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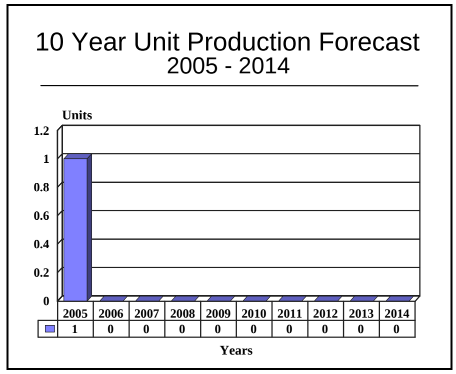
SSN-21 Seawolf Class – Archived 5/2007

Outlook

- USS *Jimmy Carter* commissioned February 2005
- Remaining two members of class serving as SSNs
- No further construction likely
- Most likely will serve as systems testbeds and technology development platforms



Orientation

Description. Nuclear-powered attack submarines tasked with the location, tracking, and destruction of hostile submarines and surface ships in blue water environments, as well as the long-range protection of U.S. Navy battle groups.

Sponsor

U.S. Navy
Naval Sea Systems Command (NAVSEA)
2531 Jefferson Davis Hwy
Arlington, Virginia (VA) 22242-5160
USA
Tel: + 1 (703) 602-6920

Licensees. No production licenses have been granted.

Status. In service.

Total Produced. Three

Pennant List

Number & Name	Builder	Construction Start	Launch	Commissioning
SSN-21 Seawolf	Electric Boat	10/1989	6/1995	7/1997
SSN-22 Connecticut	Electric Boat	9/1992	6/1997	12/1998
SSN-23 Jimmy Carter	Electric Boat	12/1995	2002	2/2005

Mission. The SSN-21 Seawolf class attack submarines were designed to rapidly deploy to militarily important hostile ocean areas and clear the way for strikes by other friendly forces, and to engage and destroy enemy submarines, surface forces, and land targets – supporting dominant maneuver as well as full-dimensional protection for afloat forces. Secondary missions are mine and special warfare.

Price Range. The lead ship of this class is estimated to have cost $2.2 billion. The total program has been cost-capped at $7.223 billion. However, according to Navy estimates in 1997, the total cost of the program, including design costs, will be in the neighborhood of $13 billion after completion of the third ship. In early 2000, the average per-unit price for the submarines of this class was pegged at $2.8 billion.

Contractors

Prime

General Dynamics Corp	http://www.gd.com, 2941 Fairview Park Dr, Suite 100, Falls Church, VA 22042-4513 United States, Tel: + 1 (703) 876-3000, Fax: + 1 (703) 876-3125, Prime
General Dynamics Electric Boat	http://www.gdeb.com, 75 Eastern Point Rd, Groton, CT 06340-4989 United States, Tel: + 1 (860) 433-3000, Fax: + 1 (860) 433-1400, Email: info@gdeb.com, Lead Contractors
ITT Industries Defense and Electronics	http://defense.itt.com, 1650 Tysons Blvd, Suite 1700, McLean, VA 22102 United States, Tel: + 1 (703) 790-6300, Fax: + 1 (703) 790-6360, Consortium Member
Raytheon Naval & Maritime Integrated Systems	http://www.raytheon.com, 1847 W Main Rd, Portsmouth, RI 02871 United States, Tel: + 1 (401) 847-8000, Fax: + 1 (401) 842-5200, Consortium Member

