/98 |
| *Lapon* | SSN 661 | 637 | Newport News | 1964 | 07/26/65 | 12/16/66 | 12/14/67 | 08/08/92 |
| *Gurnard* | SSN 662 | 637 | Mare Island | 1964 | 12/22/64 | 05/20/67 | 12/06/68 | 04/28/95 |
| *Hammerhead* | SSN 663 | 637 | Newport News | 1964 | 11/29/65 | 04/14/67 | 06/28/68 | 04/05/95 |

## NUCLEAR-POWERED ATTACK SUBMARINES (SSN)

| Name | Hull Number | Class | Builder | Shipbuilding Program FY | Keel Laid | Launched | Commissioned | Decommissioned |
|---|---|---|---|---|---|---|---|---|
| *Sea Devil* | SSN 664 | 637 | Newport News | 1964 | 04/12/66 | 10/05/67 | 01/30/69 | 10/16/91 |
| *Guitarro* | SSN 665 | 637 | Mare Island | 1965 | 12/09/65 | 07/27/68 | 09/09/72 | 05/29/92 |
| *Hawkbill* | SSN 666 | 637 | Mare Island | 1965 | 09/12/66 | 04/12/69 | 02/04/71 | 03/15/00 |
| *Bergall* | SSN 667 | 637 | Electric Boat | 1965 | 04/16/66 | 02/17/68 | 06/13/69 | 06/06/96 |
| *Spadefish* | SSN 668 | 637 | Newport News | 1965 | 12/21/66 | 05/15/68 | 08/14/69 | 04/11/97 |
| *Seahorse* | SSN 669 | 637 | Electric Boat | 1965 | 08/13/66 | 06/15/68 | 09/19/69 | 08/17/95 |
| *Finback* | SSN 670 | 637 | Newport News | 1965 | 06/26/67 | 12/07/68 | 02/04/70 | 03/28/97 |
| *Pintado* | SSN 672 | 637 | Mare Island | 1966 | 10/27/67 | 08/16/69 | 09/11/71 | 02/26/98 |
| *Flying Fish* | SSN 673 | 637 | Electric Boat | 1966 | 06/30/67 | 05/17/69 | 04/29/70 | 05/16/96 |
| *Trepang* | SSN 674 | 637 | Electric Boat | 1966 | 10/28/67 | 09/27/69 | 08/14/70 | 06/01/99 |
| *Bluefish* | SSN 675 | 637 | Electric Boat | 1966 | 03/13/68 | 01/10/70 | 01/08/71 | 05/31/96 |
| *Billfish* | SSN 676 | 637 | Electric Boat | 1966 | 09/20/68 | 05/01/70 | 03/12/71 | 07/01/99 |
| *Drum* | SSN 677 | 637 | Mare Island | 1966 | 08/20/68 | 05/23/70 | 04/15/72 | 10/30/95 |
| *Archerfish* | SSN 678 | 637 | Electric Boat | 1967 | 06/19/69 | 01/16/71 | 12/17/71 | 03/31/98 |
| *Silversides* | SSN 679 | 637 | Electric Boat | 1967 | 10/13/69 | 06/04/71 | 05/05/72 | 07/21/94 |
| *William H. Bates* | SSN 680 | 637 | Ingalls | 1967 | 08/04/69 | 12/11/71 | 05/05/73 | 02/11/00 |
| *Batfish* | SSN 681 | 637 | Electric Boat | 1967 | 02/09/70 | 10/09/71 | 09/01/72 | 03/17/99 |
| *Tunny* | SSN 682 | 637 | Ingalls | 1967 | 05/22/70 | 06/10/72 | 01/26/74 | 03/13/98 |
| *Parche* | SSN 683 | 637 | Ingalls | 1968 | 12/10/70 | 01/13/73 | 08/17/74 | 07/18/05 |
| *Cavalla* | SSN 684 | 637 | Electric Boat | 1968 | 06/04/70 | 02/19/72 | 02/09/73 | 03/30/98 |
| *L. Mendel Rivers* | SSN 686 | 637 | Newport News | 1969 | 06/26/71 | 06/02/73 | 02/01/75 | 05/10/01 |
| *Richard B. Russell* | SSN 687 | 637 | Newport News | 1969 | 10/19/71 | 01/12/74 | 08/16/75 | 06/24/94 |
