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Navy Virginia-Class Submarine Program and AUKUS Submarine (Pillar 1) Project: Background and Issues for Congress

March 28, 2025

Congressional Research Service
https://crsreports.congress.gov
RL32418

CRS REPORT
Prepared for Members and
Committees of Congress

Summary

Virginia-class submarine program. The Navy has been procuring Virginia (SSN-774) class nuclear-powered attack submarines (SSNs) since FY1998, and a total of 40 have been procured through FY2024. From FY2011 through FY2024, they have been procured at a rate of two per year. When procured at that rate, they have an estimated procurement cost of about $4.5 billion each. Although they have been procured at a rate of two boats per year, the actual Virginia-class production rate has never reached 2.0 boats per year, and since 2022 has been limited to about 1.2 boats per year, resulting in a growing backlog of boats procured but not yet built. The Navy and industry are working to increase the Virginia-class production rate to 2.0 boats per year by 2028, and subsequently to 2.33 boats per year, so as to execute the two-per-year procurement rate, replace three to five Virginia-class boats that are to be sold to Australia under the AUKUS submarine (Pillar 1) project (see below), and reduce the accumulated Virginia-class production backlog. Congress has appropriated billions of dollars of submarine industrial-base funding to support this effort.

The Navy's proposed FY2025 budget requests the procurement of one Virginia-class boat, which would be the 41st boat in the class. Prior-year Navy budget submissions had projected that two boats would be requested for FY2025. The boat requested for FY2025 has an estimated procurement cost of $5,759.5 million (i.e., about $5.8 billion), but the Navy states that about $1 billion of that is for materials and equipment for future Virginia-class boats, making the estimated cost for the requested boat itself roughly $4.8 billion. The boat has received $1,871.6 million in prior-year "regular" advance procurement (AP) funding and $272.0 million in prior-year Economic Order Quantity (EOQ) funding, which is another kind of AP funding. The Navy's proposed FY2025 budget requests the remaining $3,615.9 million needed to complete the boat's estimated procurement cost, as well as $2,422.0 million in "regular" AP funding and $1,298.3 million in EOQ funding for Virginia-class boats to be procured in future fiscal years, and $293.0 million in cost-to-complete (CTC) funding to cover cost growth on boats procured in prior years.

A key issue for Congress for FY2025 is whether to procure one or two Virginia-class boats in FY2025. The Navy states that procuring two would require adding $3,225.0 million (i.e., about $3.2 billion) to the Navy's FY2025 procurement funding request for the program, that the Navy requested one boat rather than two due to limits on the Navy's budget topline and the growing Virginia-class production backlog, and that the request includes a second shipset of selected Virginia-class components so as to provide stability to key submarine supplier firms. Supporters of procuring two boats argue that doing so would provide greater stability for the industrial base and send a stronger signal of resolve to potential adversaries such as China.

AUKUS submarine (Pillar 1) project. In September 2021, the Australian, UK, and U.S. governments announced a significant new security partnership, called AUKUS. Pillar 1 of AUKUS is a project to (1) rotationally deploy four U.S. SSNs and one UK SSN out of a port in Western Australia; (2) more significantly, sell three to five Virginia-class SSNs to Australia and subsequently build three to five replacement SSNs for the U.S. Navy; and (3) have the United States and UK provide assistance to Australia for an Australian effort to build additional three to five SSNs of a new UK-Australian SSN design to complete a planned eight-boat Australian SSN force. Congress approved enabling legislation for Pillar 1 as part of its action on the FY2024 National Defense Authorization Act (NDAA) (H.R. 2670/P.L. 118-31 of December 22, 2023). The potential benefits, costs, and risks of implementing (2) and (3) can be compared with the potential benefits, costs, and risks of an alternative of procuring up to eight additional Virginia-class SSNs that would be retained in U.S. Navy service and operated out of Australia along with the U.S. and UK SSNs that are already planned to be operated out of Australia under (1).

Contents

Figures

Tables

Appendixes

Contacts

Introduction

This report provides background information and issues for Congress on

- the Virginia (SSN-774) class nuclear-powered attack submarine (SSN) procurement program and
- the submarine (Pillar 1) project under the Australia-UK-U.S. (AUKUS) trilateral security arrangement.

The Navy has been procuring Virginia (SSN-774) class nuclear-powered attack submarines (SSNs) since FY1998, and a total of 40 have been procured through FY2024. From FY2011 through FY2024, they have been procured at a rate of two per year. The Navy's proposed FY2025 budget requests the procurement of one Virginia-class boat, which would be the 41st boat in the class. The Navy's FY2024 budget submission and its budget submissions for prior years had projected that two boats would be requested for procurement in FY2025.

A key issue for Congress for FY2025 is whether to procure one or two Virginia-class boats in FY2025. The Navy states that procuring two would require adding $3,225.0 million (i.e., about $3.2 billion) to the Navy's FY2025 procurement funding request for the program. The Navy states that it requested the procurement of one boat rather than two due to limits on the Navy's budget topline and the growing Virginia-class production backlog, and that the Navy's request includes a second shipset of selected Virginia-class components so as to provide stability to key submarine supplier firms. Supporters of procuring two boats argue that doing so would provide greater stability for the industrial base and send a stronger signal of resolve to potential adversaries such as China.

Another issue for Congress concerns the potential benefits, costs, and risks of the intention under the AUKUS Pillar 1 project to sell three to five Virginia-class submarines to Australia and subsequently build three to five additional replacement SSNs for the U.S. Navy, and to have the United States and UK provide assistance to Australia for an Australian effort to build additional three to five SSNs of a new UK-Australian SSN design to complete a planned eight-boat Australian SSN force. The potential benefits, costs, and risks of implementing these elements of Pillar 1 can be compared with the potential benefits, costs, and risks of an alternative of procuring up to eight additional Virginia-class SSNs that would be retained in U.S. Navy service and operated out of Australia along with the U.S. and UK SSNs that are already planned to be operated out of Australia under Pillar 1.

Congress's decisions on these issues could substantially affect U.S. and Australian military capabilities, U.S. Navy funding requirements, and the U.S. shipbuilding industrial base.

The U.S. Navy's SSN(X) next-generation SSN, which is the Navy's intended eventual successor to the Virginia-class SSN, is discussed in another CRS product: CRS In Focus IF11826, *Navy Next-Generation Attack Submarine (SSN[X]) Program: Background and Issues for Congress*, by Ronald O'Rourke.

The Navy's Columbia (SSBN-826) class ballistic missile submarine program is discussed in another CRS report: CRS Report R41129, *Navy Columbia (SSBN-826) Class Ballistic Missile Submarine Program: Background and Issues for Congress*, by Ronald O'Rourke.

Other CRS reports address aspects of the AUKUS agreement other than Pillar 1.[1]

[1] See CRS Report R47599, *AUKUS Pillar 2 (Advanced Capabilities): Background and Issues for Congress*, by Luke A. (continued...)

Background

U.S. Navy Submarines[2]

The U.S. Navy operates three types of submarines—nuclear-powered ballistic missile submarines (SSBNs),[3] nuclear-powered cruise missile and special operations forces (SOF) submarines (SSGNs),[4] and nuclear-powered attack submarines (SSNs). The SSNs are general-purpose submarines that can (when appropriately equipped and armed) perform a variety of peacetime and wartime missions, including the following:

- covert intelligence, surveillance, and reconnaissance (ISR), much of it done for national-level (as opposed to purely Navy) purposes;
- covert insertion and recovery of SOF (on a smaller scale than possible with the SSGNs);
- covert strikes against land targets with the Tomahawk cruise missiles (again on a smaller scale than possible with the SSGNs);
- covert offensive and defensive mine warfare;
- anti-submarine warfare (ASW); and
- anti-surface warfare, or ASuW (i.e., attacking surface ships).

The technical (including acoustic) superiority of U.S. Navy nuclear-powered submarines is generally considered a foundation of U.S. superiority in undersea warfare, which in turn underpins a U.S. ability to leverage the world's oceans as a medium of operations and maneuver, deny that to others, and thereby generate a huge asymmetric strategic advantage for the United States.

During the Cold War, ASW against Soviet submarines was the primary stated mission of U.S. SSNs, although covert ISR and covert SOF insertion/recovery operations were reportedly important on a day-to-day basis as well.[5] In the post-Cold War era, although ASW remained a

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Nicastro; CRS In Focus IF11999, *AUKUS Nuclear Cooperation*, by Paul K. Kerr and Mary Beth D. Nikitin; CRS In Focus IF12483, *U.S. Arms Transfer Restrictions and AUKUS Cooperation*, by Paul K. Kerr.

[2] In U.S. Navy submarine designations, SS stands for submarine, N stands for nuclear-powered, B stands for ballistic missile, and G stands for guided missile (such as a cruise missile). Submarines can be powered by either nuclear reactors or nonnuclear power sources such as diesel engines or fuel cells. All U.S. Navy submarines are nuclear-powered. A submarine's use of nuclear or nonnuclear power as its energy source is not an indication of whether it is armed with nuclear weapons—a nuclear-powered submarine can lack nuclear weapons, and a nonnuclear-powered submarine can be armed with nuclear weapons.

[3] The SSBNs' basic mission is to remain hidden at sea with their nuclear-armed submarine-launched ballistic missiles (SLBMs) and thereby deter a strategic nuclear attack on the United States. The Navy's SSBNs are discussed in CRS Report R41129, *Navy Columbia (SSBN-826) Class Ballistic Missile Submarine Program: Background and Issues for Congress*, by Ronald O'Rourke, and CRS Report RL31623, *U.S. Nuclear Weapons: Changes in Policy and Force Structure*, by Amy F. Woolf.

[4] The Navy's four SSGNs are former Trident SSBNs that have been converted (i.e., modified) to carry Tomahawk cruise missiles and SOF rather than SLBMs. Although the SSGNs differ somewhat from SSNs in terms of mission orientation (with the SSGNs being strongly oriented toward Tomahawk strikes and SOF support, while the SSNs are more general-purpose in orientation), SSGNs can perform other submarine missions and are sometimes included in counts of the projected total number of Navy attack submarines. The Navy's SSGNs are discussed in CRS Report RS21007, *Navy Trident Submarine Conversion (SSGN) Program: Background and Issues for Congress*, by Ronald O'Rourke.

[5] For an account of certain U.S. submarine surveillance and intelligence-collection operations during the Cold War, see (continued...)

mission, the SSN force focused more on performing the first three other missions listed above. With the shift from the post-Cold War era to a situation of renewed great power competition,[6] ASW and ASuW against Russian and Chinese submarines and surface ships has become a more prominent mission. Department of Defense (DOD) officials and other observers view SSNs as particularly useful for implementing certain elements of the national defense strategy because of their ability to evade China's extensive anti-access/area-denial (A2/AD) forces.[7]

U.S. SSN Force Levels

Force-Level Goal

Goal Current Force-Level Goal of 66 Boats

The Navy's preferred new ship force-level goal, which was submitted to Congress in June 2023, calls for achieving and maintaining a fleet of 381 manned ships, including 66 SSNs.[8] For a review of SSN force-level goals since the Reagan Administration, see **Appendix A**.

Past and Current Force Levels

During most of the 1980s, when plans called for achieving a 600-ship Navy including 100 SSNs, the SSN force included more than 90 boats, peaking at 98 boats at the end of FY1987. The number of SSNs declined after that in a manner that roughly paralleled the decline in the total size of the Navy over the same time period. The 49 SSNs in service at the end of FY2024 included the following:

- 23 Los Angeles (SSN-688) class boats;
- 3 Seawolf (SSN-21) class boats; and
- 23 Virginia (SSN-774) class boats.

The three classes of SSNs listed above are discussed further later in this report. In addition to the SSNs shown above, the Navy operates four Ohio (SSBN-726) class SSGNs. Compared to the Navy's SSNs, the SSGNs have a much larger capacity for carrying cruise missiles and SOF, but they are nevertheless general-purpose submarines that can perform missions performed by SSNs.

Projected Procurement Rates and Force Levels

The Navy's FY2025 five-year (FY2025-FY2029) shipbuilding plan includes a total of nine Virginia-class boats, including one boat requested for procurement in FY2025 and two boats per year programmed for procurement in FY2026-FY2029. The Navy's FY2025 30-year (FY2025-FY2054) shipbuilding plan projects that SSNs would continue to be procured at a rate of two boats per year from FY2030 through at least FY2043.

Sherry Sontag and Christopher Drew with Annette Lawrence Drew, *Blind Man's Bluff* (New York: Public Affairs, 1998).

[6] For more on this shift, see CRS Report R43838, *Great Power Competition: Implications for Defense—Issues for Congress*, by Ronald O'Rourke.

[7] For additional discussion, see CRS Report RL33153, *China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress*, by Ronald O'Rourke.

[8] For more on the Navy's preferred 381-ship force-level goal, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

The number of boats in the SSN force is projected to experience a valley or trough from the mid-2020s through the early 2030s. This valley is a projected consequence of having procured a relatively small number of SSNs during the 1990s, in the early years of the post-Cold War era. To help fill in part of the projected valley, the Navy plans to refuel and extend the service lives of up to seven Los Angeles-class SSNs, while also pursuing "updated service life estimates for the remaining 688s based on current hull by hull utilization."[9] Under the Navy's FY2025 30-year (FY2025-FY2054) shipbuilding plan, the SSN force would decline to 47 boats in FY2030 (marking the bottom of the valley) and then increase to 50 boats by FY2032 and 64 or 66 boats by FY2054. These projected force levels do not account for the impact of selling three to five Virginia-class boats to Australia under the AUKUS submarine (Pillar 1) project discussed later in this report.

The projected SSN valley was first identified by CRS in 1995 and has been discussed in CRS reports and testimony every year since then. Some observers are concerned that this projected valley in SSN force levels could lead to a period of heightened operational strain for the SSN force, and perhaps a period of weakened conventional deterrence against potential adversaries such as China.[10]

Submarine Construction Industrial Base

Overview

U.S. Navy submarines are built by two shipyards—General Dynamics' Electric Boat Division (GD/EB) of Groton, CT, and Quonset Point, RI, and Huntington Ingalls Industries' Newport News Shipbuilding (HII/NNS), of Newport News, VA. These are the only two shipyards in the country capable of building nuclear-powered ships. GD/EB builds submarines only, while HII/NNS also builds nuclear-powered aircraft carriers and is capable of building other types of surface ships.

In addition to GD/EB and HII/NNS, the submarine construction industrial base includes 16,000 suppliers in all 50 states,[11] as well as laboratories and research facilities in numerous states. About

[9] Source: Navy information paper on FY2022 Fiscal Planning Framework and SSN-688 class service live extension program questions, February 5, 2021, provided by Navy Office of Legislative Affairs to Congressional Budget Office (CBO) and CRS on February 5, 2021. See also Richard R. Burgess, "Vice Adm. Houston: Sub Force Approaching Inflection Point of 50 SSNs," *Seapower*, November 17, 2021; Justin Katz, "Navy Assessing LA Sub Fleet for Possible Life Extensions," *Breaking Defense*, November 18, 2021. See also Rich Abott, "Navy Assessing Los Angeles Subs for Life Extension," *Defense Daily*, November 19, 2021; David Axe, "To Keep Up Its Undersea Strength, The U.S. Navy Aims to Keep Old Submarines Longer," *Forbes*, November 22, 2021; Megan Eckstein, "US Navy Avoided a 2022 'Trough' in Submarine Fleet Size, but Industry Challenges Threaten Future Growth," *Defense News*, January 3, 2022.

[10] China took note of the projected valley. The November 2014 edition of a Chinese military journal, for example, included an article with a passage that translates as follows:

> ... in 2028, the [U.S. Navy] force of nuclear attack submarines will fall from the current number of 55 down to 41 boats. Some are concerned about whether this force level can meet the requirements of the Asia-Pacific rebalance.
>
> (Lyle Goldstein, "Evolution of Chinese Power Projection Capabilities," presentation to Center for a New American Security (CNAS) roundtable discussion, September 29, 2016, slide 7 of 41.)

[11] Source: CQ transcript of spoken testimony of Erik Raven, Under Secretary of the Navy, at an October 25, 2023, hearing on the submarine industrial base and its ability to support the AUKUS framework before the Seapower and Projection Forces Subcommittee of the House Armed Services Committee. See also Joint Statement, Honorable Erik K. Raven, Under Secretary of the Navy, VADM William J. Houston, Commander, Naval Submarine Forces, [and] RDML Jonathan Rucker, Program Executive Officer, Attack Submarines, before the House Committee on Armed Services Subcommittee on Seapower and Projection Forces, October 25, 2023, p. 5.

70% of the critical suppliers for the construction of submarines are sole-source suppliers.[12] For nuclear-propulsion component suppliers, an additional source of stabilizing work is the Navy's nuclear-powered aircraft carrier construction program.[13] Much of the design and engineering portion of the submarine construction industrial base is resident at GD/EB; additional portions are resident at HII/NNS and some of the component makers.

Submarine Construction Industrial Base Enhancement Efforts

Goal

Although Virginia-class SSNs have been procured at a rate of two boats per year from FY2011 through FY2024, the actual Virginia-class production rate has never reached 2.0 boats per year, and since 2022 has been limited by shipyard and supplier firm workforce and supply chain challenges to about 1.2 boats per year, resulting in a growing backlog of boats procured but not yet built.

The Navy and industry are working to enhance the submarine construction industrial base with a goal of increasing the Virginia-class production rate to 2.0 boats per year by 2028, and subsequently to 2.33 boats per year, the rate the Navy states will be needed to not only execute the two-per-year procurement rate, but also build replacement SSNs for the three to five Virginia-class boats that are to be sold to Australia under the AUKUS submarine (Pillar 1) project discussed later in this report, and to reduce the accumulated Virginia-class production backlog. Congress has appropriated billions of dollars of submarine industrial-base (SIB) funding to support this effort, which is discussed further below. Whether this effort will succeed in increasing the Virginia-class production rate to 2.0 boats per year by 2028, and subsequently to 2.33 boats per year, is not clear.

Funding

Funding for enhancing the SIB began in FY2018 and is projected to continue through at least FY2029. Most of the funding is for the submarine *construction* industrial base; the remainder is for the submarine *maintenance and sustainment* industrial base. The estimated total amount of funding appropriated through FY2024, requested for FY2025, and programmed for FY2026-FY2028 for the submarine *construction* industrial base is about $9.8 billion.[14] This figure excludes

- billions of dollars in additional funding for the submarine *maintenance and sustainment* industrial base;
- FY2029 funding for the submarine *construction* industrial base, the figure for which was unavailable as of June 2024; and
- $3.0 billion in funding that Australia is to provide to the United States under the AUKUS submarine (Pillar 1) project for enhancing the U.S. SIB, much of which is to be used for the submarine *construction* industrial base.

[12] Source for figure of about 70%: Email to CRS and CBO from navy Office of Legislative Affairs, July 31, 2024.

[13] For more on this program, see CRS Report RS20643, *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*, by Ronald O'Rourke. In terms of work provided to these firms, the Navy states that a carrier nuclear propulsion plant is roughly equivalent to five submarine propulsion plants.

[14] Source: Email from Navy Office of Legislative Affairs to CRS and CBO, June 7, 2024.

Much of the funding for the submarine *construction* industrial base has been appropriated through the line items in the Navy's shipbuilding budget for the Columbia-class SSBN program and the Virginia-class SSN program. Of the funds that have been appropriated for the submarine construction industrial base through FY2024, some were added by Congress in marking up the Navy's annual budget requests.

Uses of Funding

Funding for enhancing the submarine construction industrial base is being used at both the two submarine construction shipyards (GD/EB and HII/NNS) and at submarine supplier firms. It is being used for both facility improvements (aka capital expenditures, or CAPEX) and workforce development efforts.[15] The Navy states that there are six main areas of investment:

- shipbuilder infrastructure (i.e., facilities),
- strategic outsourcing,[16]
- supplier development,[17]
- workforce development,[18]
- development of technology opportunities, and
- government oversight.

Using Navy-provided industrial base funding for these efforts can reduce the cost of capital for the submarine shipyards and submarine supplier firms by avoiding a potential need for the shipyards and supplier firms to finance these efforts by borrowing money from banks or capital markets and eventually paying the money back to lenders with interest. In addition, the Navy-provided industrial base funding is largely *not* being incorporated into the stated procurement costs of submarines whose construction is facilitated by this funding. If shipyards and supplier firms were to instead finance these Navy-funded facility improvements and workforce development efforts with funds borrowed from banks or capital markets, the shipyards and supplier firms would seek recover those borrowed funds and their associated interest costs by incorporating them into the prices they charge the Navy for their work. Fully incorporating this industrial base funding into the stated procurement costs of submarines whose construction is facilitated by this funding would increase the stated procurement costs of those submarines, potentially by hundreds of millions of dollars per boat.

For additional information on Navy and industry efforts to enhance the submarine construction industrial base, see **Appendix B**.

SSN Maintenance Backlog

As shown in **Table 1**, the number of SSNs either in depot maintenance or idle (i.e., awaiting depot maintenance) has increased from 11 boats (about 21% of the SSN force) in FY2012 to 16

[15] See, for example, Josh Luckenbaugh, "Navy Investing in Industrial Base to Fix Sub Schedule, Cost Overruns," *National Defense*, October 2, 2024.

[16] Strategic outsourcing refers to using firms other than the shipyards to build sections of submarines that are then transported to the shipyards for incorporation into the submarine as part of the final assembly of the submarine.

[17] This can refer to either increasing the capabilities or capacity of existing supplier firms, or to establishing new supplier firms.

[18] This can include efforts to recruit, train, and retain workers. For an article discussing one such effort—a nationwide advertising campaign for jobs building submarines—see Lauren C. Williams, "Inside the Navy's Slick Effort to Find Workers to Build Submarines," *Defense One*, June 5, 2024.

boats (about 33% of the SSN force) as of FY2023. As also shown in the table, the increase since FY2012 in the number of SSNs in depot maintenance or idle has substantially reduced the number of SSNs operationally ready at any given moment, reducing the SSN force's capacity for meeting day-to-day mission demands and potentially putting increased operational pressure on SSNs that are operationally ready.

Table 1. Numbers of SSNs in Maintenance or Awaiting Maintenance

Average number or percentage of SSNs for each fiscal year

Fiscal year	Number in force	Number in depot maintenance	Number awaiting depot maintenance (aka idle)	Combined number in depot maintenance or idle	% of force in depot maintenance or idle	Number operationally ready
FY08	51	11	0	11	22%	40
FY09	52	10	1	11	21%	41
FY10	52	10	0	10	19%	42
FY11	52	11	0	11	21%	41
FY12	53	10	1	11	21%	42
FY13	53	12	0	12	23%	41
FY14	53	13	2	15	28%	38
FY15	53	9	1	10	19%	43
FY16	52	12	1	13	25%	39
FY17	50	12	2	14	28%	36
FY18	50	14	2	16	32%	34
FY19	50	13	3	16	32%	34
FY20	50	10	5	15	30%	35
FY21	49	14	4	18	37%	31
FY22	49	11	5	16	33%	33
FY23	48	14	2	16	33%	32

Sources: For FY2008-FY2022: Navy information paper dated June 13, 2023, and provided to CRS and Congressional Budget Office (CBO) by Navy Office of Legislative Affairs (NOLA) on June 15, 2023. For FY2023: email from NOLA to CRS and CBO, February 21, 2024.

The Navy has stated that industry best practice would call for about 20% of the SSN force to be in depot maintenance (and for none to be idle) at any given moment.[19] In advance policy questions submitted for a September 14, 2023, hearing before the Senate Armed Services Committee to consider her nomination to be Chief of Naval Operations, Admiral Lisa Franchetti,

[19] Megan Eckstein, "US Navy Hopes New Funding Model Can Cut Sub Maintenance Delays by 2026," *Defense News*, November 17, 2022; Megan Eckstein, "Navy Frustration Building over Late Weapons, Ship Deliveries," *Defense News*, January 11, 2023; Rich Abott, "Fleet Forces and SecNav Argue for More Maintenance Yards," *Defense Daily*, January 12, 2023; Justin Katz, "As AUKUS Looms, US Navy Sub Leaders Sound Alarms at Home," *Breaking Defense*, November 4, 2022.

who was then the Vice Chief of Naval Operations, stated that the Navy had adopted the 20% figure as its goal.[20]

The increase in the number of SSNs in depot maintenance or idle is due primarily to insufficient numbers of workers and facility constraints at the four government-operated Naval Shipyards (NSYs), which are the primary facilities for performing depot-level overhaul and maintenance work on the Navy's nuclear-powered ships, including the SSNs. Supply chain issues affecting the availability of repair parts for SSNs are an additional issue. To address capacity constraints at the NSYs, the Navy has increased staffing at the NSYs and in 2018 began a multibillion-dollar investment plan that is to extend at least 20 years, called the Shipyard Infrastructure Optimization Program (SIOP), to modernize the NSYs' facilities.[21] The Navy has also shifted a small number of SSN overhauls to GD/EB and HII/NNS. For additional background information on the SSN maintenance backlog, which has been a matter of concern and oversight for the congressional defense committees, see **Appendix C**.

U.S. SSN Classes[22]

Los Angeles (SSN-688) Class

A total of 62 Los Angeles-class submarines, commonly called 688s, were procured between FY1970 and FY1990 and entered service between 1976 and 1996. They are 360 feet long, have a beam (i.e., hull diameter) of 33 feet, and have a submerged displacement of about 6,900 tons. They are equipped with four 21-inch diameter torpedo tubes and can carry a total of about 26 torpedoes in their torpedo tubes and internal magazines. The final 31 boats in the class (SSN-719 and higher) were built with an additional 12 vertical launch system (VLS) tubes in their bows for carrying and launching 12 Tomahawk cruise missiles. The final 23 boats in the class (SSN-751 and higher) incorporate further improvements and are referred to as Improved Los Angeles-class boats or 688Is. As of the end of FY2023, 39 of the 62 boats in the class had been retired.

Seawolf (SSN-21) Class

Seawolf (SSN-21) class submarines are larger and more heavily armed than Los Angeles-class submarines. They are equipped with eight 30-inch-diameter torpedo tubes and can carry a total of 50 torpedoes or cruise missiles. The Seawolf class was originally intended to include about 30 boats, but Seawolf-class procurement was stopped after three boats as a result of the end of the Cold War and associated changes in military requirements and defense spending levels. The three Seawolf-class submarines are *Seawolf* (SSN-21), *Connecticut* (SSN-22), and *Jimmy Carter* (SSN-23).

[20] Senate Armed Services Committee, Advance Policy Questions for Admiral Lisa M. Franchetti, USN, Nominee for Appointment to be Chief of Naval Operations, pp. 31, 32.

[21] For an overview of the SIOP, see U.S. Navy, Naval Sea Systems Command, "Shipyard Infrastructure Optimization Program" accessed June 22, 2023, at https://www.navsea.navy.mil/Home/Shipyards/SIOP/. See also Government Accountability Office, *Navy Readiness[:] Actions Needed to Address Cost and Schedule Estimates for Shipyard Improvement*, GAO-23-106067, June 2023, 49 pp.; Government Accountability Office, *Naval Shipyards[:] Ongoing Challenges Could Jeopardize Navy's Ability to Improve Shipyards*, Statement of Diana C. Maurer, Director, Defense Capabilities and Management, Testimony Before the Subcommittees on Readiness and Management Support and Seapower, Committee on Armed Services, U.S. Senate, GAO 22-105993, May 10, 2022, 18 pp.

[22] Source for submarine lengths, beams (i.e., hull diameters), and submerged displacements: U.S. Navy, "Attack Submarines–SSN," updated March 15, 2024.

SSN-21 and SSN-22 were procured in FY1989 and FY1991 and entered service in 1997 and 1998, respectively. They are 353 feet long, have a beam of 40 feet, and have a submerged displacement of 9,138 tons. SSN-23 was originally procured in FY1992. Its procurement was suspended in 1992 and then reinstated in FY1996. It entered service in 2005. SSN-23 was built to a lengthened configuration compared to the other two ships in the class—it is 453 feet long (i.e., 100 feet longer than SSN-21 and SSN-22), has a beam of 40 feet, and has a submerged displacement of 12,158 tons. The Navy states that SSN-23 includes "a 100-foot-long, 2,500-ton hull extension, known as the multi-mission platform, to test new generations of weapons and support Navy SEAL (Sea, Air and Land forces) operations."[23]

Virginia (SSN-774) Class

The Navy has been procuring Virginia-class SSNs (**Figure 1**, **Figure 2**, and **Figure 3**) since FY1998; the first entered service in October 2004.

Figure 1. Virginia-Class Attack Submarine

Source: Cropped version of photograph accompanying Dan Ward, "Opinion: How Budget Pressure Prompted the Success of Virginia-Class Submarine Program," *USNI News*, November 3, 2014. The caption credits the photograph to the U.S. Navy and states that it shows USS *Minnesota* (SSN-783) under construction in 2012.

The Virginia-class design was developed to be less expensive and better optimized for post-Cold War SSN missions than the Seawolf-class design, and has been updated multiple times since FY1998. In addition to the Virginia Payload Module (VPM) (see discussion below), the Navy is

[23] Andrea Perez, "USS Jimmy Carter Conducts Change of Command," Defense Visual Information Distribution Service (DVIDS), December 18, 2020. See also H. I. Sutton, "SSN-23," Covert Shores, August 27, 2017; John P. Davis, "USS Jimmy Carter (SSN-23), Expanding Future SSN Missions," GlobalSecurity.org, undated. For a press report on SSN-23, see, for example, Benjamin Brimelow, "The US Navy's Only Operational Sub Named After a President Has Been Doing Top-Secret Missions for 17 Years," *Business Insider*, March 10, 2022.

introducing acoustic and other improvements to the Virginia-class design that are intended to help maintain the design's superiority over Russian and Chinese submarines.[24]

Figure 2. Virginia-Class Attack Submarine

Source: Cropped version of photograph accompanying Megan Eckstein, "Newport News Has Fully Staffed Attack Sub Line, After Years of Delays," *Defense News*, February 9, 2023. The caption credits the photograph to Matt Hildreth/HII and states that it shows USS *Montana* (SSN-794) under construction at HII/NNS.

The baseline Virginia-class design is 377 feet long, has a beam of 34 feet, and has a submerged displacement of about 7,800 tons. Virginia-class boats are equipped with four 21-inch diameter torpedo tubes and can carry a total of about 25 torpedoes in their torpedo tubes and associated torpedo room. Virginia-class boats are also equipped with vertical launch tubes in their bows for carrying and launching an additional 12 Tomahawk cruise missiles.

Most Virginia-class boats to be procured in FY2019 and subsequent years are to be built to a lengthened configuration that includes the Virginia Payload Module VPM (see discussion below). Virginia-class boats equipped with the VPM are 84 feet longer—they are 461 feet long, have a beam of 34 feet, and have a submerged displacement of about 10,200 tons. The VPM can be armed with and additional 28 additional Tomahawk cruise missiles.

[24] For press reports discussing these improvements, see Kris Osborn, "The Navy Wants to Turn Its Nuclear Attack Submarines into 'Spy' Ships," *National Interest*, May 28, 2018; Kris Osborn, "Navy Launches Most High-Tech & Stealthy Attack Sub Ever," *Scout Warrior*, November 18, 2017; Megan Eckstein, "Navy Considering Mid-Block Virginia-Class Upgrades, SSGN Construction in Late 2030s," *USNI News*, November 2, 2017; Zachary Cohen, "US Launches 'Most Advanced' Stealth Sub amid Undersea Rivalry," *CNN*, October 26, 2017; Franz-Stefan Gady, "US Navy Christens Most Advanced Attack Sub Ever," *The Diplomat*, October 17, 2017; Douglas Ernst, "Navy Christens Its 'Most Advanced' Attack Submarine Ever," *Washington Times*, October 16, 2017; Dave Majumdar, "Stealth and Armed to the Teeth: US Navy's Big Plan for Submarine Dominance," *National Interest*, July 9, 2016; Kris Osborn, "'Acoustic Superiority': US Navy's Secret Submarine Plan to Dominate the Seas," *National Interest*, June 20, 2016; Dave Majumdar, "This Is How the U.S. Navy's Submarine Force Dominates the World's Oceans," *National Interest*, May 17, 2016; Megan Eckstein, "Submarines to Become Stealthier Through Acoustic Superiority Upgrades, Operational Concepts," *USNI News*, March 1, 2016.

One of the two Virginia-class boats procured in FY2024 is to be built to a special configuration referred to as the "Modified VIRGINIA Class Subsea and Seabed Warfare (Mod VA SSW)" configuration,[25] suggesting a configuration that includes a capability for conducting seabed warfare missions.[26]

Figure 3. Virginia-Class Attack Submarine

Source: Photograph accompanying Megan Eckstein, "The US Navy Is Spending Billions to Stabilize Vendors. Will It Work?" *USNI News*, September 8, 2023. The caption credits the photograph to Ashley Cowan/HII and states that it shows the USS *New Jersey* (SSN-796) being moved at HII/NNS in April 2022.

[25] *Department of Defense, Fiscal Year (FY) 2024 Budget Estimates, Navy Justification Book Volume 1 of 1, Shipbuilding and Conversion, Navy*, March 2023, pp. 113, 115, 119.

[26] In a transcript published on September 27, 2022, of a podcast on subsea and seabed warfare recorded September 26, 2022, a GD/EB official states, "Subsea and Seabed warfare (SSW) is a new capability targeted for a single, late-block-V Virginia-class submarine. While we can't get into the details, we can say it is a complex, fast-moving program with strong Navy and congressional support. We're now well into the arrangement phase of the design, which is a critical phase of the program when we lock down major decisions on systems and components and the configuration of spaces." Another EB official states that "prior Virginia insertions [i.e., insertions of new elements into the Virginia-class design], like the Virginia Payload Module (VPM) compared to SSW, had about half as many arrangements and more time to sell them all." (Sydney Davies, "K. Graney Team Spotlight Podcast: Subsea and Seabed Warfare," EB Landing, September 27, 2022.)

Virginia-Class Program

Program Elements

Unit Procurement Cost

When procured at a rate of two boats per year, VPM-equipped Virginia-class SSNs have an estimated procurement cost of about $4.5 billion per boat.

Annual Procurement Quantities

Table 2 shows annual numbers of Virginia-class boats procured from FY1998 (the lead boat) through FY2024, and the numbers projected for procurement in FY2025-FY2029 under the Navy's FY2025 budget submission. As shown in the table, a total of 40 Virginia-class boats have been procured through FY2024.

Table 2. Actual and Projected Virginia-Class Procurement Quantities

Projected quantities for FY2025-FY2029 as shown in Navy's FY2025 budget submission

FY98	1	**FY06**	1	**FY14**	2	**FY22**	2
FY99	1	**FY07**	1	**FY15**	2	**FY23**	2
FY00	0	**FY08**	1	**FY16**	2	**FY24**	2
FY01	1	**FY09**	1	**FY17**	2	***FY25***	*1*
FY02	1	**FY10**	1	**FY18**	2	***FY26***	*2*
FY03	1	**FY11**	2	**FY19**	2	***FY27***	*2*
FY04	1	**FY12**	2	**FY20**	2	***FY28***	*2*
FY05	1	**FY13**	2	**FY21**	2	***FY29***	*2*

Source: Table prepared by CRS based on U.S. Navy data.

Multiyear Contracting

With three exceptions—the one Virginia-class boat that was procured in FY2003 and the two Virginia-class boats that were procured in FY2024—all Virginia-class boats procured to date were procured under multiyear contracting, meaning either a block buy contract (for the boats procured in FY1998-FY2002) or multiyear procurement (MYP) contracts (for the boats procured from FY2004 through FY2023).[27]

[27] For more on MYP and block buy contracting, see CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke. The sequence of multiyear contracts is as follows:

- The first four Virginia-class boats, known as the Block I boats, were procured under an FY1998-FY2002 block buy contract. This was the first instance of block buy contracting—the mechanism of a block buy contract was essentially created for procuring the first four Virginia-class boats. The Virginia-class boat procured in FY2003 fell between the FY1998-FY2002 block buy contract and the subsequent FY2004-FY2008 MYP contract, and was contracted for separately.
- The next five Virginia-class boats, known as the Block II boats, were procured under an FY2004-FY2008 MYP contract.
- The next eight Virginia-class boats, known as the Block III boats, were procured under an FY2009-FY2013

(continued...)

The Navy states that deferring the start of the next Virginia-class MYP contract from FY2024 to FY2025 will put the contract into better schedule alignment with contracts for procuring Columbia-class ballistic missile submarines, which can help maximize efficiency and supplier-firm stability for both the Virginia- and Columbia-class programs.[28] The two boats procured in FY2024 are to be added as non-MYP options to the FY2019-FY2023 Virginia MYP contract.[29]

Joint Production Arrangement

Each Virginia-class boat is built jointly by GD/EB—the program's prime contractor—and HII/NNS. The arrangement for jointly building Virginia-class boats was proposed to Congress by GD/EB, HII/NNS, and the Navy, and agreed to by Congress in 1997, as part of Congress's action on the Navy's budget for FY1998, the year that the first Virginia-class boat was procured.[30] A primary aim of the arrangement was to minimize the cost of building Virginia-class boats at a relatively low annual rate in two shipyards (rather than entirely in a single shipyard) while preserving key submarine-construction skills at both shipyards.

Under the arrangement, GD/EB builds certain parts of each boat, HII/NNS builds certain other parts of each boat, and the yards have generally taken turns building the reactor compartments and performing final assembly of the boats. The arrangement has resulted in a roughly 50-50 division of Virginia-class profits between the two yards and preserves both yards' ability to build submarine reactor compartments (a key capability for a submarine-construction yard) and perform submarine final-assembly work.[31]

Integrated Enterprise Plan (IEP)

Under an arrangement it calls the Integrated Enterprise Plan (IEP),[32] the Navy plans to build each Columbia-class ballistic missile submarine jointly at GD/EB and HII/NNS, with all of the final-assembly work (and thus most of the overall volume of work) going to GD/EB. As part of this plan, the Navy plans to adjust the division of work on the Virginia-class attack submarine

MYP contract.

- The next 10 Virginia-class boats, known as the Block IV boats, were procured under an FY2014-FY2018 MYP contract.
- The next 10 Virginia-class boats, known as the Block V boats, were procured under an FY2019-FY2023 MYP contract.

[28] Source: Navy briefing on Virginia-class program for CRS and CBO, April 28, 2023.

[29] The FY2019-FY2023 MYP contract, in other words, is be used as a contractual vehicle for procuring the two boats requested for procurement in FY2024, but those two boats would be executed as non-MYP boats, without the special MYP procurement authorities (and resultant cost reductions) that were applied to the other boats procured under the FY2019-FY2023 MYP contract.

[30] See Section 121 of the FY1998 National Defense Authorization Act (H.R. 1119/P.L. 105-85 of November 18, 1997).