Subcontractor

Delphi Connection Systems	17150 Von Karman Ave, Irvine, CA 92614-0901 United States, Tel: + 1 (949) 660-5701, Fax: + 1 (949) 660-5825, Email: info@phughes.com (Electronic Cable & Wire)
ITT Industries Avionics	http://www.ittavionics.com, 100 Kingsland Rd, Clifton, NJ 07014 United States, Tel: + 1 (201) 184-2421, Fax: + 1 (201) 284-4122 (Fiber-Optic Design)
Lockheed Martin Electronic Systems, Division HQ	http://www.lockheedmartin.com, 6801 Rockledge Dr, Bethesda, MD 20817 United States, Tel: + 1 (301) 897-6000 (SUBACS Software)
Lockheed Martin Maritime Systems and Sensors	http://www.lockheedmartin.com/ms2/, 199 Borton Landing Rd, Moorestown, NJ 08057-0927 United States, Tel: + 1 (856) 722-4933, Email: javier.j.dragone@lmco.com (UYK-43 Computer)
Northrop Grumman Norden Systems	http://www.es.northropgrumman.com/es/NDS/, 10 Norden Pl, Norwalk, CT 06856 United States, Tel: + 1 (203) 852-5000, Fax: + 1 (203) 852-7698, Email: ES_Communications@ngc.com (WLR-9A)
Raytheon - Radios and Terminals	http://www.raytheon.com, 1010 Production Rd, Fort Wayne, IN 46808 United States, Tel: + 1 (260) 429-6780, Fax: + 1 (260) 429-6736, Email: Jeffrey_L_Peterson@raytheon.com (WLR-12)
Raytheon Network Centric Systems	http://www.raytheon.com, 1801 Hughes Dr, Fullerton, CA 92834 United States, Tel: + 1 (714) 446-3118 (Mk 117 Underwater Fire Control System (FCS))
Vicor Inc	23 Frontage Rd, Andover, MA 01810 United States (Direct Current Converter)

Technical Data

	Metric	U.S.
Dimensions		
Length	107.6 m	353 ft
Beam	12.9 m	42.3 ft
Draft	10.9 m	35.8 ft
Displacement		
Surfaced		7,460 tons
Submerged		9,150 tons

SSN-21 Seawolf Class

	Metric	U.S.
Performance		
Speed – Maximum	72 kmph	39 kt
– Search	37 kmph	20 kt
Diving Depth	610+ m	2,000+ ft
Crew	12 officers, 121 enlisted	

	Type	Quantity
Armament		
Torpedo Tubes	66 cm (26 in)	8
Magazine Stowage		52 total weapons mix
Torpedoes	Mk 48 ADCAP	
Cruise Missiles	UGM-109 Tomahawk	
Anti-Ship Missiles	UGM-84 Harpoon	
Mines		100 in lieu of torpedoes
Electronics		
Command System	BSY-2	1
Combat Direction	Raytheon Mk 2 FCS	1
Computers	UYK-43, 44	
Sonars		
Bow Active/Passive	BQQ-5D(V)2	1
Passive Intercept	BQG-5D	2x3
Towed Array	TB-29	1
	TB-16D	1
Electronic Warfare		
ESM	WLQ-4(V)1 Sea Nymph	1
Acoustic	WLY-1	1
Sonar Jammer	Gnats	1
Decoys	ADC Mk 4, NLQ-1, MMD	(part of total weapons mix count)
Radar	BPS-16	1
Machinery		
Nuclear Reactor	GE PWR S6W	1x52,000 shp
Propulsion Source	Steam turbines	2
Auxiliary Power		
Diesel Engine	Westinghouse	1
Propeller	Pumpjet propulsor	1 (1 shaft)

Design Features. The SSN-21 Seawolf class nuclear attack submarine is a quiet, fast, heavily armed, shock-resistant, survivable weapon, optimized for blue water combat environments. It was developed during the closing years of the Cold War to restore the technology edge eroded by Russian submarine design advances. The intention was to maintain the U.S. technological lead in undersea warfare well into the 21st century.