| ***Narwhal*** | **SSN 671** | **671** | Electric Boat | 1964 | 01/17/66 | 09/09/67 | 07/12/69 | 01/31/00 |
| ***Glenard P. Lipscomb*** | **SSN 685** | **685** | Electric Boat | 1968 | 06/05/71 | 08/04/73 | 12/21/74 | 07/11/90 |
| ***Los Angeles*** | **SSN 688** | **688** | Newport News | 1970 | 01/08/72 | 04/06/74 | 11/13/76 | 02/04/11 |
| *Baton Rouge* | SSN 689 | 688 | Newport News | 1970 | 11/18/72 | 04/26/75 | 06/25/77 | 01/13/95 |
| *Philadelphia* | SSN 690 | 688 | Electric Boat | 1970 | 08/12/72 | 10/19/74 | 06/25/77 | 06/30/11 |
| *Memphis* | SSN 691 | 688 | Newport News | 1971 | 06/23/73 | 04/03/76 | 12/17/77 | 01/20/12 |
| *Omaha* | SSN 692 | 688 | Electric Boat | 1971 | 01/27/73 | 02/21/76 | 03/11/78 | 10/05/95 |
| *Cincinnati* | SSN 693 | 688 | Newport News | 1971 | 04/06/74 | 02/19/77 | 06/10/78 | 07/31/95 |
| *Groton* | SSN 694 | 688 | Electric Boat | 1971 | 08/03/73 | 10/09/76 | 07/08/78 | 11/07/97 |
| *Birmingham* | SSN 695 | 688 | Newport News | 1972 | 04/26/75 | 10/29/77 | 12/16/78 | 12/23/97 |
| *New York City* | SSN 696 | 688 | Electric Boat | 1972 | 12/15/73 | 06/18/77 | 03/03/79 | 04/30/97 |
| *Indianapolis* | SSN 697 | 688 | Electric Boat | 1972 | 10/19/74 | 07/30/77 | 01/05/80 | 12/22/98 |
| *Bremerton* | SSN 698 | 688 | Electric Boat | 1972 | 05/08/76 | 07/22/78 | 03/28/81 | 03/21/2021 |
| *Jacksonville* | SSN 699 | 688 | Electric Boat | 1972 | 02/21/76 | 11/18/78 | 05/16/81 | 11/16/2021 |
| *Dallas* | SSN 700 | 688 | Electric Boat | 1973 | 10/09/76 | 04/28/79 | 07/18/81 | 04/04/18 |
| *La Jolla* [2] | SSN 701 | 688 | Electric Boat | 1973 | 10/16/76 | 08/11/79 | 10/24/81 | 11/15/2019 |
| *Phoenix* | SSN 702 | 688 | Electric Boat | 1973 | 07/30/77 | 12/08/79 | 12/19/81 | 07/29/98 |
| *Boston* | SSN 703 | 688 | Electric Boat | 1973 | 08/11/78 | 04/19/80 | 01/30/82 | 11/19/99 |
| *Baltimore* | SSN 704 | 688 | Electric Boat | 1973 | 05/21/79 | 12/13/80 | 07/24/82 | 07/10/98 |
| *City of Corpus Christi* | SSN 705 | 688 | Electric Boat | 1973 | 09/04/79 | 04/25/81 | 01/08/83 | 08/03/17 |
| *Albuquerque* | SSN 706 | 688 | Electric Boat | 1974 | 12/27/79 | 03/13/82 | 05/21/83 | 02/23/17 |
| *Portsmouth* | SSN 707 | 688 | Electric Boat | 1974 | 05/08/80 | 09/18/82 | 10/01/83 | 08/18/05 |
| *Minneapolis–St. Paul* | SSN 708 | 688 | Electric Boat | 1974 | 01/20/81 | 03/19/83 | 03/10/84 | 08/28/08 |
| *Hyman G. Rickover* | SSN 709 | 688 | Electric Boat | 1974 | 07/24/81 | 08/27/83 | 07/21/84 | 12/17/07 |
| *Augusta* | SSN 710 | 688 | Electric Boat | 1974 | 04/01/82 | 01/21/84 | 01/19/85 | 02/11/09 |