[31] The joint production arrangement is a departure from prior U.S. submarine construction practices, under which complete submarines were built in individual yards. The joint production arrangement is the product of a debate over the Virginia-class acquisition strategy within Congress, and between Congress and DOD, that occurred in 1995-1997 (i.e., during the markup of the FY1996-FY1998 defense budgets). The goal of the arrangement is to keep both GD/EB and HII/NNS involved in building nuclear-powered submarines, and thereby maintain two U.S. shipyards capable of building nuclear-powered submarines, while minimizing the cost penalties of using two yards rather than one to build a submarine design that is being procured at a relatively low annual rate. The joint production agreement cannot be changed without the agreement of both GD/EB and HII/NNS.

[32] The IEP was previously called the Submarine Unified Build Strategy, or SUBS.

program so that HII/NNS will receive a larger share of the final-assembly work for that program than it has received in the past.[33]

Virginia Payload Module (VPM)

The Navy plans to build most Virginia-class boats procured in FY2019 and subsequent years with the Virginia Payload Module (VPM), an additional, 84-foot-long, mid-body section equipped with four large-diameter, vertical launch tubes for storing and launching additional Tomahawk missiles or other payloads, including payloads with diameters larger than the 21-inch diameter of a torpedo or Tomahawk missile.[34] The four additional launch tubes in the VPM can carry a total of 28 additional Tomahawk cruise missiles (seven per tube),[35] which would increase the total number of torpedo-sized weapons (such as Tomahawks) carried by the Virginia-class design from about 37 to about 65—an increase of about 76%.[36]

Building Virginia-class boats with the VPM is intended to compensate for a sharp loss in submarine force weapon-carrying capacity that will occur with the retirement in FY2026-FY2028

[33] Key elements of IEP include the following:

- GD/EB is to be the prime contractor for designing and building Columbia-class boats;
- HII/NNS is to be a subcontractor for designing and building Columbia-class boats;
- GD/EB is to build certain parts of each Columbia-class boat—parts that are more or less analogous to the parts that GD/EB builds for each Virginia-class attack submarine;
- HII/NNS is to build certain other parts of each Columbia-class boat—parts that are more or less analogous to the parts that HII/NNS builds for each Virginia-class attack submarine;
- GD/EB is to perform the final assembly on all 12 Columbia-class boats;
- as a result of the three previous points, the Navy estimates that GD/EB would receive an estimated 77%-78% of the shipyard work building Columbia-class boats, and HII/NNS would receive 22%-23%;
- GD/EB is to continue as prime contractor for the Virginia-class program, but to help balance out projected submarine-construction workloads at GD/EB and HII/NNS, the division of work between the two yards for building Virginia-class boats is to be adjusted so that HII/NNS would perform the final assembly on a greater number of Virginia-class boats than it would have under a continuation of the current Virginia-class division of work (in which final assemblies are divided more or less evenly between the two shipyards); as a consequence, HII/NNS would receive a greater share of the total work in building Virginia-class boats than it would have under a continuation of the current division of work.

See Richard B. Burgess, "Submarine Admirals: 'Unified Build Strategy' Seeks Affordability for Future Sub Fleet," *Seapower*, July 8, 2016; Julia Bergman, "Congressmen Visit EB a Day After It Is Named Prime Contractor for Ohio Replacement Program," *The Day (New London)*, March 29, 2016; Sydney J. Freedberg Jr., "Ohio Replacement Plan Is Good News for Electric Boat," *Breaking Defense*, March 29, 2016; Robert McCabe, "Newport News Shipbuilding's Share of Virginia-Class Submarine Deliveries to Grow," *Virginian-Pilot (Newport News)*, March 29, 2016; Valerie Insinna, "GD Electric Boat Chosen to Take Lead Role for Ohio Replacement Sub," *Defense Daily*, March 30, 2016: 1-3; Hugh Lessig, "Navy: More Submarine Work Coming to Newport News Shipyard," *Military.com*, March 30, 2016. See also Statement of the Honorable Sean J. Stackley, Assistant Secretary of the Navy (Research, Development and Acquisition), and Vice Admiral Joseph P. Mulloy, Deputy Chief of Naval Operations for Integration of Capabilities and Resources, and Lieutenant General Robert S. Walsh, Deputy Commandant, Combat Development and Integration & Commanding General, Marine Corps Combat Development Command, before the Subcommittee on Seapower and Projection Forces of the House Armed Services Committee on Department of the Navy Seapower and Projection Forces Capabilities, February 25, 2016, p. 12.

[34] For an illustration of the VPM, see http://www.gdeb.com/news/advertising/images/VPM_ad/VPM.pdf, which was accessed by CRS on March 1, 2012.

[35] Michael J. Conner, "Investing in the Undersea Future," *U.S. Naval Institute Proceedings*, June 2011: 16-20.

[36] A Virginia-class SSN can carry about 25 torpedoes in its four horizontal torpedo tubes and associated torpedo room, and an additional 12 Tomahawk cruise missiles (which are torpedo-sized) in its bow-mounted vertical lunch tubes, for a total of about 37 torpedo-sized weapons. Another 28 Tomahawks in four mid-body vertical tubes would increase that total by about 76%.

of the Navy's four Ohio-class SSGNs. Each SSGN is equipped with 24 large-diameter vertical launch tubes, of which 22 can be used to carry up to seven Tomahawks each, for a maximum of 154 vertically launched Tomahawks per boat, or 616 vertically launched Tomahawks for the four boats. Twenty-two Virginia-class boats built with VPMs could carry 616 Tomahawks in their VPMs.

Schedule and Cost Performance

The Virginia-class program experienced cost growth in its early years that was due in part to annual procurement rates that were lower than initially envisaged and challenges in restarting submarine production at HII/NNS.[37] The lead ship in the program, however, was delivered within four months of the target date that had been established about a decade earlier, and subsequent boats in the program were delivered largely on cost and ahead of schedule.[38] The Virginia (SSN-774) class program received a David Packard Excellence in Acquisition Award from DOD in 2008.

Beginning in 2019, it was reported that GD/EB, HII/NNS, and their supplier firms were experiencing challenges in meeting scheduled delivery times as the Virginia-class program was transitioning from production of two "regular" Virginia-class boats per year to two VPM-equipped boats per year. On April 2, 2024, the Navy announced significant projected delays in several of its shipbuilding programs. As part of this announcement, the Navy stated that deliveries of Virginia-class boats are projected to be delayed 24 to 36 months.[39] For additional background information on delays in the Virginia-class program, see **Appendix B**.

As mentioned earlier, although Virginia-class boats have been procured at a rate of two boats per year, the actual Virginia-class production rate has never reached 2.0 boats per year, and since 2022 has been limited by shipyard and supplier firm workforce and supply chain challenges to about 1.2 boats per year, resulting in a growing backlog of boats procured but not yet built. As also mentioned earlier, the Navy and industry are working to increase the Virginia-class production rate to 2.0 boats per year by 2028, and subsequently to 2.33 boats per year, the rate the Navy states will be needed to not only execute the two-per-year procurement rate, but also build replacement SSNs for the three to five Virginia-class boats that are to be sold to Australia under the AUKUS submarine (Pillar 1) project that is discussed later in this report, and to reduce the accumulated Virginia-class production backlog. Whether this effort will succeed in increasing the Virginia-class production rate to 2.0 boats per year by 2028, and subsequently to 2.33 boats per year, is not clear.

December 2021 Determinations Pursuant to Defense Production Act (DPA)

On December 21, 2021, President Biden signed three determinations permitting the use of the Defense Production Act (DPA) to strengthen the U.S. submarine industrial base for the purpose of increasing production of Virginia-class submarines. For more on these determinations, see **Appendix D**.

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[37] See Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, before the House Armed Services Committee Subcommittee on Seapower and Expeditionary Forces Hearing on Submarine Force Structure and Acquisition Policy, March 8, 2007, Table 10 on pp. 14-15.

[38] For discussions of recent exceptions, see Christopher P. Cavas, "US Navy Submarine Program Loses Some of Its Shine," *Defense News*, March 13, 2017; David B. Larter, "Virginia-Class Attack Sub Delivers Late as US Navy Aims to Get Program Back on Course," *Defense News*, June 26, 2018.

[39] For additional discussion of the Navy's April 2, 2024, announcement, see CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

FY2025 Funding Request

The Navy's proposed FY2025 budget requests the procurement of one Virginia-class boat, which would be the 41st boat in the class. The boat requested for FY2025 has an estimated procurement cost of $5,759.5 million (i.e., about $5.8 billion), but the Navy states that about $1 billion of that is for materials and equipment for future Virginia-class boats, making the estimated cost for the requested boat itself roughly $4.8 billion.[40] The boat has received $1,871.6 million in prior-year "regular" AP funding and $272.0 million in prior-year Economic Order Quantity (EOQ) funding, which is an additional kind of AP funding. The Navy's proposed FY2025 budget requests the remaining $3,615.9 million needed to complete the boat's estimated procurement cost, as well as $2,422.0 million in "regular" AP funding and $1,298.3 million in EOQ funding for Virginia-class boats to be procured in future fiscal years, and $293.0 million in cost-to-complete (CTC) funding to cover cost growth on Virginia-class boats procured in prior years.

AUKUS Submarine (Pillar 1) Project

Overview

In September 2021, the Australian, UK, and U.S. governments announced a significant new security partnership, called AUKUS (pronounced *AW-kus*, rhyming with *caucus*).[41] One major initiative under AUKUS, referred to as Pillar 1, is a project to rotationally deploy four U.S. SSNs and one UK SSN out of a port in Western Australia; more significantly, to sell three to five Virginia-class SSNs to Australia and subsequently build three to five additional replacement SSNs for the U.S. Navy; and to have the United States and UK provide assistance to Australia for an Australian effort to build additional three to five SSNs of a new UK-Australian SSN design called SSN AUKUS to complete a planned eight-boat Australian SSN force.

Today only six countries—the United States, the UK, France, Russia, China, and India—operate nuclear-powered submarines. The United States since 1958 has provided assistance to the UK's nuclear-powered submarine program.[42] The United States reportedly has turned down requests from certain other U.S. allies to provide similar assistance. Under Pillar 1, Australia is to become the second country to receive U.S. assistance in naval nuclear propulsion and nuclear-powered submarines, and the first country to purchase a complete nuclear-powered submarine from the United States.

Congress approved enabling legislation for Pillar 1 as part of its action on the FY2024 National Defense Authorization Act (NDAA) (H.R. 2670/P.L. 118-31 of December 22, 2023). Sections

[40] The Navy states that "the Total Ship estimate for the FY 2025 hull includes an additional shipset of two year advance procurement funded materials, one year advance procurement funded materials, and one year economic order quantity funded materials. This funding will be used to support contractor furnished equipment and government furnished equipment critical spare material that will be consumed on future hulls to ensure critical sub-tier vendors maintain two submarines per year cadence. As a result, the Gross Weapons System Unit Cost (End Cost) is approximately $1 billion higher than a single submarine procurement." (*Department of Defense, Fiscal Year (FY) 2025 Budget Estimates, Navy, Justification Book*, Volume 1 of 1, Shipbuilding and Conversion, Navy, March 2024, p. 115, 117, 121.)

[41] For more on the AUKUS agreement, see CRS In Focus IF12113, *AUKUS and Indo-Pacific Security*, by Derek E. Mix and Bruce Vaughn; CRS Report R47599, *AUKUS Pillar 2: Background and Issues for Congress*, by Patrick Parrish and Luke A. Nicastro; CRS In Focus IF11999, *AUKUS Nuclear Cooperation*, by Paul K. Kerr and Mary Beth D. Nikitin; and CRS In Focus IF12483, *U.S. Arms Transfer Restrictions and AUKUS Cooperation*, by Paul K. Kerr and Ilana Krill.

[42] For additional discussion of U.S. assistance to the UK's nuclear-powered submarine program, see CRS Report R41129, *Navy Columbia (SSBN-826) Class Ballistic Missile Submarine Program: Background and Issues for Congress*, by Ronald O'Rourke.

1321-1354 of the FY2024 NDAA address various matters relating to the AUKUS partnership, including Pillar 1. Pillar 1 is covered in particular in Sections 1351-1354, which are referred to collectively as the AUKUS Submarine Transfer Authorization Act.

Key Elements

Key elements of Pillar 1 include the following:[43]

- **Embedding of Australian personnel.** In 2023, Australian military and civilian personnel began to embed with the U.S. and UK navies, and in the U.S. and UK submarine industrial bases, to accelerate the training of Australian personnel. Also in 2023, the U.S. Navy began to increase SSN port visits to Australia, with Australian sailors joining U.S. crews for training and development.[44] The UK is to increase SSN port visits to Australia beginning in 2026.
- **Rotational deployments of U.S. and UK SSNs from Australia.** As early as 2027, the United States and UK are to begin forward rotations of SSNs out of HMAS Stirling, an Australian naval base near Perth, in Western Australia, to accelerate the development of Australian naval personnel, workforce, infrastructure, and regulatory system. Eventually, one UK SSN and up to four Virginia-class SSNs are to be rotationally deployed out of HMAS Stirling under the arrangement, which is referred to as Submarine Rotational Force-West (SRF-West).
- **Sale of three to five Virginia-class boats to Australia.** The United States is to sell Australia three Virginia-class submarines, with the potential to sell up to two more if needed. The first two boats, which are to be sold in FY2032 and FY2035, would be existing boats with 18 to 27 years each of remaining expected service life. The third boat, which is to be sold in FY2038, would be a new boat taken directly from the U.S. production line, and thus have a full 33-year expected service life. In combination, the sale of these three boats would transfer more than 70 boat-years of SSN capability from the U.S. Navy to Australia's navy.
- **Replacement SSNs to be built for U.S. Navy.** The U.S. Navy anticipates eventually building three to five additional SSNs in the 2030s as replacements for the three to five Virginia-class boats that are to be sold to Australia. Until the replacement boats are built, selling three to five Virginia-class boats to Australia would reduce the size of the U.S. Navy's SSN force. The reduction in the U.S. SSN force would begin in FY2032 (when the first Virginia-class boat would be sold) and (as estimated by CRS and the Congressional Budget Office [CBO])

[43] Sources: White House, "Joint Leaders Statement on AUKUS," March 13, 2023; Commonwealth of Australia, *The AUKUS Nuclear-Powered Submarine Pathway, A Partnership for the Future*, undated, released ca. March 13, 2023, 57 pp.; U.S. Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2024*, March 2023, p. 4, 15 (table note 3); Megan Eckstein, "Here's When the US Navy Plans to Sell Subs to Australia Under AUKUS," *Defense News*, November 16, 2023; Rich Abott, "Sub Boss Outlines Schedule of Virginia-Sub Sales to Australia Under AUKUS," *Defense Daily*, November 9, 2023; Mallory Shelbourne, "Australia Will Announce AUKUS Nuclear Attack Boat Build Partner Next Year," *USNI News*, November 9, 2023; Justin Katz, "US Navy Sub Boss Reveals New Details on AUKUS Virginia Class Sub Sales to Australia," *Breaking Defense*, November 8, 2023; John Hunter Farrell, "Australia to Get One New Build Virginia Class Submarine, Two from U.S. Navy," *The Drive*, June 8, 2023, which reports remarks made by Australian government officials in testimony at a May 2023 Australian parliamentary hearing.

[44] For additional discussion of Pillar 1 activities in 2023 and 2024, see Megan Eckstein, "What Has the AUKUS Alliance Accomplished in the Last Year?" *Defense News*, May 9, 2024; Department of Defense, "AUKUS Defense Ministers' Joint Statement," April 8, 2024.

would last until sometime between 2040 and 2049. For additional discussion of this reduction, see **Appendix E**.

- **UK and Australia construction of SSN AUKUS boats incorporating U.S. technology.** The UK and Australia, with U.S. assistance, are to design and build a new class of SSN AUKUS (sometimes pronounced *SNAW-kus*) boats incorporating U.S. submarine and naval nuclear propulsion technology. The UK is to build SSN AUKUS boats for use in the UK's navy, and Australia is to build SSN AUKUS boats for use in Australia's navy. The first UK-built SSN AUKUS boat is to be delivered to the UK's navy in the late 2030s, and the first Australian-built SSN AUKUS boat is to be delivered to Australia's navy in the early 2040s. If the Australian SSN AUKUS construction effort encounters delays, a fourth and perhaps fifth Virginia-class boat would be sold to Australia to permit Australia to continue the buildup of its SSN force. Australia by the mid-2050s is to operate a force of eight SSNs, including three to five Virginia-class boats and five to three SSN AUKUS boats.
- **Australian investments in U.S. and UK submarine industrial bases.** Australia is to invest at least $3 billion in its own industrial base to establish an Australian capacity for building and maintaining SSNs. In addition to that $3 billion, and for the purpose of supporting implementation of Pillar 1, Australia is to make a $3 billion contribution to the U.S. submarine industrial base,[45] and a $3 billion contribution to the UK submarine industrial base.[46] Of the $3 billion contribution to the United States, $2 billion reportedly is to be provided during 2025, and the remaining $1 billion is to be made in installments of $100 million per year for the next 10 years after that.[47] Australia reportedly made an initial payment of $500 million on February 7, 2025.[48]

In August 2024, Australia, the UK, and the United States reportedly signed an agreement permitting the exchange of technical information and materials for implementing Pillar 1.[49] A January 20, 2025, press report stated

> Australia will receive material and equipment to aid in the building of nuclear-powered submarines under the AUKUS deal, following the activation of a trilateral agreement between the three major countries.

[45] See Parliament of Australia, Foreign Affairs, Defence, and Trade Legislation Committee, October 25, 2023, transcript of committee meeting, accessed December 13, 2023, at https://www.aph.gov.au/Parliamentary_Business/Hansard/Hansard_Display?bid=committees/estimate/27450/&sid=0000.

[46] See Colin Clark, "Australia Sends $4.6B AUD to Bolster UK Sub Industry for SSN AUKUS as Shipbuilders Named," *Breaking Defense*, March 21, 2024; Lewis Jackson, "Australia Earmarks Billions for Naval Infrastructure as BAE Wins AUKUS Submarine Work," *Reuters*, March 21, 2024; Nic Fildes and Sylvia Pfeifer, "Australia and UK Sign Defence Treaty in Face of Rising Chinese Power," *Financial Times*, March 21, 2024; Shaun Turton and Sophie Mak, "Australia to Funnel $3bn to U.K. for AUKUS Sub Reactors, Designs," *Nikkei Asia*, March 22, 2024. (A figure of $4.6 Australian dollars [AUD] equates to about $3.0 billion U.S. dollars.)

[47] Abby Shepherd, "Australia to Transfer Initial $2 Billion to U.S. by End of 2025 for AUKUS," *Inside Defense*, October 10, 2024.

[48] Rich Abott, "HASC Seapower Leaders Urge Prompt DoD Australian AUKUS Funds Plan," *Defense Daily*, February 11, 2025. See also Dzirhan Mahadzir, "SECDEF: White House Supportive of AUKUS, Australia Makes $500M Payment," *USNI News*, February 10, 2025; Sam McKeith, "Trump Aware, Supportive of AUKUS Pact, US Defense Secretary Says," *Reuters*, February 7, 2025.

[49] See, for example, Agence France Presse, "Australia, US, UK Sign Nuclear Transfer Deal For AUKUS Subs," *Barron's*, August 12, 2024; Andrew Tillett, "AUKUS Deal Prioritises US, UK Subs Over Australia," *Australian Financial Review*, August 12, 2024.

> This comes after the AUKUS Naval Nuclear Propulsion Agreement came into effect over the weekend - just days before Donald Trump is inaugurated into the White House for the second time on Tuesday morning.[50]

Previous Countries That Requested but Did Not Receive U.S. Naval Nuclear Propulsion Technology

U.S. submarine technology and naval nuclear propulsion technology, reflecting decades of cumulative U.S. Navy research, development, design, construction, and operational experience, are generally considered crown jewels of U.S. military technology and consequently are highly protected by the United States. As noted earlier, the technical (including acoustic) superiority of U.S. Navy nuclear-powered submarines is generally considered a foundation of U.S. superiority in undersea warfare, which in turn underpins a U.S. ability to leverage the world's oceans as a medium of operations and maneuver, deny that to others, and thereby generate a huge asymmetric strategic advantage for the United States.

Given both its high degree of importance to overall U.S. national security strategy and U.S. technical superiority in the field, U.S. naval nuclear propulsion technology to date has been shared with only one other country—the UK—through an arrangement begun in 1958 reflecting the U.S.-UK special relationship and U.S.-UK cooperation on nuclear weapons and other nuclear-related matters dating back to the Manhattan project in World War II.

During the Cold War, when the United States and its allies were engaged in an extended, high-stakes, and costly strategic competition against the Soviet Union and Warsaw Pact allies, the United States reportedly turned down requests from four U.S. treaty allies other than the UK—France, Italy, the Netherlands, and Japan—to share U.S. naval nuclear propulsion technology. The United States also reportedly turned down earlier requests from Australia. A sixth U.S. treaty ally—Canada—also requested but did not receive this technology. Canada canceled its SSN project before the United States acted fully on Canada's request. A seventh country, Pakistan, also reportedly requested but did not receive the technology. For additional details regarding these six cases, see **Appendix F**.

Alternative of a U.S.-Australia Division of Labor

An alternative to Pillar 1 as currently structured would be a U.S.-Australia military division of labor under which U.S. SSNs would perform both U.S. and Australian SSN missions while Australia invested in military capabilities for performing non-SSN missions for both Australia and the United States. Such a U.S.-Australia military division of labor might be broadly similar to military divisions of labor that exist between the United States and some or all of its NATO or other allies (including Australia itself) for naval capabilities such as aircraft carriers, SSNs, large

[50] Jessica Wang, "US, UK and Australia to Begin Sharing Materials, Supplies in AUKUS Submarine Deal," *News.com.au*, January 20, 2025.

A 2025 UK government report assessing major government projects during the period 2023-2024 using a color rating system assigned a red color rating to the capability for producing nuclear reactor cores for the UK navy's submarine program, including the "capability to manufacture further cores for a fleet of flexible and adaptable attack submarines delivered under the AUKUS agreement." The report defines a red color rating as follows: "Successful delivery of the project appears to be unachievable. There are major issues with project definition, schedule, budget, quality and/or benefits delivery, which at this stage do not appear to be manageable or resolvable. The project may need re-scoping and/or its overall viability reassessed." (UK government, Infrastructure and Projects Authority, *Annual Report on Major Projects 2023-24*, Reporting to Cabinet Office and HM Treasury, 2025, reflecting data as of March 31, 2024, pp. 15, 43.)

surface combatants, and amphibious ships, and for non-naval capabilities such as (to name only some examples) nuclear weapons, space assets, and ISR capabilities.

Under a U.S.-Australia military division of labor for performing SSN missions and non-SSN missions

- the forward rotations of U.S. and UK SSNs to Australia planned under Pillar 1—SRF-West—would still be implemented;
- up to eight additional Virginia-class SSNs would be built, and instead of three to five of them being sold to Australia, these additional boats would instead be retained in U.S. Navy service and operated out of Australia along with the five U.S. and UK SSNs that are already planned to be operated out of Australia under Pillar 1 as SRF-West; and
- Australia, instead of using funds to purchase, build, operate, and maintain its own SSNs, would instead invest those funds in other military capabilities—such as, for example, long-range anti-ship missiles, drones, loitering munitions, B-21 long-range bombers, or other long-range strike aircraft—so as to create an Australian capacity for performing non-SSN military missions for both Australia and the United States.[51]

[51] For more on the B-21 program, see CRS Report R44463, *Air Force B-21 Raider Long-Range Strike Bomber*, coordinated by John R. Hoehn. For an article discussing the B-21 as an alternative to SSNs, see Michael Shoebridge, "An AUKUS Remix Delivering Greater Military Power Faster: the B-21 Raider," Defence Connect, November 15, 2023. (Also posted as Michael Shoebridge, "AUKUS Plan B: Delivering Greater Military Power Faster—The B-21 Raider," Real Clear Defense, November 16, 2023.) For further discussion of the option of Australia purchasing B-21s, see Marcus Hellyer and Andrew Nicholls, *'Impactful Projection': Long-Range Strike Options for Australia*, Australian Strategic Policy Institute (ASPI), December 2022, 53 pp.

For an article discussing a long-range strike aircraft other than the B-21, such as the P-8 maritime patrol aircraft, see Peter Briggs, "To B-21 or Not to B-21: What Are Australia's Best Long-Range Strike Options?" *Strategist*, December 6, 2022.

For an article discussing Australian procurement of loitering munitions, see Gordon Arthur, "Australia Takes Aim with US-Made Loitering Munitions," *Defense News*, July 9, 2024.

For a study that recommends increased procurement of long-range anti-ship missiles as a high-priority for improving U.S. and allied capabilities for countering Chinese aggression in a U.S.-China conflict over Taiwan, see Mark F. Cancian, Matthew Cancian, and Eric Heginbotham, *The First Battle of the Next War, Wargaming a Chinese Invasion of Taiwan*, Center for Strategic and International Studies (CSIS), January 2023, 158 pp., which states on page 4 (emphasis as in original)

> **Recommendation: Increase the arsenal of long-range anti-ship cruise missiles.** Bombers capable of launching standoff, anti-ship ordnance offer the fastest way to defeat the invasion with the least amount of U.S. losses. Procuring such missiles and upgrading existing missiles with this anti-ship capability needs to be the top procurement priority.

For an article discussing Australian investment in facilities to produce anti-ship missiles, see Colin Clark, "Aussies Investing Over $850M in New Kongsberg NSM, JSM Plant," *Breaking Defense*, August 21, 2024. See also Australian Government, "Acquisition of Joint Strike Missile to boost Australia's Long-Range Strike Capability," media release, September 5, 2024.

See also Henry Sokolski, "It's Time to Ditch Virginia Subs for AUKUS and Go to Plan B," *Breaking Defense*, March 6, 2025, which argues that "rather than sacrificing much of its defense program to buy nuclear submarines, Canberra should instead adopt an AUKUS Plan B that would field new defense technologies such as uncrewed systems and hypersonic weapons that would enhance Australia's security faster, and for far less."

For an alternative view, see Peter Briggs, "When It Comes to Submarines, Australia Is Going to Be Left High and Dry," *War on the Rocks*, March 11, 2025, which argues that "an alternative solution lies in the French Suffren-class [nuclear-powered attack] submarine, which presents a more practical and cost-effective option for Australia's naval needs."

Variations of this potential alternative include but are not necessarily limited to the following:

- Under one variation, the proposed sharing of U.S. naval nuclear propulsion technology and U.S. submarine technology, the proposed Australian investments in Australian and U.S. submarine-construction capability, and the other proposed actions for supporting eventual Australian construction of AUKUS SSNs would continue, and Australia would eventually build its own AUKUS SSNs, reducing at that point the need for U.S. SSNs to perform Australian SSN missions.
- Under another variation of this potential alternative, the performance of Australian SSN missions by U.S. SSNs would continue indefinitely, and instead of implementing the technology sharing, making Australian investments in submarine-construction capability, and taking the other actions that would be needed to eventually build AUKUS SSNs, Australia would continue investing in other military capabilities for supporting a continuing U.S.-Australia division of labor. Under this variation, the size of the U.S. SSN force would eventually be expanded above previously planned levels by eight boats (i.e., the planned eventual number of SSNs that Australia had planned to acquire).

As noted above, under both variations of this potential alternative, U.S. Navy SSNs that would perform Australian SSN missions could be operated out of a port in Australia, in an arrangement perhaps similar to the SRF-West arrangement that forms another part of Pillar 1, or to the arrangement under which U.S. Navy nuclear-powered ballistic missile submarines (SSBNs) from 1961 to 1991 underwent inter-deployment refits at a forward-located facility in Holy Loch, Scotland.[52] **Table 3** summarizes certain features of Pillar 1 as currently structured and the two above-described variations of the potential alternative of a U.S.-Australia division of labor for performing SSN missions and non-SSN missions.

Table 3. Pillar 1 as Currently Structured and Potential Alternative

		Potential alternative of U.S.-Australia division of labor	
	Pillar 1 as currently structured	**One variation**	**Another variation**
Australian SSN missions to be performed in 2030s and beyond by…	Australian Navy SSNs, consisting initially of Virginia-class boats sold to Australia, later augmented by Australian-made AUKUS SSNs	U.S. Navy SSNs, until replaced by Australian-made AUKUS SSNs	U.S. Navy SSNs
Forward rotations of U.S. and UK SSNs to Australia	Yes	Yes	Yes
3 to 5 Virginia-class SSNs sold to Australia	Yes	No	No
AUKUS SSNs built in Australia for Australian use	Yes	Yes	No

Source: Table prepared by CRS.

[52] For a short history of the Holy Loch arrangement, see Ronald D. Gumbert, "History of Submarine Squadron Fourteen," *Submarine Review*, January 1992: 72-77, accessed June 12, 2024, at https://archive.navalsubleague.org/1992/history-of-submarine-squadron-fourteen.

Issues for Congress

Whether to Procure 1 or 2 Virginia-Class Boats in FY2025

A key issue for Congress for FY2025 is whether to procure one or two Virginia-class boats in FY2025. The Navy states that procuring two would require adding $3,225.0 million (i.e., about $3.2 billion) to the Navy's FY2025 procurement funding request for the program. This is the Navy's estimate of the *net* increase in funding that would be needed to convert a one-boat buy to a two-boat buy. The second boat would cost more than $3,225 million, but some of the second boat's materials and equipment are already funded in prior-year budgets or requested to be procured under the Navy's FY2025 budget submission, and adding the second boat would reduce the cost of the first boat due to increased production economies of scale.

The Navy states that it requested the procurement of one boat rather than two for FY2025 due to limits on the Navy's budget topline and the growing Virginia-class production backlog,[53] and that the Navy's request includes a second shipset of selected Virginia-class components so as to provide stability to key submarine supplier firms. The Department of the Navy's FY2025 budget highlights book states

> Aligned with Congressional intent, this budget request delivers the most ready and lethal Naval Forces feasible under the FRA [Fiscal Responsibility Act—H.R. 3746/P.L. 118-5 of June 3, 2023] budget caps. These caps, paced well below even historical inflation targets, force hard choices. Due to the residual effects of inflationary pressures of the past few years, workforce challenges, plus increased labor and supply costs across the defense enterprise, all drove costs associated with our shipbuilding account up roughly 20% over the last couple of years. Hard choices were made, particularly in the procurement accounts. An analytic review of production performance identified areas where we could take risk to comply with the congressional fiscal caps. The Department requests only 1 Virginia Class submarine in PB25 [the President's (proposed) budget for FY2025], dropping the total number of ships requested down one from what we estimated we would request in FY 2025 during last year's budget.[54]

The Navy's FY2025 budget-justification book for its shipbuilding account states that the FY2025 funding request for the Virginia-class program

> includes an additional shipset of two year advance procurement funded materials, one year advance procurement funded materials, and one year economic order quantity funded materials. This funding will be used to support contractor furnished equipment and government furnished equipment critical spare material that will be consumed on future hulls to ensure critical sub-tier vendors maintain two submarines per year cadence.[55]

A March 14, 2024, press report stated

> During the rollout of the Pentagon's fiscal 2025 request senior DoD officials pointed to $3.9 billion set for submarine industrial base investment in the next fiscal year, some of which is long lead procurement so parts are ready and waiting.…
>
> "We see [advanced procurement funding] as incredibly important in terms of supporting the supplier base to set ourselves up for the needed production rate both for Virginia-

[53] Source: Navy FY2025 budget rollout briefing for CBO and CRS, March 12, 2024.

[54] Department of the Navy, *Highlights of the Department of the Navy FY 2025 Budget*, 2024, pp. 1-12 to 1-13.

[55] *Department of Defense, Fiscal Year (FY) 2025 Budget Estimates, Navy, Justification Book Volume 1 of 1, Shipbuilding and Conversion, Navy*, March 2024, pp. 115, 117, 121.

> class… [and] we include support for Columbia-class," Navy Undersecretary Erik Raven said. Raven elsewhere said the service anticipates the Virginia-class program will hit the two-sub-per-year delivery cadence by 2028.
>
> Pentagon comptroller Mike McCord said the Pentagon cut to one submarine buy so it would not keeping doing the same thing over and over, which had not resulted in an appreciable production increase.
>
> "The boats that are delivering … this year are averaging over 30 months late, and we have more than a dozen on order that are still in production already. So the question was really: 'What can we do to get a better result [rather] than keep doing the same thing and hoping for a different result?'"[56]

Supporters of procuring one Virginia-class boat in FY2025 could, like the Navy, cite limits on the defense budget topline, the Virginia-class production backlog, and the funding requested for a second shipset of selected Virginia-class components. They could also cite the potential impacts of funding reductions to other DOD programs that might be needed to offset increasing FY2025 procurement funding for the Virginia-class program by $3,225 million.

Supporters of procuring two Virginia-class boats in FY2025 argue that doing so would provide greater stability for the industrial base and send a stronger signal of resolve to potential adversaries such as China. For example, at an April 17, 2024, hearing before the Seapower and Projection Forces subcommittee of the House Armed Services Committee on Department of the Navy FY2025 seapower and projection forces programs, Representative Joe Courtney, the ranking member of the subcommittee, stated in his opening remarks

> This [FY2025 Navy shipbuilding budget] request includes six battle force ships, a sharp deviation from last year's Future Years Defense Plan [FYDP] and 30-year shipbuilding plan.
>
> At the same time, 19 battle force ships are being decommissioned, as [subcommittee] Chairman [Trent] Kelly just noted [in his own opening remarks]. [Of] particular note, it [i.e., the FY2025 Navy shipbuilding budget request] seeks to reduce procurement of the Virginia-class submarine program from 13 consecutive years of steady two-per-year cadence down to just one submarine in fiscal year 2025. This decision to cut procurement in the Virginia[-class] program contradicts our own combatant commanders that have emphasized the need for more attack submarines to deter the intensifying threats in the undersea domain.
>
> During our posture hearings in the last month, we have consistently heard from combatant commanders from INDOPACOM, EUCOM, and NORTHCOM—Admiral [John] Aquilino, General [Christopher] Cavoli, [and] General [Glen VanHerck]—that their requirements for attack submarines are—are far higher beyond [sic] the number of boats in the Navy's inventory.
>
> Equally concerning is that Congress has already appropriated in the last two years nearly $1 billion in advance procurement [funding] for the second submarine that the Navy now seeks to eliminate. This unexpected change in demand signal has and will cause serious reverberations throughout the industrial base and friends overseas who based on my conversations in those arenas are frankly incredulous.
>
> I've already shared those concerns with you and we will explore that in further depth today. The Navy's public justification for dropping a submarine is that the sizable investments in the submarine industrial base, known as the SIB in the budget, will offset its cut in

[56] Colin Clark, "AUKUS Critics Jump on Virginia-class Sub Budget Plan, but Canberra Sanguine," *Breaking Defense*, March 14, 2024.

> procurement and fleet size. As a member who has secured Congressional increases in the SIB starting in 2018, I wholly support the Navy's embrace of that effort.
>
> However, I reject the ivory tower theory that SIB investment is a substitute for a consistent demand signal for orders and business. The two enterprises have to incur in tandem. Over the Easter break, I had the opportunity to meet with several supply chain companies and the message was clear, submarine industrial base investments as welcome as they are don't pay the bills and are [sic] particularly for these firms that doesn't—particularly for those firms that don't qualify for SIB assistance.
>
> It is important to remember that cutting [submarine] procurement going back to the 1990s is precisely the reason why the submarine industrial base has eroded over the last 30 years. Indeed, Undersecretary Robert LaPlante testified to that point before the House Armed Services Committee few weeks ago. The decades of financial trauma the industrial base has experienced due to the Navy's consistently inconsistent procurement profiles is still deeply seared in the supply chain companies and metal trades unions that represent the welders, electricians, machinists, and pipefitters that are hard at work today, as we sit here in this committee room.[57]

Prior to the submission of the Navy's proposed FY2025 budget, a January 17, 2024, letter to President Biden from the chairman and ranking member of the House Armed Services Committee (Representative Mike Rogers and Representative Adam Smith, respectively) and the chairman and ranking member of the Seapower and Projection Forces subcommittee of the House Armed Services Committee (Representative Trent Kelly and Representative Joe Courtney, respectively) stated

> We, the undersigned, are writing to you as a bipartisan coalition that supported advancement of the recently enacted Fiscal Year (FY) 2024 National Defense Authorization Act (NDAA). One of the most significant provisions of the new law are several authorities to enable execution of the trilateral AUKUS security agreement amongst the United States, Australia, and the United Kingdom….
>
> … Now that AUKUS is codified, we are writing to express our conviction that the U.S. Navy and Congress maintain continued procurement of two Virginia-class submarines per year, as detailed in the Navy's FY2024 30-Year Shipbuilding Plan.
>
> Our belief is based on the promising increase in U.S. submarine production tonnage in 2023. Part of this growth is due to investments from the Navy and Congress in workforce and supply chain development over the last five years, which requires continuous support to mature and stabilize the health of the industrial base. Even more importantly, this growth is dependent on the persistent two-per-year demand signal to the nationwide submarine industrial base that Congress has defended since 2011. That commitment has driven suppliers to make critical capital investments and expand capacity based on a predictable forecast in expected work. It has also driven metal trades workers, designers, and engineers to choose shipbuilding as promising careers in record numbers. Deviation from projected procurement rates in the FY2025 budget request would upend the faith of a steady procurement profile in the Future Years Defense Plan by our suppliers, as well as any plans for future capital investments in the supply chain.
>
> In March 2023, the joint announcement of the AUKUS Optimal Pathway by the heads of government of the United States, Australia, and the United Kingdom triggered a robust discussion in Congress that generated significant support and increased international attention to the critical need for, and challenges facing, the Virginia-class program. The

[57] Source: CQ transcript of hearing. The passage as presented includes some typographical corrections made by CRS. See also Mallory Shelbourne and Sam LaGrone, "Navy's Single Sub Buy Plan Raises Concerns with Congress," *USNI News*, April 18 (updated April 24), 2024; Justin Katz, "Top Seapower Hawk Rep. Courtney Rejects Navy's Pitch for 1 Virginia-Class Sub Buy," *Breaking Defense*, April 17, 2024.