The SSN-21 Seawolf class was intended to have greater weapons storage capacity than the Los Angeles class submarines, reflecting the greater variety of weapons to be carried. The U.S. Navy also specified that the SSN-21 should have higher underwater speed and deeper diving capability than the Los Angeles class. The restoration of the under-ice capabilities lost with the Los Angeles class was also specified. These design specifications resulted in the adoption of a significantly larger hull, made from HY-100 steel, with a shorter and broader form than the SSN-688 class. The driving factor here was the need to restore the ideal hydrodynamic shape lost with the Los Angeles class, but the change also gives more internal volume and allows the installation of better silencing, including extensive rafting and sound decoupling.

The hull features both internal and external acoustic layers. The former decouple the internal systems of the submarine from the water to reduce sound emissions, the latter to further reduce emissions and also to reduce the target area and response offered to active sonars. There have been reports that the Seawolf class uses active noise cancellation, which employs out-of-phase emissions to cancel generated noise and broadcasts deliberately chosen frequencies so that the emitted sound profile corresponds to that of ambient noise. This avoids the theoretical possibility of a black hole effect, by which a very quiet submarine could be spotted by the absence of noise from a given area as opposed to the background.

SSN-21 Seawolf Class

The other purpose of the increased hull volume is to enhance weapons capability. A new 660mm torpedo tube has been included (the often-quoted 762mm figure refers to the outer diameter of the tube). This is the first break in the U.S. use of 21-inch torpedo tubes for submarines since 1913. The new tubes provide swim-out capability for existing 21-inch weapons and accommodate a new generation of larger tube-launched missiles and torpedoes. According to current reports, these tubes are currently lined-down to the conventional 21-inch standard, and the new Virginia class is reverting to the existing 21-inch tube. Magazine capacity is provided for a total of 52 weapons.

The class is powered by an S6W pressurized water-cooled reactor developed by General Electric. The reactor drives steam turbines with a power output of 45,000 shp. The submarine is propelled by a multiblade pumpjet propulsor of classified configuration. This propulsor draws on British experience with the pumpjet unit installed on the Trafalgar class.

Operational Characteristics. The Seawolf class is designed to deal with both enemy submarines and surface combatants. The primary weapon systems of the class are the Mk 48 ADCAP torpedo and various versions of the Tomahawk cruise missile. All weapons are carried internally, and fired through the eight bow-mounted 660mm torpedo tubes. They are installed aft of the bow sonar sphere and angled 10° from the centerline. Full power reload is provided for the tubes.

BSY-2 is the combat system of the Seawolf class submarine. The program stopped using the BSY-1 when the system encountered severe problems in 1985-86. BSY-2 retains the original goal of largely distributed processing, having multifunction consoles and combat-system display consoles, a horizontal plotter, and a tactical-situation display (TACSIT). A published drawing (1991) shows six ship data displays and 11 consoles. Software is written in Ada.

The major system sensors are a large spherical bow array (LSA) inside the face of the bow, an LF bow array (LFBA) inside the bow, an active hemispherical array (AHA) below the LFBA (using a transmit group, TG), an HF array (HFA) in the sail (for SADS/MlDAS), the WAA (BQG-5), a long thin-line (TB-29) towed array, and a shorter TB-16D array. The long thin array is associated with TARP, the towed-array range processor. The same system processes all seven arrays to form a coherent tactical picture. As in earlier integrated sonars, passive targets are detected primarily by automatic line integration. When the strength of a line exceeds a threshold, the target is detected and inserted into the system.

BSY-2 differs from its predecessors in the number of lines and frequency ranges it can cover simultaneously. All sonar output flows into array processors for signal conditioning and beam-forming. Outputs go into signal processors (UYS-2s) and also into the workstations' functional processors. The latter also receive processed digital data. The workstations are connected to the weapons launch system by a flexnet databus, and they also feed into the combat system's display consoles. There is no central computer. The system as a whole comprises 61 enclosures, and requires a total of 570 kW and a maximum of 157 gal/min of cooling water.