## NUCLEAR-POWERED ATTACK SUBMARINES (SSN)

| Name | Hull Number | Class | Builder | Shipbuilding Program FY | Keel Laid | Launched | Commissioned | Decommissioned |
|---|---|---|---|---|---|---|---|---|
| *San Francisco* [3] | SSN 711 | 688 | Newport News | 1975 | 05/26/77 | 10/27/79 | 04/24/81 | 05/15/2022 |
| *Atlanta* | SSN 712 | 688 | Newport News | 1975 | 08/17/78 | 08/16/80 | 03/06/82 | 12/16/99 |
| *Houston* | SSN 713 | 688 | Newport News | 1975 | 01/29/79 | 03/21/81 | 09/25/82 | 08/24/17 |
| *Norfolk* | SSN 714 | 688 | Newport News | 1976 | 08/01/79 | 10/31/81 | 05/21/83 | 12/11/14 |
| *Buffalo* | SSN 715 | 688 | Newport News | 1976 | 01/25/80 | 05/08/82 | 11/05/83 | 01/30/19 |
| *Salt Lake City* | SSN 716 | 688 | Newport News | 1977 | 08/26/80 | 10/16/82 | 05/12/84 | 10/25/06 |
| *Olympia* | SSN 717 | 688 | Newport News | 1977 | 03/31/81 | 04/30/83 | 11/17/84 | 02/05/21 |
| *Honolulu* | SSN 718 | 688 | Newport News | 1977 | 11/10/81 | 09/24/83 | 07/06/85 | 10/30/07 |
| *Providence* | SSN 719 | 688 | Electric Boat | 1978 | 10/14/82 | 08/04/84 | 07/27/85 | 08/22/22 |
| *Pittsburgh* | SSN 720 | 688 | Electric Boat | 1979 | 04/15/83 | 12/08/84 | 11/23/85 | 04/15/20 |
| *Chicago* | SSN 721 | 688 | Newport News | 1980 | 01/05/83 | 10/13/84 | 09/27/86 | 07/21/23 |
| *Key West* | SSN 722 | 688 | Newport News | 1980 | 07/06/83 | 07/20/85 | 09/12/87 | ——— |
| *Oklahoma City* | SSN 723 | 688 | Newport News | 1981 | 01/04/84 | 11/02/85 | 07/09/88 | 09/09/22 |
| *Louisville* | SSN 724 | 688 | Electric Boat | 1981 | 09/24/84 | 12/14/85 | 11/08/86 | 03/09/21 |
| *Helena* | SSN 725 | 688 | Electric Boat | 1982 | 03/28/85 | 06/28/86 | 07/11/87 | ——— |
| *Newport News* | SSN 750 | 688 | Newport News | 1982 | 03/03/84 | 03/15/86 | 06/03/89 | ——— |
| *San Juan* | SSN 751 | 688i[4] | Electric Boat | 1983 | 08/09/85 | 12/06/86 | 08/06/88 | ——— |
| *Pasadena* | SSN 752 | 688i[4] | Electric Boat | 1983 | 12/20/85 | 09/12/87 | 02/11/89 | ——— |
| *Albany* | SSN 753 | 688i | Newport News | 1984 | 04/22/85 | 06/13/87 | 04/07/90 | ——— |
| *Topeka* | SSN 754 | 688i | Electric Boat | 1984 | 05/13/86 | 01/23/88 | 10/21/89 | ——— |
| *Miami* | SSN 755 | 688i | Electric Boat | 1984 | 10/24/86 | 11/12/88 | 06/30/90 | 03/28/14 |
| *Scranton* | SSN 756 | 688i | Newport News | 1985 | 08/29/86 | 07/03/89 | 01/26/91 | ——— |
| *Alexandria* | SSN 757 | 688i | Electric Boat | 1985 | 06/19/87 | 06/23/90 | 06/29/91 | ——— |
| *Asheville* | SSN 758 | 688i | Newport News | 1985 | 01/09/87 | 02/24/90 | 09/28/91 | ——— |
| *Jefferson City* | SSN 759 | 688i | Newport News | 1985 | 09/21/87 | 08/17/90 | 02/29/92 | ——— |
| *Annapolis* | SSN 760 | 688i | Electric Boat | 1986 | 06/15/88 | 05/18/91 | 04/11/92 | ——— |
| *Springfield* | SSN 761 | 688i | Electric Boat | 1986 | 01/29/90 | 01/04/92 | 01/09/93 | ——— |
| *Columbus* | SSN 762 | 688i | Electric Boat | 1986 | 01/09/91 | 08/01/92 | 07/24/93 | ——— |
| *Santa Fe* | SSN 763 | 688i | Electric Boat | 1986 | 07/09/91 | 12/12/92 | 01/08/94 | ——— |
| *Boise* | SSN 764 | 688i | Newport News | 1987 | 05/25/88 | 03/23/91 | 11/07/92 | ——— |
| *Montpelier* | SSN 765 | 688i | Newport News | 1987 | 05/19/89 | 08/23/91 | 03/13/93 | ——— |