> AUKUS partnership relies on our nation to sustain a consistent build rate for attack submarines required to fulfill our obligation to successfully transfer, via sale, Virginia-class submarines to Australia while meeting our own force structure requirements. It is imperative to maintain a steady two-per-year procurement rate to assure our partners in our ability to meet commitments and address concerns about our nation's undersea capabilities.
>
> Simply put, now is not the time to insert instability in the supply chain with uncertainty in procurement rates. The FY2025 budget will come at a pivotal time for the Virginia-class submarine program and sustaining our unmatched edge in the undersea domain. Any deviation from the planned cadence of the construction and procurement of two submarines per year will reverberate both at home and abroad, with allies and competitors alike.[58]

Cost Growth and Proposals for Addressing It

Overview

Another issue for Congress concerns cost growth in the Virginia-class program and proposals for addressing it. Reported cost growth in the Virginia-class program includes

- $1.95 billion in cost growth for the two Virginia-class submarines procured in FY2024—boats whose procurement costs were nominally fully funded in the FY2024 DOD Appropriations Act, which was enacted in March 2024,[59] and
- a reported projected funding shortfall of $17 billion for submarines to be procured through FY2030.[60]

Cost growth in the Virginia-class program can be viewed as due in part at least to inflation in Navy shipbuilding costs in general. As discussed in another CRS report,[61] shipbuilding, like other sectors of defense procurement and the U.S. economy in general, has experienced significant inflation since the start of the COVID-19 pandemic due to supply chain disruptions and other impacts. The Department of the Navy states in its FY2025 budget highlights book that "the residual effects of inflationary pressures of the past few years, workforce challenges, plus increased labor and supply costs across the defense enterprise, all drove costs associated with our shipbuilding account up roughly 20% over the past couple of years."[62]

Requested Supplemental Appropriation for FY2024 Boats

As a proposal for addressing the $1.95 billion in cost growth for the two Virginia-class submarines procured in FY2024, DOD included—as part of a package of requested anomalies (i.e., special legislative provisions) for a continuing resolution (CR) to fund government

[58] Letter dated January 17, 2024, to The Honorable Joseph R. Biden President of the United States, from Representative Mike Rogers, Representative Adam Smith, Representative Trent Kelly, and Representative Joe Courtney, accessed June 12, 2024, at https://s3.documentcloud.org/documents/24367170/011724-hasc-fc-spf-fy25-virginia-class-submarine-letter-final.pdf. See also Mallory Shelbourne and Sam LaGrone, "House Members Send Warning to White House Over AUKUS, Attack Submarine Procurement," *USNI News*, January 18, 2024.

[59] The FY2024 DOD Appropriations Act is Division A of the Further Consolidated Appropriations Act, 2024 (H.R. 2882/P.L. 118-47 of March 23, 2024).

[60] See, for example, Office of Representative Ken Calvert, "Rep. Calvert Opening Statement from Shipbuilding Program Briefing," press released dated September 19, 2024; Tony Capaccio, "New US Subs Running $17 Billion Over Budget, Lawmaker Says," *Wall Street Journal*, September 20, 2024.

[61] See CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[62] Department of the Navy, *Highlights of the Department of the Navy FY 2025 Budget*, 2024, p. 1-12.

operations at the start of FY2025—a request for a provision making $1.95 billion in supplemental appropriations for the two boats.[63] The CR that was enacted just prior to the start of FY2025—the Continuing Appropriations and Extensions Act, 2025 (H.R. 9747/P.L. 118-83 of September 26, 2024)—did not include this appropriation. As noted later, in the Legislative Activity section, Division A of the American Relief Act, 2025 (H.R. 10545/P.L. 118-158 of December 21, 2024)—the CR that funds government operations until March 14, 2025—provides an appropriation of $5.691 billion in ship procurement funding for the Virginia-class program and other nuclear-powered ship programs (i.e., the Columbia-class ballistic missile submarine program and the Gerald R. Ford [CVN-78] class aircraft carrier program).

SAWS Proposal for Restructuring Procurement Funding

One option that reportedly has emerged from the Navy and industry for addressing the projected $17 billion shortfall for submarines to be procured through FY2030 and for making investments in the submarine construction industrial base is a proposal for restructuring submarine procurement funding called the Shipbuilder Accountability and Workforce Support (SAWS) proposal. A September 13, 2024, press report about SAWS states

> Facing ballooning costs for shipbuilders, the Navy is proposing restructuring how it pays for submarine and aircraft carrier workers to allow more flexibility for shipyards to raise wages and build infrastructure, USNI News has learned….
>
> The Navy wants to take some of the labor money obligated for submarines not yet under construction and pull it forward to use on the current worker wage shortfall in an acquisition change called Shipyard Accountability and Workforce Support (SAWS).
>
> Submarine and aircraft carrier labor at shipbuilders Electric Boat and HII Newport News Shipbuilding in Virginia broadly come in two types – the touch labor workers who work on specific hulls, like welders and pipefitters, and support services shipbuilders, like supervisors and crane operators who work all across the yard. SAWS would take the money frozen for support services labor from the individual contracts not yet under construction and create a large pool of funds for shipbuilders to both boost wages and make capital improvements without asking Congress for additional appropriations, several people familiar with the idea told USNI News over the last several days.
>
> The Navy's pitch under SAWS would pay the yards an annual service fee for the shipbuilders who work across the yard and keep the touch labor costs tied to each individual hull. The idea would separate payments for the two workforces and would increase flexibility across both yards over the life of the submarine programs.
>
> Proponents say the arrangement would solve a near-term wage issue for shipyard workers and prevent jarring cost increases like the $1.95 billion funding anomaly the White House requested Congress add to the already $9.4 billion appropriated in the Fiscal Year 2024 budget for two Virginia-class attack submarines. The bulk of those additional funds were to pay for labor costs. However, not everyone is convinced.
>
> SAWS was considered as part of the arrangement for the two FY 2024 boats—SSN-812 and SSN-813—as part of a larger negotiation for a total of 17 submarines, but the Office of Management and Budget said no to the proposal, instead asking for the anomaly, USNI News understands. In addition to the 2024 boats, the Navy and EB are negotiating multi-year deals for the next ten Block VI attack boats and five Build II [i.e., Block 2] Columbia-class ballistic nuclear missile submarines.

[63] For a press report discussing this request, see Sam LaGrone, "White House Wants an Extra $2B for FY24 Virginia-class Subs, Attack Boat Pair Could Cost $11.3B," *USNI News*, September 4, 2024.

> Following the decision from OMB for the FY 2024 boats and amidst the other negotiations some in Congress, the Navy and the shipbuilders have asked OMB and the administration to take a close look at SAWS.
>
> "The SAWS plan would provide the workforce support necessary to increase ship production rates—all without requiring additional appropriation. While not a silver bullet, this proposal stands to improve the way the Navy does business on critical defense programs," Sen. Roger Wicker (R-Miss.), the ranking member on the Senate Armed Services Committee, told USNI News on Friday.
>
> In a statement, Wicker compared SAWS to other service contract arrangements like launch services for military satellites and fees associated with aircraft and missile production.
>
> SASC Seapower chairman Sen. Tim Kaine (D-Va.) provided USNI News a statement that was short of an endorsement and asked the White House to take a second look at SAWS in the context of the U.S. deal with the U.K. and Australia to provide Canberra Virginia-class nuclear attack submarines.
>
> "The Australia-U.K.-U.S. partnership is a once-in-a-generation national security agreement, and it's going to take a once-in-a-generation investment in our submarine industrial base to meet it. I urge the Biden Administration to take a careful look at this proposal to determine if it is the best path forward to do that," reads the statement.
>
> General Dynamics spokesperson Jeff Davis told USNI News, "we support the Navy's initiative to improve submarine construction schedules by allowing us to accelerate investments in throughput and increase wages for our workforce."
>
> In a statement to USNI News HII said, "we are aware of and supportive of a Navy initiative to explore innovative approaches to address the narrowing wage gap between entry-level pay and that of other industries, as well as infrastructure to create efficiencies and increase production. For specifics on SAWS, I refer you to Navy."
>
> A Navy spokesperson declined to comment on SAWS when contacted by USNI News on Friday [September 13].
>
> This week both Secretary of the Navy Carlos Del Toro and shipbuilders will appear in separate closed sessions with the House Appropriations Committee to discuss shipbuilding in general and SAWS in particular, several defense and legislative officials told USNI News this week.
>
> Congressional appropriators have been more leery of the proposal since it would reduce funding control over submarine contracts, USNI News understands.[64]

A September 19, 2024, press report about the SAWS proposal stated

> Navy Secretary Carlos Del Toro heads to the Hill today [September 19] to try to revive a plan to speed up submarine construction—just weeks after the White House shot it down. He may face an uphill battle with lawmakers as well….
>
> The Navy proposal, called Shipyard Accountability and Workforce Support, seeks to reallocate some portion of the money that was set aside for future Virginia- and Columbia-class submarines and instead use it to cover shipyards' current inflation-related costs and worker pay shortfalls. The Navy and industry argue those issues are keeping them from building nuclear-powered submarines on schedule.
>
> Not everyone agrees with the approach. The Office of Management and Budget rejected it and instead asked for nearly $2 billion for two [FY2024] Virginia-class subs in any final

[64] Sam LaGrone, "New Navy Sub Funding Proposal to Combat Growth in Labor Costs Raises Questions in Congress, White House," *USNI News*, September 13 (updated September 14), 2024.

> stopgap spending bill. When asked for comment, OMB highlighted that recommendation as proof it is willing to work with the Navy to tweak submarine funding….
>
> The proposed spending plan is a key part of negotiations to fund and build 17 subs, including Virginia- and Columbia-class boats—the Navy's top acquisition priority for years.…
>
> Lawmakers on Wednesday appeared skeptical of Del Toro's new proposal. HAC-D Chair Ken Calvert voiced frustration, noting that the plans went to the Hill only last week. "I don't like it—my first blush at least," he told your anchor [for this newsletter], adding that he's planning "a pretty strong statement" for today….
>
> SASC Chair Jack Reed, who is also an appropriator, said the Navy must show how its plans would boost savings and submarine output in the long run. "The devil's in the details," he told your anchor….
>
> HII CEO and President Christopher Kastner told Paul, "I credit Secretary Del Toro, the Navy and DOD with a solution that is kind of genius: addresses the wage gap and invests in the industrial base without the need for funding above the Navy's planned budget. It gets at the underlying current challenges in shipbuilding so we can get these ships built and delivered on schedule to support the Navy and AUKUS."…
>
> Executives from HII Newport News Shipbuilding and General Dynamics Electric Boat were invited to brief lawmakers on the plan this Friday [September 20]….
>
> SASC ranking member Sen. Roger Wicker, meanwhile, is in the Navy's corner. He said in a statement that the plan "would provide the workforce support necessary to increase ship production rates—all without requiring additional appropriation. While not a silver bullet, this proposal stands to improve the way the Navy does business on critical defense programs."
>
> HASC Seapower ranking member Rep. Joe Courtney, whose Connecticut district is home to the General Dynamics Electric Boat shipyard, expressed optimism about the Hill meetings. He argued the Navy's proposal is crucial to stabilizing recruitment and retention by keeping submarine production rates steady.
>
> Courtney told your anchor that moving beyond the "straitjacket" of one-year budget cycles remains a challenge, but he underscored the importance of the upcoming discussions. "The sooner we get this done, the better."[65]

A January 9, 2025, press report stated

> The head of shipbuilder HII said he believes the incoming presidential administration may prove more "receptive" to a plan developed by the Navy and industry to boost shipyard wages and accelerate submarine production.
>
> "I think there is an opportunity with the new administration. I think there's probably more receptivity to innovation in contracting and that could potentially support getting these 17 boats under contract," Chris Kastner told a group of reporters on Thursday [January 9].[66]

Another January 9, 2025, press report similarly stated: "Finalizing the delayed contract award for 17 new nuclear-powered submarines will require a 'SAWS-like approach,' HII CEO Chris

[65] "The Big News," *Politico Pro Morning Defense*, September 19, 2024.

[66] Justin Katz, "New Admin May Be More 'Receptive' to Navy-Industry Plan to Boost Shipyard Wages: HII CEO," Breaking Defense, January 9, 2025. See also Mallory Shelbourne, "Submarine Funding Anomaly Insufficient to Get Boats the Navy Wants, Says HII CEO," *USNI News*, January 9, 2025.

Kastner said today, referring to a Navy proposal intended to combat submarine schedule delays and cost growth by restructuring how the vessels are paid for."[67]

A February 6, 2025, press report similarly stated: "The year-plus delay in signing contracts for the 17 boats has been at the center of a struggle for how Navy, Congress and industry should manage the ballooning costs of submarine construction after the COVID-19 pandemic. HII is pushing a plan called the Shipbuilder Accountability and Workforce Support, or SAWS, that the Navy developed and then abandoned."[68]

Potential Oversight Questions

Potential oversight questions include the following:

- When did the Navy become aware of the reported $1.95 billion in cost growth on the two Virginia-class submarines procured in FY2024, and the reported projected funding shortfall of $17 billion for submarines to be procured through FY2030? When did the Navy inform Congress of this cost growth?
- When did the Navy and/or industry begin to develop the SAWS proposal?
- How fully developed is the SAWS proposal? What aspects of the SAWS proposal, if any, remain to be worked out?
- Does the Navy support the SAWS proposal?
- What new legislative authorities, if any, would Congress need to provide to the Navy to implement SAWS?
- When did the Navy inform Congress of the SAWS proposal? How much time does Congress have to understand and assess the SAWS proposal before making a decision on whether it should be implemented?
- What implications would the SAWS proposal, if implemented, have for
  - the need for appropriating additional funds to cover the $1.95 billion in cost growth on the two Virginia-class submarines procured in FY2024?
  - the need for making increased appropriations in coming years to cover the reported projected funding shortfall of $17 billion for submarines to be procured through FY2030?
  - funding requirements for previously planned Navy investments in the submarine construction industrial base?
  - shipyard and supplier firm productivity improvements resulting from the investments in the submarine construction industrial base that would be made under SAWS, and the impact those improvements might have on reducing estimated procurement costs for submarines to be procured in coming years?
  - the definition of the unit procurement cost of the submarine—the cost elements that would be included or not included in unit procurement cost figures reported to Congress?

[67] Nick Wilson, "Finalizing 17-sub buy will require a 'SAWS-like approach,' HII CEO says," *Inside Defense*, January 9, 2025.

[68] Sam LaGrone, "Shipbuilders, Navy Want Deal on 2 Virginia Attack Boats 'As Soon as Possible,'" *USNI News*, February 6, 2025.

  - how the budgetary treatment and budget displays for submarines would compare to that of other Navy shipbuilding programs or other DOD procurement end items, such as aircraft?
- Should the SAWS concept be applied not just to submarines (or nuclear-powered warships), but to all Navy shipbuilding programs?
- Will the Navy and Congress have adequate visibility into the yard services costs for submarines that would be restructured under SAWS?
- What impact, if any, would implementing SAWS have on incentive fee payments to the shipbuilders that would be made under their contracts with the Navy to build the submarines in question?

Reported Faulty Welds on Submarines and Aircraft Carriers

Another issue for Congress concerns reported faulty welds on submarines and aircraft carriers built at HII/NNS. A September 26, 2024, press report stated

> Shipuilder Newport News Shipbuilding, Va., informed the Department of Justice of faulty welds that may have been made intentionally on non-critical components on in-service Navy submarines and aircraft carriers, USNI News has learned.
>
> HII reported to the Navy that welds on new construction and in-service submarines and Ford-class aircraft carriers were made not following welding procedure, according to a Tuesday memo from Assistant Secretary of the Navy for Research, Development and Acquisition Nickolas Guertin to Secretary of the Navy Carlos Del Toro and Chief of Naval Operations Adm. Lisa Franchetti.
>
> Guertin told SECNAV and CNO the workers did not follow proper techniques to weld the suspect joints with an early indication that some of the welding errors were intentional. Based on the Newport News assessment of the welds, the shipyard notified the Department of Justice over the issue.
>
> Portions of Guertin's memo were first circulated on social media sites on Thursday [September 26].
>
> Newport News acknowledged their internal quality assurance systems discovered production problems in a Thursday statement to USNI News
>
> "We recently discovered through internal reporting that the quality of some welds did not meet our high-quality standards. Upon this discovery, we took immediate action to communicate with our customers and regulators, investigate, determine root cause, bound these matters and insert immediate corrective actions to prevent any recurrence of these issues," reads the statement.
>
> "HII's Newport News Shipbuilding is committed to building the highest-quality aircraft carriers and submarines for the U.S. Navy. We do not tolerate any conduct that compromises our company's values and our mission of delivering ships that safeguard our nation and its sailors."
>
> The Navy acknowledged the ongoing look into the scope of the welding problem in a Thursday statement to USNI News.
>
> "The Navy is aware of the issue and a thorough evaluation is underway to determine the scope. The safety of our Sailors and our ships is of paramount importance. We are working

> closely with industry partners to address this situation and will provide additional information when available," reads the statement.[69]

On September 27, 2024, the House Armed Services Committee announced that it is investigating the issue.[70] An October 4, 2024, press report stated

> Secretary of the Navy Carlos Del Toro told the House Armed Services Committee that "the Navy is evaluating all legal options" over suspected faulty welds on three in-service ships and 23 ships yet-to-be delivered at HII's Newport News Shipbuilding, according to an Oct. 3 letter obtained by USNI News.
>
> Additionally Del Toro told the committee that "this matter has been referred to the Department of Justice to investigate any potential claims for breach of contract or false claims." Navy Times first reported on the message from Del Toro on Friday [October 4].
>
> HII referred USNI News to the Department of Justice when asked about a potential investigation.
>
> The letter came the same day as a HASC request this week to Del Toro to provide the committee more information about several welds on aircraft carriers and Virginia-class and Columbia-class submarines that were made by shipyard workers at HII's Newport News Shipbuilding who did not follow proper procedures.
>
> "NNS reports that the issues involve welders who did not follow welding procedures properly … As of today, the Navy has identified three in-service ships that are affected by this welding deficiency: USS George Washington (CVN-73), USS Hyman G. Rickover (SSN-795) and USS New Jersey (SSN-796)," wrote Del Toro.
>
> "Naval Sea Systems Command has assessed that the welds were not components or systems that affect ship safety or operations. NAVSEA … has determined the ships are safe to operate."
>
> In addition to the two Virginia-class attack boats and George Washington, Del Toro said NAVSEA is in the process of evaluating welds on a combination of 23 new construction ships and aircraft carriers during their mid-life refueling and overhaul, with a goal of completing the assessment by mid-October.
>
> Del Toro said he was initially informed of the suspected faulty welds on Sept. 24.
>
> Assistant Secretary of the Navy for Research, Development and Acquisition Nickolas Guertin wrote in a Sept. 24 memo to Del Toro and Chief of Naval Operations Adm. Lisa

[69] Sam LaGrone, "DoJ Notified of Suspected Faulty Welds on Subs, Aircraft Carriers at Newport News Shipbuilding," *USNI News*, September 26, 2024. See also Wyatt Olson, "Report Says East Coast Shipbuilder Discovered Faulty Welds on Subs, Aircraft Carriers," *Stars and Stripes*, September 27, 2024; Christina Shaw, "Newport News Shipbuilding Suspects Intentionally Faulty Welds On Multimillion-Dollar Naval Vessels," *Fox News*, September 27, 2024; Rich Abott, "HII Admits To Faulty Welds On Carriers And Subs, House Committee Investigating," *Defense Daily*, September 30, 2024; Maritime Executive, "Workers at Newport News Made Faulty Welds on U.S. Navy Carriers and Subs," *Maritime Executive*, September 30, 2024; Konstantin Toropin, "Navy Says 26 Ships Affected by Faulty Welds at Newport News Shipyard in Virginia," *Military.com*, October 7, 2024.

[70] House Armed Services Committee, "HASC Investigates Reports of Faulty Welds Knowingly Made to U.S. Navy Vessels," press release, September 27, 2024. See also House Armed Services Committee, "HASC Demands Answers on Reports of Faulty Welds Knowingly Made to U.S. Navy Vessels," press release, October 3, 2024; Sam LaGrone, "Lawmakers to Investigate Faulty Sub, Carrier Welding at Newport News Shipbuilding," *USNI News*, September 27, 2024; Mike Glenn, "Lawmakers Press Navy over Faulty Welding Reports on Submarines, Aircraft Carriers Under Construction," *Washington Times*, September 27, 2024; Rich Abott, "HII Admits To Faulty Welds On Carriers And Subs, House Committee Investigating," *Defense Daily*, September 30, 2024; Sam LaGrone, "HASC Wants Navy Info on Suspected Faulty Welds, Says Letter to SECNAV," *USNI News*, October 3, 2024; Valerie Insinna, "HASC Leaders Probe Navy on Newport News Faulty Welding Problem," *Breaking Defense*, October 4, 2024; Leo Shane III and Geoff Ziezulewicz, "Navy Identifies Three Vessels Impacted by Faulty Shipyard Weld Work," *Military Times*, October 4, 2024.

> Franchetti that the nature of the procedural violations prompted HII to notify the Department of Justice. It's unclear when HII initially discovered the problems and reported them to the Navy.
>
> In a statement earlier this week, HII told USNI News that "upon discovery of some welders not consistently following procedures we followed our protocol and took action to communicate with our customers and regulators in a timely manner and began working the issue with the Navy."
>
> Del Toro has ordered additional inspections and said that the shipyard is increasing training for welders.
>
> "While I am deeply disappointed about this failure to uphold quality on the part of the shipyard as required by contract, my top priority is ensuring the safety of our sailors and platforms and communicating transparently with the Congress and the American people," he wrote.[71]

An October 31, 2024, press report stated

> Fewer than two dozen shipyard workers are responsible for suspicious welds that were discovered on aircraft carriers and submarines built at HII's Newport News Shipbuilding, company officials said during an earnings call for the shipbuilder on Thursday [October 31].
>
> Company leaders in the earnings call framed the suspicious welds, made on Ford and Nimitz-class aircraft carriers and Columbia and Virginia-class submarines, as the a result of a small subset of workers in the yard.
>
> "This is a process issue. This is a small fraction of some welders in the yard and a small fraction of welds that were impacted," HII CEO Christopher Kastner said on the earnings call.
>
> "We're working very closely with the customer to bound the issue and come through the issue, and we think we'll march through that very smartly."[72]

Whether to Implement Certain Elements of AUKUS Pillar 1

Overview

Another issue for Congress is whether to implement certain elements of the AUKUS submarine (Pillar 1) project, specifically, the intention to sell three to five Virginia-class submarines to Australia and subsequently build three to five replacement SSNs for the U.S. Navy, and to have the United States and UK provide assistance to Australia for an Australian effort to build additional three to five SSNs of a new UK-Australian SSN design to complete a planned eight-boat Australian SSN force. The potential benefits, costs, and risks of implementing these elements of Pillar 1 can be compared with the potential benefits, costs, and risks of the alternative division-of-labor approach for performing SSN missions and non-SSN missions outlined earlier, in which up to eight additional Virginia-class SSNs would be procured and retained in U.S. Navy service and operated out of Australia along with the U.S. and UK SSNs that are already planned to be operated out of Australia under Pillar 1, while Australia invested in military capabilities (such as,

[71] Sam LaGrone, "SECNAV Del Toro is 'Evaluating All Legal Options' Over Suspected Faulty Welds at Newport News Shipbuilding," *USNI News*, October 4, 2024.

[72] Sam LaGrone, "HII: Fewer than 2 Dozen Shipyard Workers Involved in Suspect Welds, Delay in 17-Sub Contract Creates 'Unpredictability,'" *USNI News*, October 31, 2024.

for example, long-range anti-ship missiles, drones, loitering munitions, B-21 long-range bombers, or other long-range strike aircraft) for performing non-SSN missions.

In comparing the potential benefits, costs, and risks of these elements of Pillar 1 with the potential benefits, costs, and risks of the division-of-labor alternative, key factors that Congress may consider include, but are not necessarily limited to, the following:

- **deterrence and warfighting cost-effectiveness**—costs relative to resulting deterrence and warfighting capability;
- **technology security**—the potential impact on the risk of China, Russia, or some other country gaining access to U.S. submarine or naval nuclear propulsion technology; and
- **risk of accident and public acceptability of U.S. Navy nuclear-powered ships**—the risk of an accident involving an Australian-owned SSN that might call into question for third-party observers the safety of all U.S. Navy nuclear-powered ships and thereby affect U.S. public support for operating U.S. Navy nuclear-powered ships and/or the ability of U.S. Navy nuclear-powered ships to make port calls around the world.

Of the three factors listed above, the first is one is typically involved in considering the merits of defense programs, while the second and third arose in connection with Congress's consideration of the merits of a project that Canada began in 1987 and canceled in 1989 to acquire a force of 10 to 12 UK- or French-made SSNs (see **Appendix G** and **Appendix I**).[73]

Arguments for Implementing Certain Pillar 1 Elements

Supporters of selling three to five Virginia-class submarines to Australia and subsequently building three to five replacement SSNs for the U.S. Navy, and of having the United States and UK provide assistance to Australia for an Australian effort to build additional three to five SSNs of a new UK-Australian SSN design to complete a planned eight-boat Australian SSN force, can make various arguments, including those outlined below.

Deterrence and Warfighting Cost-Effectiveness

Arguments relating to deterrence and warfighting cost-effectiveness include the following:

- Selling Virginia-class boats to Australia would substantially enhance deterrence of potential Chinese aggression by sending a strong signal to China of the collective determination of the United States and Australia, along with the UK, to counter China's military modernization effort. The fact that the United States has never before sold a complete SSN to another country—not even the UK[74]—would underscore the depth of this determination, and thus the strength of the deterrent signal it would send.
- The deterrent value of selling Virginia-class boats to Australia would be greater than the deterrent value of keeping those SSNs in U.S. Navy service. Compared

[73] For additional discussion, see CRS Issue Brief IB88083, *Canadian Nuclear-Powered Attack Submarine Program: Issues for Congress*, updated April 24, 1989 (archived), by Ronald O'Rourke. This report is available to congressional clients directly from the author.

[74] To help the UK build its first SSN, the United States transferred to the UK a U.S. SSN propulsion plant (i.e., the "back half" of a U.S. SSN), but the UK designed and built the forward part (the "front half") of the boat and married it to the U.S.-supplied propulsion plant.

with the option of keeping the SSNs in U.S. Navy service and waiting for Australia to build its own AUKUS SSNs, selling Virginia-class boats to Australia would substantially accelerate the creation of an Australian force of SSNs and thereby present China much sooner with a second allied decisionmaking center (along with the United States) for SSN operations in the Indo-Pacific. This would enhance deterrence of potential Chinese aggression in the Indo-Pacific by complicating Chinese military planning. In this regard, selling Virginia-class boats to Australia would be broadly comparable to

  - the help that the United States provided to the UK's nuclear-powered submarine program starting in 1958, which accelerated the creation of the UK's SSN force, thereby presenting the Soviet Union much sooner with a second allied decisionmaking center (along with the United States) for SSN operations in the European theater, which enhanced deterrence of potential Soviet aggression in Europe by complicating Soviet military planning; and
  - the help that the United States, secretly at the time, reportedly provided to France during the Cold War on the design of France's nuclear warheads, so as to speed up the development and fielding of France's strategic nuclear deterrent force and thereby present the Soviet Union much sooner with three decisionmaking centers—the United States, the UK, and France—that were armed with effective strategic nuclear deterrent forces.[75]

- A division of labor arrangement in which U.S. SSNs perform SSN missions for Australia would not generate this multiple-decisionmaking-center form of deterrence.
- Australia's promised $3 billion investment in the U.S. submarine industrial base would help accelerate the date by which replacement SSNs, strictly construed, could be built for the U.S. Navy, and thereby minimize the time during which the size of the U.S. SSN force is reduced due to the sale of Virginia-class boats to Australia. Investments that Australia would make in the U.S. and Australian submarine construction industrial bases would increase the capacity of the combined U.S.-Australia submarine construction industrial base at a time when limits on the capacity of the U.S. submarine construction industrial base have become a matter of concern for U.S. policymakers.
- Australia intends to increase its defense budget as needed to be able to finance the purchase, operation, and maintenance of its Virginia-class boats without having to reduce funding for other Australian military capabilities that are needed for deterring or countering potential Chinese aggression. Increases to Australia's military budget would be sufficient to ensure that Pillar 1 would have a net positive impact on Australia's overall military capabilities for deterring potential Chinese aggression.

[75] See Richard H. Ullman, "The Covert French Connection," *Foreign Policy,* Summer 1989 (No. 75): 3-33, accessed at https://www.jstor.org/stable/1148862; "The French Bomb, with Secret U.S. Help, Documents from Nixon and Ford Administrations Show U.S. Assistance for French Nuclear Forces Earlier than Previously Reported," National Security Archive, George Washington University, May 26, 2011, accessed at https://nsarchive2.gwu.edu/nukevault/ebb346/; William Burr, "U.S. Secret Assistance to the French Nuclear Program, 1969-1975: From 'Fourth Country' to Strategic Partner," Wilson Center, undated, accessed at https://www.wilsoncenter.org/publication/us-secret-assistance-to-the-french-nuclear-program-1969-1975-fourth-country-to-strategic.

Technology Security

Arguments relating to technology security include the following:

- Australia is fully capable of, and fully committed to, protecting U.S. submarine and naval nuclear propulsion technology. The Australian government has stated, "Building on the decades of experience that the UK and the US have in protecting sensitive and classified nuclear material, naval nuclear propulsion technology and SSN capabilities, Australia has committed to a strong security posture to deliver an uncompromised SSN program, as a responsible steward of nuclear technology."[76]
- In a February 28, 2024, address presenting his annual threat assessment for 2024, Mike Burgess, Australia's Director-General of Security, stated: "Our adversaries are willing to commit to complex, multi-year efforts to acquire our cutting-edge technologies, aggressively using espionage in all its forms—cyber, human intelligence, technical collection, exploiting public information. And yes, we have seen the A-team [of adversary intelligence personnel] offering Australian defence industry employees money in return for reports on AUKUS, submarine technology, missile systems and many other sensitive topics. My colleagues in [Australia's Department of] Defence know all this; they are well aware of the scale and sophistication of the threat and are working with ASIO [the Australian Security Intelligence Organisation] to calibrate their responses accordingly. They know BAU [business as usual] just won't do."[77]
- At an October 25, 2023, hearing on the submarine industrial base and its ability to support the AUKUS framework before the Seapower and Projection Forces Subcommittee of the House Armed Services Committee, Under Secretary of the Navy Erik Raven stated, "We're working very closely with Australia and the UK to make sure that there's a common set of security principles that governs all the AUKUS security work we're deeply engaged with. Also, NCIS [Naval Criminal Investigative Service] is establishing a presence in Australia to manage a lot of the—the counterintelligence and other concerns, but certainly part of AUKUS again is going towards an integrated industrial base so that when we talk security, we're speaking the same language."[78]

[76] Commonwealth of Australia, *The AUKUS Nuclear-Powered Submarine Pathway, A Partnership for the Future*, undated, released ca. March 13, 2023, p. 38.

[77] Australian Government, Australian Security Intelligence Organisation, "Director-General's Annual Threat Assessment 2024," February 28, 2024. See also Michael E. Miller, "Australia's Spy Chief Warns of Rising Antisemitism, Intolerance," *Washington Post*, February 19, 2025, which also discusses "an uptick in espionage and foreign interference surrounding AUKUS"; Kirsty Needham, "Foreign Spies Seeking AUKUS Secrets, Australia Intelligence Chief Says," *Reuters*, February 19, 2025; Rod McGuirk, "State-Sponsored Online Spies Likely to Target Australian Submarine Program, Spy Agency Says," *Associated Press*, November 15, 2023; Matthew Cranston, "ASIO on High Alert as Middle East Explodes," *Australian Financial Review*, October 19, 2023; Matthew Knott, "ASIO Agents Embedded in Defence to Protect AUKUS Secrets from Foreign Spies," *Sydney Morning Herald*, May 23, 2023.

[78] Source: CQ transcript of heating. Under Secretary Raven's statement was made in reply to a question from Representative Donald Norcross, who asked: "If you could just touch base on a bit of a twist, that when we step up to the nuclear facilities classification and being able to clear a workforce, which Australia has a certain level, but certainly nowhere close to where it has to be. The challenges that they're going to face from a domestic workforce and then their challenge like us, they're bringing in many others from around the world to be part of that workforce. How are they going to address that challenge?"

Risk of Accident

Arguments relating to the risk of an accident include the following:

- The Australian Navy is a fully professional force that would operate and maintain its Virginia-class boats in a manner fully adhering to the U.S. Navy's strict and exacting safety, quality-control, and accountability standards for submarines and nuclear-powered ships[79] so as to minimize, to the same extent as in the U.S. Navy, the risk of an accident that might call into question for third-party observers the safety of U.S. Navy nuclear-powered ships.
- Australia fully understands that avoiding accidents can be important to maintaining access for U.S. Navy nuclear-powered ships to ports around the world, because Australia itself in 1971 suspended visits by U.S. Navy and other nuclear-powered ships to Australian ports pending a review of the safety implications of such visits.[80]
- Under Pillar 1, Australian personnel would be trained in the same philosophy and procedures used by the U.S. Navy to minimize the risk of such an accident. Given the limited scale of Australia's existing nuclear-reactor infrastructure—Australia currently operates only one nuclear reactor, a research reactor that uses low-enriched uranium (LEU)[81]—U.S. Navy personnel who train Australian personnel would not face a significant task in overcoming preexisting, ingrained Australian practices that might be inconsistent with U.S. Navy philosophy and procedures.
- In November 2023, the Australian government introduced into Australia's parliament the Australian Naval Nuclear Power Safety Bill 2023, which is a bill to "establish a new, independent regulator to ensure Australia applies the highest standards of nuclear safety across its nuclear-powered submarine enterprise and can continue to implement AUKUS without delay."[82]

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[79] For further discussion on these standards, see, for example, John W. Crawford and Steven L. Krahn, "The Naval Nuclear Propulsion Program: A Brief Case Study in Institutional Constancy," *Public Administration Review*, vol. 58, no. 2, March/April 1998: 159-166.

[80] See Commonwealth of Australia, Royal Australian Navy, *Port Visits to Australia by Nuclear-Powered Vessels: A Historical Context*, 2023, PDF pages 7 to 10 of 26, accessed November 8, 2023, at https://www.navy.gov.au/sites/default/files/documents/Port%20Visits%20to%20Australia%20by%20Nuclear-Powered%20Vessels%20-%20A%20Historical%20Context.pdf. See also Australian Government, Australian Radiation Protection and Nuclear Safety Agency, "Nuclear-Powered Vessel Visit Planning," accessed October 11, 2023, at https://www.arpansa.gov.au/research/radiation-emergency-preparedness-and-response/visits-by-nuclear-powered-warships.

[81] For more on this reactor, see Australia's Nuclear Science and Technology Organisation (ANSTO), "OPAL Multi-Purpose Reactor," accessed December 13, 2023, at https://www.ansto.gov.au/facilities/opal-multi-purpose-reactor.

[82] The Australian government further states that

> The new Australian Naval Nuclear Power Safety Regulator will draw on the experience of the US and the UK to deliver international best practice in nuclear safety, as the Government delivers Australia's conventionally armed, nuclear-powered submarine capability.
>
> The Regulator will be an independent, statutory agency within the Defence portfolio and operate within Australia's existing system of regulation.
>
> The legislation will also establish a fit-for-purpose regulatory framework that imposes strict nuclear safety duties and licensing requirements for activities related to nuclear-powered submarines.
>
> It will also impose new offences for breaches of nuclear safety duties, including serious criminal and civil penalties.
>
> (Australian Government, Defence, "New Legislation to Ensure Naval Nuclear Power Safety,"

(continued...)

Arguments for Instead Implementing Alternative Division-of-Labor Approach

Supporters of the alternative division-of-labor approach for performing SSN missions and non-SSN missions outlined earlier—in which up to eight additional Virginia-class SSNs would be procured and retained in U.S. Navy service and operated out of Australia along with the U.S. and UK SSNs that are already planned to be operated out of Australia under Pillar 1, while Australia invested in military capabilities (such as, for example, long-range anti-ship missiles, drones, loitering munitions, B-21 long-range bombers, or other long-range strike aircraft) for performing non-SSN missions—can make various arguments, including those outlined below.

Deterrence and Warfighting Cost-Effectiveness

Arguments relating to deterrence and warfighting cost-effectiveness include the following:

- Australian Defence Minister Richard Marles in March 2023 reportedly confirmed that in exchange for the Virginia-class boats, Australia's government made no promises to the United States that Australia would support the United States in a future conflict over Taiwan.[83] Similarly, the chief of Australia's navy in July 2024 reportedly stated that the AUKUS agreement would not automatically pull Australia into a war to defend Taiwan.[84] Selling three to five Virginia-class SSNs to Australia would thus convert those SSNs from boats that would be available for use in a U.S.-China crisis or conflict into boats that might not be available for use in a U.S.-China crisis or conflict. This could weaken rather than strengthen

media release, November 16, 2023. See also Australian Government, Defence, "Australian Naval Nuclear Power Safety Bill 2023," undated; Parliament of Australia, "Australian Naval Nuclear Power Safety Bill 2023 [and] Australian Naval Nuclear Power Safety (Transitional Provisions) Bill 2023," Bills Digest No. 32, 2023–24, November 24, 2023; Parliament of Australia, Bills of the Current Parliament, "Australian Naval Nuclear Power Safety Bill 2023," posted at https://parlinfo.aph.gov.au/parlInfo/search/display/display.w3p;query=Id%3A%22legislation%2Fbillhome%2Fr7104%22; Australian Government, Defence, *Discussion Paper: The Legal and Regulatory Framework to Support Naval Nuclear Power Safety*, undated, 18 pp.; Kirsty Needham, "Australia to create navy nuclear safety watchdog for AUKUS," *Reuters*, December 12, 2023.)

[83] Rod McGuirk, "Australia Won't Promise to Side with US in Taiwan Conflict," *Associated Press*, March 20, 2023; Daniel Hurst, "Australia Has 'Absolutely Not' Committed to Join US in Event of War over Taiwan, Marles Says," *Guardian*, March 18, 2023; Georgia Hitch, "No Promise Given to US to Assist in Potential Taiwan Conflict in Exchange for Submarines, Says Defence Minister Richard Marles," *ABC.net.au*, March 18, 2023.