The TB-29 is part of the BQQ-5D and BSY-2. The designation does not indicate a new version of the earlier TB-12; rather, it seems to mean an array with an acoustic aperture 12 times as long as that of the TB-16 and more than three times the length of the TB-23. That probably means about 2,500 feet (12 TB-l6s would be 1,880 feet long, but the TB-16 acoustic aperture must be shorter than the total array length). Compared to the TB-14, the TB-29 is credited with improved passive detection and ranging and improved IF performance; it is described officially as a quantum improvement in long-range detection and localization. TB-29 is part of the BQQ-5E, superseding the TB-14 of the BQQ-5D. The TB-29 designation appears to have been applied to the new array in 1990; it was confirmed in the 1994 advance costings.

The TB-16D is stowed in a tube running outside the pressure hull – the reel, cable, and winch being located in the forward main ballast tank. The array is streamed out of a tube leading from the port horizontal stabilizer. This installation was designed for Permit class submarines, the early Los Angeles class being fitted with a permanently streamed (clip-on) array. This was later replaced with arrays using tube stowage, operational experience having shown that the fixed array could be damaged during high-speed runs. The original TB-16 acoustic array is 140 feet long and 4.5 inches in diameter (1,400 lb), towed on a 1,600-foot cable (0.47-in diameter). It consists of two vibration-isolation modules (VIM), one transverse VIM, one sensor module, five acoustic modules (presumably of varying frequencies) with a total of 50 hydrophones, and one array stabilization module. Compared to a thin-line array, the shorter but thicker TB-16 should suffer less self-noise at a given speed, but will be effective only at higher frequencies.

Seawolf Class Attack Submarine

Source: U.S. Navy

Variants/Upgrades

SSN-23 Jimmy Carter. The third of the Seawolf class, the USS *Jimmy Carter* (SSN-23), was chosen to serve as a testbed for studying the evolution of submarine missions in the 21st century. She supports classified research, development, test and evaluation (RDT&E) efforts for notional naval special warfare (NSW) missions, tactical undersea surveillance, and undersea warfare concepts. The Navy, with funding approved by Congress to complete the Multimission Project, tasked General Dynamics' Electric Boat Division (EB) with providing the *Jimmy Carter* with additional volume and functionality to support new multimission opportunities. These changes give her an enhanced payload capability with a more modular architecture. The required modifications delayed her scheduled delivery by approximately 33 months, until February 2005. The submarine is now reported to be fully operational.

The Ocean Interface. The alterations included lengthening the hull behind the sail and inserting an Ocean Interface (OI) section that supports the Multimission Project by opening larger payload apertures to the sea. The resulting modular architecture allows the ship to be configured for specific missions using interchangeable payloads and tailored support services, yet it preserves the submarine's core mission capabilities for normal tasking.

The OI hull insert is unique, having a horizontal "hourglass" configuration that necks the pressure hull down to a "wasp waist" so that when the section is faired over, significant external volume is available outside the pressure hull, but still within the skin of the ship. This allows more flexibility in designing and adding systems and storage, while maintaining a smooth hydrodynamic hull shape with minimal impact on the ship's draft. The OI facilitates more flexible payload interfaces with the water and imposes far fewer constraints on the shape or size of weapons, auxiliary vehicles, and sensors to be deployed from the submarine. The OI, in addition, supports the launch and recovery of tethered and autonomous vehicles without incurring many of the difficulties of current designs using torpedo tubes. The external volume under the shroud can also contain the necessary support systems for such vehicles. This approach would allow the host submarine to control the vehicle from within the ship without consuming valuable internal space for large cable reels or other support equipment.

The OI also allows the ship to deploy and retrieve a new generation of weapons, countermeasures, and sensors, which can now be developed without the size limitations imposed by torpedo or vertical launch tubes. In addition, the *Jimmy Carter* is configured with an advanced communications mast to support the high-volume data requirements of network-centric warfare, as well as DSB-recommended auxiliary maneuvering devices for low-speed operations in littoral regions.