## NUCLEAR-POWERED ATTACK SUBMARINES (SSN)

| Name | Hull Number | Class | Builder | Shipbuilding Program FY | Keel Laid | Launched | Commissioned | Decommissioned |
|---|---|---|---|---|---|---|---|---|
| *Charlotte* | SSN 766 | 688i | Newport News | 1987 | 08/17/90 | 10/03/92 | 09/16/94 | ——— |
| *Hampton* | SSN 767 | 688i | Newport News | 1987 | 03/02/90 | 04/03/92 | 11/16/93 | ——— |
| *Hartford* | SSN 768 | 688i | Electric Boat | 1988 | 02/22/92 | 12/04/93 | 12/10/94 | ——— |
| *Toledo* | SSN 769 | 688i | Newport News | 1988 | 05/06/91 | 08/28/93 | 02/24/95 | ——— |
| *Tucson* | SSN 770 | 688i | Newport News | 1988 | 08/15/91 | 03/20/94 | 08/18/95 | ——— |
| *Columbia* | SSN 771 | 688i | Electric Boat | 1988 | 04/21/93 | 09/24/94 | 10/09/95 | ——— |
| *Greeneville* | SSN 772 | 688i | Newport News | 1989 | 02/28/92 | 09/17/94 | 02/16/96 | ——— |
| *Cheyenne* | SSN 773 | 688i | Newport News | 1990 | 07/06/92 | 04/16/95 | 09/13/96 | ——— |
| ***Seawolf*** | **SSN 021** | **021** | Electric Boat | 1989 | 10/25/89 | 06/24/95 | 07/19/97 | ——— |
| *Connecticut* | SSN 022 | 021 | Electric Boat | 1991 | 09/14/92 | 09/01/97 | 12/11/98 | ——— |
| *Jimmy Carter* | SSN 023 | 021 | Electric Boat | 1996 | 12/12/95 | 05/13/04 | 02/19/05 | ——— |
| ***Virginia*** | **SSN 774** | **774** | Electric Boat | 1998 | 09/02/99 | 08/07/03 | 10/23/04 | ——— |
| *Texas* | SSN 775 | 774 | Newport News | 1999 | 07/12/02 | 04/09/05 | 09/09/06 | ——— |
| *Hawaii* | SSN 776 | 774 | Electric Boat | 2001 | 08/27/04 | 04/28/06 | 05/05/07 | ——— |
| *North Carolina* | SSN 777 | 774 | Newport News | 2002 | 05/22/04 | 05/05/07 | 05/03/08 | ——— |
| *New Hampshire* | SSN 778 | 774 | Electric Boat | 2003 | 04/30/07 | 02/21/08 | 10/25/08 | ——— |
| *New Mexico* | SSN 779 | 774 | Newport News | 2004 | 04/12/08 | 01/07/09 | 03/27/10 | ——— |
| *Missouri* | SSN 780 | 774 | Electric Boat | 2005 | 09/27/08 | 11/20/09 | 07/31/10 | ——— |
| *California* | SSN 781 | 774 | Newport News | 2006 | 05/01/09 | 11/13/10 | 10/29/11 | ——— |
| *Mississippi* | SSN 782 | 774 | Electric Boat | 2007 | 06/09/10 | 10/13/11 | 06/02/12 | ——— |
| *Minnesota* | SSN 783 | 774 | Newport News | 2008 | 05/20/11 | 11/03/12 | 09/07/13 | ——— |
| *North Dakota* | SSN 784 | 774 | Electric Boat | 2009 | 05/11/12 | 09/15/13 | 10/25/14 | ——— |
| *John Warner* | SSN 785 | 774 | Newport News | 2010 | 03/16/13 | 09/10/14 | 08/01/15 | ——— |
| *Illinois* | SSN 786 | 774 | Electric Boat | 2011 | 06/02/14 | 08/08/15 | 10/29/16 | ——— |
| *Washington* | SSN 787 | 774 | Newport News | 2011 | 11/22/14 | 03/25/16 | 10/07/17 | ——— |
| *Colorado* | SSN 788 | 774 | Electric Boat | 2012 | 03/07/15 | 12/29/16 | 03/17/18 | ——— |
| *Indiana* | SSN 789 | 774 | Newport News | 2012 | 05/16/15 | 06/04/17 | 09/29/18 | ——— |
| *South Dakota* | SSN 790 | 774 | Electric Boat | 2013 | 04/04/16 | 10/14/17 | 02/02/19 | ——— |
| *Delaware* | SSN 791 | 774 | Newport News | 2013 | 04/30/16 | 12/14/18 | 04/02/22 | ——— |