[84] A July 24, 2024, press report stated

> The AUKUS agreement will not automatically drag Australia into a war to defend Taiwan, the ADF's navy boss has declared.
>
> Chief of navy Vice Admiral Mark Hammond spoke on stage with his counterparts—US Admiral Lisa Franchetti and UK Admiral Sir Ben Key—at day one of the Indian Ocean Conference on Wednesday [July 24].
>
> The three admirals represent each nation in the trilateral AUKUS agreement that will see rotations of nuclear-powered submarines visit Australia from 2027….
>
> When asked if AUKUS meant Australia would inevitably be "dragged" into a conflict over the island-nation, Admiral Hammond replied sharply: "No."
>
> "Any participation by Australian Defence Force in any conflict, anywhere on the planet is a sovereign decision of the Australian Government, so no," he continued.
>
> "We operate ships that have been designed and built overseas. It doesn't leave our sovereign decision making to those foreign governments."
>
> (Jake Dietsch, "Navy Chief Vice Admiral Mark Hammond Say[s] AUKUS Doesn't Mean War with China over Taiwan Is Inevitable," *West Australian*, July 24, 2024.

deterrence and warfighting capability in connection with a U.S.-China crisis or conflict. The reduced certainty of whether boats sold to Australia would be available for use in a U.S.-China crisis or conflict would be, in effect, the flip side of the argument made by supporters of Pillar 1 about having Australia become a second allied decisionmaking center (along with the United States) for SSN operations in the Indo-Pacific. Selling Virginia-class boats to Australia could also weaken deterrence of potential Chinese aggression if China were to find reason to believe, correctly or not, that Australia might use its Virginia-class boats less effectively than the U.S. Navy would use them.[85]

- Australian officials have stated consistently that, in line with Australia's commitments as a non-nuclear-weapon state under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT),[86] Australia's SSNs would be armed

[85] An October 2023 CBO report states

> Would China be less deterred if the United States reduced the number of its attack submarines to help Australia develop its submarine force? Because the United States and Australia have a strong alliance, improving the Australian Navy's [SSN] capability could help offset the U.S. Navy's potential loss of [SSN] capability. That loss might even be more than offset because the Australian submarines would be based in the Western Pacific region and therefore could respond more quickly to any conflict with China involving Taiwan or other issues in the South China Sea. However, Australia would control its own submarines, and their participation in any particular conflict would not be guaranteed. In fact, in March 2020 [sic: 2023], the Australian defense minister stated that his country did not promise to support the United States in the event of a conflict involving Taiwan and the People's Republic of China."
>
> (Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2024 Shipbuilding Plan*, October 2023, p. 29.)

A February 1, 2024, opinion piece states

> While Australia is a top US ally, it isn't guaranteed that Canberra will join Washington in responding to a China-related contingency. Shortly after the March 2023 "optimal pathway" announcement, Australia's Defence Minister Richard Marles said his government had "absolutely not" made a deal with the United States to join a fight over Taiwan as part of AUKUS. Indeed, a core selling point for AUKUS supporters in Australia is that Canberra will retain full sovereign control over how, where, and when it deploys its SSNs.
>
> Washington and Canberra are strategically aligned, but that doesn't mean there isn't or won't be daylight between them at times. Closing these gaps will require a deeper level of defence planning and military coordination to jointly uphold deterrence and manage crises – something which should be done whether SSNs are sold to Australia or not. Yet, regardless of how advanced US-Australia defence coordination becomes, US policymakers can't afford to transfer a scare capability that it would have no sovereign control over during a crisis.
>
> (Matthew C. Mai, "Is AUKUS Pillar I unworkable?" *Interpreter*, February 1, 2024.)

A February 17, 2024, opinion piece states

> The fact remains that the AUKUS plan would weaken America's submarine forces in a war with China. Even if Australia promised that its RAN [Royal Australian Navy] Virginia-class subs would fight alongside American boats in a war with China, our inexperienced crews would not operate them as effectively as US crews. And could the US be certain of our commitment? Canberra has refused to make that promise.
>
> It is hard to see how the AUKUS plan can survive this yawning gap between American expectations and Australian commitments.
>
> (Hugh White, "Sinking Feeling: Is the AUKUS Plan Feasible?" *Australian*, February 17, 2024.)

See also Andrew Greene, "Australia Won't Be Automatically Dragged into Future China Conflicts, US General Says," *ABC.net.au*, May 23, 2024, reporting on remarks by Lieutenant General Stephen Sklenka, Deputy Commander of U.S. Indo-Pacific Command (USINDOPACOM).

[86] For more on Australia's commitments under the NPT, see "Treaty on the Non-Proliferation of Nuclear Weapons (continued...)

only with conventional weapons. Selling three to five Virginia-class SSNs to Australia would thus convert those SSNs from boats that could in the future be armed with the U.S. nuclear-armed sea-launched cruise missile (SLCM-N) with an aim of enhancing deterrence[87] into boats that would never be armed with SLCM-N. This reduction in the number of SLCM-N-capable Virginia-class boats could weaken rather than strengthen deterrence capability in connection with a U.S.-China or U.S.-Russia crisis or conflict.

- Some observers are concerned about potential Chinese aggression against Taiwan over the next few years, a period sometimes characterized as the Davidson window (the time between now and 2027) or decade of concern (the time between now and 2030).[88] Pillar 1 as currently structured would not increase the total number of SSNs available for performing U.S., UK, and Australian SSN missions above what it otherwise would have been until sometime in the 2040s, when the first replacement SSN for the U.S. Navy or the first SSN AUKUS boat for the Australian navy (whichever comes first) enters service. Pillar 1 as currently structured would, however, absorb resources over the next few years that could instead be invested in Australian military capabilities that could be fielded sooner, and in some cases (e.g., drones and loitering munitions) soon enough to address the Davidson window or decade of concern.[89] This could weaken rather than strengthen deterrence within the Davidson window or decade of concern.
- More generally, the costs for Australia of Pillar 1 could reduce, perhaps significantly, funding within Australia's military budget for other Australian military capabilities, particularly if SSN acquisition, operation, and maintenance costs turn out to be higher than expected. If this were to occur, there could be a net negative impact on Australia's overall military capabilities for deterring potential Chinese aggression.[90]

(NPT) in "Nuclear Weapons," Australian Government, undated, accessed June 10, 2024, at https://www.dfat.gov.au/international-relations/security/non-proliferation-disarmament-arms-control/nuclear-weapons#treaty. For more on the NPT, see CRS Report R41216, *2010 Non-Proliferation Treaty (NPT) Review Conference: Key Issues and Implications*, coordinated by Paul K. Kerr and Mary Beth D. Nikitin.

[87] For more on the SLCM-N program, see CRS In Focus IF12084, *Nuclear-Armed Sea-Launched Cruise Missile (SLCM-N)*, by Anya L. Fink.

[88] For additional discussion of the Davidson window and decade of concern, see CRS Report RL33153, *China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress*, by Ronald O'Rourke.

[89] For examples of opinion pieces arguing this point, see Nishank Motwani, "AUKUS's Three Pillars of Uncertainty: Sovereignty, Strategy and Costs," Australian Strategic Policy Institute (ASPI), October 23, 2023; Michael Shoebridge, "An AUKUS Remix Delivering Greater Military Power Faster: the B-21 Raider," *Defence Connect*, November 15, 2023. (Also posted as Michael Shoebridge, "AUKUS Plan B: Delivering Greater Military Power Faster—The B-21 Raider," *Real Clear Defense*, November 16, 2023.) A July 2, 2024, press report states: "Former Defence deputy secretary Peter Jennings said the government was 'gutting the ADF' to pay for the future force. 'This is becoming a major crisis for the government. They are destroying the current ADF [Australian Defence Force] for the future submarines, which we won't see until at the earliest until the mid-2030s,' Mr Jennings said." (Ben Packham, "Cut-back Deployment Sends 'Dangerous Message' on ADF Capability," *Australian*, July 2, 2024.) Another observer has argued that "for the [Australian] Government, the AUKUS subs are a magic pudding, so far away you don't have to spend any real money on them, and so impressive sounding they convince people you're doing something on defence when you're doing nothing. And if a few lefties complain, all the better. But it still produces no defence capability for Australia over the next ten years, and quite possibly nothing after that either." (Greg Sheridan, "Pantomime World of the Albanese Government's Defence Policy," *Australian*, November 28, 2023.)

[90] One observer states that "rather than a creating a force structure driven by strategy, what [the Australia Department (continued...)

- The U.S. Navy's FY2025 30-year shipbuilding plan (like previous editions of the Navy's annual 30-year shipbuilding plan) projects that there will be a shortfall of U.S. SSNs relative to the Navy's 66-boat SSN force-level goal during the 2030s and 2040s. Selling three to five Virginia-class boats will reduce the size of the U.S. SSN force below the projected levels shown in the FY2025 30-year shipbuilding plan (which does not account for sales of Virginia-class boats to Australia), increasing this projected shortfall until replacements for the sold boats enter service.[91] This could reduce the Navy's capacity to perform SSN missions of interest to the United States but not Australia, including potentially missions in the Arctic, the North Atlantic, and the Mediterranean for countering Russia or other potential adversaries in those regions. This could weaken deterrence of potential aggression by Russia or those other potential adversaries. Given the challenges that the U.S. submarine industrial base is experiencing in achieving a construction rate of 2.0 Virginia-class boats per year to meet U.S. Navy needs, the ability of the submarine industrial base to achieve the higher target rate of 2.33 boat per year, so as to build replacement SSNs for the U.S. Navy, is uncertain. The duration of the impact of selling Virginia-class boats to Australia on the size of the U.S. SSN force is thus uncertain and could be longer than anticipated.
- There is little indication that, prior to announcing the AUKUS Pillar 1 project in September 2021, an analysis of alternatives (AOA) or equivalent rigorous comparative analysis was conducted to examine whether Pillar 1 would be a more cost-effective way to spend defense resources for generating deterrence and warfighting capability than potential alternative courses of action, such as a U.S.-Australian division of labor for performing SSN missions and non-SSN missions.[92] Such an AOA or equivalent rigorous comparative analysis (or a summary of one) has not been released. Performing an AOA or equivalent rigorous comparative analysis can test the validity of beliefs or presumptions about the cost-effectiveness of an envisioned course of action, and can produce unexpected or counter-intuitive results. Programs initiated in the absence of an AOA or an equivalent rigorous comparative analysis can lack a sound business case. The Government Accountability Office (GAO) has stated that "a program should not go forward into product development unless a sound business case can be made," and that "weapon systems without a sound business case are at greater risk for schedule delays, cost growth, and integration issues." The U.S. Navy's Littoral Combat Ship (LCS) program, for example, was initiated without a prior

of] Defence's plans are delivering now and well into the future is a budget-driven force structure dominated by a maritime force composed of large surface ships and nuclear submarines. The structural effect of the massive and distorting budget demands of these platforms isn't a temporary one just in this decade, but a new permanent feature of Australia's defence landscape, with permanent—and quite negative—consequences that will become more obvious for capabilities outside the maritime domain this decade, over the 2030s and even beyond." (Marcus Hellyer, "The Enduring Structural Distortion from the ADF's Shipbuilding Plans, The Defence Budget Remains an Exploding Suitcase, Now with No Room for Our Air Force," Strategic Analysis Australia, 2024.) See also Colin Clark, "AUKUS Will 'Cannibalize' Other Programs with No Budget Boost: Former Top Aussie General," *Breaking Defense*, November 20, 2024.

[91] For additional discussion regarding this reduction in the size of the U.S. SSN force, see **Appendix E**.

[92] For citations relating to this point, see **Appendix H**.

rigorous AOA. The LCS program subsequently became controversial, was widely criticized, and was ultimately truncated.[93]

- Some Australian officials have characterized Pillar 1 as "too big to fail."[94] Some observers argue that acquisition projects viewed as too big to fail can be at elevated risk of cost growth that can reduce their achieved cost effectiveness.[95]
- The enabling legislation for Pillar 1 that was included in the FY2024 National Defense Authorization Act (NDAA) (H.R. 2670/P.L. 118-31 of December 22, 2023) includes a provision (§1352(d)(2)) that was requested by the Administration as part of a package of requested legislative proposals for the FY2024 NDAA relating to the AUKUS agreement.[96] The provision provides a waiver for a certification to be made by the Chief of Naval Operations under 10 U.S.C. 8678. The text of 10 U.S.C. 8678 is as follows:

  > **§8678. Chief of Naval Operations: certification required for disposal of combatant vessels**
  >
  > Notwithstanding any other provision of law, no combatant vessel of the Navy may be sold, transferred, or otherwise disposed of unless the Chief of Naval Operations certifies that it is not essential to the defense of the United States.

- Prior to the 2040s, Pillar 1 as currently structured will contribute to deterrence and warfighting capability primarily via the positional advantage of operating Virginia-class boats from Australia, which is something can be done without selling the boats to Australia. Operating up to 12 U.S. Navy Virginia-class boats from Australia—the four boats that are to be operated there under Pillar 1's SRF-West arrangement, plus up to eight additional U.S. Navy Virginia-class boats—would send a strong signal of U.S.-Australian alliance solidarity and resolve, in part because it would make Australia second only to Japan in terms of numbers of U.S. Navy forward-homeported or forward-operating ships.[97] A 2002 CBO report on options for increasing the capability of the U.S. SSN force mentioned Australia as a potential site for forward-homeporting additional U.S. SSNs in the Western Pacific.[98] Australian shipyards could perform maintenance, overhaul, and repair work on the up-to-eight additional U.S. Navy boats, as currently planned under Pillar 1 for the four Virginia-class boats that are to operate out of Australia as part of SRF-West.

[93] For further discussion of AOAs, business cases (including the GAO statements quoted here), and the LCS program, see **Appendix H**.

[94] See, for example, Daniel Hurst, "AUKUS Nuclear Submarine Deal Will Be 'Too Big to Fail', Richard Marles Says," Guardian, March 17, 2023, quoting Australian Defence Minister Richard Marles; Farrah Tomazin, "'Too Big to Fail': US Insists AUKUS Deal Is Not Sub Par," *Sidney Morning Herald*, March 15, 2024, quoting ambassador Paul Myler.

[95] See, for example, the citations in **Appendix J**.

[96] For the text of this legislative package, which was sent to Congress on May 2, 2023, see the section entitled "May 2023 DOD Legislative Package Relating to AUKUS Agreement" on pages 44-47 of the June 12, 2024, version of this CRS report. The requested provision relating to 10 U.S.C. 8678 appears on page 45.

[97] In terms of number of homeported U.S. Navy ships, Japan is the U.S. Navy's largest overseas homeporting location, and since the early 1970s has homeported a U.S. Navy aircraft carrier strike group. As of 2023, U.S. Navy ships homeported in Japan included one nuclear-powered aircraft carrier, 11 cruisers and destroyers, three amphibious ships, four mine countermeasures ships, and eight command, auxiliary, and support ships.

[98] Congressional Budget Office, *Increasing the Mission Capability of the Attack Submarine Force*, March 2002, p. 31 (Box 3).

- Similar to what the U.S. Navy argued in 1988 regarding Canada's then-proposed SSN acquisition program, it would be more cost-effective to pursue a U.S.-Australia division of labor for SSN missions and non-SSN missions.[99] Such a division of labor would follow the general model of military divisions of labor that exist between the United States and some or all of its NATO and other allies for naval capabilities such as aircraft carriers, SSNs, large surface combatants, and amphibious ships, and for non-naval capabilities such as (to name only some examples) nuclear weapons, space assets, and ISR capabilities. Pillar 1 would result in parallel SSN-related investments in the United States, Australia, and the UK comparable to parallel investments in certain military capabilities among NATO countries that have been criticized by some observers for their collective inefficiencies.[100]

[99] In connection with a project that Canada initiated in 1987 (and canceled in 1989) to acquire a force of 10 to 12 UK- or French-made SSNs, Admiral Kinnaird R. McKee, then-Director of the U.S. Naval Nuclear Propulsion Program (aka Naval Reactors), testified in March 1988 that the project "puts at risk resources that ought to be used for other purposes" and that Canada "could make a better contribution to NATO in other areas with the same amount of money." (U.S. Congress. House. *Hearings on National Defense Authorization Act for Fiscal Year 1989—H.R. 4264, and Oversight of Previously Authorized Programs, Before the Committee on Armed Services, House of Representatives, Seapower and Strategic and Critical Materials Subcommittee, Title 1*, 100th Cong., 2nd sess., Hearings held March 1, 3, 8, 9, 10, and 17, 1988, GPO, 1988, H.A.S.C. No. 100-70, p. 345. The hearing in question, on submarine programs, was held on March 9, 1988. [Included in CRS/FDT bound volume collection as *House Armed Services Committee, Hearings. (Vol.) 5, 100th Congress, 2d Sess.*, 1988, CRS-F.].)

[100] For examples of reports and articles discussing such inefficiencies among NATO countries and potential steps to mitigate these inefficiencies, see "EU Incentivizing Common Procurement Between Members," *Aviation Week*, October 10, 2023; Stephen Flanagan and Anna M. Dowd, "Alliance Assignments: Defense Priorities for Key NATO States," *War on the Rocks*, October 4, 2023; David A. Ochmanek et al., *Inflection Point, How to Reverse the Erosion of U.S. and Allied Military Power and Influence*, RAND, 2023, 217 pp.; Nicole Koenig et al., *Defense Sitters, Transforming European Militaries in Times of War*, Special Edition of the Munich Security Report on European Defense, Munich Security Conference (MSC), June 2023, 95 pp.; Max Bergmann and Otto Svendsen, *Transforming European Defense, A New Focus on Integration*, Center for Strategic and International Studies (CSIS), June 2023, 64 pp.; Sean Monaghan, "Solving Europe's Defense Dilemma: Overcoming the Challenges to European Defense Cooperation," Center for Strategic and International Studies (CSIS), March 1, 2023; Luigi Scazzieri, "Is European Defence Missing Its Moment?" Centre for European Reform, January 16, 2023; "EU Defence Review Calls for Greater European Cooperation to Match Defence Spending Increases," European Defence Agency, November 15, 2022; Bastian Giegerich and Ester Sabatino, "The (Sorry) State of EU Defense Cooperation," Carnegie Europe, October 6, 2022; Paul Taylor, "How to Spend Europe's Defense Bonanza Intelligently, EU Countries Must Coordinate Procurement and Pool Resources to Avoid Wasting Money," *Politico*, September 2, 2022; Max Bergmann, Colin Wall, Sean Monaghan, and Pierre Morcos, "Transforming European Defense," Center for Strategic and International Studies (CSIS), August 18, 2022.

Under Pillar 1, the UK's SSN AUKUS boats would be built in the UK, on the UK's submarine production line, while Australia's SSN AUKUS boats would be built largely in Australia, on a second submarine production line located there. (The nuclear reactor compartments of Australia's SSN AUKUS boats reportedly would be built in the UK or United States and then shipped to Australia, where they would be incorporated into Australia's SSN AUKUS boats during the final assembly process. See, for example, Peter Layton, "AUKUS Sets Sail in the Indo-Pacific," European Security & Defence, June 2, 2023; Nick Childs, "The AUKUS Plan: A Grand Bargain with Significant Risks," International Institute for Strategic Studies [IISS], March 16, 2023; Andrew Probyn, "Australia Begins Its Nuclear Age as AUKUS Overcomes Years of Submarine Struggles," ABC.net.au, March 14, 2023; Noah C. Mayhew, "AUKUS and Nuclear-Powered Submarines: Let's All Just Take a Breath," Bulletin of the Atomic Scientists, November 17, 2022.)

This would lead to a long-term average submarine production rate (for boat sections other than nuclear reactor compartments) of about one boat every three years for the UK's submarine production line and about one boat every four years for Australia's submarine production line. (Current UK plans call for maintaining a UK submarine force of 11 boats, including 7 SSNs and 4 SSBNs. Assuming an expected average service life of 33 years—the current expected average service life for a U.S. SSN—maintaining a force of 11 boats would require a long-term average production rate of one boat every three years. [Planned force size divided by service life equals the long-term average production rate; 11 divided by 33 equals 0.33 boats per year, or one boat every three years.] The UK could choose to space the (continued...)

Technology Security

Arguments relating to technology security include the following:

- Chinese cyber and other espionage in the past reportedly has been successful on multiple occasions in acquiring U.S. military information and technology,[101] including information relating to undersea warfare.[102] In 2018, Chinese hackers reportedly stole a large amount of unclassified but sensitive information relating to undersea warfare from a U.S. contractor working for the Naval Undersea Warfare Center in Newport, RI.[103] Some observers have expressed concern about the cybersecurity readiness of defense contractors.[104]
- Notwithstanding Australia's capability for, and commitment to, protecting U.S. submarine and naval nuclear propulsion technology, sharing this technology with another country, particularly in an era of advanced and persistent computer hacking threats, would increase the attack surface, meaning the number of potential digital and physical entry points that China, Russia, or some other

production of its 11 boats more closely together than one boat every three years, but this would lead to a subsequent period where the production rate would be less than one boat every three years, and the average over the long run [i.e., over a period of 33 years] would still work out to one boat every three years. Similarly, and again assuming an expected average service life of 33 years, maintaining Australia's planned force of 8 SSNs would require a long-term average production rate of about one boat every four years. [8 divided by 33 equals about 0.24 boats per year, or about one boat every four years.])

An alternative approach of building all SSN AUKUS boats—those for both the UK and Australia—on the UK's production line would lead to an average long-term submarine production rate for the production line in the UK of about one boat every 1.75 years. (Assuming an expected average service life of 33 years, maintaining a combined UK and Australian submarine force of 19 boats—11 for the UK and 8 for Australia—would require a long-term average production rate of about one boat every 1.75 years. [19 divided by 33 equals about 0.58 boats per year, or about one boat every 1.75 years.])

Relative to using two submarine production lines in the UK and Australia, using a single production line in the UK could reduce recurring submarine procurement costs for both the UK and Australia via increased production economies of scale, including greater spreading of shipyard fixed overhead costs and reduced loss of production learning curve benefits between each boat. Nonrecurring investments needed for converting Australia's conventionally powered submarine production line into a nuclear-powered submarine production line would be avoided, and those savings would be offset at least partially by nonrecurring investments that could be needed to expand the capacity of the UK's existing nuclear-powered submarine production line.

[101] See, for example, "Survey of Chinese Espionage in the United States Since 2000," Center for Strategic and International Studies (CSIS), undated, accessed November 12, 2023, at https://www.csis.org/programs/strategic-technologies-program/archives/survey-chinese-espionage-united-states-2000; Xiaoshan Xue, "US Experts Urge More Efforts to Thwart China's Acquisition of US Military Technology," *VOA*, March 17, 2023; Nicholas Yong, "Industrial Espionage: How China Sneaks Out America's Technology Secrets," *BBC*, January 16, 2023; Jeffrey B. Jones, *Confronting China's Efforts to Steal Defense Information*, Belfer Center for Science and International Affairs, Harvard Kennedy School, May 2020, 34 pp.; Ellen Ioanes, "China Steals US Designs for New Weapons, and It's Getting Away with 'the Greatest Intellectual Property Theft in Human History,'" *Business Insider*, September 24, 2019.

[102] A June 8, 2021, press report about China's acquisition of undersea warfare technology states that "China fields increasingly advanced and 'smart' technologies, including torpedoes, mines, and UUVs [unmanned underwater vehicles]. As highlighted by the case of Qin Shuren, at least some of these advances are being made with the help of U.S. technology. Sometimes the technology is purchased on the open market and other times it is gained through illicit means that range from cyber theft to old-fashioned espionage and smuggling." (Ma Xiu and Peter W. Singer, "How China Steals US Tech to Catch Up in Underwater Warfare," *Defense One*, June 8, 2021.)

[103] Ellen Nakashima and Paul Sonne, "China Hacked a Navy Contractor and Secured a Trove of Highly Sensitive Data on Submarine Warfare," *Washington Post*, June 8, 2018; Helene Cooper, "Chinese Hackers Steal Unclassified Data from Navy Contractor," *New York Times*, June 8, 2023.

[104] See, for example, Eric Noonan, "The US Just Got Serious About Cybersecurity. Contractors Aren't Ready," *Federal Times*, November 3, 2023.

country could attempt to penetrate to gain access to that technology.[105] In this instance, the addition to the attack surface could include not only Australian government organizations, but Australian contractors and subcontractors involved in Pillar 1 efforts.

- Hackers linked to China reportedly are highly active in attempting to penetrate Australian government and contractor computers.[106] A March 1, 2023, press report stated that "Chinese hackers 'significantly increased' attacks on Australian government, industry and education after the AUKUS nuclear submarine pact came under the crosshairs of the world's most prolific espionage operation, according to cyber security experts." The article quoted a senior employee of the cybersecurity company CrowdStrike as stating that the AUKUS agreement "has been in the crosshairs of Australia's cybersecurity adversaries since it was announced."[107]
- A July 15, 2024, press report states: "The US earlier this year failed to certify that Australia and the UK have adequate procedures to protect classified information."[108]

Risk of Accident

Arguments relating to the risk of an accident include the following:

- While the Australian Navy is a fully professional force that would operate and maintain its Virginia-class boats in a manner fully adhering to the U.S. Navy's strict and exacting safety, quality-control, and accountability standards for submarines and nuclear-powered ships, selling Virginia-class boats to Australia or building for Australia AUKUS SSNs that incorporate U.S. naval nuclear propulsion technology would unavoidably make another country (Australia)

[105] The National Institute of Standards and Technology (NIST) defines attack surface as "the set of points on the boundary of a system, a system element, or an environment where an attacker can try to enter, cause an effect on, or extract data from, that system, system element, or environment." (National Institute of Standards and Technology, Computer Security Resource Center, "Attack Surface," accessed October 23, 2023, at https://csrc.nist.gov/glossary/term/attack_surface.) IBM similarly defines it as "the sum of vulnerabilities, pathways or methods—sometimes called attack vectors—that hackers can use to gain unauthorized access to the network or sensitive data, or to carry out a cyberattack." (IBM, "What Is an Attack Surface?" accessed October 23, 2023, at https://www.ibm.com/topics/attack-surface.) The cybersecurity firm CrowdStrike similarly defines it as "the total number of all possible entry points for unauthorized access into any system. It includes all vulnerabilities and endpoints that can be exploited to carry out a security attack. The attack surface is also the entire area of an organization or system that is susceptible to hacking." (CrowdStrike, "What Is an Attack Surface?" accessed October 23, 2023, at https://www.crowdstrike.com/cybersecurity-101/attack-surface/.)

[106] See, for example, Max Mason, "Chinese Hackers Use G7 Ruse to Target Australian Government Officials," *Australian Financial Review*, June 19, 2023; News.com.au, "Chinese Cyber Attack on Australia Exposed," *News.com.au*, August 30, 2022; Bill Toulas, "Chinese Hackers Target Australian Govt with ScanBox Malware," *Bleeping Computer*, August 30, 2022; Jamie Tarabay, "How Hackers Hammered Australia After China Ties Turned Sour," *Bloomberg*, August 30, 2021; Jacob Greber, "US Accuses Chinese Nationals of Hacking Australian Defence Contractor," *Australian Financial Review*, July 22, 2020; Daniel Hurst, "Hackers Linked to China Allegedly Stole Data from Australian Defence Contractor," *Guardian*, July 22, 2020; Lauren Ferri and Charlie Coë, "Top Chinese Hackers Stole a Treasure Trove of Information from an Australian Defence Contractor Including Top-Secret Weapon and Military Data," *Daily Mail*, July 21, 2020.

[107] Justin Vallejo, "Extent of Hacks Against Australia After AUKUS Deal Revealed," *Herald Sun*, March 1, 2023.

[108] Courtney McBride and Ben Westcott, "Biden's Australia-UK Arms Deal Facing Pressure Over Delay Fears," *Bloomberg*, July 15, 2024.

responsible for preventing an accident with an SSN that might call into question for third-party observers the safety of U.S. Navy nuclear-powered ships.

- The second variation of a U.S.-Australian division of labor outlined earlier—the variation under which U.S. SSNs perform Australian SSN missions indefinitely—would keep all U.S.-made SSNs under the control of the U.S. Navy, which has a proven record extending back to 1954[109] of safely operating its nuclear-powered ships.

Legislative Activity: Appropriation in CR and Legislative Activity for FY2025

Summary of Congressional Action on FY2025 Funding Request

The Navy's proposed FY2025 budget requests the procurement of the 41st Virginia-class boat. The boat has an estimated procurement cost of $5,759.5 million (i.e., about $5.8 billion). The boat has received $1,871.6 million in prior-year "regular" AP funding and $272.0 million in prior-year Economic Order Quantity (EOQ) funding, which is an additional kind of AP funding that can occur under an MYP contract. The Navy's proposed FY2025 budget requests the remaining $3,615.9 million needed to complete the boat's estimated procurement cost, and $2,422.0 million in "regular" AP funding for Virginia-class boats to be procured in future fiscal years, $1,298.3 million in EOQ funding, and $293.0 million in cost-to-complete (CTC) funding to cover cost growth on Virginia-class boats procured in prior years, bringing the total amount of procurement, AP, EOQ, and CTC funding requested for FY2025 to $7,629.2 million (i.e., about $7.6 billion).

The Navy states that procuring two would require adding $3,225.0 million (i.e., about $3.2 billion) to the Navy's FY2025 procurement funding request for the program. This is the Navy's estimate of the *net* increase in funding that would be needed to convert a one-boat buy to a two-boat buy. The second boat would cost more than $3,225 million, but some of the second boat's materials and equipment are already funded in prior-year budgets or requested to be procured under the Navy's FY2025 budget submission, and adding the second boat would reduce the cost of the first boat due to increased production economies of scale.

Table 4 summarizes congressional action on the Navy's FY2025 funding request for the procurement of Virginia-class boats in FY2025 and subsequent years.

[109] The U.S. Navy's first nuclear-powered ship, the attack submarine *Nautilus* (SSN-571), was commissioned into service on September 30, 1954.

Table 4. Congressional Action on FY2025 Funding Request

Millions of dollars, rounded to nearest tenth

		Authorization			Appropriation				
							Enacted		
	Request	HASC	SASC	Enacted	HAC	SAC	H.R. 10545	H.R. 1968	H.R. 10545 + H.R. 1968
Procurement	3,615.9	4,315.9	4,265.9	3,972.9	3,615.9	3,972.9	5,691.0	3,615.9	
Advance procurement (AP) (including both "regular" AP and EOQ))	3,720.3	3,720.3	4,200.3	3,720.3	3,720.3	3,720.3		3,720.3	
(Quantity)	*(1)*	*(2)*	*(2)*	*(1)*	*(1)*	*(1)*	*n/a*	*(1)*	
Cost-to-complete	293.0	293.0	293.0	293.0	293.0	1,293.0	n/a	293.0	
Total	**7,629.2**	**8,329.2**	**8,759.2**	**7,986.2**	**7,629.2**	**8,986.2**	**5,691.0**	**7,629.2**	**13,320.2**

Sources: Table prepared by CRS based on Navy's original FY2025 budget submission, committee and conference reports, and explanatory statements on FY2025 National Defense Authorization Act and FY2025 DOD Appropriations Act. Figures may not add due to rounding.

Notes: HASC is House Armed Services Committee, **SASC** is Senate Armed Services Committee, **SAC** is Senate Appropriations Committee, **HAC** is House Appropriations Committee. Advance procurement funding includes both "regular" AP funding and Economic Order Quantity (EOQ) funding for multiyear procurement (MYP).

FY2025 National Defense Authorization Act (H.R. 8070/S. 4638/H.R. 5009/P.L. 118-159)

House

The House Armed Services Committee, in its report (H.Rept. 118-529 of May 31, 2024) on H.R. 8070, recommended the funding levels shown in the HASC column of **Table 4**.

The recommended net increase of $700.0 million in procurement funding includes a recommended reduction of $300.0 million for "Cost growth" and a recommended increase of $1.0 billion for "One additional ship." (Pages 425-426)

Section 1018 of H.R. 8070 would provide authority to use incremental funding for procuring a Virginia-class submarine in FY2025.

Section 1058 would direct the Navy to submit a report on the price elasticity of the labor supply for the industrial base for building and maintaining naval vessels that is to include, among other things, an assessment of and recommendation for any extraordinary relief that may be appropriate for fixed-price, MYP contracts for Virginia-class submarines in order to increase pay and benefits for workers at shipyards and supplier firms under those contracts.

H.Rept. 118-529 states

> *Virginia class submarine*

> The committee continues to be perplexed by the Navy's inconsistent funding of shipbuilding and specifically that of Virginia class submarines. For the second time in less than 5 years, the Navy has surprised both Congress and industry by removing a submarine from the budget request that had previously been planned for inclusion. This sporadic funding will only further stress an already stressed industrial base while also delaying the time it will take to reach the Navy's stated goal of 66 fast attack submarines (SSNs). The Navy claims that by continuing to fund the advanced procurement line at the two SSN rate per year they will mitigate the impact to suppliers and the overall industrial base. However, in their response to committee questions they state that ''the previously purchased contractor and government furnished equipment will be used as critical material that will be consumed on future hulls''. Navy budget documents and committee briefings fail to identify what future hull will receive these components leading to further uncertainty for the industrial base. The committee can only conclude that it is the Navy's plans to reduce advanced procurement (AP) funding at a future date of which they are incapable of or refuse to identify. This is the worst way to project future work to industry and will only cause reluctance in their decisions to invest in their workforce, facilities, and tooling due to their lack of confidence in Navy budgeting. The Navy also fails to recognize the impact of removing one SSN in fiscal year 2025 has on the suppliers that only receive funding that is provided in the full funding line. This will most likely result in stable suppliers becoming at-risk suppliers.
>
> The committee also notes Congress' considerable efforts last year to enact the needed legislation that enabled the Australia-United Kingdom-United States (AUKUS) trilateral security pact. The foundation of the agreement was an acknowledgement by the Department of Defense, the Navy, Congress and industry that we are all collectively committed to 2 SSNs and 1 Columbia per year, commonly referred to as 2+1. To renege on that commitment in just the first year after achieving the needed enabling legislation sends an inconsistent message to our allies and a talking point for our adversaries propaganda.
>
> Finally, the committee remains committed to providing the maximum amount of undersea capacity to the Navy fleet, a consistent message to our workforce and unwavering support of the AUKUS pact. Therefore, the committee directs the Secretary of the Navy to provide a briefing to the House Committee on Armed Services not later than February 1, 2025 on how the Navy plans to mitigate the impact to suppliers of reducing the amount of AP in future budgets. (Pages 26-27)

H.Rept. 118-529 also states

> Comptroller General Review of Submarine Force Generation
>
> The Navy's attack submarines provide the United States an asymmetric advantage to gather intelligence undetected, attack enemy targets, and insert special forces, among other things. These capabilities make attack submarines some of the most requested assets by the global combatant commanders. The 2022 National Defense Strategy states that the Department of Defense will prioritize a future force that is lethal, sustainable, resilient, survivable, and agile to strengthen and sustain deterrence and prevail in conflict, if necessary. Between fiscal years 2014 and 2020, however, attack submarines incurred 9,568 days of idle time and maintenance delays resulting in the Navy spending more than $1.50 billion in fiscal year 2018 constant dollars to support attack submarines that provided no operational capability while waiting for maintenance. Sustainably maximizing operational availability depends on the Navy adhering to its schedules for maintenance, training, and deployment. Submarines were the last to implement the Navy's new force generation process, the Optimized Fleet Response Plan, and their ability to meet the goals under this revised process has not been independently evaluated.

> Therefore, the committee directs the Comptroller General of the United States to assess the readiness and availability of the Navy's attack submarine fleet. This review should address the following:
>
> (1) to what extent have Navy attack submarines met the intended goals (such as meeting desired operational availability, timely maintenance, adequate crewing, and training to fight advanced adversaries) of the Optimized Fleet Response Plan;
>
> (2) what factors, if any, affect submarine readiness and how has the Navy mitigated any readiness challenges; and
>
> (3) how does the Navy's approach to submarine force generation compare to that of strategic competitors and what insights, if any, can be leveraged to enhance the Navy's attack submarine fleet.
>
> The committee directs the Comptroller General to provide a briefing to the House Committee on Armed Services not later than April 1, 2025, on the Comptroller General's preliminary findings and present final results in a format and timeframe agreed to at the time of the briefing. (Page 116)

Senate

The Senate Armed Services Committee, in its report (S.Rept. 118-188 of July 8, 2024) on S. 4638, recommended the funding levels shown in the SASC column of **Table 4**. The recommended increase of $650.0 million in procurement funding is for "Build 2x Virginia-class SSNs per year," and the recommended increase of $480.0 million in advance procurement (AP) funding is for "Incremental funding for second ship" ($400 million) and "Submarine industrial base programs" ($80.0 million). (Page 443)

Section 129 of S. 4638 would provide authority to use incremental funding for procuring a Virginia-class submarine in FY2025.

Section 3115 would require a briefing on the activities during the preceding calendar year of activities taken under the 1958 U.S.-UK Mutual Defense Agreement,[110] including, among other things, a description of the activities' relationship, if any, with AUKUS.

S.Rept. 118-188 states

> **Virginia-class submarines**
>
> The budget request included $3.6 billion in line 5 of Shipbuilding and Conversion, Navy (SCN) to build one Virginia-class submarine in fiscal year 2025 and $3.7 billion in advance procurement in line 6 to support building Virginia-class submarines in future years.
>
> The committee has significant concerns about the effect that a reduction from the usual two-per-year construction rate may have on the 2nd and 3rd tier submarine supplier base.
>
> Therefore, the committee recommends an increase of $650.0 million in SCN line 5 and an increase of $400.0 million in line 6 to support incremental funding of a second boat in fiscal year 2025. A provision to authorize incremental funding [Section 129, noted above] is found elsewhere in this Act.
>
> **Submarine industrial base programs**
>
> The budget request included $180.0 million in the Virginia-class procurement program in Shipbuilding and Conversion, Navy (SCN), line 5, for efforts to support the submarine

[110] For more on the 1958 agreement, see CRS In Focus IF11999, *AUKUS Nuclear Cooperation*, by Paul K. Kerr and Mary Beth D. Nikitin, and Appendix B of CRS Report R41129, *Navy Columbia (SSBN-826) Class Ballistic Missile Submarine Program: Background and Issues for Congress*, by Ronald O'Rourke.

> supplier base. The budget request also included $2.0 billion in the Columbia-class procurement program request for SCN line 1, for the same purposes.
>
> Last year, Congress provided $1.2 billion in regular appropriations and $3.0 billion in the fiscal year 2024 National Security Supplemental Act (Public Law 118–50) to support the submarine industrial base. Despite this additional funding, the shipbuilders and their supply chains are not meeting the requirement to produce one Columbia-class and two Virginia-class submarines per year.
>
> Therefore, the committee recommends an additional $80.0 million in SCN line 6 for enhancing the submarine industrial base. (Page 16)

S.Rept. 118-188 also states

> **Report on feasibility of replicating the Accelerated Training in Defense Manufacturing model to address submarine industrial base workforce shortages**
>
> The committee is concerned that the submarine industrial base workforce is not sufficiently large enough to support current submarine production, let alone the increased production needed to be able to build two Virginia-class and one Columbia-class submarine per year. The committee recognizes the excellent work the U.S. Navy has done to increase the training pipeline for this workforce at its Additive Manufacturing Center of Excellence through the Accelerated Training in Defense Manufacturing (ATDM) program. The committee believes there are opportunities to expand this model to increase the number of workers participating in this program.
>
> Therefore, the committee directs the Secretary of the Navy to provide a briefing to the congressional defense committees, not later than March 1, 2025, on the advisability and feasibility of creating a second location for the ATDM program to address workforce shortages across the submarine industrial base through collaboration with relevant industry partners and academic institutions. This briefing shall include the following:
>
> (1) An assessment of the skills and workforce development programs offered through the ATDM model, with a focus on additive manufacturing, computer numerical control machining, non-destructive testing, quality control inspection, and welding;
>
> (2) An analysis of the hiring and retention rates of graduates of the ATDM into manufacturing positions within the defense industrial base;
>
> (3) An identification of the requirements necessary for replicating the ATDM program in another location, including recommended selection criteria;
>
> (4) A cost-benefit-analysis of replicating the ATDM program; and
>
> (5) An analysis of the impact that replicating the ATDM program could have on reducing workface shortfalls in the submarine industrial base. (Page 208)

Enacted

The joint explanatory statement for H.R. 5009/P.L. 118-159 of December 23, 2024, recommended the funding levels shown in the authorization enacted column of **Table 4**. The recommended increase of $357.0 million in procurement funding is for "Program increase: Submarine class material [for a] second ship set." (PDF page 520 of 696)

Section 1028 of H.R. 5009/P.L. 118-159 provides authority for using incremental funding in the Virginia-class program. Regarding Section 1028, the joint explanatory statement states

> *Sec. 1028 - Authority to use incremental funding to enter into a contract for the construction of a Virginia-class submarine program*

The House bill contained a provision (sec. 1018) that would provide incremental funding authority for an additional Virginia-class submarine in fiscal year 2025.