Warfighting Capability. Despite the modification to conduct classified RDT&E, the *Jimmy Carter* retains all her organic warfighting capability. She can support the fleet commander as an attack submarine in conducting undersea warfare, surveillance and reconnaissance, covert special operations, mine warfare, and strike operations, just as her two sister ships do. She is also available to the Navy to test future concepts for weapons, countermeasures, and nontraditional payloads – tasking that is currently divided among several submarines. In addition to these robust capabilities, the *Jimmy Carter* is also capable of supporting Special Operations Forces (SOF), with provision for operating the Dry Deck Shelter (DDS) and Advanced SEAL Delivery System (ASDS).

While the *Jimmy Carter* had already been programmed to support NSW, the additional volume and length of the OI provides even greater potential to develop new roles for submarines in special operations. The OI will provide a hangar or garage capability for locking-in and locking-out future generations of SEAL delivery vehicles, and her reconfigurable cargo area can accommodate dry stowage and access for maintenance. Other internal volume will be available as command and control space for mission planning and monitoring. In addition, berthing space will be available for up to 50 SOF team members. The extra external volume created by the hourglass design allows for stowage of SOF supplies such as Combat Raiding Craft, fuel, munitions, or delivery vehicles.

The USS *Jimmy Carter* is capable of launching and recovering a wide range of tethered and autonomous vehicles and sensors of varying sizes and shapes. The OI, with its associated electronics and cargo space, will give the ship enough weight and volume reserve to support a variety of defensive unmanned underwater vehicles (UUVs) and sensors. Significantly, it will not constrain the design of future submarine-launched offensive mines, since future weapons could be carried outboard and launched from the OI. In the future, the OI could conceivably house the means for not only controlling a UAV, but also launching it.

Program Review

Background. In the late 1970s, the U.S. Navy began developing a new attack submarine design to replace the SSN-688 Los Angeles, SSN-585 Skipjack, and SSN-594 Permit submarine classes. The program ran under a variety of names at various times, including SSN-X, NA-SSN, and FAS. The operational requirement was similar to that of earlier nuclear attack submarines: protecting battle groups, detecting and sinking hostile submarines and surface ships, and conducting barrier and chokepoint warfare. Three types of nuclear-powered submarines – an improved version of the Sturgeon class and two improved derivatives of the Los Angeles class – were chosen for further study.

In 1980 the Navy completed conceptual design studies and began a preliminary design of the Los Angeles follow-on. Preliminary design was completed in 1981 and contract design initiated. A reappraisal of Navy needs, prompted by Soviet submarine developments, led to the decision to maintain Los Angeles class production, with improvements incorporated in new submarine construction. This decision changed the Los Angeles from a limited-production, special-purpose design to a standard fleet type.

Design Options and Alternatives. Although the study for a follow-on submarine in the mid-1980s had not been completed, the Reagan administration favored an FA-SSN that would be smaller and less expensive, but also slower, than the SSN-688. This design was an improved 5,000-ton Sturgeon class, about two-thirds the size and cost of the Los Angeles class. Because it cost less than the Los Angeles class, the FA-SSN could be bought in greater numbers. The 1982 plan called for only one submarine to be procured in FY85.

The Navy plans for the SSN-21 were questioned during 1987 congressional hearings. Various observers criticized the SSN-21 design, saying that it did not have the speed, depth, or sensor capabilities required to counter the latest Soviet submarines. The alternative course of action proposed was that the Navy continue efforts to upgrade the SSN-688 design, while moving ahead with efforts to design a much more advanced submarine to be ordered in the late 1990s and early in the 21st century. Defenders of the SSN-21 design countered that the SSN-688 had reached the limits of its development, that the design margin in these ships was very thin, precluding further equipment upgrades, and that the SSN-21 design was adequate for its designated roles and missions. The Navy added that submarine design and development was a trade-off between the best technology in all areas and what could be afforded and procured in the required numbers to meet national commitments.