## NUCLEAR-POWERED ATTACK SUBMARINES (SSN)

| Name | Hull Number | Class | Builder | Shipbuilding Program FY | Keel Laid | Launched | Commissioned | Decommissioned |
|---|---|---|---|---|---|---|---|---|
| *Vermont* | SSN 792 | 774 | Electric Boat | 2014 | 10/20/18 | 03/27/19 | 04/18/20 | ——— |
| *Oregon* | SSN 793 | 774 | Electric Boat | 2014 | 07/08/17 | 04/20/18 | 05/28/22 | ——— |
| *Montana* | SSN 794 | 774 | Newport News | 2015 | 05/16/18 | 05/08/19 | 06/25/22 | ——— |
| *Hyman G. Rickover* | SSN 795 | 774 | Electric Boat | 2015 | 05/11/18 | 08/26/21 | 10/18/23 | ——— |
| *New Jersey* | SSN 796 | 774 | Newport News | 2016 | 05/25/19 | 04/14/22 | 09/14/24 | ——— |
| *Iowa* | SSN 797 | 774 | Electric Boat | 2016 | 08/20/19 | 08/19/23 | ——— | ——— |
| *Massachusetts* | SSN 798 | 774 | Newport News | 2017 | 12/11/20 | 02/24/24 | ——— | ——— |
| *Idaho* | SSN 799 | 774 | Electric Boat | 2017 | 08/24/20 | 08/06/24 | ——— | ——— |
| *Arkansas* | SSN 800 | 774 | Newport News | 2018 | 11/19/22 | ——— | ——— | ——— |
| *Utah* | SSN 801 | 774 | Electric Boat | 2018 | 09/01/21 | ——— | ——— | ——— |
| *Oklahoma* | SSN 802 | 774 | Newport News | 2019 | 08/02/23 | ——— | ——— | ——— |
| *Arizona* | SSN 803 | 774 | Electric Boat | 2019 | 12/07/22 | ——— | ——— | ——— |
| *Barb* | SSN 804 | 774 | Electric Boat | 2020 | ——— | ——— | ——— | ——— |
| *Tang* | SSN 805 | 774 | Electric Boat | 2020 | 08/17/23 | ——— | ——— | ——— |
| *Wahoo* | SSN 806 | 774 | Newport News | 2021 | ——— | ——— | ——— | ——— |
| *Silversides* | SSN 807 | 774 | Newport News | 2021 | ——— | ——— | ——— | ——— |
| *John H. Dalton* | SSN 808 | 774 | Electric Boat | 2022 | ——— | ——— | ——— | ——— |
| *Long Island* | SSN 809 | 774 | Newport News | 2022 | ——— | ——— | ——— | ——— |
| *San Francisco* | SSN 810 | 774 | Electric Boat | 2023 | ——— | ——— | ——— | ——— |
| *Miami* | SSN 811 | 774 | Newport News | 2023 | ——— | ——— | ——— | ——— |
| *Baltimore* | SSN 812 | 774 | Electric Boat | 2024 | ——— | ——— | ——— | ——— |
| *Atlanta* | SSN 813 | 774 | Newport News | 2024 | ——— | ——— | ——— | ——— |

## NUCLEAR-POWERED BALLISTIC MISSILE SUBMARINES (SSBN)

| Name | Hull Number | Class | Builder | Shipbuilding Program FY | Keel Laid | Launched | Commissioned | Decommissioned |
|---|---|---|---|---|---|---|---|---|
| ***George Washington*** | **SSBN 598** | 598 | Electric Boat | 1958 | 11/01/57 | 06/09/59 | 12/30/59 | 01/24/85 |
| *Patrick Henry* | SSBN 599 | 598 | Electric Boat | 1958 | 05/27/58 | 09/22/59 | 04/11/60 | 05/25/84 |
| *Theodore Roosevelt* | SSBN 600 | 598 | Mare Island | 1958 | 05/20/58 | 10/03/59 | 02/13/61 | 02/28/81 |
| *Robert E. Lee* | SSBN 601 | 598 | Newport News | 1959 | 08/25/58 | 12/18/59 | 09/16/60 | 12/01/83 |
| *Abraham Lincoln* | SSBN 602 | 598 | Portsmouth | 1959 | 11/01/58 | 05/14/60 | 03/11/61 | 02/28/81 |
| ***Ethan Allen*** | **SSBN 608** | 608 | Electric Boat | 1959 | 09/14/59 | 11/22/60 | 08/08/61 | 03/31/83 |
| *Sam Houston* | SSBN 609 | 608 | Newport News | 1959 | 12/28/59 | 02/02/61 | 03/06/62 | 09/06/91 |
| *Thomas A. Edison* | SSBN 610 | 608 | Electric Boat | 1959 | 03/15/60 | 06/15/61 | 03/10/62 | 12/01/83 |