The Senate committee-reported bill contained a similar provision (sec. 129) that would also increase funding for the Virginia-class submarine program with offsets from elsewhere in the Navy budget.

The agreement includes the House provision with various technical amendments and an amendment to stipulate that funds available from a change to the contracting approach may only be used to provide for an increase in wages for the shipbuilder workforce or an increase in non-executive level salaries.

We are concerned with the lack of transparency that has occurred between the Navy and Congress over the last 18 months. The Navy negotiated a funding strategy with industry that would have addressed cost growth, future cost to complete, workforce wage increases and infrastructure investments at both shipyards. The Navy did this in isolation and failed to not only inform Congress but also the Office of Management and Budget.

As a result of the lack of communication, the Office of Management and Budget has not moved the strategy forward and Congress has been denied the opportunity to review the strategy's documentation and details. To remedy the deficiencies, the Office of Management and Budget asked Congress for significant emergency appropriations in fiscal year 2025 to support a plan that will require an undisclosed amount of additional appropriations above the future years' estimates in the President's Budget for fiscal year 2025. At no point during the normal budgeting and legislative process did the Navy inform Congress that there was large cost growth on the fiscal year 2024 submarines and the one fiscal year 2025 submarine being requested. Unfortunately, the lack of communication regarding program challenges and potential solutions has left Congress with few options to address this situation and likely none that will rectify it going forward.

We recognize that Congress has responsibility for oversight of the executive branch including access to information on how final decisions were reached, particularly for decisions of strategic importance where the dollar value of such a decision far surpasses the major defense acquisition program threshold. Denial of requests for information and veiled threats of reprisals against briefers to Congress who may provide requested information creates a dangerous precedent that is out of line the checks and balances inherent to the branches of government of the United States. (PDF pages 246-247 of 696)

FY2025 DOD Appropriations (H.R. 8774/S. 4921/H.R. 10545/P.L. 118-158/H.R. 1968/P.L. 119-4)

House

The House Appropriations Committee, in its report (H.Rept. 118-557 of June 17, 2024) on H.R. 8774, recommended the funding levels shown in the HAC column of **Table 4**.

Section 8010 of H.R. 8774 would provide authority for using multiyear procurement (MYP) for procuring Virginia-class submarines.

H.Rept. 118-557 states

SUBMARINE CONSTRUCTION

The Committee is dismayed by delays in construction of the lead Columbia-class submarine. The program is the Navy's top priority and fundamental to the nuclear triad. The Committee recognizes the strategic importance of the Columbia-class program and has fully funded every shipbuilding construction request to ensure on time delivery of the lead boat and overall success of the program. The Committee is troubled that the Navy

> lacked the appropriate oversight of a program of such significance that it only learned of the year delay to the program in recent months.
>
> Further, the Committee notes the delays in the Columbia-class program will undoubtably impact Virginia-class submarine construction. Virginia-class construction remains challenged with production hovering at a 1.2 submarine per year cadence versus the necessary cadence of two per year. The Committee believes that given the findings of the 45-day Shipbuilding Review showing a delay of upwards of 3 years in Virginia-class submarine construction, that the Committee recommendation of one Virginia-class submarine, coupled with robust investment in the submarine industrial base, appropriately reflects the current capacity for submarine construction and deliberately targets funding to the industrial base to achieve long-term sustainable production.
>
> The Committee believes that providing significant and strategic investment in the Submarine Industrial Base (SIB) is necessary to achieving the ''1+2'' production rate for the Columbia and Virginia-class programs. Therefore, the Committee recommendation includes $4,004,400,000 for the SIB, including $2,134,000,000 in the Shipbuilding and Conversion account. This funding is in addition to the $3,013,400,000 included in the Indo-Pacific Security Supplemental Appropriations Act, 2024 and the $1,188,000,000 provided in the Department of Defense Appropriations Act, 2024. The Committee believes investment in supplier capacity and capability, strategic domestic outsourcing, workforce development, and technology and infrastructure is key to achieving and sustaining the required submarine production cadence in the long-term and maintaining international commitments under the trilateral Australia, United Kingdom, United States (AUKUS) security partnership. (Pages 131-132)

Senate

The Senate Appropriations Committee, in its report (S.Rept. 118-204 of August 1, 2024) on S. 4921, recommended the funding levels shown in the SAC column of **Table 4**. The recommended increase of $357.0 million in procurement funding is for "Program increase: Submarine class material second ship set." (Page 132) The recommended increase of $1,000.0 million (i.e., $1.0 billion) in cost-to-complete funding is for "Program increase: FY24 Virginia-class submarines (emergency)." (Page 132) The use of the term *emergency* for this recommended funding increase means that it would be designated as being for an emergency requirement pursuant to Section 251(b)(2)(A)(i) of the Balanced Budget and Emergency Deficit Control Act of 1985. For further discussion of recommended additional emergency appropriations in S. 4921, see pages 8-9 of S.Rept. 118-204.

S.Rept. 118-204 states

> *Submarine Industrial Base*.—The Committee recognizes that strengthening the submarine industrial base [SIB] is essential to ensuring that new submarines can be constructed at the pace outlined in the Navy's shipbuilding plan to meet national security needs. Therefore, the Committee strongly supports the Navy's efforts to invest in the infrastructure and workforce of shipbuilders and suppliers. The fiscal year 2025 President's budget requests funding for one new construction VIRGINIA Class Submarine [VCS] and increased investment in the SIB in order to more fully mature SIB capacity and workforce before returning to a two VCS construction cadence. The Committee understands that an additional $1,000,000,000 of supplier workload could further stabilize and improve performance of the industrial base. Based on extensive dialogue with the Navy, the Committee understands that the Navy can resource $643,000,000 for this opportunity from VCS Block IV economic order quantity funding appropriated in the Department of Defense Appropriations Act, 2024 (Public Law 118–47), VCS SIB construction spares funding appropriated in the National Security Supplemental Appropriations Act, 2024 (Public Law 118–50), and funding the Committee recommends in this act that was requested in the

> fiscal year 2025 President's budget request. The Committee recommends an additional $357,000,000 in the VCS program line to further solidify this key supplier capacity in support of a second VCS shipset of materials, and to stabilize the SIB.
>
> In addition, the Committee recognizes that the opportunity presented by historic levels of appropriated SIB support can only achieve this capacity through carefully-targeted investments and proper stewardship of funds. Therefore, the Committee directs the Secretary of the Navy to submit a report to the congressional defense committees not later than 90 days after the enactment of this act, and semi-annually thereafter, on the Navy's planned oversight approach for overseeing all phases of the SIB funding cycle, including the identification of gaps, selection of projects, oversight of funding execution, and determining return on investment.
>
> The Committee also directs the Comptroller General of the United States to submit a report to the congressional defense committees not later than 1 year after the enactment of this act that assesses the extent to which the Department of Defense's SIB investment strategy and associated funding will result in a shipbuilding industrial base capable of achieving the "2 + 1" annual submarine construction rate called for in the Navy's 30-year shipbuilding plan. This report shall include an assessment of: (1) how the Departments of Defense and Navy are assessing the return on investment of SIB funding to improve submarine construction performance, (2) the extent to which the Navy intends to utilize such assessments to inform the selection of future SIB projects, and (3) the extent to which previously appropriated SIB funding and programmed funding in future years, in combination with other key factors, are likely to achieve the SIB capacity and throughput to meet the Navy's submarine requirements.
>
> Finally, the Committee has received spend plans from the Navy for SIB funding contained in the Department of Defense Appropriations Act, 2024 (Public Law 118–47) and prior acts, as well as the National Security Supplemental Appropriations Act, 2024 (Public Law 118–50). The Committee notes that such plans do not involve the purchase of land or property. The Committee directs the Secretary of the Navy to brief the congressional defense committees not less than 45 days prior to obligating funds that would deviate from those spend plans. (Pages 133-134)

Enacted (H.R. 10545/P.L. 118-158)

Division A of the American Relief Act, 2025 (H.R. 10545/P.L. 118-158 of December 21, 2024), is a continuing resolution (CR) that funded government operations until March 14, 2025. Section 157 of Division A provided an appropriation of $5.691 billion in ship procurement funding for the Virginia-class program and other nuclear-powered ship programs (i.e., the Columbia-class ballistic missile submarine program and the Gerald R. Ford [CVN-78] class aircraft carrier program) that is separate from funding that was requested for the Virginia-class program in the Navy's proposed FY2025 budget. Section 157 states

> Sec. 157. (a) In addition to amounts otherwise provided by section 101, there is appropriated to the Department of Defense for 'Procurement—Shipbuilding and Conversion, Navy', $5,691,000,000, for an additional amount for fiscal year 2025, to remain available until September 30, 2029, for the Virginia Class Submarine program and for workforce wage and non-executive salary improvements for other nuclear-powered vessel programs: Provided, That such amount is designated by the Congress as being for an emergency requirement pursuant to section 251(b)(2)(A)(i) of the Balanced Budget and Emergency Deficit Control Act of 1985.
>
> (b) Amounts appropriated by subsection (a) may be used to incrementally fund contract obligations for the improvement of workforce wages and non-executive level salaries on new or existing contracts pertaining to the Virginia Class Submarine program or to other nuclear-powered vessel programs.

The funding provided in Section 157 is shown in the H.R. 10545 column of **Table 4**.

Enacted (H.R. 1968/P.L. 119-4)

Section 1404 of the Full-Year Continuing Appropriations and Extensions Act, 2025 (H.R. 1968/P.L. 119-4 of March 15, 2025), a full-year continuing resolution (CR), provides the funding figures shown in the H.R. 1968 column of **Table 4**.

Section 1418 provides authority for using multiyear procurement (MYP) for procuring Virginia-class submarines.

Appendix A. Past SSN Force-Level Goals

This appendix summarizes attack submarine force-level goals since the Reagan Administration (1981-1989).

The Reagan-era (i.e., 1980s-era) plan for a 600-ship Navy included an objective of achieving and maintaining a force of 100 SSNs.

The George H. W. Bush Administration's proposed Base Force plan of 1991-1992 originally called for a Navy of more than 400 ships, including 80 SSNs.[111] In 1992, however, the SSN goal was reduced to about 55 boats as a result of a 1992 Joint Staff force-level requirement study (updated in 1993) that called for a force of 51 to 67 SSNs, including 10 to 12 with Seawolf-level acoustic quieting, by the year 2012.[112]

The Clinton Administration, as part of its 1993 Bottom-Up Review (BUR) of U.S. defense policy, established a goal of maintaining a Navy of about 346 ships, including 45 to 55 SSNs.[113] The Clinton Administration's 1997 QDR supported a requirement for a Navy of about 305 ships and established a tentative SSN force-level goal of 50 boats, "contingent on a reevaluation of peacetime operational requirements."[114] The Clinton Administration later amended the SSN figure to 55 boats (and therefore a total of about 310 ships).

The reevaluation called for in the 1997 QDR was carried out as part of a Joint Chiefs of Staff (JCS) study on future requirements for SSNs that was completed in December 1999. The study had three main conclusions:

- "that a force structure below 55 SSNs in the 2015 [time frame] and 62 [SSNs] in the 2025 time frame would leave the CINC's [the regional military commanders-in-chief] with insufficient capability to respond to urgent crucial demands without gapping other requirements of higher national interest. Additionally, this force structure [55 SSNs in 2015 and 62 in 2025] would be sufficient to meet the modeled war fighting requirements";
- "that to counter the technologically pacing threat would require 18 Virginia class SSNs in the 2015 time frame"; and
- "that 68 SSNs in the 2015 [time frame] and 76 [SSNs] in the 2025 time frame would meet all of the CINCs' and national intelligence community's highest operational and collection requirements."[115]

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[111] For the 80-SSN figure, see Statement of Vice Admiral Roger F. Bacon, U.S. Navy, Assistant Chief of Naval Operations (Undersea Warfare) in U.S. Congress, House Armed Services Committee, Subcommittee on Seapower and Strategic and Critical Materials, *Submarine Programs*, March 20, 1991, pp. 10-11, or Statement of Rear Admiral Raymond G. Jones Jr., U.S. Navy, Deputy Assistant Chief of Naval Operations (Undersea Warfare), in U.S. Congress, Senate Armed Services Committee, Subcommittee on Projection Forces and Regional Defense, *Submarine Programs*, June 7, 1991, pp. 10-11.

[112] See Richard W. Mies, "Remarks to the NSL Annual Symposium," *Submarine Review*, July 1997, p. 35; "Navy Sub Community Pushes for More Subs than Bottom-Up Review Allowed," *Inside the Navy*, November 7, 1994, pp. 1, 8-9; *Attack Submarines in the Post-Cold War Era: The Issues Facing Policymakers*, op. cit., p. 14; Robert Holzer, "Pentagon Urges Navy to Reduce Attack Sub Fleet to 50," *Defense News*, March 15-21, 1993, p. 10; Barbara Nagy, " Size of Sub Force Next Policy Battle," *New London Day*, July 20, 1992, pp. A1, A8.

[113] Secretary of Defense Les Aspin, U.S. Department of Defense, *Report on the Bottom-Up Review*, October 1993, pp. 55-57.

[114] Secretary of Defense William S. Cohen, U.S. Department of Defense, *Report of the Quadrennial Defense Review*, May 1997, pp. 29, 30, 47.

[115] Department of Navy point paper dated February 7, 2000. Reprinted in *Inside the Navy*, February 14, 2000, p. 5.

The conclusions of the 1999 JCS study were mentioned in discussions of required SSN force levels, but the figures of 68 and 76 submarines were not translated into official DOD force-level goals.

The George W. Bush Administration's report on the 2001 QDR revalidated the amended requirement from the 1997 QDR for a fleet of about 310 ships, including 55 SSNs. In revalidating this and other U.S. military force-structure goals, the report cautioned that as DOD's "transformation effort matures—and as it produces significantly higher output of military value from each element of the force—DOD will explore additional opportunities to restructure and reorganize the Armed Forces."[116]

DOD and the Navy conducted studies on undersea warfare requirements in 2003-2004. One of the Navy studies—an internal Navy study done in 2004—reportedly recommended reducing the attack submarine force level requirement to as few as 37 boats. The study reportedly recommended homeporting a total of nine attack submarines at Guam and using satellites and unmanned underwater vehicles (UUVs) to perform ISR missions now performed by attack submarines.[117]

In March 2005, the Navy submitted to Congress a report projecting Navy force levels out to FY2035. The report presented two alternatives for FY2035—a 260-ship fleet including 37 SSNs and 4 SSGNs, and a 325-ship fleet including 41 SSNs and 4 SSGNs.[118]

In May 2005, it was reported that a newly completed DOD study on attack submarine requirements called for maintaining a force of 45 to 50 boats.[119]

In February 2006, the Navy proposed to maintain in coming years a fleet of 313 ships, including 48 SSNs.

Although the Navy's ship force-level goals have changed repeatedly in subsequent years, the figure of 48 SSNs remained unchanged until December 2016, when the Navy released a force-level objective for achieving and maintaining a force of 355 ships, including 66 SSNs. As noted earlier in this report, the Navy's preferred new ship force-level goal, which was submitted to Congress in June 2023, calls for achieving and maintaining a fleet of 381 manned ships, including 66 SSNs.

[116] U.S. Department of Defense, *Quadrennial Defense Review*, September 2001, p. 23.

[117] Bryan Bender, "Navy Eyes Cutting Submarine Force," *Boston Globe*, May 12, 2004, p. 1; Lolita C. Baldor, "Study Recommends Cutting Submarine Fleet," *NavyTimes.com*, May 13, 2004.

[118] U.S. Department of the Navy, *An Interim Report to Congress on Annual Long-Range Plan for the Construction of Naval Vessels for FY 2006*. The report was delivered to the House and Senate Armed Services and Appropriations Committees on March 23, 2005.

[119] Robert A. Hamilton, "Delegation Calls Report on Sub Needs Encouraging," *The Day (New London, CT)*, May 27, 2005; Jesse Hamilton, "Delegation to Get Details on Sub Report," *Hartford (CT) Courant*, May 26, 2005.

Appendix B. Submarine Construction Industrial Base Capacity and Enhancement Efforts

This appendix presents additional background information on the capacity of the submarine construction industrial base and Navy and industry efforts to enhance that capacity.

Overview

A major concern relating to the Columbia- and Virginia-class submarine programs relates to the ability of the submarine construction industrial base to execute the work associated with procuring one Columbia-class SSBN plus two VPM-equipped Virginia-class SSNs per year (a procurement rate referred to in short as 1+2). (In the "1+2" nomenclature, the 2 refers to being able to produce 2.0 Virginia-class boats per year.) Policymakers and other observers have expressed concern about the industrial base's capacity for executing a 1+2 workload without encountering bottlenecks or other production problems in one or both of these programs. In a nutshell, the challenge for the industrial base—both shipyards and supplier firms—is to ramp up production from one "regular" Virginia-class boat's work per year (the volume of work prior to FY2011) to the equivalent of about five "regular" Virginia-class boats' work per year (the approximate volume of work represented by two Virginia Payload Module [VPM]-equipped Virginia-class boats and one Columbia-class boat).[120] In other words, the challenge for the industrial base is to quintuple the pre-2011 volume of annual production by 2028. The challenge is depicted in the Navy graph shown in **Figure B-1**.

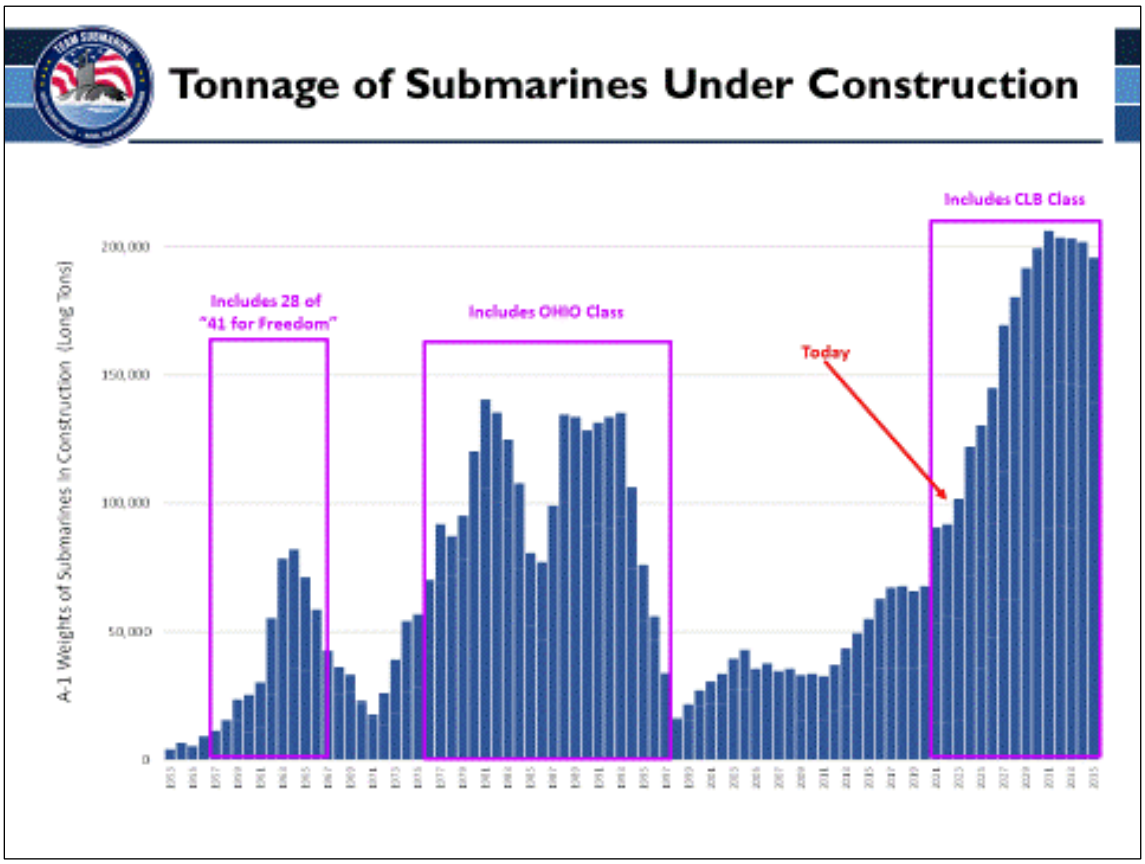
Concerns about the ability of the submarine construction industrial base to execute the workload resulting from a sustained 1+2 procurement rate were heightened starting in 2019 by reports about challenges faced by the two submarine-construction shipyards and associated supplier firms in meeting scheduled delivery times for Virginia-class boats as the Virginia-class program transitions from production of two "regular" Virginia-class boats per year to two VPM-equipped boats per year.[121]

[120] Starting in FY2019, the Navy began to procure a lengthened version of the Virginia-class design that incorporates the Virginia Payload Module (VPM), 84-foot-long, mid-body section equipped with four large-diameter, vertical launch tubes for storing and launching additional Tomahawk missiles or other payloads. If building a "regular" Virginia-class boat is viewed as requiring one unit of work, then building a VPM-equipped Virginia-class boat can be viewed as requiring about 1.25 units of work, and building a Columbia-class boat can be viewed as requiring about 2.5 units of work. On this basis, building two VPM-equipped Virginia-class boats and one Columbia-class boat would require about five units of work (1.25 + 1.25 + 2.5 = 5.0).

[121] See, for example, Government Accountability Office, *Columbia Class Submarine[:] Overly Optimistic Cost Estimate Will Likely Lead to Budget Increases*, GAO-19-497, April 2019, pp. 20-23; David B. Larter, "Late Is the New Normal for Virginia-Class Attack Boats," *Defense News*, March 20, 2019; Megan Eckstein, "Navy: Lack of Submarine Parts Slowing Down Maintenance, New Construction," *USNI News*, March 26, 2019; David B. Larter, "The US Navy, Seeking Savings, Shakes Up Its Plans for More Lethal Attack Submarines," *Defense News*, April 3, 2019; Anthony Capaccio, "U.S. Navy Sub Firepower Upgrade Delayed by Welding Flaws," *Bloomberg*, August 13, 2019; Paul McLeary, "Weld Problems Spread To Second Navy Sub Program," *Breaking Defense*, August 14, 2019; David B. Larter, "Questions About US Navy Attack Sub Program Linger as Contract Negotiations Drag," *Defense News*, August 16, 2019; Emma Watkins, "Will the U.S. Navy Soon Have a Missile-Tube Problem?" *National Interest*, August 19, 2019; David B. Larter, "As CNO Richardson Departs, US Submarine Builders Face Pressure," *Defense News*, August 22, 2019; David B. Larter, "After a Leadership Shakeup at General Dynamics, a Murky Future for Submarine Building," *Defense News*, October 28, 2019; Rich Abott, "Navy Says Virginia Sub Delays Due To Faster Production Rate," *Defense Daily*, November 6, 2019.

Figure B-1. Navy Graph Showing Projected Growth in Submarine Tonnage Under Construction

Red arrow indicates date of November 2023



Source: Navy graph provided to CRS and CBO by Navy Office of Legislative Affairs, November 16, 2023.

Although Virginia-class submarines are being procured at a rate of two boats per year, the Navy testified in March 2025 that the production rate of Virginia-class submarines was about 1.1 boats per year.[122] A November 13, 2024, press report stated

> For Virginia-class production, [Rear Admiral Jonathan Rucker, program executive officer for attack submarines] said prior to the COVID-19 pandemic "we actually got close to two per year," up to 1.85 before material challenges crept in and dragged the rate down to the 1.1 and 1.2 range, he said. "Now, if you look at where we were, and then you add the planned capacity, planned investments we're going to make, add Virginia on top, projections were, get to 2028, and then we have threshold values. We're trying to hover between those two," with the end goal of getting up to a 2.33 production rate in the early 2030s, he said. "Then support the needs for AUKUS as well."
>
> Rucker said the 2028 goal is risky as the submarine industrial base struggles with challenges that saw the service's submarine production goal fall short this year.

[122] Statement of Dr. Brett A. Seidle, Acting, Assistant Secretary of the Navy (Research, Development and Acquisition), before the Seapower and Projection Forces Subcommittee of the House Armed Services Committee on the State of U.S. Shipbuilding, March 11, 2025, PDF page 6 of 10.

> "I'll be frank. There are some risks to achieving these goals," Rucker said. "We have done great things and we've made progress, but more is needed. This is our north star. … This is the challenge of our time."
>
> The goal by the end of the calendar year was a production rate of 1.5 boats per year, with a threshold of 1.3, Rucker said. "We continue to hover around a production rate of 1.1 to 1.2 boats per year. … Right now, we're tracking the threshold value. We will not make the goal. We'll be closer to 1.3," he said.
>
> Reasons cited for the shortfall include "continuing challenges" related to maintenance and workforce as well as "material delays," Rucker said. He said what he called sequence-critical material delays "directly [impact] the ability to build boats in the order they were supposed to be built."
>
> What that means is "you end up doing it out of sequence, which is not efficient," he said. "We've had some first-time quality issues, both at the shipbuilders and suppliers and our workforce attrition, proficiency and efficiency all have to improve," he added.
>
> The roadmap for the 2028 timeline was developed in 2022 and 2023, "and we were really taking a step back to look at the analytics, production rates, projected production rates, and we developed a kind of a ramp that we thought was a realistic, executable ramp to get there, based on what we knew at the time," he said.
>
> Problems that plagued production beginning in 2018 are slowly being overcome, he said. But "the whole system has to be uplifted. We're on that journey. We're about halfway there, and we're going to continue to get there. And that's why I say there is some risk to the 2028 [goal], because this year we're at the threshold value" of 1.3.[123]

A March 31, 2023, press report stated that Navy officials estimated that it will take another five years—until 2028—before the delivery rate will increase to 2.0 boats per year.[124] In advance policy questions submitted for a September 14, 2023, hearing before the Senate Armed Services Committee to consider her nomination to be Chief of Naval Operations, Admiral Lisa Franchetti, the Vice Chief of Naval Operations, stated that the Navy's goal is to stabilize the Virginia-class construction rate at 1.4 boats per year by the end of 2023, increase it to at least 1.5 boats per year by the end of 2024, and increase it to 2.0 boats per year by 2028.[125]

The Navy has testified that meeting both U.S. Navy needs and additional needs under the AUKUS (Australia-UK-US) security agreement announced in September 2021 would require increasing the Virginia-class production rate further, to 2.33 boats per year. Under the nomenclature used here, such a combined Columbia-plus-Virginia procurement rate would be expressed as 1+2.33.[126]

The Navy's report on its FY2025 30-year (FY2025-FY2054) shipbuilding plan states

[123] Laura Heckmann, "Navy Hopes to Bump Sub Production to 3 Per Year by 2028," *National Defense*, November 13, 2024. See also Sam LaGrone, "Naval Reactors: Virginia-class Will Extend to Block VIII, SSN(X) Start in 2040s," *USNI News*, November 13, 2024; Justin Katz and Valerie Insinna, "Supply Chain Issues Slowing Down General Dynamics Sub Construction, CEO says," *Breaking Defense*, October 23, 2024; Sam LaGrone, "GD CEO: Electric Boat to Scale Back Submarine Work Due to 'Major Component' Delays," *USNI News*, October 23, 2024; Cal Biesecker, "Navy Work, Aerospace Lift GD To Strong Third Quarter; Submarine Supply Chain Woes Persist," *Defense Daily*, October 23, 2024.

[124] Sam LaGrone, "Navy Estimates 5 More Years for Virginia Attack Sub Production to Hit 2 Boats a Year," *USNI News*, March 31, 2023.

[125] Senate Armed Services Committee, Advance Policy Questions for Admiral Lisa M. Franchetti, USN, Nominee for Appointment to be Chief of Naval Operations, p. 31.

[126] For more on the submarine component of the AUKUS agreement, see CRS Report RL32418, *Navy Virginia-Class Submarine Program and AUKUS Submarine Proposal: Background and Issues for Congress*, by Ronald O'Rourke.

> To achieve the goal of simultaneous construction of the Columbia-class SSBN and two Virginia-class SSNs annually, the DoN [Department of the Navy] is investing heavily in the submarine industrial base to reduce production risk, stabilize critical suppliers, and help enable recruitment and retention of the skilled production workforce. Industry must do its part to deliver capability on time and within cost….
>
> The DoN is committed to fortifying the submarine production and sustainment industrial base to meet U.S. needs while also enabling the sale of three Virginia class submarines to Australia. From FY2018 appropriation/execution through FY2023, the DoD, DoN, and Congress have worked in partnership with state/local governments and industry to invest over $2.3B across shipyard, workforce, suppliers, strategic outsourcing and modern manufacturing technology lines of effort. The Navy estimates additional $17.5 billion in additional funding will be needed from FY 2024 through FY 2029 to achieve sustained production levels of 1 Columbia SSBN + 2.0 Virginia SSNs by 2028, with additional productivity required thereafter to support selling SSNs to Australia. This additional funding was included in the FY2024 budget request, and FY2024 supplemental and is included in the PB2025 budget request. This funding is displayed in Table 2.[127]

Table 2: Submarine Industrial Base Funding FY2024 through FY2029 (TY$B)

PB23 FYDP	$1.6
PB24 FYDP	$2.2
FY24 Supplemental[1]	$3.3
PB25 FYDP[1]	$10.4
Total with SIOP	$17.5

Note 1: Includes Shipyard Infrastructure Optimization Program (SIOP)

At an October 25, 2023, hearing on the submarine industrial base and its ability to support the AUKUS framework before the Seapower and Projection Forces Subcommittee of the House Armed Services Committee, the Navy provided testimony on its plan to increase the industrial base's capacity to support the production of 2.33 Virginia-class boats per year and thus a combined Columbia-plus-Virginia procurement rate of 1+2.33. The Navy's testimony on its plan is reprinted later in this appendix.

A July 16, 2024, press report stated

> Deloitte Consulting has won a potential five-year, $2.4 billion contract to work with the Navy and Defense Department on their efforts to modernize and expand the submarine industrial base.
>
> Workforce development is one of several aspects Deloitte will seek to help the Navy and DOD's Innovation Capability and Modernization Office address, as part of their larger effort to address regional and broader challenges in submarine manufacturing.
>
> Awarded on Monday [July 15], the contract has an initial one-year base period and up to four option years. The General Services Administration managed the procurement for the Navy and DOD.
>
> Solicitation documents describe the Navy's goal as being able to "rapidly reach and sustain a programmed production rate of 1+2 submarines per year with a predominant emphasis on closing associated industrial workforce gaps."

[127] U.S. Navy, Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2025, March 2024, pp. 5-6.

> The scope of the challenge to accomplish that is vast. The Navy, submarine makers and the latter's suppliers need more than 100,000 workers over the next decade to build more subs….
>
> Deloitte will act as the enterprise integration partner responsible for providing the needed labor, equipment, and materials to the Navy and DOD.
>
> A second major goal of the effort is to accelerate the development and adoption of more modern manufacturing techniques and processes across the U.S.' maritime supply chain.
>
> Shipyard infrastructure, supplier development, and strategic outsourcing represent other major focus areas of the contract.[128]

Strategic Outsourcing

One option for addressing industrial-base challenges of building both Columbia-class boats and Virginia-class SSNs at the same time is to increase the use of shipyards other than GD/EB and HII/NNS, as well as other manufacturing facilities, in building components of Columbia- and/or Virginia-class boats—a practice sometimes referred to as strategic outsourcing. An October 21, 2022, press report states

> The U.S. Navy is pouring billions of dollars into shoring up the companies that help build nuclear-powered submarines and aircraft carriers.
>
> But these companies, and especially prime contractors General Dynamics Electric Boat and HII's Newport News Shipbuilding, cannot hire enough people to keep up with demand.
>
> So they're outsourcing work that was previously done in-house, two admirals said.
>
> Rear Adm. Jon Rucker, the program executive officer for attack submarines, said the Navy spent more than $1 billion between fiscal 2018 and fiscal 2022, and that the service is committed to $2.4 billion from fiscal 2023 to fiscal 2027.
>
> These funds cover supplier development, workforce development, shipbuilder infrastructure, the development of technologies such as additive manufacturing and nondestructive testing, government oversight, and strategic outsourcing.
>
> In terms of tonnage of submarine construction, the Navy will see a 5.5 times increase from FY11 to FY25. But the number of suppliers has dropped to about 5,000, compared to 17,000 companies during the last submarine construction surge in the 1980s, Rucker said last month at an American Society of Naval Engineers conference.
>
> Rucker said the Navy is trying to target its investments where it can make the most impact: 350 companies are considered "critical suppliers" in the submarine-industrial base, and 55% of those are located in six states. So workforce development dollars are focused on those states to do the most good for critical suppliers in need of more workers. This effort could see the establishment of new training sites in Virginia and Pennsylvania.
>
> Outsourcing is becoming more important as some regions realize they aren't receiving enough interest for people to join the manufacturing industry, despite federal and state government efforts to create manufacturing training opportunities.
>
> "We are saturated in certain areas of the country. The Northeast is one of those. If we cannot bring the people to the work, we're going to take the work to the people," Rucker said.

[128] Ross Wilkers, "The Pentagon Is Paying a Consultant up to $2.4B to Boost Submarine Production," *Defense One*, July 16, 2024. See also Nick Wilson, "Deloitte Consulting Awarded $2.4 Billion to Orchestrate Submarine Production Revival," *Inside Defense*, July 17, 2024.

> Today, he explained, Electric Boat outsources 1.1 million hours' worth of work a year and Newport News Shipbuilding outsources 900,000 hours as they build new Virginia- and Columbia-class submarines.
>
> By 2025, that combined 2 million hours will grow to 5 million, he said—which equates to half the work to build a Virginia submarine.
>
> Rucker said companies across the U.S. are building structural pieces of submarines, including some large modules, that were previously built at Electric Boat and Newport News facilities. Now they're constructed by companies with available workers and space, and then shipped to the shipyard for assembly.[129]

Austal USA of Mobile, AL—a shipyard that builds conventionally powered surface ships for the Navy—reportedly is a significant submarine strategic outsourcing location.[130] South Carolina is another example of a strategic outsourcing location.[131]

October 25, 2023, Navy Testimony

At an October 25, 2023, hearing on the submarine industrial base and its ability to support the AUKUS framework before the Seapower and Projection Forces Subcommittee of the House Armed Services Committee, the Navy testified on its efforts (and associated funding) for increasing the capacity of the submarine construction industrial base to support a construction rate of one Columbia-class ballistic missile submarine (SSBN) per year plus 2.33 Virginia-class attack submarines (SSNs) per year (i.e., a "1+2.33" rate). This is the rate, the Navy testified, that would be sufficient to meet both U.S. Navy needs and needs under the AUKUS agreement for building SSNs while also building Columbia-class SSBNs for the U.S. Navy. The Navy's testimony stated

> **Submarine Industrial Base (SIB)**
>
> The US Submarine Force and our SIB [submarine industrial base] are crucial to the security of our Nation, and maintaining overmatch in the Undersea Warfare domain is one of the top priorities in the Department of Defense. Submarines, therefore, are one of the most important battle force vessels in our Navy. Forward deployed, combat-credible attack submarines project US decisive naval power essential in today's security environment. Construction and sustainment of our submarine force is complex, difficult, and requires a continuous focus on safety and nuclear stewardship. Our SIB is supporting the largest

[129] Megan Eckstein, "Defense Firms Outsource Sub, Carrier Construction amid Labor Woes," *Defense News*, October 21, 2022.

[130] See, for example, Keith Lane, "Austal USA Breaks Ground on New Manufacturing Facility to Support the U.S. Navy Sub Base," *NBC 15 News (mynbc15.com)*, October 23, 2024; Sam LaGrone, "Navy Taps Private Equity Fund to Build New Alabama Sub Module Facility, Austal Awarded $152M to Support Effort," *USNI News*, September 22, 2024; Naval Sea Systems Command Office of Corporate Communication, "Navy Partners with Private Industry to Grow Submarine Industrial Base Capacity," Naval Sea Systems Command, September 20, 2024; Lee Ferran, "Navy Takes 'Really Big Swing' with Private Investment to Boost Sub Industrial Base," *Breaking Defense*, September 20, 2024; Nick Wilson, "Navy Announces Private-Equity Partnership Aimed at Submarine Industrial Base Improvements," *Inside Defense*, September 20, 2024; Sam LaGrone, "Austal USA Awarded $450M to Build a Submarine Construction Facility in Mobile," *USNI News*, September 16, 2024; Justin Katz, "In Expansion, Austal USA Undergoes 'Unique Evolution' Beyond a Two-Trick Shipbuilder," *Breaking Defense*, August 21, 2024; Nick Wilson, "Austal Poised to Expand Submarine Module Work as Legacy Programs Sunset," *Inside Defense*, August 15, 2024; Justin Katz, "Known for LCS, Alabama-Based Austal USA Starts Submarine Work," *Breaking Defense*, January 19, 2023; Rich Abott, "Austal Starts Submarine Construction Support Work," *Defense Daily*, December 12, 2022; Rojoef Manuel, "Austal, General Dynamics Team Up for US Navy Nuclear Submarine Production," *Defense Post*, December 8, 2022; Austal USA, "Austal USA Commences Submarine Work," December 6, 2022.

[131] See, for example, Nick Wilson, "HII's Outsourcing Strategy Takes Root as Carrier and Submarine Work Begins at South Carolina Facility," *Inside Defense*, March 18, 2025.

submarine recapitalization effort in nearly 50 years and at a time when American manufacturing and shipbuilding capacity has atrophied by more than 60 percent since the end of the Cold War.