Program Under Way. The Navy awarded the contract for the first SSN-21 class submarine to Electric Boat on January 9, 1989. The original schedule stated that work was to be completed by May 1995. In 1990 the SSN-21 program again came under fire. The General Accounting Office (now Government Accountability Office) reiterated its concerns over the concurrence issue. As part of the Major Warships review, the SSN-21 was comprehensively evaluated. Based on the results of this review, the Department of Defense changed the procurement requirements from three ships every two years to one ship per year. However, then-President George Bush later recommended cancellation of the SSN-21 program altogether, citing the greatly diminished threat from advanced-design submarines.

In place of the Seawolf class, the development of a new class of submarine was proposed. This would be smaller, less expensive, and less capable than Seawolf, but would be procurable in larger numbers. This program started life as Centurion, then later was renamed the New Attack Submarine (NAS). Part of the objective of the NAS project was to exploit technologies that had become available since the development of the Seawolf class.

Issuing an RFP

The Request for Proposals (RFP) for the second submarine of the Seawolf class was let to Electric Boat and Newport News Shipbuilding in late 1990. The construction contract was issued to Electric Boat, but Newport News took the case to court and was awarded a preliminary injunction, stopping all work. In March 1992, the courts upheld the award of the contract for the SSN-22 to Electric Boat. However, the Bush administration refused to spend the money authorized for the second boat as well as a third boat authorized in the FY92 budget. In the end, political considerations resulted in a compromise. This compromise, reached in May 1992, provided for building the second SSN-21, with discretion for the additional funds appropriated for the third boat to be used toward the possible purchase of another Improved Los Angeles class boat.

This matter was not resolved in the proposed FY94 budget. The budget allocated $540 million for the Navy to expend on either a third member of the Seawolf class or an additional Improved Los Angeles class, or to add to the $449 million allocated to the development of the NAS. However, in July 1993 the Navy indicated that it wished to build a third Seawolf class submarine, primarily to keep the submarine-building infrastructure intact until the NAS became available. This proposal received support from the Clinton administration.

An Alternative Procurement?

Between November 1993 and January 1994, a series of alternate procurement strategies for the future U.S. submarine fleet were evaluated. These ranged from building diesel-electric submarines to attempting a radically new series of technological solutions. Once the extremes of procurement policy had been discarded, the remaining options revolved around when, if at all, production should switch from the Seawolf class to the NAS and what level of technology the NAS should represent.

In July 1994, the Senate Armed Services Committee produced an alternative submarine production plan, under which four additional Seawolf class submarines, for a total of six, would be procured and the New SSN delayed until 2003. This proposal would save some $4.7 billion over the following five years and $14.4 billion over the forecast period. Some of this money would then be reinvested in a submarine technology program which would ensure that the delayed New SSN truly would exploit the most advanced developments available.

Political opposition to Seawolf continued to gain momentum with proposals to abandon the third of class. The most extreme opponents, led by Senator John S. McCain, even proposed canceling the two boats already under construction. Congressional action capped the expenditure on these two submarines at a total of $4.8 billion. By the end of FY94, however, this spending cap already appeared to be at risk.

Battle of the Third Seawolf. In 1995, funding for the third Seawolf was included in the original budget request but removed by Congress. It was, however, reinstated by the Senate Armed Services Committee, an addition approved by the Senate. Seawolf funding remained within the final defense budget passed by Congress, but this compromise bill was then rejected by

SSN-21 Seawolf Class

Congress due to matters not related to the military aspects of the agreement.

Eventually, a revised bill was presented to President Bill Clinton, who vetoed it. Still later, a further revised bill was authorized. As a result, the plan to go ahead with the construction of the third boat became firm. Construction of SSN-23 began in December 1995, and $699 million was included for the SSN-23 in the FY97 budget request. In June 1996, a $1 billion fixed-price-incentive contract was awarded to Electric Boat for the construction of SSN-23, with the projected completion date no later than December 2001.