## NUCLEAR-POWERED BALLISTIC MISSILE SUBMARINES (SSBN)

| Name | Hull Number | Class | Builder | Shipbuilding Program FY | Keel Laid | Launched | Commissioned | Decommissioned |
|---|---|---|---|---|---|---|---|---|
| *John Marshall* | SSBN 611 | 608 | Newport News | 1959 | 04/04/60 | 07/15/61 | 05/21/62 | 07/22/92 |
| *Thomas Jefferson* | SSBN 618 | 608 | Newport News | 1961 | 02/03/61 | 02/24/62 | 01/04/63 | 01/24/85 |
| ***Lafayette*** | **SSBN 616** | 616 | Electric Boat | 1961 | 01/17/61 | 05/08/62 | 04/23/63 | 08/12/91 |
| *Alexander Hamilton* | SSBN 617 | 616 | Electric Boat | 1961 | 06/26/61 | 08/18/62 | 06/27/63 | 02/23/93 |
| *Andrew Jackson* | SSBN 619 | 616 | Mare Island | 1961 | 04/26/61 | 09/15/62 | 07/03/63 | 08/31/89 |
| *John Adams* | SSBN 620 | 616 | Portsmouth | 1961 | 05/19/61 | 01/12/63 | 05/12/64 | 03/24/89 |
| *James Monroe* | SSBN 622 | 616 | Newport News | 1961 | 07/31/61 | 08/04/62 | 12/07/63 | 09/25/90 |
| *Nathan Hale* | SSBN 623 | 616 | Electric Boat | 1961 | 10/02/61 | 01/12/63 | 11/23/63 | 11/03/86 |
| *Woodrow Wilson* | SSBN 624 | 616 | Mare Island | 1961 | 09/13/61 | 02/22/63 | 12/27/63 | 09/01/94 |
| *Henry Clay* | SSBN 625 | 616 | Newport News | 1961 | 10/23/61 | 11/30/62 | 02/20/64 | 11/05/90 |
| *Daniel Webster* [5] | SSBN 626 | 616 | Electric Boat | 1961 | 12/28/61 | 04/27/63 | 04/09/64 | 08/30/90 |
| ***James Madison*** | **SSBN 627** | 627 | Newport News | 1962 | 03/05/62 | 03/15/63 | 07/28/64 | 11/20/92 |
| *Tecumseh* | SSBN 628 | 627 | Electric Boat | 1962 | 06/01/62 | 06/22/63 | 05/29/64 | 07/23/93 |
| *Daniel Boone* | SSBN 629 | 627 | Mare Island | 1962 | 02/06/62 | 06/22/63 | 04/23/64 | 02/18/94 |
| *John C. Calhoun* | SSBN 630 | 627 | Newport News | 1962 | 06/04/62 | 06/22/63 | 09/15/64 | 03/28/94 |
| *Ulysses S. Grant* | SSBN 631 | 627 | Electric Boat | 1962 | 08/18/62 | 11/02/63 | 07/17/64 | 06/12/92 |
| *Von Steuben* | SSBN 632 | 627 | Newport News | 1962 | 09/04/62 | 10/18/63 | 09/30/64 | 02/26/94 |
| *Casimir Pulaski* | SSBN 633 | 627 | Electric Boat | 1962 | 01/12/63 | 02/01/64 | 08/14/64 | 03/07/94 |
| *Stonewall Jackson* | SSBN 634 | 627 | Mare Island | 1962 | 07/04/62 | 11/30/63 | 08/26/64 | 02/09/95 |
| *Sam Rayburn* [6] | SSBN 635 | 627 | Newport News | 1962 | 12/03/62 | 12/20/63 | 12/02/64 | 07/31/89 |
| *Nathanael Greene* | SSBN 636 | 627 | Portsmouth | 1962 | 05/21/62 | 05/12/64 | 12/19/64 | 12/15/86 |
| ***Benjamin Franklin*** | **SSBN 640** | 640 | Electric Boat | 1963 | 05/25/63 | 12/05/64 | 10/22/65 | 11/23/93 |
| *Simon Bolivar* | SSBN 641 | 640 | Newport News | 1963 | 04/17/63 | 08/22/64 | 10/29/65 | 02/24/95 |
| *Kamehameha* | SSBN 642 | 640 | Mare Island | 1963 | 05/02/63 | 01/16/65 | 12/10/65 | 04/02/02 |
| *George Bancroft* | SSBN 643 | 640 | Electric Boat | 1963 | 08/24/63 | 03/20/65 | 01/22/66 | 09/21/93 |