The US is simultaneously replacing our strategic Ballistic Missile Submarine (SSBN) force with the COLUMBIA Class, transitioning our SSN force from LOS ANGELES to VACL [Virginia class] , and replacing our Guided Missile Submarine (SSGN) capability[132] with 'strike optimized' VIRGINIA Payload Module (VPM) submarines. VPM includes a new hull section with additional vertical launch tubes for conventionally armed missiles to the VACL submarine design. Adding AUKUS requires us to improve our new-construction and sustainment efforts to ensure we meet our domestic requirements while supporting the trilateral partnership. Both our SIB uplift effort and the AUKUS program are executing aggressive and deliberate schedules designed to meet our national security needs. Continued partnership with Congress is foundational to our collective success in these two generational opportunities. The SIB, consisting of our public shipyards and two prime shipbuilders, General Dynamics Electric Boat (GDEB) and Huntington Ingalls Industries Newport News Shipbuilding (HII-NNS), along with the 16,000 suppliers (5,000 direct contractual relationships and 11,000 sub-tier vendors) across the country, support both our new-construction submarines and sustainment of the in-service submarine fleet.

It has been nearly 50 years since the US ramped-up its submarine construction capability and infused equivalent volumes of complexity and work into the industrial base. Following the Cold War, the country underwent significant shifts in economics and culture, punctuated by a clear transition from a manufacturing-based economy to a services-based economy. This pivot undermined foundational industrial capabilities and capacities and challenged our ability to maintain the sufficiently skilled and sized workforce needed for a resilient and robust SIB.

In FY 2018, with leadership and support from Congress, the DON began infusing funding into the SIB to increase capability and capacity at new and existing suppliers to meet growing demand and increase resilience across the supply chain. In October 2020, the DON established the SIB Program within the Program Executive Office for Strategic Submarines (PEO SSBN). The SIB Program, in partnership with the Office of the Secretary of Defense Industrial Base Analysis and Sustainment program, is executing a holistic strategy to expand and strengthen the SIB by investing in six key areas: shipbuilder infrastructure, supply chain capability/capacity, scaling new technologies, addressing workforce trade skill gaps and constraints, expanding capacity via strategic outsourcing, and government oversight of expanded industrial base efforts.

The AUKUS partnership provides an unprecedented opportunity to leverage the capabilities of our partner nations, strengthen our defense industrial bases, create jobs, and drive innovation across our SSN force. AUKUS relies on a strong SIB that designs, delivers, maintains, and modernizes our apex predators of the oceans – SSNs. Our domestic industrial base will benefit from the industrial capabilities of our partner nations, such as joining with an Australian company to mature and scale metallic additive manufacturing across the SIB. Ultimately, AUKUS will increase commonality, interoperability, and therefore, warfighting lethality across our three submarine forces.

Australia's investment into the US SIB builds upon on-going efforts to improve industrial base capability and capacity, create jobs, and utilize new technologies. This contribution is necessary to augment VACL production from 2.0 to 2.33 submarines per year to support

[132] This is a reference to the first four Ohio (SSBN-726) class SSBNs, which were converted into cruise missile and special operations forces (SOF) submarines (SSGNs). The four conversions were completed in 2005-2007. The SSGNs are to reach their ends of their service lives and be retired in FY2026-FY2028. For more on the SSGN conversion program, see CRS Report RS21007, *Navy Trident Submarine Conversion (SSGN) Program: Background and Issues for Congress*, by Ronald O'Rourke.

both US Navy and AUKUS requirements. Through sustained investment, consistent with our ongoing strategy, the ultimate goal is to increase repair capacity and capability of US shipyards to get more SSNs out of maintenance and back to the Fleet. AUKUS also presents a unique demand on the US SIB requiring a "Whole of Government, Whole of Industry" approach to achieve and sustain pace, including supporting both US and partner nation efforts.

Submarine Construction:

The current submarine construction rate, coupled with systemic challenges facing the US SIB, resulted in the current annual production rate of 1.2 to 1.3 VACL SSNs per year, compared to the goal of 2.0 VACL SSNs per year. This SSN construction rate, coupled with COLUMBIA Class SSBN serial production starting in FY 2026 (pending Congressional authorization and appropriations) is what we call "1+2," for the one COLUMBIA Class SSBN and two VACL SSNs per year.

The recapitalization process to achieve the 1+2 cadence increases the demand on the US SIB by a "workload equivalent" factor of five by 2028. 2015 was the last year the Navy was scheduled to deliver one VACL SSN (1.0). One COLUMBIA Class SSBN represents approximately 2.5 VACL SSNs in terms of build resources (manning) and tonnage. The addition of the VPM design equates to 1.25 legacy (2015) VACL SSNs. Thus, a 1.0 build rate from 2015 becomes 5.0 in 2028 to achieve 1+2 cadence (2.5 + (1.25 + 1.25)). The DON's submarine builders, GDEB and HII-NNS, and their supporting supplier base are working to achieve this 1+2 rate in 2028 by investing in workforce development and retention efforts, increasing capacity and capability through infrastructure and equipment upgrades, and partnering with the DON to mature and scale advanced manufacturing technology throughout the SIB….

SIB Recapitalization

The recapitalization of the US Submarine Force, plus the investment in AUKUS, requires continued and significant investments in US facilities, infrastructure, and workforce. Our SIB recapitalization effort creates large numbers of hands-on jobs across the nation. Targeted workforce growth includes, but is not limited to:

• Trades – Welders, Shipfitters, Electricians, Machinists, Pipefitters, Painters, and Electronics Technicians.

• Supporting Disciplines – Planners, Estimators, Material Managers, Contract Specialists, Information Technology Experts, Quality Assurance Specialists, and Project Leaders.

• STEM – Structural, Electrical, Mechanical, and Nuclear Engineers; Designers; Test Coordinators; Metallurgists; Computer Scientists; Logisticians; etc.

Significant investments into the submarine supplier base will produce increased volume of basic materials, specialized materials, and engineered components required for modern nuclear-powered submarine construction, such as:

• Steel and specialty metals.

• High-tech castings and forgings.

• Electrical components.

• Combat Systems.

• Propulsion Plant components.

• Valves, pumps, pipes, fittings, and fans.

• Software and information systems.

In partnership with Congress, the Office of the Secretary of Defense and the DON made substantial SIB investments, with $2.3 billion across FY 2018 through FY 2023 currently in execution and $1.6 billion planned for FY 2024 through FY 2027. There is also an additional $2.2 billion for submarine sustainment efforts submitted in the President's Budget for FY 2024 through 2028. This much-needed resourcing is purposefully designed to help build and strengthen SIB capacity, capability, and resilience. These resources are primarily being utilized across six lines of effort, and are needed to support efforts to increase submarine construction and sustainment rates:

1. Supplier Development: Add capability and/or capacity to existing suppliers, reduce single/sole-source risks for resiliency and robustness, improve first time quality.

2. Shipyard Infrastructure: Accelerate investments in shipbuilder facilities, footprint, and machines/fixtures.

3. Strategic Outsourcing: Increase supplier capacity to shift non-core workload away from the two submarine shipbuilders to free up footprint, resources, and focus for shipbuilder-only work.

4. Workforce Development: Train current and future trades at sufficient rates, and help build adequate hiring pool for vendors and shipbuilders.

5. Government Oversight: Increase the Navy's oversight of the vendor base as result of lessons learned from historical quality and schedule adherence challenges.

6. Technology Opportunities: Implement additive manufacturing, and non-destructive test imaging technology to remove known production risk areas and bottlenecks.

The DON began execution of these SIB efforts several years ago as building facilities, growing workforces, and increasing production rates takes time. Our dividends are not fully matured yet. Some of the significant returns on this investment include:

• 194 suppliers in 31 states received funding to generate increased production and increase capacity.

• Approximately 4 million hours strategically sourced by EB and HII-NNS to key fabricators (goal is at least 6 million hours by 2026).

• Approximately 1,000 new workforce members in more than 120 second and third-tier key suppliers with more to come each year.

• Establishment of dedicated training centers trained more than 3,500 workers since 2020.

• Establishment of an industry-wide consortium for advanced manufacturing technology supplying critical submarine components from 6 crucial submarine-specific metals contributing to 75-percent of troubled submarine components.

The DON also worked with a non-profit partner to develop the workforce recruiting and support website, "Build Submarines.com." This site serves as a central hub of information to support workforce development efforts related to our national advertising campaign for the SIB including resources for those interested in submarine construction or SIB related careers.[133] The DON is on a mission to make ship and submarine manufacturing a preferred profession again and it is a national imperative.

[133] For press reports discussing BuildSubmarines.com, see, for example, Konstantin Toropin, "Amid Struggle to Build Subs, Navy Gives Company Running Ads and Website a $1 Billion Contract," *Military.com*, September 12, 2024; Lauren C. Williams, "Navy adds $1B to Unconventional Effort to Boost Sub Production," *Defense One*, September 12, 2024; Justin Katz, "Navy Awards BlueForge Alliance New $950M Contract to Boost Sub Industrial Base," *Breaking Defense*, September 11, 2024; Sam LaGrone, "Navy Awards BlueForge Alliance $951M Contract for 'Uplifting' U.S. Submarine Industrial Base," *USNI News*, September 10 (updated September 11), 2024; Justin Katz, "Navy Investment (continued...)

> Deepening our cooperation and integration with AU [Australia] and the UK across the submarine enterprise presents a unique opportunity for innovation, growth, and mutual development. The partnership will create jobs, contribute to the diversification of ideas, and augment our collective technical and intellectual base. The partnership will also open up new markets and business opportunities, enhancing the resilience of both nations' economies. This will pave the way for additional joint ventures, thereby fostering a shared sense of purpose, knowledge exchange, and a more connected community of subject matter experts.[134]

June 2024 GAO Report

A June 2024 GAO report—the 2024 edition of GAO's annual report surveying DOD major acquisition programs—stated the following regarding the Block V version of the Virginia-class design:

> **Current Status**
>
> VCS program officials reported that the VCS delivery rate stabilized at 1.2 submarines per year, and they plan to produce at a rate of two submarines per year by 2028. However, the Navy will be challenged to improve production enough to meet the Australia-United Kingdom-United States initiative for Australia to acquire conventionally-armed nuclear-powered submarines, while also meeting the Navy's planned submarine fleet numbers.
>
> To mitigate the effects of the workforce shortages and slower-than-expected work completion rates we reported last year, program officials reported that they continue to outsource additional work, re-sequence tasks, and attempt to grow the workforce, among other actions. The Navy also rebaselined Block V's construction schedule in 2023 to align with demonstrated performance, though its delivery dates remain unchanged from last year.
>
> In June 2023, the Navy found that the shipbuilder was not meeting efficiency and schedule criteria the program set to assess shipbuilder readiness for full construction for SSN 808. As a result, the Navy delayed that event. However, program officials stated that they have been able to continue construction largely as planned. They stated that these assessments help establish priorities with the shipbuilder, and working without formal construction authorization does not limit the Navy's ability to discuss shipbuilder performance.
>
> The shipbuilder is completing work at a higher cost than expected due to the workforce shortages and slow progress noted above. Consequently, the Navy estimated in its fiscal year 2024 budget request that it will need $530 million more to complete the first two Block V submarines over the next five years.
>
> **Program Office Comments**
>
> We provided a draft of this assessment to the program office for review and comment. The program office provided technical comments, which we incorporated where appropriate. According to the program office, the Navy is working closely with the shipbuilders and the industrial base to stabilize its production rate and improve the construction process. The program stated that it has a goal of 1.5 submarine deliveries per year by the end of 2024,

in BlueForge Alliance Up to $500 Million, and Growing," *Breaking Defense*, June 7, 2024; Lauren C. Williams, "Inside the Navy's Slick Effort to Find Workers to Build Submarines," *Defense One*, June 5, 2024.

[134] Joint Statement, Honorable Erik K. Raven, Under Secretary of the Navy, VADM William J. Houston, Commander, Naval Submarine Forces, [and] RDML Jonathan Rucker, Program Executive Officer, Attack Submarines, before the House Committee on Armed Services Subcommittee on Seapower and Projection Forces, October 25, 2023, pp. 4-8.

and that continued investment in the industrial base is critical to achieve its goal of reaching a delivery rate of two per year by the end of 2028.[135]

[135] Government Accountability Office, Weapon Systems Annual Assessment[:] DOD Is Not Yet Well-Positioned to Field Systems with Speed, GAO-24-106831, June 2024, p. 153.

Appendix C. SSN Maintenance Backlog

This appendix presents additional background information on the SSN maintenance backlog.

A January 12, 2023, press report stated

> Top Navy officials this week promoted the idea of adding more public shipyards [i.e., government-operated naval shipyards, or NSYs] to improve ship maintenance.
>
> Speaking during the annual Surface Navy Association symposium on Wednesday [January 11], Adm. Daryl Caudle, Commander of U.S. Fleet Forces Command, emphatically said there is a good argument for the need to add at least a fifth public shipyard.
>
> "Of course. I need six! I need enough capacity in our shipyards to drive the backlog down to zero…I can today, if I had the backlog chipped down, have a more effective, larger fleet today." Caudle said on Wednesday during the Surface Navy Association symposium.[136]

A November 17, 2022, press report stated (emphasis added)

> **The U.S. Navy has nearly twice as many submarines sidelined for maintenance than it should**, and those boats in maintenance ultimately require three times more unplanned work than they should, the program executive officer for attacks subs has said.
>
> But the service thinks it can turn these and other problematic statistics around by changing when and how it funds submarine maintenance. In fact, Rear Adm. Jon Rucker said he thinks the Navy can implement industry best practices starting in fiscal 2026 and, by the end of that fiscal year, get to almost zero delay days.
>
> Several aspects of submarine maintenance preparation are awry, setting up the boats for poor outcomes, Rucker said this month at the Naval Submarine League's annual conference.
>
> On the planning side, engineers aren't sticking to milestones that lock the work package at a certain point; instead, they continue to jam in more work, which throws off assumptions about the materials to order and the availability of skilled labor.
>
> Because of the addition of extra work once the maintenance availability starts, coupled with unexpected problems that arise, Rucker said 30% of the total work on submarines is unplanned, compared to an industry best practice of 10%.
>
> The Navy has set a goal to get to 10% unplanned work by FY26, and much of that improvement will come from discipline in the planning process.
>
> When it comes to ordering materials, Rucker said, the Navy isn't funding these at the right amount or at the right time.
>
> For starters, he explained, the Navy only funds 40% to 50% of materials ahead of the start of a maintenance availability; the remaining amount is ordered after the availability starts and workers can get a closer look at the insides of the boat. Much of this material is considered "contingent"—the Navy will not order it until workers see that the condition of the submarine requires certain work be done and therefore materials to be ordered.
>
> The problem is that almost every single boat requires all the same contingent work, Rucker said, meaning it would be better to assume up front the work will be done and the parts are required. "We're going to buy the material anyway; we just buy it late" under the current system, he explained.
>
> By fiscal 2026, he said, the Navy will aim to have 90% to 95% of total material on hand when an availability starts, rather than today's 40% to 50% figure. This issue of buying

[136] Rich Abott, "Fleet Forces and SecNav Argue for More Maintenance Yards," *Defense Daily*, January 12, 2023.

materials earlier is made all the more dire by the increasing delivery times of many materials.

Rucker told reporters after his speech at the conference that the Navy used to get away with later material orders for two reasons: The older Los Angeles-class attack boats had a more plentiful inventory of spare parts on hand due to investments when that submarine class was in construction, and because parts not already on hand could typically be delivered within two to 12 months.

Today, the Navy has few spares on hand for the newer Virginia-class boats. And when items like large pumps and valves are unexpectedly needed, it can take as long as three years to get them made and delivered.

"We have to phase the money differently. Our model's broken because it was built on an assumption of the way things were 20 or 30 years ago, when we had three times the suppliers [in the industrial base], a very mature class" with plenty of spares on hand, he said.

"But the model doesn't support the fact that we have longer leads, fewer suppliers; it takes more time, and we didn't buy all the stuff we needed to. We're going to adjust the way we buy things," he added.

He made clear the Navy isn't asking to buy materials "early," but rather on a new timeline that better reflects long delivery times and the imperative to have 90% to 95% of the material on hand at the start of work.

Rucker said the submarine community decided on these changes too late to modify the FY23 funding request. He's working to get them implemented in the FY24 budget request, which is to be released in the spring. If the Navy can properly phase its spending on materials for submarine repair work, it will give industry a more predictable workload, ensure more materials are on hand at the start of a repair project and reduce a major barrier to submarines coming out of maintenance on schedule.

Overall, Rucker explained in his speech, the Navy has gone from nearly 1,600 delay days of maintenance for attack submarines in FY19 to 1,100 delay days in FY22, which ended Sept. 30.

Late materials alone account for more than 100 of those days, Rucker said.

His office projects that figure will come down to about 700 delay days by FY26 based on changes already implemented—and Rucker said that better planning and earlier materials purchased will get the community to as close to zero as possible by the end of FY26, assuming the changes are implemented this next budget cycle.

This drive to zero delay days comes in the context of an undersized attack submarine force that's kept busy. Navy and Pentagon leadership repeatedly call the submarine force among America's top advantages over adversaries like China and Russia; yet the U.S. has 50 attack submarines and four related "large payload submarines," compared to a requirement for a combined 66 to 72 attack and large payload subs.

Of the 50 attack subs, Rucker said 18 are in maintenance or waiting for their turn. Industry best practice would call for just 20% to be tied up in repairs, or 10 boats instead of 18.[137]

The Navy in 2010 decided to put the submarines through fewer but longer maintenance availabilities, allowing the boats to have longer operational cycles. But Rucker said this

[137] Regarding this point, see also Megan Eckstein, "Navy Frustration Building over Late Weapons, Ship Deliveries," *Defense News*, January 11, 2023; Rich Abott, "Fleet Forces and SecNav Argue for More Maintenance Yards," *Defense Daily*, January 12, 2023; Justin Katz, "As AUKUS Looms, US Navy Sub Leaders Sound Alarms at Home," *Breaking Defense*, November 4, 2022.

> new model—when all the delays are taken into account—means a sub going into maintenance is out of the fleet for an average of 450 to 700 days, depending on the class, at a time when operational commanders are itching for all the submarine presence they can get.
>
> To help overcome the backlog of maintenance work faster, construction yards Newport News Shipbuilding and General Dynamics Electric Boat are helping with some repairs of Los Angeles-class subs. The former has Columbus, and the latter was awarded a contract over the summer for repairs on Hartford.
>
> Boise, the poster child for submarine maintenance woes—it returned from its last deployment in January 2015 and has been waiting to get into maintenance since fiscal 2016, losing its certification to dive amid the delays—is expected to go into maintenance at Newport News. But Rucker said a final decision on its funding would be revealed in the FY24 budget request, and he would not comment further on plans for that boat.[138]

A November 14, 2022, press report stated

> When a U.S. attack submarine arrives for shipyard maintenance, Navy rules say the vast majority of the necessary parts and materiel must be there waiting. But most jobs actually begin with half or even fewer of the needed items on hand. That means delays, extra cost, and usually, stealing items from other projects, which compounds the problems across the sub force.
>
> That's a planning and funding problem, according to the program executive officer for attack submarines, who says he's working to fix it by 2026.
>
> "On the material side, we are not funding them properly…We do not fund the right amount and we do not phase it properly," Rear Adm. Jonathan Rucker said Nov. 2 at the annual Naval Submarine League symposium in Arlington, Virginia....
>
> Currently, just 40 to 50 percent of the required parts and material are on hand when a sub arrives in the yard, Rucker said.
>
> Part of the problem is that the Navy lacks funds for "contingent material": parts to fix problems that are discovered during the work, like valves that are found to need replacement. But, Rucker said, these kinds of things are actually predictable.
>
> "Every availability—about 90 percent—we use the same stuff. We know that, but we don't order it until then," he said.
>
> Because submarine parts are so specialized and the supply chain so constrained, this generally means the yard has to take the items from some other planned submarine-maintenance project, Rucker said.
>
> "And with lead times of material on the order of up to two years and some more, no wonder we don't have the material we have to count on," he said. "Because we order it after the avail starts, and we don't get it in time to do it, so we got to take it from somewhere else."
>
> Rucker said for new construction, the material is bought upfront. He wants to do the same for sustainment.
>
> "So, we're changing that model so where we're going to phase the funding differently and order the contingent material in advance and so it's ready," he said. "So when we get to that point, the stuff's on the shelf. That's part of the problem of not buying all that stuff early on. Decisions were made early; we got to get after it."

[138] Megan Eckstein, "US Navy Hopes New Funding Model Can Cut Sub Maintenance Delays by 2026," *Defense News*, November 17, 2022.

> By 2026, each availability will start with the required 90 to 95 percent of the material on hand, he said.
>
> But missing material is only part of what causes submarine-maintenance delays. Rucker said that planning and shipyard throughput are also causes for not "executing."
>
> Currently, the attack submarine force has about 1,100 days of maintenance delay, down from about 1,500 to 1,600 days in 2019, Rucker said, adding that improvements already in the works will reduce total annual delay days to 700 by 2026.
>
> Late material adds 100 to 111 days of delay to each availability. These are the delays that better planning and funding is intended to reduce.
>
> How the Navy could do this phased-funding approach is unclear. Rucker told reporters he is working to see which budget year to introduce it. When asked about the budgeting process for implementing something like this, officials with U.S. Naval Sea Systems Command and the Navy said they could not comment on internal budget deliberations or future budgets.[139]

A November 2, 2022, press report stated

> Within the next year the US Navy wants to initiate a "scoping study" aimed at determining if the service needs to establish a fifth public shipyard to support future submarine maintenance, according to a senior officer involved in the task, a notion that previously met with some resistance from lawmakers.
>
> Rear Adm. Jonathan Rucker, program executive officer for attack submarines, told reporters here at the Naval Submarine League symposium that industry frequently asks the Navy about considerations for a new public shipyard. He also stressed that the scoping study was preliminary and there is no clear consensus in the service yet about whether another shipyard is even necessary, let alone whether it will be built.
>
> "Right now, we're in a stage to say: 'Let's go scope how capable our shipyards could be?'" he said. Once the service completes its Shipyard Infrastructure Optimization Program, "how efficient will we be?" he continued, referring to the Navy's 20-year plan to overhaul the four existing public shipyards....
>
> Breaking Defense in May published an extensive report about one Ohio businessman's proposal to the Navy to do just that [see the May 9, 2022, press report excerpted below]. Ed Bartlett, an engineer and former enlisted sailor, called his proposal "the only actionable plan" to relieve the Navy's submarine maintenance backlog, and he has numerous former admirals, shipbuilding industry giants and local politicians backing his ideas. But at the time, lawmakers on Capitol Hill seemed unconvinced that now's the time for such a major investment. [Rep.] Joe Courtney, Conn., a House Democrat known for being hawkish on Navy spending, called it a "tall order."
>
> Rucker today said the service had underestimated several issues that are now causing problems, such as the second- and third-tier ramifications of the coronavirus pandemic. But he added that another shipyard is a "big path to go down," if that decision is ever made. Right now, the Navy's urgent focus is on improving the capabilities and efficacy of the current shipyards, he added.[140]

[139] Caitlin M. Kenney, "Only Half the Parts Are Waiting When US Attack Submarines Come in For Repairs," *Defense One*, November 14, 2022. See also Justin Katz, "As AUKUS looms, US Navy Sub Leaders Sound Alarms at Home," *Breaking Defense*, November 4, 2022.

[140] Justin Katz, "Navy 'Scoping Study' to Examine Shipyard Capacity, Potential for a New Yard," *Breaking Defense*, November 2, 2022.

A September 21, 2022, press report stated

> The submarine industrial base, already strained by demand for new construction, may need to accelerate its production of spare parts to alleviate submarine maintenance woes.
>
> The vast majority of submarine maintenance availabilities run late, in part due to poor planning practices and in part because repair yards rely on a pool of replacement parts "that just doesn't exist" after the Navy failed to sufficiently prepare for Virginia-class submarine sustainment, according to two admirals.
>
> "That upfront investment didn't happen for Virginia-class, so we're missing that whole sustainment tail, or a big portion of that," Rear Adm. Scott Brown, the deputy commander of Naval Sea Systems Command for industrial operations (NAVSEA 04), said Sept. 20 at the American Society of Naval Engineers' annual Fleet Maintenance and Modernization Symposium here.
>
> "It's resulting in a lot of churn, a lot of cannibalization—so we have to take things off other boats to stick them on the boat we're trying to get out—and a lot of, frankly, frustration with the workforce on waiting for stuff that doesn't exist," he added. "Of course, that leads to delays."
>
> He said the Navy asked the Center for Naval Analyses to study the connection between material delays and extended maintenance availabilities; the research organization found the lack of material on hand "is a fairly large contribution to our delays," according to Brown.
>
> Vice Adm. Bill Galinis, the commander of NAVSEA, said Sept. 21 at the same conference that only 20% to 30% of submarine maintenance availabilities over the last decade have finished on time. The problem is worsening as the Virginia-class submarines account for a greater percentage of the undersea fleet, he said.
>
> "We've seen a significant growth in the amount of man days required to complete a submarine [maintenance] availability, particularly a Virginia-class one, and [we're] really trying to deep-dive and understand why that really is," Galinis added.
>
> He pointed to a couple potential factors. For parts purchased with annual operations and maintenance funding, global supply chain issues mean it takes longer for parts to be delivered. In some cases, it's taking up to two years, putting current and upcoming availabilities at risk.
>
> For spare parts managed through the Defense Logistics Agency or the Naval Supply Systems Command, the Navy has only funded some of these at about 40% or 50% in recent years. As a result, parts simply aren't in the inventory when needed by the Navy's four public shipyards.
>
> And, Galinis added, the rotable pool of spares is too small due to a lack of investment in the early years of the Virginia-class acquisition. The rotable pool is made up of parts taken off a submarine by shipyard workers and later refurbished for use in the future.
>
> He added that the refurbishment process is moving too slowly, meaning parts aren't available when needed. Galinis said the Navy may have to contract out some of that refurbishment work.
>
> Brown told Defense News his office, which oversees the work of all four public shipyards, wants to increase the inventory of each component in the rotable pool and also add new types of components that have particularly blocked the service from completing maintenance availabilities on time.
>
> Brown said he doesn't expect the problem to cost the Navy more, but the service may need to spend more quickly on spares and sustainment.

> "That's going to cause a push of material dollars to the left in the [five-year Future Years Defense Program] to buy early to make sure we have that stuff. But it's eventually going to equalize out, because we're going to end up buying it anyway," he said.
>
> Galinis also pointed to a lack of rigor in submarine planning and project management, which he said is exacerbating the maintenance delays.
>
> A number of pre-availability assessments and tests must take place on all submarines, aircraft carriers and surface ships to help identify the exact condition of the ship and what work is needed.
>
> "The submarine force is probably the hardest one for us to get that done, principally because of their operational schedule and just in some cases the difficulty getting teams out to a submarine," Galinis said. But it means some planning documents aren't completed until the submarine is back in port, generating additional delays.
>
> Indeed, whereas surface ships only see about 10% so-called unplanned work, aircraft carriers have been seeing a 22% unplanned work rate and submarines are nearing 30%, the NAVSEA commander said.[141]

A July 11, 2022, press report stated that

> maintenance issues are hindering the East Coast fleet's readiness, according to Adm. Daryl Caudle, who leads U.S. Fleet Forces Command....
>
> [Caudle stated:] "As far as some things I'm seeing where we're not performing: Let's go to the submarine force first. The lack of capacity and the lack of performance at our public and private yards are driving availabilities—these are depot availabilities now—past our class maintenance time frames to such an extent that they have consumed all the dry docks. So if I have an emergent issue, I don't really have good options to bring in units for those things that may be emergent dry-docking repairs. They have also forced ships—because submarines expire, their hulls expire—for them to be tied up alongside waiting on their availability to start because there's no place to put them. We call those idle submarines.
>
> "The number of idle submarines has crept up over time. They fluctuate now between five to, worst case, it got to a point we were at about nine out. So these are submarines just sitting pierside because the hulls expired, they can't submerge and they're not ready to go into their depot availability. This backlog is causing me to lose fleet size due to this problem."[142]

A May 12, 2022, press report states

> Chief of Naval Operations Adm. Michael Gilday had blunt words today for two powerhouse companies that build submarines for the Navy: We need your shipyards, but not the problems that come with them.
>
> "We know that we don't have the capacity in our public shipyards to handle all of that [submarine] maintenance. We need Electric Boat and we need Huntington Ingalls to be able to do that work," said Gilday. "They are under performing. They are over cost and way over schedule."
>
> Gilday was testifying before the Senate Armed Services Committee about the Navy's fiscal 2023 budget request alongside Navy Secretary Carlos Del Toro and Marine Corps Commandant Gen. David Berger....

[141] Megan Eckstein, "Submarine Fleet Needs More Spare Parts to Stem Maintenance Delays," *Defense News*, September 21, 2022. See also Sam LaGrone, "NAVSEA: Navy 'Struggling' to Get Attack Subs Out of Repairs on Time as Demand Increases," *USNI News*, September 21, 2022.

[142] Megan Eckstein, "Six Questions with the Head of US Fleet Forces Command," *Defense News*, July 11, 2022.

> Todd Corillo, a Newport News Shipbuilding spokesman, in a statement to Breaking Defense, acknowledged the shipbuilder has "experienced challenges" since reconstituting its submarine repair business "following a 10-year hiatus."
>
> "In this time, we have built a proficient workforce, matured the supply chain, developed process improvements and made smart investments in required facilities," he said. "Although we experienced challenges with our transition back into this complex business, we are now keeping pace with current submarine repair needs and also forecasting future workflow to drive predictable capacity and performance."[143]

A May 9, 2022, press report stated

> With the Navy working through its long-term plan to relieve the notorious submarine maintenance backlog and other well-known issues piling up at the service's four public shipyards, into the space has stepped Ed Bartlett, an engineer and former enlisted sailor who has spent the last several years arguing that the solution is obvious: It's time to build a fifth shipyard.
>
> Bartlett has now twice pitched the Navy on a proposal to buy and build a fifth public shipyard and depot facility in Ohio. His company calls the proposal "the only actionable plan" to relieve the Navy's submarine maintenance backlog, and his offer has the backing of former admirals, a shipbuilding industry giant and local politicians.
>
> But what may seem an easy solution on paper has, so far, been met with cold reality. The Navy rejected Bartlett's proposal the first time due to cost and policy concerns, and still sees issues with a revised proposal submitted earlier this year. There's also a host of technical and legal hurdles any plan for a new shipyard in the Great Lakes would have to overcome.
>
> And while lawmakers have been less than impressed with the Navy's long-term, $21 billion Shipyard Infrastructure Optimization Plan (SIOP), there doesn't seem to be much energy around the idea of a new shipyard—at least outside of the Ohio delegation, who would benefit from Bartlett's pitch.
>
> With the Navy's first admiral directly charged with overseeing SIOP set to testify in front of Congress this week for the first time, the one thing that all sides seem to agree on is this: The Navy must move faster to get its ships out of port and underway, and business as usual will only leave the US critically vulnerable in a future conflict.[144]

A February 16, 2022, press report stated

> The U.S. Navy attack submarine force inventory is at a low, and maintenance backlogs are making it harder to conduct important development work, the commander of the submarine force in U.S. Pacific Fleet said this week.
>
> Rear Adm. Jeffrey Jablon said the SSN fleet sits at just 47 today—down from 50 attack subs in the fall, due in part to submarine decommissionings happening as planned while new deliveries from industry run behind schedule.
>
> That 47 is further diminished by maintenance challenges, he said while speaking at a Feb. 16 panel at the WEST 2022 conference, cohosted by the U.S. Naval Institute and AFCEA International.
>
> In fiscal 2016, because of idle time for subs awaiting maintenance—on boats which have exceeded their operational limits and were no longer allowed to submerge under the water until they underwent maintenance—the Navy lost about 360 days of operations.

[143] Justin Katz, "Navy's Submarine Builders 'Over Cost', 'Under Performing': Top Admiral," *Breaking Defense*, May 12, 2022.

[144] Justin Katz, "Is a New Navy Shipyard Realistic, or Just a 'Tall Order?'" *Breaking Defense*, May 9, 2022.

> In FY21, the fleet lost nearly 1,500 days to idle time—the equivalent of taking four submarines out of the fleet.
>
> Additionally, Jablon said in FY21 the fleet lost the equivalent of 3.5 submarines to repair periods that ran longer than planned.
>
> "That's about seven and a half SSNs that I cannot use last year because of awaiting maintenance or maintenance delay," he said.
>
> Even with that smaller fleet, he told Defense News, "we meet all our operational commitments. We're able to ensure that our ships are combat ready when they deploy. We meet the requirements of our combatant commanders that are placed upon us."
>
> But "it results in less ability to do tactical development at sea," Jablon added, noting it also cuts into commanding officers' discretionary time at sea to bolster training in particular areas.
>
> "We're still able to prepare the ship to be combat ready when they deploy," he said, but "it's more difficult, it's more deliberate, it takes more input from the [type commander] staff to do that."[145]

A September 22, 2020, press report stated

> It has been five years since the attack submarine Boise returned from its last patrol, and this whole time she has been waiting on some loving care and attention in the shipyards.
>
> On Monday [September 21], the check cleared for roughly $351.8 million that covers the initial planning and work as part of her overhaul at Huntington Ingalls Newport News Shipbuilding where she has been in dry dock since earlier this year. Another contract covering the full engineering overhaul is in negotiations, according to Naval Sea System Command spokesperson Colleen O'Rourke,[146] work that will include significant maintenance on the nuclear propulsion system and modernization upgrades.
>
> The running tab on Boise so far is $355 million, with advanced planning money already awarded, according to the Defense Department contract announcement. The work under this contract is scheduled to wrap up in May 2023, eight years after the sub left the operational fleet.
>
> While Boise could be wrapped up by 2023—the overhaul was initially scheduled for 25 months—it's possible the repairs could take longer, O'Rourke said.
>
> The bill will be paid out of 2020 Operations & Maintenance funding, according to the contract announcement.
>
> Boise has been something of a cause célèbre among congressional leaders, who have pointed to the ship's long wait to enter the shipyard as emblematic of the Navy's struggle with maintenance delays. The issue with attack submarines has been complicated, because while that work would typically be done in the public shipyards, those have been backed up with aircraft carriers and the Ohio-class ballistic missile subs.
>
> Some of the Navy's problems will resolve themselves after ballistic missile subs are refueled, said Bryan Clark, a retired submarine officer and analyst with the Center for Strategic and Budgetary Assessments, in a 2019 interview.
>
> "The big factor here is that attack submarines are last in line when it comes to maintenance," Clark explained then. "And that maintenance is done in the public yards, both the refueling and non-refueling overhauls. So that's why you see submarines like

[145] Megan Eckstein, "Submarine Maintenance Backlogs and Delays Take Toll on Fleet's Development Work at Sea," *Defense News*, February 16, 2022.

[146] Colleen O'Rourke is no relation to Ronald O'Rourke.

Boise who have been waiting a long time to get in, because carriers had a lot of maintenance backlog".

"And working through that backlog pushed SSBN refuelings back, and that in turn pushed attack subs to the end of the line. Now that they are working through the carrier backlog and the SSBN refueling is now largely completed, that's going to mean the attack submarines can be brought back into the public shipyards. So that's a structural issue that's going to work itself out."

But other aspects of the Navy's quest to dig out of the submarine backlog are thornier and will require the service to make long-term commitments to private shipyards, Clark said. One of the main issues with assigning attack subs to private shipyards is that they are not necessarily set up as maintenance shops: They're more so built and organized as new construction yards.

Naval Sea Systems Command acknowledged as much in a statement to the Virginian Pilot as part of a story on the delays of Columbus and Helena, which the command attributed to "the workforce's inexperience in conducting submarine maintenance, which differs greatly from new construction."…

In an interview with USNI News, former Naval Sea Systems Command head Vice Adm. Thomas Moore said he thought Boise would go better than previous attempts at maintaining attack boats in private shipyard.

"I think we are well-positioned on Boise, certainly way better than we were on Helena and Columbus, when we learned so many lessons the hard way," Moore said. "They hadn't done submarine work in 10 years, and I think we underestimated how they had atrophied in that skill set. I think they did as well.

"And the other thing is, I think we recognized that we probably put too much on their plate, with multiple [maintenance] availabilities [i.e., ship maintenance projects] on their plate at one time."[147]

An August 2020 GAO report on maintenance delays on aircraft carriers and submarines stated

The Navy's four shipyards completed 38 of 51 (75 percent) maintenance periods late for aircraft carriers and submarines with planned completion dates in fiscal years 2015 through 2019, for a combined total of 7,424 days of maintenance delay. For each maintenance period completed late, the shipyards averaged 113 days late for aircraft carriers and 225 days late for submarines.

Unplanned work and workforce factors—such as shipyard workforce performance and capacity (having enough people to perform the work)—were the main factors GAO identified as causing maintenance delays for aircraft carriers and submarines. The Navy frequently cited both factors as contributing to the same days of maintenance delay. Unplanned work—work identified after finalizing maintenance plans—contributed to more than 4,100 days of maintenance delays. Unplanned work also contributed to the

[147] David B. Larter, "The Hapless Attack Sub Boise Could Return to the Fleet in 2023 After 8 Years Sidelined," *Defense News*, September 22, 2020.