First Metal Cut

First metal was cut on the SSN-23 in December 1995. In April 1998, the U.S. Navy announced that the new submarine was to be named the USS *Jimmy Carter*, making this the third category of naming to be applied to the Seawolf class (the first being named after two previous submarines with distinguished records, the second after a state, and the third after an ex-president). At that time, the construction of the submarine was proceeding according to schedule, but in April 1999, the U.S. Navy decided to modify the USS *Jimmy Carter* into a "Special Projects" submarine to replace the USS *Parche* and *Mendel Rivers*, currently serving in that role. The proposed modifications included the addition of a 100-foot-long wasp-waist section aft of the sail that would provide sheltered accommodation for operating unmanned underwater vehicles and other covert operations assets. These modifications would, it was expected, delay completion of the submarine until mid-2004.

A Special Projects Boat

In late 2001 it was disclosed that the modification programs were running behind schedule and that the USS *Jimmy Carter* would not be commissioned until December 2005, almost exactly 10 years after construction had started. This announcement was followed by a decision, made n early in 2002, to homeport the new submarine in Bangor, Maine.

Although commissioned in July 1997, the USS *Seawolf* did not enter service until June 25, 2001, when she made her first operational patrol. The Tomahawk launch capability had still not been incorporated at that point, the submarine was still experiencing problems with the pumpjet propulsor, and the BSY-2 combat system was still not operating satisfactorily – nearly 17 years after project inception and well over a decade since the submarine was ordered. The long delay stemmed in part from the submarine's removal from service in August 2000 after cracks were found in the air flasks needed for the ballast system. The other two boats do not have this problem, because different materials were used in the construction of the flasks.

Most of the anticipated delays with the SSN-23 appear to have been recovered, and the USS *Jimmy Carter* formally commissioned in February 2005. With this ceremony, formal construction of the Seawolf class came to an end.

Funding

The SSN-21 research program, PE#0604561N, funded at $256.6 million, conducted many of the research and development projects that previously had been carried out under separate programs. These included S0218-Submarine Silencing, S0207-Advanced Submarine Control, S0344-Submarine Auxiliaries, S0348-Deep Components, S0364-Submarine Damage Prevention, S0923-Improved Performance Machinery, S0971-Submarine Survivability, S1266-Submarine Propellers, S0221-Target Strength Reduction, S0320-Submarine Weapons Stowage-Launch, and S1255-Advanced Submarine Technology.

Program Element #0604562N supports development of new acoustic attack sensors and the improvement of existing sensors. These include the Submarine Acoustic Warfare Sensor (the WLR-9A, WLR-12, and BLR-14) and the Combat Control System Improvement Program to upgrade the Mk 117 Fire Control System. Program Element #0604561N ties together many projects related to the SSN-21 Seawolf design, while PE#0604524N is developing the BSY-2 Combat System. Program Element #0603522N is researching a variety of technologies to support submarine warfare operations in the Arctic region.

From late 1986 through early 1989, two research programs, Program Elements #0604524N and #0604561N, received nearly 90 percent of the Navy's research and development funding. The FY87 efforts under Program Element #0604524N included full-scale development and limited production of the BSY-2. Program Element #0604561 efforts in 1987 included tests of the SSN-21's batteries and qualification testing of the main sea water pump.

Several programs have been discontinued, including the following: Program Element #25634N studied submarine noise problems and noise-reduction techniques. Program Element #0603561N developed various improvements, including new atmosphere control systems; new split sternplate control systems; and components for deeper submergence such as shaft seals, piping, and heat exchangers. Program Element #0603531N developed the HY-130 high-strength steel that will be used on the SSN-21 follow-on, while Program Element #0603540N studied different diesel-electric submarine designs and the systems that might be installed in such submarines.