| *Lewis and Clark* | SSBN 644 | 640 | Newport News | 1963 | 07/29/63 | 11/21/64 | 12/22/65 | 08/01/92 |
| *James K. Polk* | SSBN 645 | 640 | Electric Boat | 1963 | 11/23/63 | 05/22/65 | 04/16/66 | 07/09/99 |
| *George C. Marshall* | SSBN 654 | 640 | Newport News | 1964 | 03/02/64 | 05/21/65 | 04/29/66 | 09/24/92 |
| *Henry L. Stimson* | SSBN 655 | 640 | Electric Boat | 1964 | 04/04/64 | 11/13/65 | 08/20/66 | 05/05/93 |
| *Geo. Washington Carver* | SSBN 656 | 640 | Newport News | 1964 | 08/24/64 | 08/14/65 | 06/15/66 | 03/18/93 |
| *Francis Scott Key* | SSBN 657 | 640 | Electric Boat | 1964 | 12/05/64 | 04/23/65 | 12/03/66 | 09/02/93 |
| *Mariano G. Vallejo* | SSBN 658 | 640 | Mare Island | 1964 | 07/07/64 | 10/23/65 | 12/16/66 | 03/09/95 |
| *Will Rogers* | SSBN 659 | 640 | Electric Boat | 1964 | 03/20/65 | 07/21/66 | 04/01/67 | 04/12/93 |
| ***Ohio*** [7] | **SSGN 726** | 726 | Electric Boat | 1974 | 04/10/76 | 04/07/79 | 11/11/81 | ——— |
| *Michigan* [7] | SSGN 727 | 726 | Electric Boat | 1975 | 04/04/77 | 04/26/80 | 09/11/82 | ——— |
| *Florida* [7] | SSGN 728 | 726 | Electric Boat | 1975 | 01/19/81 | 11/14/81 | 06/18/83 | ——— |
| *Georgia* [7] | SSGN 729 | 726 | Electric Boat | 1976 | 04/07/79 | 11/06/82 | 02/11/84 | ——— |
| *Henry M. Jackson* | SSBN 730 | 726 | Electric Boat | 1977 | 01/19/81 | 10/15/83 | 10/06/84 | ——— |
| *Alabama* | SSBN 731 | 726 | Electric Boat | 1978 | 08/27/81 | 05/19/84 | 05/25/85 | ——— |
| *Alaska* | SSBN 732 | 726 | Electric Boat | 1978 | 03/09/83 | 01/12/85 | 01/25/86 | ——— |
| *Nevada* | SSBN 733 | 726 | Electric Boat | 1980 | 08/08/83 | 09/14/85 | 08/16/86 | ——— |
| *Tennessee* | SSBN 734 | 726 | Electric Boat | 1981 | 06/09/86 | 12/13/86 | 12/17/88 | ——— |
| *Pennsylvania* | SSBN 735 | 726 | Electric Boat | 1983 | 03/02/87 | 04/23/88 | 09/09/89 | ——— |
| *West Virginia* | SSBN 736 | 726 | Electric Boat | 1984 | 12/18/87 | 10/14/89 | 10/20/90 | ——— |
| *Kentucky* | SSBN 737 | 726 | Electric Boat | 1985 | 12/18/87 | 08/11/90 | 07/13/91 | ——— |
| *Maryland* | SSBN 738 | 726 | Electric Boat | 1986 | 04/22/86 | 08/10/91 | 06/13/92 | ——— |
| *Nebraska* | SSBN 739 | 726 | Electric Boat | 1987 | 07/06/87 | 08/15/92 | 07/10/93 | ——— |
| *Rhode Island* | SSBN 740 | 726 | Electric Boat | 1988 | 09/01/88 | 07/17/93 | 07/09/94 | ——— |
| *Maine* | SSBN 741 | 726 | Electric Boat | 1989 | 07/03/90 | 07/16/94 | 07/29/95 | ——— |
| *Wyoming* | SSBN 742 | 726 | Electric Boat | 1990 | 08/08/91 | 07/15/95 | 07/13/96 | ——— |
| *Louisiana* | SSBN 743 | 726 | Electric Boat | 1991 | 10/23/92 | 07/27/96 | 09/06/97 | ——— |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ***District of Columbia*** | **SSBN 826** | 826 | Electric Boat | 2020 | 06/04/22 | ——— | ——— | ——— |
| *Wisconsin* | SSBN 827 | 826 | Electric Boat | 2020 | ——— | ——— | ——— | ——— |