> Navy's 36 percent underestimation of the personnel resources necessary to perform maintenance. The workforce factor contributed to more than 4,000 days of maintenance delay on aircraft carriers and submarines during fiscal years 2015 through 2019.
>
> The Navy has taken steps but has not fully addressed the unplanned work and workforce factors causing the most maintenance delays. First, the Navy updated planning documents to improve estimates and plans to annually update these data, but knowing whether changes improve results may take several years. Second, the Navy has consistently relied on high levels of overtime to carry out planned work. GAO's analysis found that high overtime among certain production shops, such as painting or welding, averaged from 25 to 32 percent for fiscal years 2015 through 2019, with peak overtime as high as 45 percent. Furthermore, shipyard officials told us that production shops at all four shipyards are working beyond their capacity. Overtime at such rates has been noted as resulting in diminished productivity. Third, the Navy initiated the Shipyard Performance to Plan initiative in the fall of 2018 to address the unplanned work and workforce factors, but it has not yet developed 13 of 25 planned metrics that could improve the Navy's understanding of the causes of maintenance delays. In addition, the Shipyard Performance to Plan initiative does not include goals, milestones, and a monitoring process along with fully developed metrics to address unplanned work and workforce weaknesses. Without fully developing metrics and implementing goals, action plans, milestones, and a monitoring process, the shipyards are not likely to address unplanned work and workforce weaknesses and the Navy is likely to continue facing maintenance delays and reduced time for training and operations with its aircraft carriers and submarines.[148]

A May 26, 2020, press report stated

> After years of struggling to conduct attack submarine maintenance—with the four public naval shipyards prioritizing SSN work last, behind a backlog of ballistic-missile sub and aircraft carrier work, and private shipyards finding it tough to resume submarine repair work after years of only doing new construction—the Navy appears back on track for its SSN maintenance, the head of Naval Sea Systems Command told USNI News.
>
> The move of attack submarine USS Boise (SSN-764) to the dry dock at Newport News Shipbuilding in Virginia is the most visible sign of things moving in the right direction, after the sub has been sitting pier side at nearby Norfolk Naval Shipyard for more than four years waiting for maintenance to begin.
>
> The Navy had previously hoped to get Boise into Newport News as early as 2018, but the private yard struggled with its first two Los Angeles-class SSN maintenance periods—for USS Helena (SSN-725) and USS Columbus (SSN-762)—and didn't have the room for the sub or the workforce to start working on it. As Boise lingered, it became a focal point in the discussion about a lack of repair capacity and a backup of work at the four public naval shipyards.
>
> But, NAVSEA Commander Vice Adm. Tom Moore told USNI News, the Navy is moving into a new era of on-time submarine maintenance….
>
> Moore told USNI News in an interview last week that "I think we are well-positioned on Boise, certainly way better than we were on Helena and Columbus, when we learned so many lessons the hard way: that, one, they hadn't done submarine work in 10 years, and I think we underestimated how they had atrophied in that skill set, and I think they did as well; and the other thing is, I think we recognized that we probably put too much on their plate, with multiple availabilities on their plate at one time." …
>
> Moore said that Electric Boat likely won't be a provider of submarine maintenance for much longer–aside from an availability for USS Hartford (SSN-768) that starts in

[148] Government Accountability Office, *Navy Shipyards[:] Actions Needed to Address the Main Factors Causing Maintenance Delays for Aircraft Carriers and Submarines*, GAO-20-588, August 2020, summary page.

> November 2021, the Connecticut yard will have its hand full with construction of Columbia-class SSBNs and Block V Virginia-class SSNs. Moore said it's important to get the sub repair capability reconstituted at Newport News Shipbuilding so that one private yard can serve as part of the SSN repair community….
>
> Moore acknowledged that the bulk of the Navy's problems in recent years was that its four public shipyards, tasked with maintaining nuclear-powered submarines and aircraft carriers, did not have the capacity to keep up with demand….
>
> If the plan can be executed, Moore said the anticipated work at Norfolk Naval Shipyard matches the workforce capacity, meaning there should be no more backlog….
>
> Though Boise has remained a "problem child" for longer than anticipated, Moore noted in the recent interview that SSN maintenance is wrapping up on time more and more as capacity at the public yards grows….
>
> Moore said he was confident NAVSEA was in a good position on SSN maintenance because a whole set of improvements had been made in tandem in recent years: not only was the [naval shipyard] workforce now up to its goal of 36,700 personnel, but an effort to create better business practices is underway and the first projects in a 20-year Shipyard Infrastructure Optimization Plan (SIOP) program are already hitting the waterfront.[149]

A March 2019 Navy report to Congress states that in response to the above committee report language

> The Navy submitted an initial [submarine maintenance] plan in December 2018, that reflected FY 2019 budget information. The Navy has [now] updated this plan to incorporate data from the President's FY 2020 budget submitted on March 11, 2019….
>
> … In the post-Cold War and post 9/11 era, there have been decades of decisionmaking associated with the re-posturing of defense strategies, such as: the reduction in maintenance capacity and flexibility though Base Realignment and Closures (BRAC), increased Operational Tempo (OPTEMPO), evolution of submarine life cycle maintenance plans, budget reductions, and budget uncertainties that have contributed to the current challenges facing the submarine fleet.
>
> The root cause of submarine idle time and associated loss of operational availability, as discussed in the recent Government Accountability Office (GAO) report 19-229, "Actions Needed to Address Costly Maintenance Delays Facing the Attack Submarine Fleet" (issued November 2018), is largely due to public shipyard capacity not keeping pace with growing maintenance requirements that have been building for a number of years prior to the USS BOISE (SSN 764) FY 2016 Engineered Overhaul (EOH). The workload to capacity mismatch resulted in lower priority attack submarine (SSN) availabilities (as compared to ballistic missile submarines and nuclear-powered aircraft carriers) being delivered late and a bow-waving of workload from one fiscal year to the next that could not be executed. The workload backlog exacerbated the public shipyard workload-to-capacity mismatch and contributed to an increasing trend in late SSN [maintenance] deliveries.
>
> The Navy has taken several actions to improve the workload-to-capacity balance at the public shipyards. Notably, over 20,600 workers were hired from FY 2013 through FY 2018, which after accounting for attrition, increased total end strength from 29,400 to 36,700. However, the accelerated hiring resulted in 56 percent of the production workforce having less than five years of experience. The less experienced workforce requires a greater investment in training, as described in the Navy's Report to Congress on the Naval Shipyard Development Plan (issued March 2018), which offers some near term productivity gains. The Navy has also taken additional actions to balance workload at our

[149] Megan Eckstein, "NAVSEA Says Attack Sub Repairs Much Improved as USS Boise Enters Yard Following 4-Year Wait," *USNI News*, May 26, 2020.

> public shipyards by outsourcing four submarine maintenance availabilities to the private sector and plans to outsource another two submarine availabilities to the private shipyards starting in FY 2020 and FY 2021. Additionally, to ensure on-time delivery from maintenance availabilities, availability inductions have been rescheduled to occur when the shipyards have the capacity to accomplish the availability(s) within programmed schedule durations. This necessary action to improve the on-time delivery of current maintenance availabilities has resulted in some additional submarine maintenance backlog and some accumulation of idle time. Based on actions and initiatives the Navy is currently pursuing to improve submarine operational availability and the outsourcing of two additional submarine availabilities to the private sector, the Navy assesses that the submarine idle time will be eliminated by the end of FY 2023 and the submarine maintenance backlog will be worked off by the end of FY 2023.[150]

A November 2018 GAO report on the issue stated the following:

> The Navy has been unable to begin or complete the vast majority of its attack submarine maintenance periods on time resulting in significant maintenance delays and operating and support cost expenditures. GAO's analysis of Navy maintenance data shows that between fiscal year 2008 and 2018, attack submarines have incurred 10,363 days of idle time and maintenance delays as a result of delays in getting into and out of the shipyards. For example, the Navy originally scheduled the USS Boise to enter a shipyard for an extended maintenance period in 2013 but, due to heavy shipyard workload, the Navy delayed the start of the maintenance period. In June 2016, the USS Boise could no longer conduct normal operations and the boat has remained idle, pierside for over two years since then waiting to enter a shipyard…. GAO estimated that since fiscal year 2008 the Navy has spent more than $1.5 billion in fiscal year 2018 constant dollars to support attack submarines that provide no operational capability—those sitting idle while waiting to enter the shipyards, and those delayed in completing their maintenance at the shipyards.
>
> The Navy has started to address challenges related to workforce shortages and facilities needs at the public shipyards. However, it has not effectively allocated maintenance periods among public shipyards and private shipyards that may also be available to help minimize attack submarine idle time. GAO's analysis found that while the public shipyards have operated above capacity for the past several years, attack submarine maintenance delays are getting longer and idle time is increasing. The Navy may have options to mitigate this idle time and maintenance delays by leveraging private shipyard capacity for repair work. But the Navy has not completed a comprehensive business case analysis as recommended by Department of Defense guidelines to inform maintenance workload allocation across public and private shipyards. Navy leadership has acknowledged that they need to be more proactive in leveraging potential private shipyard repair capacity. Without addressing this challenge, the Navy risks continued expenditure of operating and support funding to crew, maintain, and support attack submarines that provide no operational capability because they are delayed in getting into and out of maintenance.[151]

[150] U.S. Navy, *President's FY 2020 Budget Update to Report to Congress on Submarine Depot Maintenance Prepared by Secretary of the Navy*, generated March 12, 2019, with cover letters dated March 21, 2019, provided to CRS by Navy Office of Legislative Affairs on March 27, 2019, pp. 3-4.

[151] Government Accountability Office, *Navy Readiness[:] Actions Needed to Address Costly Maintenance Delays Facing the Attack Submarine Fleet*, GAO-19-229, November 2018, summary page.

Appendix D. December 2021 Determinations Pursuant to Defense Production Act (DPA)

This appendix presents background information on three determinations signed by President Biden on December 21, 2021, permitting the use of the Defense Production Act (DPA)[152] to strengthen the U.S. submarine industrial base for the purpose of increasing production of Virginia-class submarines.

A December 21, 2021, memorandum from President Biden to Secretary of Defense Lloyd Austin stated

> By the authority vested in me as President by the Constitution and the laws of the United States of America, including section 303 of the Defense Production Act of 1950, as amended (the "Act") (50 U.S.C. 4533), I hereby determine, pursuant to section 303(a)(5) of the Act, that
>
> (1) Large Scale Fabrication, Shipbuilding Industrial Base Expansion for Resilience and Robustness, and Maritime Workforce Training Pipelines in support of Virginia Class attack submarine production are industrial resources, materials, or critical technology items essential to the national defense;
>
> (2) without Presidential action under section 303 of the Act, United States industry cannot reasonably be expected to provide the capability for the needed industrial resource, material, or critical technology item in a timely manner; and
>
> (3) purchases, purchase commitments, or other action pursuant to section 303 of the Act are the most cost-effective, expedient, and practical alternative method for meeting the need.
>
> Pursuant to section 303(a)(7)(B) of the Act, I find that action to expand the domestic production capability for these supply chains is necessary to avert an industrial resource or critical technology item shortfall that would severely impair national defense capability. Therefore, I waive the requirements of section 303(a)(l)-(a)(6) of the Act for the purpose of expanding the domestic production capability for these supply chains.
>
> Ensuring a robust, resilient, and competitive domestic defense industrial base that has the capability, capacity, and workforce to meet the Virginia Class submarine undersea warfighting mission is essential to our national security.
>
> You are authorized and directed to publish this determination in the Federal Register.[153]

A December 22, 2021, DOD statement about the presidential determinations stated

> The president signed on Dec. 21, 2021 three determinations permitting the use of the Defense Production Act (DPA) to strengthen the U.S. submarine industrial base. The expansion of the authority will allow the U.S. Navy to maintain its maritime superiority.
>
> Scaling the production of Virginia Class Attack Submarines will ensure the U.S. Navy can meet its missions to maintain open sea lanes for global communication and commerce, enhance diplomatic partnerships, and grow a robust underwater warfare capability.

[152] For more on the DPA, see CRS Report R43767, *The Defense Production Act of 1950: History, Authorities, and Considerations for Congress*, by Heidi M. Peters, and CRS In Focus IF11767, *The Defense Production Act Committee (DPAC): A Primer*, by Michael H. Cecire.

[153] White House, "Memorandum on the Presidential Determination Pursuant to Section 303 of the Defense Production Act of 1950, as Amended," December 21, 2021.

> Through the DPA, the U.S. Navy can make key investments with the manufacturers and suppliers executing the submarine shipbuilding plan.
>
> These activities will strengthen the shipbuilding industrial base and allow its heavy manufacturing and large scale fabrication suppliers to meet growing demand and expand the maritime workforce training pipeline.
>
> The department continues to work with key stakeholders to use the DPA authorities to address risks and challenges across the Submarine Enterprise supply chain. These authorities expand options and opportunities to accelerate and scale critical investments across key markets.[154]

Regarding Title III of the DPA, DOD states

> The Defense Production Act (DPA) Title III program is dedicated to ensuring the timely availability of essential domestic industrial resources to support national defense and homeland security requirements. The program works in partnership with the Uniformed services, other government agencies, and industry to identify areas where critical industrial capacity is lagging or non-existent. Once an area is identified, the program engages with domestic companies to mitigate these risks using grants, purchase commitments, loans, or loan guarantees. By executing its mission, the DPA Title III program reduces the nation's reliance on foreign supply chains and ensures the integrity of materials supplied to the American Warfighter.
>
> The DPA Title III program, governed by 50 USC 4531-4534, is one of the key investment tools of the [DOD] Industrial Policy office.[155]

A December 22, 2021, Navy information paper states

> The Defense Production Act (DPA) Title III program is dedicated to ensuring the timely availability of essential domestic industrial resources to support national defense and homeland security requirements. The program works in partnership with the Uniformed services, other government agencies, and industry to identify areas where critical industrial capacity is lagging or non-existent. Once these fragilities, vulnerabilities, or opportunities are identified, DPA authorities are uniquely positioned to allow engagement with domestic suppliers that mitigate capacity and capability risks using grants, purchase commitments, loans, or loan guarantees
>
> As the U.S. Navy continues to build a more lethal force that maintains maritime superiority, enables sea lanes of global communication and commerce, and ensures diplomatic partnerships, strategic undersea warfare remains the foundation. With VIRGINIA Class (VCS) currently challenged to meet a two per year production cadence, increasing the capacity and capabilities of the submarine industrial base is necessary to achieve the generational increase in demand. This demand will continue to grow with serial production of one (1) COLUMBIA Class (CLB) submarine plus two VIRGINIA Class (VCS) submarines per year expected to start in Fiscal Year 2026.
>
> DPA Title III authorities granted in these PDs support Navy efforts to achieve and sustain consistent production of the VCS Program, meeting schedule and a cadence of two VCS per year in accordance with authorizations and appropriations, concurrent with the national priority CLB Class Ballistic Missile Submarine Program. Specific areas of focus for leveraging these authorities are: strategic sourcing expansion, shipbuilding industrial base expansion for resilience and robustness, and growing the maritime workforce training pipeline.

[154] Department of Defense, "Defense Production Act Title III Presidential Determinations for Submarine Industrial Base Production Capacity Essential to the Virginia Class Attack Submarine Program," December 22, 2021.

[155] Department of Defense, "Defense Production Act (DPA) Title III," undated, accessed January 3, 2022.

Specific projects with associated costs and timelines to support sustained 1 CLB + 2 VCS per year are being refined, and the Navy will consider where this DPA Title III authority will best mitigate capacity and capability risks.[156]

[156] Navy information paper entitled "Defense Production Act Title III—Presidential Determination for Virginia Class Production," December 22, 2021, provided to CRS and CBO by Navy Office of Legislative Affairs on January 7, 2022. See also Sten Spinella, "Defense Production Expansion Could Bring Help to Region's Submarine Industry," *New London Day*, January 3, 2022.

Appendix E. AUKUS-Related: Reduction in Size of U.S. SSN Force from Selling Virginia-Class Boats to Australia

This appendix provides further discussion of the reduction in the size of the U.S. SSN force that would result from selling three to five Virginia-class boats to Australia.

Overview

The U.S. Navy anticipates eventually building three to five additional Virginia-class SSNs in the 2030s as replacements for submarines sold to Australia. Until the replacement boats are built for the U.S. Navy, selling three to five Virginia-class boats to Australia would reduce the size of the U.S. Navy's SSN force. The reduction in the U.S. SSN force would begin in FY2032 (when the first Virginia-class boat would be sold) and (as estimated by CRS and CBO) would last until sometime between 2040 and 2049:

- Based on Navy testimony and potential construction times for SSNs, CRS notionally estimates that if the Navy were able to increase SSN production rates along the lines that the Navy has described, then the third replacement boat might enter service around 2043, and the fourth and fifth replacement boats, if needed, might enter service around 2046 and 2049, respectively.
- CBO, based on a detailed SSN procurement projection CBO developed, estimates that if the Navy were able to increase SSN production rates along the lines that the Navy has described, then the third replacement boat would enter service in 2040 and the fourth and fifth replacement boats, if needed, would enter service in 2042 and 2049, respectively.
- In other words, CRS and CBO estimate that if three Virginia-class boats are sold to Australia, the reduction in the size of the U.S. SSN force would last until 2040 (CBO) or 2043 (CRS), that if four Virginia-class boats are sold to Australia, the reduction would last until 2042 (CBO) or 2046 (CRS), and that if five Virginia-class boats are sold to Australia, the reduction would last until 2049 (both CBO and CRS).
- These estimated dates are dependent on the ability of the Navy and the U.S. submarine construction industrial base to increase the Virginia-class production rate to 2.0 boats per year by 2028 and to 2.33 boat per year sometime after that. If the Virginia-class production rate falls short of these goals, then the reduction in the size of the SSN force could last longer than the dates cited above.

Detailed Discussion

The Navy stated in its FY2024 30-year shipbuilding plan that "the Navy anticipates building additional Virginia class SSNs in the 2030s as replacements for submarines sold to Australia." Strictly construed, building additional SSNs as replacements for three to five Virginia-class boats sold to Australia would involve building three to five SSNs that would be in addition to those that were already envisaged as being built under the Navy 30-year shipbuilding plan that preceded the announcement of the AUKUS agreement in September 2021. The Navy 30-year shipbuilding plan with 30-year ship procurement profiles that preceded the announcement of the AUKUS

agreement in September 2021 is the Navy FY2020 30-year (FY2020-FY2049) shipbuilding plan, which was submitted in March 2019. This 30-year plan includes the procurement of SSNs at a steady rate of two boats per year from FY2021 through FY2049.[157]

On this basis, it might be argued that building replacement SSNs for three to five Virginia-class boats sold to Australia would involve building SSNs at a rate of something more than two boats per year. At an October 25, 2023, hearing on the submarine industrial base and its ability to support the AUKUS framework before the Seapower and Projection Forces Subcommittee of the House Armed Services Committee, the Navy testified that supporting both U.S. Navy and AUKUS needs would require the increasing the Virginia-class construction rate from 2.0 boats per year to 2.33 boats per year.[158] Compared with a previously planned procurement rate of 2.0 boats per year, a procurement rate of 2.33 boats per year would equate to one additional boat every three years.

If the first replacement boat were procured in FY2030 and an additional replacement boat were procured every three years thereafter (i.e., in FY2033, FY2036, and so on if needed), and if each boat were to take seven years to build (which is a construction time that might be reasonable under projected construction conditions), then CRS notionally estimates that the third replacement boat might enter service around 2043, and the fourth and fifth replacement boats, if needed, might enter service around 2046 and 2049, respectively.

CBO, based on a detailed SSN procurement projection CBO developed under which the first four replacement boats are procured at one- and two-year intervals rather than three-year intervals, estimates that the third replacement boat would enter service in 2040, and the fourth and fifth replacement boats, if needed, would enter service in 2042 and 2049, respectively.[159]

Whether the U.S. submarine construction industrial base would be able to achieve an SSN construction rate of 2.33 boats per year, particularly as it also is building new Columbia-class ballistic missile submarines, is a question that may be considered. As discussed later in this report, although Virginia-class submarines are currently being procured at a rate of two boats per year, the submarine construction industrial base is currently able to build them at a rate of about 1.2 to 1.3 boats per year, resulting in a growing backlog of SSN construction work, and the Navy does not anticipate the Virginia-class construction rate reaching 2.0 boats per year until 2028.

As noted earlier, the supplemental funding for the submarine industrial base requested on October 20, 2023, is intended to help increase the capacity of the submarine industrial base to support both pre-AUKUS U.S. Navy needs and additional submarine-construction needs that would be required for implementing the AUKUS agreement. If the Navy is not able to achieve an SSN construction rate of 2.33 boats per year, then replacement boats for those sold to Australia could enter service with the U.S. Navy later than indicated in the above CRS and CBO estimates, or perhaps not be built at all.

Under the Navy's FY2024 30-year (FY2024-FY2053) shipbuilding plan, the Navy's SSN force—without the sale of any Virginia-class boats to Australia—was projected to include 50 SSNs in FY2035 and either 55, 57, or 60 SSNs in FY2045. The FY2035 figure of 50 SSNs represents a shortfall of about 24% relative to the Navy's SSN force-level goal of 66 boats, while the FY2045

[157] U.S. Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020*, March 2019, Table A2-1 on page 13.

[158] Joint Statement, Honorable Erik K. Raven, Under Secretary of the Navy, VADM William J. Houston, Commander, Naval Submarine Forces, [and] RDML Jonathan Rucker, Program Executive Officer, Attack Submarines, before the House Committee on Armed Services Subcommittee on Seapower and Projection Forces, October 25, 2023, p. 5.

[159] Source CBO email to CRS, October 30, 2023. See also Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2024 Shipbuilding Plan*, October 2023, Box 1 on pp. 28-29.

figures of 55, 57, and 60 boats represent shortfalls of about 17%, 14%, and 9%, respectively, relative to the Navy's SSN force-level goal of 66 boats.

Selling three Virginia-class boats to Australia by FY2035, and not replacing them through the construction of additional Virginia-class boats by FY2035, would reduce the projected number of SSNs in FY2035 to 47 boats, which would increase the percentage shortfall in the number of Navy SSNs relative to the Navy's SSN force-level goal in FY2035 from the above-mentioned figure of about 24% to about 29%.

Selling three Virginia-class boats to Australia by FY2045, and not replacing them through the construction of additional Virginia-class boats by FY2045, would reduce the projected number of SSNs in FY2045 to 52, 54, or 57 boats, which would increase the percentage shortfalls in the number of Navy SSNs relative to the Navy's SSN force-level goal in FY2045 from the above-mentioned figures of about 17%, 14%, and 9%, respectively, to about 21%, 18%, and 14%, respectively.

Selling five Virginia-class boats to Australia by FY2045, and not replacing them through the construction of additional Virginia-class boats by FY2045, would reduce the projected number of SSNs in FY2045 to 50, 52, or 55 boats, which would increase the percentage shortfalls in the number of Navy SSNs relative to the Navy's SSN force-level goal in FY2045 from the above-mentioned figures of about 17%, 14%, and 9%, respectively, to about 24%, 21%, and 17%, respectively.

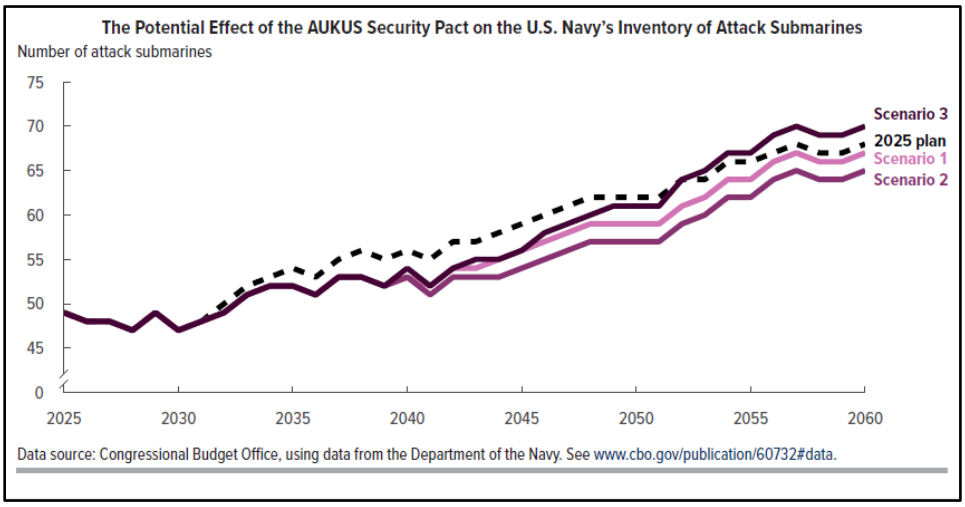
January 2025 CBO Report

A January 2025 CBO report on the cost of the Navy's FY2025 30-year (FY2025-FY2054) shipbuilding plan stated the following regarding the impact on the U.S. SSN force of selling three to five Virginia-class boats to Australia:

> The Navy's 2025 shipbuilding plan discusses the prospective submarine sales under the AUKUS security pact, but it does not address whether or when replacements for those submarines would be ordered. The report states that the Navy would purchase 2 SSNs per year "in support of the National Defense Strategy and AUKUS."1 However, given the Virginia class submarines' 33-year service life, purchasing 2 SSNs per year would allow the Navy only to achieve and maintain its own force goal of 66 attack submarines; to accommodate the prospective sales under AUKUS, the submarine industrial base would need to increase the production rate of the SSNs….
>
> In Scenario 1, the United States would sell 3 Virginia class SSNs to Australia—2 used (in 2032 and 2035) and 1 new (in 2038). The used ships would have roughly 20 years of remaining service life, so they would probably come from the recently completed or soon-to-be-completed group of submarines known as Block IV. The new SSN would be the first ship completed from the group of submarines the Navy plans to order between 2030 and 2036, known as Block VII.
>
> In Scenario 2, the United States would sell 5 attack submarines to Australia—2 used ships from Block IV (in 2032 and 2035) and 3 new ones from future blocks (in 2038, 2041, and 2044). Under the 2025 plan, the SSN force would consistently number 50 or more ships beginning in 2032 and would grow to 66 by 2054. In Scenarios 1 and 2, the Navy would have between 3 and 5 fewer SSNs during most of the 2033–2053 period. The loss of those submarines translates to a loss of 65 operational years for the SSN force from 2032 to 2060 in Scenario 1 and a loss of 102 operational years over that period in Scenario 2. Those losses result in 28 fewer SSN deployments in Scenario 1 and 43 fewer deployments in Scenario 2.

In Scenario 3, the United States would sell 5 SSNs to Australia—2 used and 3 new, just as it would in Scenario 2—but the Navy would buy 5 more submarines in the 2030s and 2040s (1 ship every three years starting in 2033) to replace them, effectively increasing production of SSNs to 2.33 ships per year during the period in which they are scheduled to be built. In that case, the Navy would still have fewer attack submarines for 20 years, from 2032 to 2052, than it would have under its 2025 plan but more than it would have in the other two AUKUS scenarios. By 2053, however, the Navy would have a slightly larger force of SSNs in Scenario 3 than it would under the Navy's 2025 plan. Although the service would lose 40 operational years through 2052 in that scenario, it would begin regaining them in 2053, and by 2060, it would have recovered 13 of the lost operational years. The Navy would lose 17 deployments before 2052 but then regain 6 of them from 2053 to 2060. (More operational years would be regained after 2060, but estimating the amount was outside the scope of this analysis.)

CBO developed those scenarios under the assumption that Australia would purchase the smaller Virginia class SSNs instead of the larger ships with Virginia payload modules (VPMs), which add four large-diameter payload tubes to ships of that class. Under that assumption, the first two scenarios represent the minimum and maximum potential capability, respectively, that Australia could acquire from the United States under AUKUS given the time required to build new submarines. For example, the United States could not sell and deliver 5 new Virginia class SSNs to Australia in the 2030s unless Australia wanted the larger submarines with VPMs.



Would China be less deterred if the United States reduced the number of its attack submarines to help Australia develop its own submarine force? Because the United States and Australia have a strong alliance, improving the Australian navy's capability could help offset the U.S. Navy's potential loss of capability. That loss might even be more than offset because the Australian submarines would be based in the Western Pacific region and therefore could respond more quickly to any conflict with China over Taiwan or other issues in the South China Sea. However, Australia would control its own submarines, and their participation in any particular conflict would not be guaranteed. In March 2023, the Australian defense minister articulated that point when he specifically stated that his country had not promised to support the United States in any future conflict with the People's Republic of China over Taiwan as part of the AUKUS agreement.[160]

[160] Congressional Budget Office, *An Analysis of the Navy's 2025 Shipbuilding Plan*, January 2025, pp. 30-31 (Box 1).

Appendix F. AUKUS-Related: Previous Countries That Requested but Did Not Receive U.S. Naval Nuclear Propulsion Technology

This appendix provides additional background information on previous countries that requested but did not receive U.S. naval nuclear propulsion technology.

As noted earlier in this report, during the Cold War, when the United States and its allies were engaged in an extended, high-stakes, and costly strategic competition against the Soviet Union and Warsaw Pact allies, the United States reportedly turned down requests from four U.S. treaty allies other than the UK—France, Italy, the Netherlands, and Japan—to share U.S. naval nuclear propulsion technology. The United States also reportedly turned down earlier requests from Australia. A sixth U.S. treaty ally—Canada—also requested but did not receive this technology. Canada canceled its SSN project before the United States acted fully on Canada's request. A seventh country, Pakistan, also requested but did not receive the technology.

In a November 18, 1987, presentation at a conference in Ottawa, Canada, U.S. Navy Captain Robert F. Hofford, the U.S. naval attaché in Ottawa—who stated that he was expressing his own views, which did not necessarily reflect those of the U.S. government—stated that

> Canada is not the only country that has requested this particular advantage from the U.S. As a matter of fact, Canada stands at the end of a line of about six different nations [other than the UK] that have requested exactly the same support from the U.S. for [a] nuclear submarine program. In fact we have turned them all down up to this point, so Canada is in a unique position of being the first country other than the British to be allowed or to even start a technology information flow that will allow the country to pursue its lines toward a nuclear program.[161]

Regarding France, Italy, and the Netherlands, a November 5, 1987, letter from Representative Melvin Price to Secretary of Defense Caspar W. Weinberger and Secretary of Energy John S. Herrington, the full text of which is reprinted in **Appendix G**, states in part,

> It is important to appreciate that there is nothing new about an ally wanting our naval nuclear propulsion technology—or about the consistently strong U.S. policy against its releases. Over the years, we have turned down requests from a number of countries, including France, Italy, and the Netherlands.

Regarding France, a 1989 journal article on assistance that the United States provided to France on the design of French nuclear warheads stated

> One area in which the French requested but did not receive help was in antisubmarine-warfare (ASW) technology and, in particular, in silencing their own ballistic missile submarines to make them less easily tracked by Soviet hunter-killers. The U.S. Navy adamantly opposed any such assistance. Behind the navy's position was the extreme sensitivity of its own counter-ASW regime. "The security of our Poseidon-Trident force was so important that we were not going to share with anybody else the methods we used to preserve it," a senior civilian told me. Another said, "This is a jewel the navy will give to no one."[162]

[161] Transcript of presentation.

[162] Richard H. Ullman, "The Covert French Connection," *Foreign Policy*, Summer 1989 (No. 75): 16-17, accessed at https://www.jstor.org/stable/1148862.

Regarding Japan, Admiral Kinnaird R. McKee, then-Director of the U.S. Naval Nuclear Propulsion Program (aka Naval Reactors), testified in March 1988:

> Frankly, I think Japan is smart enough, if they really want to, to develop a phase-to-phase [sic: phased-array] radar.[163] They have also asked us for help in nuclear submarines. We say[,] "If you want to get into the nuclear submarine business, go ahead and do it. You don't need our help."[164]

Regarding Australia, a July 1, 2024, press report on the AUKUS Pillar 1 project states

> Previous Australian attempts to acquire nuclear-powered submarines with US technology were rejected by Washington….
>
> Since the turn of the century, Australian officials have on at least two occasions—it may well be more—sought access from Washington to the technology for nuclear-powered submarines. It appears that towards the end of the [Prime Minister John] Howard era [1996-2007], senior defence officials made one such approach to the US but were rebuffed.
>
> Some defence analysts were privately claiming around 2011-12 that the US would in time provide the technology to Australia, a claim which, once heard by American ears, elicited the same response: "No."
>
> As one defence insider who observed these events at close quarters says, "The Americans would first make the obvious point that if Australia wanted nuclear submarines, Canberra would need to double its defence budget." Then came the medicine. Washington would not hand over the technology, the Australians were told, because "you are friends, not family".[165]

Regarding Pakistan, Admiral McKee testified in March 1988: "We have a letter from the Pakistanis who want one [i.e., a U.S. nuclear-powered submarine] because the Soviets gave [sic: leased] one [i.e., a Soviet nuclear-powered submarine] to India.[166]

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[163] Admiral McKee's testimony at this point is referring to a proposal at the time, which he was asked to comment on, to sell to Japan the U.S. Navy's surface ship Aegis weapon system, which included the SPY-1 phased-array radar. The system was eventually sold to Japan and is now used on eight Japanese destroyers. The system was also sold to South Korea, Australia, Spain, and Norway for use on ships in the navies of those countries. For more on the Aegis system, see CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke, and CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, by Ronald O'Rourke.

[164] U.S. Congress. House. *Naval Nuclear Propulsion Program—1989, Hearing on National Defense Authorization Act for Fiscal Year 1989—H.R. 4264, and Oversight of Previously Authorized Programs, Department of Energy National Security Programs, Before the Procurement and Military Nuclear Systems Subcommittee of the Committee on Armed Services, House of Representatives*, 100th Cong., 2nd sess., March 3, 1988, GPO, 1988, H.A.S.C. No. 100-75, p. 3. (Included in CRS/FDT bound volume collection as *House Armed Services Committee, Hearings. [Vol.] 9, 100th Congress, 2d Sess.*, 1988, CRS-F.)

[165] James Curran, "Morrison's 'Longest Night': Inside the Making of AUKUS," *Australian Financial Review*, July 1, 2024.

[166] Energy and Water Development Appropriations for 1989, hearings before a Subcommittee of the Committee on Appropriations, House of Representatives, Subcommittee on Energy and Water Development, 100th Cong., 2nd sess., GPO, 1988, p. 1327.

India leased a nuclear-powered submarine with the hull number K-43 from the Soviet Union in September 1987. The boat served in India's navy from 1988 to 1991, and the lease is viewed as helping India with its effort to design and build its own nuclear-powered submarines. (See, for example, "Soviet Submarine *K-43*," Wikipedia, updated March 19, 2023, accessed October 30, 2023.) India leased a second nuclear-powered submarine from Russia in 2012 (the boat served in India's Navy from 2012 to 2021) and in 2019 signed a lease with Russia for a third nuclear-powered submarine that reportedly is to join India's navy by 2025. (See, for example, Vivek Raghuvanshi, "India Signs $3 Billion Contract with Russia for Lease of a Nuclear Submarine," *Defense News*, March 8, 2019; "List of Submarines of the Indian Navy," Wikipedia, updated October 21, 2023, accessed October 30, 2023.)

Admiral McKee's testimony about Japan and Pakistan was given in connection with a project that Canada initiated in 1987 to acquire a force of 10 to 12 UK- or French-made SSNs. A choice by Canada to select the UK SSN design (the Trafalgar-class design) would have involved the transfer to Canada of naval nuclear propulsion technology in the Trafalgar-class design that was derived from the naval nuclear propulsion technology that the United States provided to the UK beginning in 1958, which would have raised a question of U.S. approval for a potential sale of UK-made SSNs to Canada. The issue was discussed in a 1988 CRS report.[167] Canada canceled its SSN project in 1989, mooting the potential question of whether to share with Canada naval nuclear propulsion technology in the Trafalgar-class design that was derived from the naval nuclear propulsion technology that the United States provided to the UK beginning in 1958. For 1987-1988 letters and statements from Members of Congress regarding the Canadian SSN project, see **Appendix G**.

[167] For a discussion of this issue, see CRS Issue Brief IB88083, *Canadian Nuclear-Powered Attack Submarine Program: Issues for Congress*, updated April 24, 1989 (archived), by Ronald O'Rourke. This report is available to congressional clients directly from the author.

Appendix G. AUKUS-Related: 1987-1988 Letters and Statements from Members Regarding Proposed Canadian SSN Project

The following are the texts of letters and statements from Members of Congress in 1987 and 1988 regarding Canada's proposed SSN acquisition project, which Canada canceled in 1989.

1987 Letter from Representative Charles E. Bennett

A November 3, 1987, letter from Representative Charles E. Bennett, chairman, Seapower and Strategic and Critical Materials Subcommittee, House Armed Services Committee,[168] to Secretary of Defense Caspar W. Weinberger stated

> I would like to comment on Secretary of Energy [John S.] Herrington's letter to the committee of October 28, 1987 concerning the Statutory Determination signed by both of you regarding transfer of information by the U.K. to Canada about nuclear propulsion.
>
> In addition to considering the potential defense benefits that a force of Canadian [nuclear-powered] submarines might offer to the West, I believe it is also important for the United States to keep in mind some of the possible drawbacks such a program might involve. One, of course, is the issue of the use of such vessels for enforcement of the disputed Canadian claim of sovereignty over the Northwest Passage. Another is the danger of compromise of our nuclear [propulsion] technology, one of our most prized achievements. And third is the fact that a mishap involving a Canadian nuclear submarine could undermine the public confidence necessary for the successful operation of our own nuclear [-powered] Navy, [which accounts for] over 40 percent of our ships.
>
> I have recently had an "op-ed" piece published on this matter in the Toronto *Globe and Mail*, which I am enclosing.[169] I hope you will find these views helpful as you continue your deliberations on this important issue. I have sent a similar letter to Secretary Herrington.

1987 Letter from Representative Melvin Price

A November 5, 1987, letter from Representative Melvin Price[170] to Secretary of Defense Caspar W. Weinberger and Secretary of Energy John S. Herrington stated

> I have recently learned that the Government of Canada is seeking access to U.S. naval nuclear propulsion technology via the United Kingdom. Apparently Canada wants to develop its first nuclear submarine. Since Congress and previous administrations have considered similar proposals in the past from other countries, I believe it is important that I convey to you the thoughts expressed in this letter.
>
> As a charter member and former chairman of the Joint Committee on Atomic Energy, I was privileged to participate in the shaping of our national Naval [nuclear] Propulsion

[168] Charles E. Bennett was a Member of Congress from January 3, 1949, to January 3, 1993. (Source: https://bioguide.congress.gov/search/bio/B000371.)

[169] Charles E. Bennett, "Tough Questions Rise to the Surface," *Globe and Mail*, October 29, 1987.

[170] Melvin Price was a Member of Congress from January 3, 1945, until his death on April 22, 1988. He was chairman of the Joint Committee on Atomic Energy in the 93rd Congress (1973-1974) and chairman of the House Armed Services Committee in the 94th through 98th Congresses (1975-1984). (Source: https://bioguide.congress.gov/search/bio/P000522.)

Program. The safety and performance record of our nuclear [-powered] ships is the payoff for engineering excellence. We gained our naval nuclear propulsion technology by spending taxpayer dollars wisely under highly disciplined managerial and technical direction.

It is important to appreciate that there is nothing new about an ally wanting our naval nuclear propulsion technology—or about the consistently strong U.S. policy against its releases. Over the years, we have turned down requests from a number of countries, including France, Italy, and the Netherlands. Heretofore, the United States' position has been clear and firm.

As you know, applicable law tightly controls any disclosure of naval nuclear propulsion technology. Congress authorized the 1958 DREADNOUGHT[171] agreement with Great Britain only because of special circumstances. The British, having already embarked in developing their own naval nuclear propulsion plant, encountered problems and requested the assistance of the United States. The United States decided to help in nuclear propulsion and provide nuclear weapons technology because we needed to have British nuclear submarines and weapons on line in a strategic location at the earliest date. We also took into account the special relationship we had with the British and our close cooperation on nuclear matters during the war [i.e., World War II], including the Manhattan project.

Technical data alone did not prove to solve Britain's problems, so the United States ended up providing an entire U.S. nuclear propulsion plant. U.S. assistance, however, was limited to the propulsion plant on the lead ship to help ensure that the United Kingdom would not become dependent on the United States. We considered the requirement for self-sufficiency to be essential for the establishment of the type of discipline necessary for the safe application of naval nuclear propulsion. In addition to strict security precautions, the agreement provides that this technology may not be transferred to third parties without prior U.S. approval.