Funding for the classified modification project on the third boat of the class, known as the Multimission Project (MMP), will be provided by way of offsets to other programs, allowing the Navy to spend $48 million in FY02 and $152 million in FY03. The Office of the Secretary of Defense approved the Navy-requested funding reallocation in program budget decision No. 738 of December 18, 1998, shifting $200 million to the Navy's shipbuilding and conversion account in the above fiscal years.

Contracts / Orders & Options

Contractor	Award ($ millions)	Date/Description
General Dynamics (Electric Boat)	887.0	Dec 10, 1999 – Modifications to SSN-23 hull for Special Projects duties.
Northrop Grumman Newport News	87.0	Nov 1, 2002 – Design services for the SSN-21 class.
Northrop Grumman Newport News	17.2	Mar 17, 2003 – Engineering design improvements for the SSN-21 class.
General Dynamics, Electric Boat	21.5	Dec 29, 2003 – Selected Restricted Availability overhaul of SSN-21 Seawolf.

Timetable

Month	Year	Major Development
	1983	SSN-21 Conceptual Design completed
Dec	1983	SSN-21 Preliminary Design completed
Jul	1985	Design contract awarded to Newport News
Aug	1985	Design contract awarded to Electric Boat
Aug	1986	Navy announces Newport News will perform final design
Oct	1986	Contract design completed
Jan	1987	Detailed design initiated
Jan	1989	SSN-21 Seawolf ordered from Electric Boat
	1992	President recommends program cancellation in FY93 budget
May	1992	Compromise on second and third submarines reached
Jul	1993	Decision made to proceed with third Seawolf
	1995	Order for third unit canceled
Jun	1996	Third unit funding reinstated
Jul	1996	SSN-21 Seawolf completes initial sea trials
Jul	1997	SSN-21 Seawolf commissioned
Sep	1997	Second of series christened Connecticut
Apr	1998	Third of series christened Jimmy Carter
Aug	1998	Post-shakedown availability trials of SSN-21 Seawolf
Dec	1998	SSN-22 Connecticut commissioned
Jan	1999	Navy asked to reconsider full shock trials for SSN-21 Seawolf
June	2001	Operational evaluation of SSN-21 Seawolf
Feb	2005	SSN-23 Jimmy Carter commissioned

Worldwide Distribution / Inventories

This is a **U.S.**-only program. Three submarines of this class are in service.

Forecast Rationale

With the commissioning of the USS *Jimmy Carter* in February 2005, formal construction of the SSN-21 Seawolf class has come to an end after almost 30 years of research, development and debate. This report has now also reached the end of its life and, next year, it will be archived. Now, therefore, is a good time to look back on this program and attempt to determine what lessons can be learned from it.

Lessons from the Past

Historically, the Seawolf class ships represent the ultimate in the classical ASW-oriented SSN. At the time of their conception this made perfect sense, but the problems kicked in from that point onward. The Seawolf class was, perhaps, the most prominent manifestation of the procurement disease introduced by Robert McNamara. Their design became a victim of repeated reviews that exemplified the concept of "study in lieu of procurement." As the Seawolf studies and reviews ate up years, more Los Angeles boats were built to keep up fleet numbers while the strategic environment changed out of all recognition. By the time the Seawolf class started to become reality, their design was conceptually obsolete and the Fleet was filled with the newly built Los Angeles class. Had the design been pushed ahead as it merited, it is probable that, today, the U.S. Navy would have many more Seawolfs, fewer Los Angeles class, and be the better for the change.

Their successors, the new Virginia class submarines, represent the more flexible multirole designs that will provide the backbone of the future U.S. attack submarine fleet for the next two decades. Their design has taken much less time than the ill-fated Seawolf class and it may well be that the demonstrated need to push designs through quickly and efficiently will be Seawolf's most lasting contribution to the Fleet.

Ten-Year Outlook

The Seawolf program has now concluded with the delivery of the third submarine, and no further construction will take place. Therefore, the forecast chart has been deleted.

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