[1] Lost at sea
[2] Removed from fleet service and converted to training platform Moored Training Ship 701 (MTS 701).
[3] Removed from fleet service and converted to training platform Moored Training Ship 711 (MTS 711).
[4] "688i" denotes "Improved Los Angeles class."
[5] Removed from fleet service and converted to training platform Moored Training Ship 626 (MTS 626) in 1990.
[6] Removed from fleet service and converted to training platform Moored Training Ship 635 (MTS 635) in 1989.
[7] Converted to SSGN.

## DEEP SUBMERGENCE RESEARCH VEHICLE

| Name | Hull Number | Class | Builder | Shipbuilding Program FY | Keel Laid | Launched | Commissioned | Decommissioned |
|---|---|---|---|---|---|---|---|---|
| *Submarine NR-1* | ——— | —— | Electric Boat | 1965 | 06/10/67 | 01/25/69 | 10/27/69 | 11/21/08 |

# U.S. Nuclear-Powered Surface Ships

## NUCLEAR-POWERED AIRCRAFT CARRIERS

| *Name* | *Hull Nr.* | *Class* | *Builder* | *Shpbldg Prog. FY* | *Keel Laid* | *Launched* | *Comm'd* | *Decomm'd* |
|---|---|---|---|---|---|---|---|---|
| ***Enterprise*** | **CVN 65** | **65** | Newport News | 1958 | 02/04/58 | 09/24/60 | 11/25/61 | 02/03/17 |
| ***Nimitz*** | **CVN 68** | **68** | Newport News | 1967 | 06/22/68 | 05/13/72 | 05/03/75 | ——— |
| *Dwight D. Eisenhower* | CVN 69 | 68 | Newport News | 1970 | 08/15/70 | 10/11/75 | 10/18/77 | ——— |
| *Carl Vinson* | CVN 70 | 68 | Newport News | 1974 | 10/11/75 | 03/15/80 | 03/13/82 | ——— |
| *Theodore Roosevelt* | CVN 71 | 68 | Newport News | 1980 | 10/31/81 | 10/27/84 | 10/25/86 | ——— |
| *Abraham Lincoln* | CVN 72 | 68 | Newport News | 1983 | 11/03/84 | 02/13/88 | 11/11/89 | ——— |
| *George Washington* | CVN 73 | 68 | Newport News | 1983 | 08/25/86 | 07/21/90 | 07/04/92 | ——— |
| *John C. Stennis* | CVN 74 | 68 | Newport News | 1988 | 03/13/91 | 11/13/93 | 12/09/95 | ——— |
| *Harry S Truman* | CVN 75 | 68 | Newport News | 1988 | 11/29/93 | 09/07/96 | 07/25/98 | ——— |
| *Ronald Reagan* | CVN 76 | 68 | Newport News | 1995 | 02/12/98 | 03/10/01 | 07/12/03 | ——— |
| *George H. W. Bush* | CVN 77 | 68 | Newport News | 2001 | 05/19/03 | 10/09/06 | 01/10/09 | ——— |
| ***Gerald R. Ford*** | **CVN 78** | **78** | Newport News | 2008 | 11/14/09 | 11/17/13 | 07/22/17 | ——— |
| *John F. Kennedy* | CVN 79 | 78 | Newport News | 2013 | 07/20/15 | 10/29/19 | ——— | ——— |
| *Enterprise* | CVN 80 | 78 | Newport News | 2019 | 08/27/22 | ——— | ——— | ——— |
| *Doris Miller* | CVN 81 | 78 | Newport News | 2019 | ——— | ——— | ——— | ——— |

## NUCLEAR-POWERED CRUISERS

| *Name* | *Hull Nr.* | *Class* | *Builder* | *Shpbldg Prog. FY* | *Keel Laid* | *Launched* | *Comm'd* | *Decomm'd* |
|---|---|---|---|---|---|---|---|---|
| ***Long Beach*** | **CGN 09** | **09** | Bethlehem | 1957 | 12/02/57 | 07/14/59 | 09/09/61 | 05/01/95 |
| ***Bainbridge*** | **CGN 25** | **25** | Bethlehem | 1959 | 05/15/59 | 04/15/61 | 10/06/62 | 09/13/96 |
| ***Truxtun*** | **CGN 35** | **35** | NY Shipbuilding | 1962 | 06/17/63 | 12/19/64 | 05/27/67 | 09/11/95 |
| ***California*** | **CGN 36** | **36** | Newport News | 1967 | 01/23/70 | 09/22/71 | 02/16/74 | 07/09/99 |
| *South Carolina* | CGN 37 | 36 | Newport News | 1968 | 12/01/70 | 07/01/72 | 01/25/75 | 07/30/99 |
| ***Virginia*** | **CGN 38** | **38** | Newport News | 1970 | 08/19/72 | 12/14/74 | 09/11/76 | 11/10/94 |
| *Texas* | CGN 39 | 38 | Newport News | 1971 | 08/18/73 | 08/09/75 | 09/10/77 | 07/16/93 |
| *Mississippi* | CGN 40 | 38 | Newport News | 1972 | 02/22/75 | 07/31/76 | 08/05/78 | 07/28/97 |
| *Arkansas* | CGN 41 | 38 | Newport News | 1975 | 01/17/77 | 10/21/78 | 10/18/80 | 07/07/98 |