Over the years, earnest diplomats have urged that we share our sensitive nuclear submarine technology for purposes of worthwhile objectives. Congress rejected those proposals, recognizing the significant differences between exporting sensitive nuclear propulsion and exporting airplanes or tanks. It is one thing to share very sensitive intelligence between two allies; quite another to expose in a commercial environment the technology that has enabled us to hold a military advantage over a much larger Soviet submarine fleet.

Your decision to authorize the United Kingdom to release certain naval nuclear propulsion information to Canada is a softening of U.S. policy and invites further interest by Canada and similar propositions from other nations. The considerations that persuaded us to grant an exception for the British simply do not exist today with respect to Canada or other allies.

In one of its last reports, (Naval Nuclear Propulsion Program—1970) the Joint Committee on Atomic Energy addressed this issue succinctly:

> "The Joint Committee noted with concern the testimony regarding persistent efforts of elements within the Executive Branch to disseminate sensitive and strategically vital U.S. naval nuclear propulsion technology among foreign governments as diplomatic 'currency' in cooperative arrangements of marginal military value. The committee has reviewed the arguments favoring such cooperation repeatedly in the past, and has found them lacking in appreciation for both the technical complexities and strategic value of this critical technology."

[171] The UK's first nuclear-powered submarine—the one built with a transferred U.S. Navy submarine propulsion plant—was HMS Dreadnought.

> "The committee strongly recommends that no further consideration be given to cooperative arrangements in the field of naval nuclear propulsion for the indefinite future."

The Joint Committee's recommendation is as sound today as it was then.

Incidentally, the bilateral agreement with Canada on Cooperation for Mutual Defense Purposes, in paragraph E of Article II which you are proposing to implement, states that the "extent" and "means" of the exchange of classified information are to be agreed upon by the U.S. and Canada, presumably in advance. In view of the extreme sensitivity of this matter, if and when such agreement is reached it should be submitted to the Armed Services Committees of both Houses of Congress.

In any event, I want to state unequivocally my opposition to the transfer of any U.S. naval nuclear propulsion technology to Canada, because I believe it would be contrary to the best interests of our own submarine program and our national security.

1988 Exchange at Hearing Involving Senator J. James Exon

At a March 21, 1988, hearing before the Senate Armed Services Committee to consider the nomination of William Ball III to be Secretary of the Navy, the following exchange occurred between Ball and Senator J. James Exon, the chairman of the Strategic Forces and Nuclear Deterrence subcommittee of the Senate Armed Services Committee.

> SENATOR EXON [addressing Ball]: I'm going to ask you about another subject now that we talked about when you were in to see me a few days ago. Senator Warner and I will definitely be on the floor this week raising some questions publicly about the matter that we discussed with regard to the Canadians wishing to acquire our nuclear submarine technology that we share only with Britain. The Canadians are trying to get into an arrangement with regard to the British providing them with nuclear submarines and some training.
>
> There have been many other discussions with them [the Canadians] regarding why don't they work into this gradually. They want to go into it as a crash program. There are some serious concerns in this area with regard to the safety, and what that might do to the whole nuclear submarine program. Certainly before any arrangement is made on this, which seems to be about to happen, the Congress should review it. I have talked to several people about this including the Chairman of the Joint Chiefs [of Staff] and the general consensus I obtained was well, is that this is a political situation that we don't see we can stop.
>
> The Congress has a role to play in this because as you know it is [written] into the law that nothing like this can happen if the Congress wants to stop it. There are some of us that want to know a great deal more about this than we know right now, including Senator Warner and myself and others that I have mentioned. I think it would be very appropriate if you would give us what views you have on this subject before you become Secretary of the Navy.
>
> MR. BALL: Senator, let me mention that I understand that the Canadian Defense Ministry has first of all put together a white paper that sets forth a number of areas where they wish to improve their forces. At the outset let me say that having reviewed that effort, the [U.S] Navy is exceedingly high on the concept of the Canadians investing more in certain areas, such as maritime patrol aircraft and the construction of new frigates and other areas where we have a good and strong relationship, and we feel that those kinds of initiatives are going in the right direction.
>
> The Navy does have some concerns, and I've not had an opportunity to speak with everyone in the Navy who would have an interest in this yet, but the Navy leadership does

> have some concerns about sharing nuclear power technology which members of this committee are very familiar with.
>
> The ultimate decision on this question I imagine will be made by Congress. Prior to there being any decision taken by the administration I am sure there will be a healthy review of all aspect of this. There are political questions involved, there are also military questions involved, and that will be, I'm sure, extensively discussed before a recommendation is taken to the President.[172]

A March 22, 1988, press report about the hearing stated

> After the hearing, [Senator J. James] Exon and fellow committee member Sen. John Warner (R-Va.) said in an interview that the [Canadian SSN] project is a dangerous technological and political gamble for Canada and the United States.
>
> Both said they plan to take the matter to the Senate floor within a few days to spotlight what they termed the dangers.
>
> "Any minor accident with the nuclear power plant could result in our own nuclear-powered vessels being barred from 80 percent of the world's ports," Exon said. "If we let Canada have this secret nuclear technology, what do we say to the next ally who wants it?"[173]

1988 Floor Statement from Senator J. James Exon

The *Congressional Record* for March 25, 1988, includes the following floor statement from Senator Exon.

> THE PROPOSED TRANSFER OF UNITED STATES NUCLEAR SUBMARINE TECHNOLOGY TO CANADA
>
> Mr. EXON. Mr. President, I rise today to voice my concern regarding the proposed transfer of United States nuclear submarine technology to Canada. Let me state up front that I am not necessarily opposed to such a transfer. However, I do have a number of concerns which I would like to explore in hearings when and if this proposed transfer is sent to the Congress for our approval.
>
> In its 1987 "Defence White Paper," our good ally and very close friend, Canada, expressed a commitment to acquire 10 to 12 nuclear-powered submarines. Canada does have diesel-electric submarines in its fleet today but is opting for nuclear propulsion for its future submarines. The rationale for this is that Canada must patrol three oceans, the Pacific, Atlantic, and Arctic, and only nuclear-powered submarines have the speed, endurance, and the ability to safely operate under ice.
>
> The wisdom of this decision is not one for our Nation to yield to the Canadian on. It is not for this Nation to determine what should be the proper course of action to our friend and ally to the north. There are good arguments for the Canadians to spend an awful lot of money on this proposition but at the same time I think we could legitimately ask the

[172] U.S. Congress. Senate. Nominations before the Senate Armed Services Committee, 100th Congress, 2nd sess., Hearings before the Committee on Armed Services, United States Senate, 100th Cong., 2nd sess., on nominations of Grant S. Green (January 28); J. Daniel Howard (January 28); Ronald F. Lehman II (February 1); Jack Katzen (March 3); William Lockhart Ball III (March 21); Gordon A Smith (May 13); Michael P.W. Stone (May 13); Kenneth P. Bergquist (May 27); David S.C. Chu (June 24); Charles S. Whitehouse (June 24); Milton L. Lohr (September 14); Ken Kramer (September 23); Clyde O. Glaister (October 4); Karen R. Keesling (October 11); George L. Monahan Jr. (October 12); January 28; February 1; March 3, 21; May 13, 27; June 24; September 14, 23; October 4, 11, 12, 1988; GPO, 1989. S.Hrg. 100-991, pp. 116-117.

[173] George C Wilson, "Transfer of U.S. Nuclear Sub Technology Considered," *Washington Post*, March 22, 1988, p. 4. The article was published in other editions of the paper with the headline "U.S. Considers Transfer of Secret Sub Technology."

question of our key supporter in NATO whether or not it is wise for them to spend $8 billion of their defense dollars for a fleet of 10 to 12 nuclear submarines.

Indeed, I personally welcome the recent acknowledgment by the Canadians that they should be doing more for their own defense and in contribution to NATO. The concern of the United States should focus, in my opinion, on whether or not we wish to transfer nuclear submarine technology to another nation. We have done so only once in the past, to the British, who now operate 19 nuclear submarines of their own. Great Britain is a special friend and ally with whom we have very close defense ties. We enjoy similar ties with the Canadians.

My specific concern, however, has to do with whether Canada fully recognizes and can afford the extensive infrastructure of training and support facilities to ensure that our transferred technology will be operated safely. Mr. President, more and more ports of the world are being closed to the U.S. Navy for reasons of antinuclear sentiment around the world. From New Zealand to the Philippines to Northern Europe, we are faced with a serious challenge to the continued operation of and support for the necessary presence of the U.S. Navy. In short, in this era of nuclear phobia, we must maintain and enhance our safe standards of shipboard nuclear propulsion.

Our Navy has had over 34 years experience with nuclear-powered ships and we have had no accidents. This is the result of a very careful training program, very stringent operating procedures, and shipyards and workers highly skilled in nuclear technology.

For Canada, nuclear-powered ships will be a new experience. Although the Canadians considered acquiring nuclear subs in the early 1960's and began an exchange program with the United States and Royal Navies on the matter, the proposed submarines would be Canada's first nuclear-powered ships. To be fair, the Canadians do operate nuclear powerplants and their safety record is good. But submarines are different.

Canada's Navy is indeed impressive in its professionalism and technology. Its record is long and admirable. In fact, the Royal Canadian Navy was the third largest navy in the world at the end of World War II. We have worked long and closely with the Canadians in the area of nuclear weapons and defense. That is a sound relationship which could be expanded if it proves prudent to do so.

But Mr. President, I want to be absolutely sure that the Canadians understand the tremendous responsibility they assume when they acquire nuclear submarines.

If they should ever experience a nuclear accident or incident, the blame, rightly or wrongly, could be transferred by the United States. Rightly or wrongly, our Nation as well as Canada, could and probably would bear the consequences. We could see more ports around the world closed to our nuclear powered or nuclear armed ships. This is the heart of my concern. With 40 percent of our naval forces nuclear, any nuclear-powered accident, however minimal, would be blown all out of proportion and we would very likely find a "Not Welcome" sign posted more prominently in more ports where it is vital for our ships to port if they are to perform their critical mission.

So before we either transfer nuclear power technology or allow the British to transfer the technology we initially provided to them, I will pursue this matter very carefully in the hearings in the Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence.

This subcommittee, which I chair, has oversight responsibility for our Navy's Nuclear Propulsion Program. I have already discussed this issue with Secretary of Defense Frank Carlucci, Secretary of State George Shultz, and other officials of our Defense and Navy Departments. I think they understand and share my concerns.

I want to alert all that, should the administration decide to transfer this technology, the Senator will exercise his right and responsibility to review and act on such a decision. This is a decision that thus far has been pursued without congressional consultation. I am also

> fearful that the administration has not addressed the fundamental question that if we authorize the British to transfer our highly classified and closely held naval nuclear technology to the Canadians, how can we justify keeping this from other allies?
>
> This is the decision that has thus far been pursued by the administration simply on their own without consultation with Congress. I am also fearful that the administration has not addressed the fundamental question: If we authorize the British to transfer our highly classified and closely held technology in this area to the Canadians, how, Mr. President, can we justify keeping this from our other allies?
>
> I am pleased and delighted to see my good friend [Senator John Warner], working colleague, the Senator from Virginia, former Secretary of the Navy, and the ranking member of the Armed Services Committee is here on the floor. He has expressed similar sentiment. And without objection, I would like to yield to the Senator from Virginia at this time. [See floor statement below from Senator John Warner.][174]

1988 Floor Statement from Senator John Warner

Immediately following the statement from Senator Exon quoted above, the *Congressional Record* for March 25, 1988, includes the following floor statement from Senator John Warner, the ranking member of the Senate Armed Services Committee.

> The PRESIDING OFFICER. The Senator from Virginia is recognized.
>
> Mr. WARNER. I thank my distinguished colleague.
>
> Mr. President, the Senator from Nebraska [Senator Exon], and I came to the Senate some 9 years ago, and we have sat side by side at the table of the Senate Armed Services Committee, where he succeeded me as the chairman of an important subcommittee, the Subcommittee on Strategic Forces and Nuclear Deterrence.
>
> He speaks with considerable knowledge on all subjects relating to nuclear power, and in particular on this one.
>
> Mr. President, on March 15 I had an opportunity to attend a breakfast meeting with members of the British press. During the course of that breakfast, we discussed the current proposal of the Canadian Government to manufacture nuclear-powered submarines. This is an ambitious undertaking. Simply stated, it entails the building and operating of one of the most complicated and costly weapons platforms in the world.
>
> It has come to my attention that portions of that morning's discussion have been reported in the British press in a way that might imply that I have reached a final decision to oppose this Canadian proposal. I have not made a decision, but take this opportunity to state my present concerns, along with my distinguished colleague, the Senator from Nebraska [Mr. Exon.] The United States executive and legislative branches should weigh these concerns when viewing Canada's proposal to acquire a nuclear submarine fleet by the year 2010, because those submarines might incorporate restricted United States technology. I plan to take an active role in the congressional debate.
>
> In June of 1987, the Canadian Government issued a White Paper on defense proposing the acquisition of 10 to 12 nuclear-powered submarines. Canada is currently considering options of either acquiring the British Trafalgar-class submarine design or the French Rubis-class submarine design. Since the Trafalgar-class nuclear propulsion technology is a derivative of designs and equipment supplied to the British by the United States in the

[174] *Congressional Record*, March 25, 1988, pp. 5293-5294.

late 1950's, United States approval-including congressional consent-is required prior to transfer from Great Britain to Canada of this technology.

The role of Congress in any transfer of naval nuclear propulsion technology is set forth in the Atomic Energy Act of 1954, as amended. That act provides for a 90-day notice-and-wait period, during which Congress has the opportunity to hold hearings—which our distinguished chairman and I recommend—and, if it chooses, to pass a joint resolution of disapproval.

As a former Secretary and Under Secretary of the Navy (1969-74), I am familiar with the enormous complexities and special requirements of nuclear submarine technology and procedures. I was involved with the development, design approval, acquisition, and continuing infrastructure needed to support nuclear-powered vessels, particularly the SSN-688 class attack boats and the initiation of the Trident program; and also had responsibility for developing and supporting before the U.S. Congress the budgets required to support these programs. I have an appreciation, both in that capacity and today as a member of the Armed Services Committee, of the potential for the enormous cost overruns that often accompany nuclear construction programs.

Just recently, the problem of the current cost overruns with the [Los Angeles] [SSN-]688 class [nuclear-powered attack submarines], both past and present, were brought to the attention of the Armed Services Committee. A news article reported that the cost to complete construction of 23 Los Angeles (SSN-688) class submarines might be $1.2 billion above contract target costs.

The U.S. Congress knows from decades of experience that the costs associated with ocean-going nuclear vessels are enormous, encompassing not just development and acquisition, but also constant training and elaborate supporting shore establishment and overhaul facilities. Let there be no misunderstanding: This is an enormously complex and costly matter, and no nation should enter into such an undertaking without an exhaustively thorough appreciation for those complexities and costs. Congress will carry certain responsibilities as assigned by the Atomic Energy Act of 1954, should the Canadians desire the British submarine design. With the benefit of knowledge derived from our own experience, Congress must conscientiously and fairly examine the Canadian proposal, in our own national security interests. We need to know how Canada proposes to institute this program; and how Canada proposes to insure, as my distinguished chairman mentioned, that the standard of nuclear safety of such a fleet will be at least as high as that of the United States and the British in the operation of their fleets.

Additional questions should be raised. For example, the Soviets have introduced eight new attack submarine designs within the last 10 years and have accelerated the rate at which they are reducing the noise levels of their submarines. Soviet technological advances are expected to continue. The Soviets are pouring unrestricted sums into their submarine program. Will the Trafalgar or the Rubis designs—if one or the other is selected for the Canadian submarine force—will they be sufficiently quiet and combat capable to produce a credible force against the likely increase in capability of the Soviet submarine fleet? That Soviet force will be entering operation in the late 1900’s and beyond and would be in direct competition with any such submarines as Canada may have operating in its Arctic waters.

Canada is a close ally and trusted friend. We need not mention that here. Canada is a sovereign nation, entitled to decide how it will allocate its defense resources. As an ally, it is the responsibility of the United States to give such advice as may be requested—I repeat, advice as may be requested—to assist Canada in structuring its proposal. It is my understanding that the administration is now cooperating with Canada and Great Britain to ascertain the scope of United States technology involved; and it is my expectation and hope that the United States will share in every other respect our experience, both cost and otherwise, in operating our submarine force.

In the past, other allies have made inquiries of the United States for assistance in developing nuclear submarine programs and, with the exception of Great Britain, this assistance has not been provided. This newest proposal would involve changing U.S. policies and procedures developed over the years for the transfer of naval nuclear propulsion technology.

Mr. President, let me make my position clear. I have not yet taken a position in opposition to the transfer of this nuclear technology to Canada. I now alert the Congress, however, to the magnitude of the decision it may be asked to make. I am simply reserving my judgment until all inter-government discussions are completed, both the United States and the Canadians have a thorough understanding of the implications of this undertaking, together with Great Britain, and the administration, if it so elects, petitions the Congress.

Mr. President, I also ask unanimous consent to have printed in the RECORD the relevant provisions of the Atomic Energy Act concerning the role of Congress in this procedure. This is set forth in the Atomic Energy Act of 1954, as amended (42 U.S.C. 2152), paragraphs c and d.

There being no objection, the material was ordered to be printed in the RECORD, as follows:…[175]

[175] *Congressional Record*, March 25, 1988, pp. 5294-5295.

Appendix H. AUKUS-Related: Analysis of Alternatives (AOA) and Business Case

This appendix provides background information regarding evidence for the performance an analysis of alternatives (AOA) for the AUKUS Pillar 1 project, and on the role of AOAs and business cases in defense acquisition programs in general.

Little Indication an AOA Was Conducted for AUKUS Pillar 1

As stated earlier, there is little indication that, prior to announcing the AUKUS Pillar 1 project in September 2021, an analysis of alternatives (AOA) or equivalent rigorous comparative analysis was conducted to examine whether Pillar 1 would be a more cost-effective way to spend defense resources for generating deterrence and warfighting capability than potential alternative courses of action, such as a U.S.-Australian division of labor for performing SSN missions and non-SSN missions.

A July 1, 2024, press report stated

> In interviews with insiders with intimate knowledge of the process, the Financial Review can reveal: Australia's pathway to a nuclear submarine capability was intended to be an exclusively British one [without direct U.S. involvement]; [Australia's Department of the] Treasury and the Department of Foreign Affairs were excluded from the process; and serious risk and feasibility studies were largely sacrificed in the name of securing a politically symbolic deal….
>
> As is now well known, the project to buy and build nuclear submarines for Australia under the AUKUS agreement arose from a crisis in the contract with France [for acquiring a new class of non-nuclear-powered submarines for Australia]….
>
> As a result, the [AUKUS Pillar 1] project emerged hurriedly, almost on the back of an envelope, and in top secret. The lead was taken by politicians in the National Security Committee of cabinet and a closed group of officials and advisers in Scott Morrison's office. For secrecy and political reasons, they could not draw upon the depth of strategic thinking in defence nor on experts knowledgeable of the serious issues in both the US and British submarine construction industries….
>
> The Australian Labor Party, for fear of being [politically] wedged, bought into Scott Morrison's AUKUS deal, but did not de-risk the proposals nor include new and essential strategic analysis.[176]

A July 2, 2024, press report (Part 2 of the July 1, 2024, press report quoted above) stated

> The situation raises the pressing question of why the risk and feasibility studies leading to the original AUKUS announcement in September 2021 did not include basic strategic questioning, such as: which is the best submarine for Australia of those proposed? What are the tasks the submarine will be required to undertake? How quickly can Australia move on from the Collins-class submarines? What is the true capacity of the Australian submarine-building industry and is it really possible to build up a crew of one thousand submariners in 15 years? And how does AUKUS maintain Australian sovereignty?[177]

[176] James Curran, "Morrison's 'Longest Night': Inside the Making of AUKUS," *Australian Financial Review*, July 1, 2024.

[177] James Curran, "'A Cruel Joke': Why AUKUS Might Leave Australia Stranded," *Australian Financial Review*, July 2, 2024.

Another July 2, 2024, press report (a companion piece to the two articles quoted above) states

> What emerges from the investigation into the construction plan of AUKUS and the problems it now faces on the "optimal pathway" is just how perilous a course the Albanese government is taking.
>
> It has done so not on the basis of rigorous, contested policy work and debate. Rather it has inherited a flawed and hasty decision-making process of the previous government and proceeded in like manner.[178]

A November 15, 2023, opinion piece from a different author stated

> In a different world, where [Australia's Department of] Defence was meeting its core obligations to provide cogent, well-founded advice to support government decision making, we would expect that there had been a proper analysis of alternative ways of increasing Australia's deterrent capabilities and long-range strike against the backdrop of a dangerous region centred on an aggressive China.
>
> But it is almost certain that this did not happen in the lead-up to the AUKUS announcement.
>
> Instead, the same key defence leadership that has self-proclaimed its failures in an analogous chain of advice and decision making [for Australia's Hunter-class frigate program] was a part of a tiny coterie of people around the then prime minister who were solely focused on "How can Australia acquire nuclear submarines?"
>
> Looking at deterrence and strike [capability] through a straw that only lets the answer be a submarine is an oddly blinkered position to take on something that is about an essential element in our national defence.
>
> It also doesn't let you think clearly about the huge opportunity costs involved in the financial and human capital tied up in the AUKUS subs plan and the consequences these have for the rest of our military power.[179]

Analysis of Alternatives (AOA)

In terms of the time, funding, personnel, technology, and industrial work that would be involved, implementing all the elements of the AUKUS submarine (Pillar 1) project would be an effort comparable in scale and complexity to a major DOD acquisition program. Major DOD acquisition programs are generally not initiated without first demonstrating that there is a rigorous analytical basis for the program—something that is typically done by conducting a formal study, often called an analysis of alternatives (AOA) or analysis of multiple concepts (AMC), that rigorously compares various potential courses of action so as to identify the one that the analysis shows to be the most cost-effective. Performing an AOA, AMC, or equivalent rigorous comparative analysis prior to initiating a program can test the validity of beliefs or presumptions about the cost-effectiveness of an envisioned course of action, and sometimes produce unexpected or counter-intuitive results.[180]

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[178] James Curran, "AUKUS 'Moonshot' May Be a Tragically Expensive Failure," *Australian Financial Review*, July 2, 2024.

[179] Michael Shoebridge, "An AUKUS Remix Delivering Greater Military Power Faster: The B-21 Raider," *Defence Connect*, November 15, 2023. Also posted as Michael Shoebridge, "AUKUS Plan B: Delivering Greater Military Power Faster—The B-21 Raider," *Real Clear Defense*, November 16, 2023. See also Greg Sheridan, "Albanese's Five Catastrophic Mistakes Rendering Australia Defenceless," *Australian*, September 7, 2024.

[180] For more on AOAs, AMC, or equivalent studies and their roles in defense acquisition, see

- Department of Defense, "Analysis of Alternatives," DOD Instruction 5000.84, August 4, 2020, accessed June

(continued...)

Business Case

Establishing a firm analytical basis for an acquisition program by conducting an AOA, AMC, or equivalent rigorous comparative analysis can help form part of what GAO refers to as a sound business case for proceeding with an acquisition program. GAO since at least 2006 has reported and testified multiple times on the risks associated with initiating acquisition programs without a sound business case. A 2006 GAO report, for example, states

> We have frequently reported on the importance of using a solid, executable business case before committing resources to a new product development effort. In the case of DOD, a business case should be based on DOD acquisition policy and lessons learned from leading commercial firms and successful DOD programs. The business case in its simplest form is demonstrated evidence that (1) the warfighter's needs are valid and that they can best be met with the chosen concept, and (2) the chosen concept can be developed and produced within existing resources—that is, proven technologies, design knowledge, adequate funding, and adequate time to deliver the product when it is needed. A program should not go forward into product development unless a sound business case can be made.[181]

A 2015 GAO report states

> A business case provides demonstrated evidence that (1) the warfighter need exists and that it can best be met with the chosen concept and (2) the concept can be developed and produced within existing resources—including proven technologies, design knowledge, adequate funding, and adequate time to deliver the product when needed. Establishing a business case calls for a realistic assessment of risks and costs; doing otherwise undermines the intent of the business case and invites failure.[182]

A 2020 GAO report states

> GAO's previous work has shown that weapon systems without a sound business case are at greater risk for schedule delays, cost growth, and integration issues….
>
> We have previously reported on the importance of establishing a solid, executable business case before committing resources to a new development effort. A business case demonstrates that (1) the warfighter's needs are valid and that they can best be met with the chosen concept and (2) the chosen concept can be developed and produced within existing resources. In addition to an acquisition strategy, other basic elements of a sound acquisition business case include firm requirements, a plan for attaining mature technologies, and a reliable cost estimate and affordability analysis….[183]

In 2021 testimony on DOD acquisition, GAO states

10, 2024, at https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/500084p.pdf;

- "Analysis of Alternatives," Defense Acquisition University (DAU), undated, accessed June 10, 2024, at https://aaf.dau.edu/aaf/mca/aoa/; and
- "Analysis of Alternatives (AoA)," *AcqNotes, The Defense Acquisition Encyclopedia*, updated February 13, 2024, accessed June 10, 2024, at https://acqnotes.com/acqnote/acquisitions/analysis-of-alternatives.

[181] Government Accountability Office, *Defense Acquisitions[:] Improved Business Case Is Needed for Future Combat System's Successful Outcome*, GAO-06-367, March 2006, p. 8.

[182] Government Accountability Office, *Acquisition Reform[:] DOD Should Streamline Its Decision-Making Process for Weapon Systems to Reduce Inefficiencies*, GAO-15-192, February 2015, footnote 11 on page 9. A similar statement is found in Government Accountability Office, *Defense Acquisitions[:] Joint Action Needed by DOD and Congress to Improve Outcomes*, Testimony Before Committee on Armed Services, House of Representatives, Statement of Paul L. Francis, Managing Director, Acquisition and Sourcing Management, GAO-16-187T, October 27, 2015, highlights page.

[183] Government Accountability Office, *Defense Acquisitions[:] Action Is Needed to Provide Clarity and Mitigate Risks of the Air Force's Planned Advanced Battle Management System*, GAO-20-389, April 2020, highlights page and p. 7.

> GAO annually assesses selected DOD weapon programs and their likely outcomes by analyzing: (1) the soundness of a program's business case—which provides evidence that the warfighter's needs are valid and the concept can be produced within existing resources—at program start, and (2) the knowledge a program attains at other key points in the acquisition process. For example, the Navy's Ford-class aircraft carrier program began with a weak business case, including an unrealistic cost estimate based on unproven technologies, resulting in over $2 billion in cost growth and years of delays to date for the lead ship….
>
> For years, we have reported on the importance of using a solid, executable business case—a justification for a proposed project or undertaking—before committing resources to a new product development effort. An executable business case uses realistic cost and schedule targets to meet the warfighter's performance and quality expectations by balancing inherent uncertainties in acquisition programs….
>
> While cost and schedule metrics provide decision makers with performance information in hindsight, we have found that assessing a program's business case at the start of development and attainment of certain product knowledge at key points in the acquisition process can help predict a program's performance.[184]

Navy Littoral Combat Ship (LCS) Program

In the case of the Navy's Littoral Combat Ship (LCS) program, the Navy, prior to announcing the start of that program in November 2001, did not perform a rigorous AOA, AMC, or equivalent rigorous comparative analysis to show that a ship like the LCS was not simply one way, but rather the best or most promising way, to perform the missions that the Navy was seeking a capability to perform. The Navy in April 2003 testimony acknowledged that it did not conduct such a study until after it had selected the LCS as its preferred solution, raising a question as to whether that study was tainted by the knowledge that the Navy had already selected the LCS as its preferred solution. The absence of a rigorous AOA, AMC, or equivalent rigorous comparative analysis performed prior to the announcement of the LCS program could be viewed as a factor that contributed to the program's subsequent controversy and ultimate truncation.[185]

[184] Government Accountability Office, *DOD Acquisition Reform[:] Increased Focus on Knowledge Needed to Achieve Intended Performance and Innovation Outcomes*, Testimony Before the Subcommittee on Readiness and Management Support, Committee on Armed Services, U.S. Senate, Statement of Shelby S. Oakley, Director, Contracting and National Security Acquisitions, GAO-21-511T, April 28, 2021, highlights page and pp. 1-2, 6.

[185] For further discussion, see pages 20-27 of the May 12, 2017, version of CRS Report RL33741, *Navy Littoral Combat Ship (LCS) Program: Background and Issues for Congress*, by Ronald O'Rourke. Similar discussions can be found in earlier versions of this report.

Appendix I. AUKUS-Related: Technology Security and Risk of Accident

This appendix presents background information on two issues that arose in connection with congressional review of Canada's project in 1987-1989 to acquire a force of 10 to 12 UK- or French-made SSNs:

- **technology security**—the potential impact, if any, of sharing U.S. submarine and naval nuclear propulsion with another country on the risk of that technology being stolen by China, Russia, or some other country; and
- **risk of accident**—the risk of an accident involving an Australian-owned SSN—either a Virginia-class SSN or an AUKUS SSN incorporating U.S. naval nuclear propulsion technology—and the impact such an accident might have on U.S. public support for operating U.S. Navy nuclear-powered ships and/or the ability of U.S. Navy nuclear-powered ships to make port calls around the world.

Technology Security

Admiral Kinnaird R. McKee, then-Director of the U.S. Naval Nuclear Propulsion Program (aka Naval Reactors), testified in March 1988 (i.e., years before the rise of the internet and internet-based cyber espionage):

> We have a number of very sensitive arrangements with a lot of our allies on a government-to-government, navy-to-navy, military-to-military basis that deal with certain things we do. But once the Canadians talk about launching into a 12 nuclear submarine building program, we are talking about a proliferation of technology across a very broad industrial base. The Canadians intend to do 65 percent of the work [for building those submarines] in Canada. That is proliferating the technology over a wide range of industrial activities that have never had any involvement in this kind of business.
>
> So there is, I think, a clear and present concern that dissemination would not be in our national interests. That is how we get into it.[186]

Later in March 1988, before a different committee, Admiral McKee similarly testified

> The concern about the security of the technology is a little complicated. The Canadians are good neighbors. We have shared alliance commitments with them. That is true; we have shared a lot of sophisticated, sensitive information, sophisticated tactical information, working exercises together, but that is between our Navies and our governments.
>
> Taking this very sophisticated technology and disseminating it through a broad range of Canadian industry is a whole different story. They have only built ten submarines to date—during World War I. Part of the commitment is that these will be 65 percent Canadian built. That requires us to proliferate a broad range of technology in Canadian industry that is not used to dealing with this degree of sophistication, but more important, the sensitivity of the technology….

[186] U.S. Congress. House. *Hearings on National Defense Authorization Act for Fiscal Year 1989—H.R. 4264, and Oversight of Previously Authorized Programs, Before the Committee on Armed Services, House of Representatives, Seapower and Strategic and Critical Materials Subcommittee,* Title 1, 100th Cong., 2nd sess., Hearings Held March 1, 3, 8, 9, 10, and 17, 1988, GPO, 1988. H.A.S.C. No. 100-70, p. 351. The hearing in question, on submarine programs, was held on March 9, 1988. [Included in CRS/FDT bound volume collection as, *House Armed Services Committee, Hearings. (Vol.) 5, 100th Congress, 2d Sess.*, 1988, CRS-F.]

> I would rather see them go to the French than take the risk associated with transfer of [U.S.-derived] *Trafalgar* technology.[187]

Risk of Accident

Port calls made by U.S. Navy nuclear-powered ships at ports around the world can be made for purposes of sending deterrent signals of alliance resolve and solidarity to potential adversaries; conducting diplomacy and engagement activities with the countries being visited; resupplying U.S. Navy nuclear-powered ships with food and other provisions; and providing rest and recreation for the crews of those ships.

A 2020 publication from the U.S. Naval Nuclear Propulsion Program (aka Naval Reactors) states

> Naval Reactors maintains an outstanding record of over 166 million miles safely steamed on nuclear power. The Program currently operates 98 reactors and has accumulated over 7,100 reactor-years of operation…. 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….
>
> From the beginning, the [U.S. Naval Nuclear Propulsion] 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 effect 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….
>
> Throughout the Program's entire history—over 7,100 reactor years of operation and more than 166 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.[188]

At an April 6, 1987, hearing before the Seapower and Strategic and Critical Materials subcommittee of the House Armed Services Committee on the Navy's Seawolf (SSN-21)

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[187] U.S. Congress. House. *Energy and Water Development Appropriations for 1989, Hearings Before a Subcommittee of the Committee on Appropriations, House of Representatives, Subcommittee on Energy and Water Development*, 100th Cong., 2nd sess., p. 1328. The hearing in question, on atomic energy defense activities, was held on March 23, 1988. Following the ellipse in the above-quoted passage, the subcommittee Chairman, Representative Tom Bevill, stated: "Then maybe you ought to let them get their submarine from the French." Admiral McKee replied: "That is what I have said. The French thing raises all kinds of ghosts in the British mind, as you can well imagine. The French alternative has been used as a hammer—the Canadians emphasize that we have to help them or they will go to the French. I would rather see them go to the French than take the risk associated with transfer of *Trafalgar* technology."

[188] Department of Energy and Department of the Navy, *The United States Naval Nuclear Propulsion Program 2020, Over 166 Million Miles Safely Steamed on Nuclear Power*, pp. 1, 31, 32. The Department of Energy similarly states

> From the beginning, the [Naval Nuclear Propulsion] 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 effect from the operation of U.S. nuclear-powered warships. Because of this record, these ships are welcome in over 150 ports in more than 50 countries and dependencies, as well as in U.S. ports.
>
> (Department of Energy, National Nuclear Security Administration, "Powering the Navy" expandable section entitled "Concern for the Environment," accessed October 11, 2023 at https://www.energy.gov/nnsa/powering-navy.)

submarine program, Admiral Kinnaird R. McKee, then-Director of the U.S. Naval Nuclear Propulsion Program (aka Naval Reactors), listed the attributes that the Navy wanted the SSN-21 design to have, including the following:

> Finally, safety. Don't forget, if there is even the perception of a reactor accident, the fundamental security posture of the United States could change overnight. Imagine a Chernobly-type [sic: Chernobyl-type] accident in Norfolk on the [Navy's nuclear-powered aircraft carrier] U.S.S. *Nimitz*. So we have to take safety factors into account.[189]

In 1987-1988, some observers argued that an accident with a Canadian-owned, British-designed SSN whose propulsion plant employed technology derived from the U.S. nuclear propulsion technology that the United States provided to the UK beginning in 1958 could affect U.S. public support for operating U.S. Navy nuclear-powered ships and/or the ability of U.S. Navy nuclear-powered ships to make port calls around the world. A 1990 National War College report stated that

> the strongest opposition to the U.K.-Canadian SSN deal within DOE [the Department of Energy] came from Naval Reactors, which wanted no part of any nuclear propulsion transfer deal. For DOE the issues were simple. For Canada to build SSN's, large amounts of sensitive classified nuclear propulsion technology would have to be transferred to the Canadian government and industry. The question was would it be protected? Second, Canada did not have the critically important technology infrastructure which Naval Reactors knew was necessary for the safe application of naval nuclear propulsion. Their greatest concern, one shared by all in DOE and DOD, was that a reactor accident aboard a Canadian SSN using U.S.-design nuclear technology could severely damage public confidence in the safety of all nuclear vessels, severely curtailing the operational freedom and port access of the U.S. Navy, 40% of whose vessels were nuclear[-powered].[190]

A November 23, 1987, press report on remarks made to reporters by U.S. Navy Captain Robert F. Hofford, the U.S. naval attaché in Ottawa, following the end of a November 18, 1987, presentation at a conference in Ottawa, Canada, stated that

> some in the Pentagon fear that a Canadian submarine accident could derail the United States' plan to procure its own new class of attack submarine, the SSN-21. An accident in Canada would galvanize anti-nuclear and pacifist groups against the U.S. submarine program.
>
> If an accident should happen, "We can't wipe our hands of the Canadian program. I think that realization is coming out here," he [Hofford] told reporters.
>
> "We would like the Canadian submarine program to be autonomous," he said. Assuming Canada awards the contract [for its then-planned SSN acquisition program] to the British, any nuclear accident "would reflect on the United States and could very easily put our programs into jeopardy. We don't want that to happen because we realize the strategic value of the [American] submarine and the submarine program."[191]

A November 27, 1987, press report stated that

[189] U.S. Congress. House. SSN-21, Hearing before the Seapower and Strategic and Critical Materials Subcommittee of the Committee on Armed Services, House of Representatives, 100th Cong., 1st sess., Hearing Held April 6, 1987, H.A.S.C. No. 100-49, GPO, 1988, p. 19.

[190] Gerald L. Brubaker, *Taking a Dive for a Friend—The Decision to Transfer Nuclear Submarine Technology to Canada*, National War College, December 10, 1990, pp. 6-7.

[191] David Silverberg, "U.S. Navy Fears May Snag Canadian Nuclear Sub Buy," *Defense News*, November 23, 1987: 1, 35.

> the degree of potential American opposition [to the Canadian SSN project] was underscored last week by remarks made at a defense contractors' conference in Ottawa by the United States naval attaché here, Capt. Robert F. Hofford.
>
> Captain Hofford said that concerns about the Canadian submarines, which would be built in Canadian shipyards, could cause Congress to delay granting permits for the use of American reactor technology beyond the March 1988 deadline set by the [Canadian] Government for a choice between contending [UK and French] designs….
>
> In part, safety concerns have been prompted by the fact that Canadian shipyards have built no submarines since World War I, and no nuclear-powered vessels of any kind….
>
> Canadian officials say the United States has continued to argue that Canada should abandon the submarine program and spend the money on upgrading its conventional defenses, which have withered badly over the last 20 years.[192]

A November 5, 1987, letter from Representative Melvin Price[193] to Secretary of Defense Caspar W. Weinberger and Secretary of Energy John S. Herrington stated that "a mishap involving a Canadian nuclear submarine could undermine the public confidence necessary for the successful operation of our own nuclear [-powered] Navy, [which accounts for] over 40 percent of our ships."[194]

At a March 21, 1988, hearing before the Senate Armed Services Committee to consider the nomination of William Ball III to be Secretary of the Navy, Senator J. James Exon, the chairman of the Strategic Forces and Nuclear Deterrence subcommittee of the Senate Armed Services Committee, discussed the Canadian SSN project. A March 22, 1988, press report about the hearing stated "After the hearing, Exon and fellow committee member Sen. John Warner (R-Va.) said in an interview that the project is a dangerous technological and political gamble for Canada and the United States…. 'Any minor accident with the nuclear power plant could result in our own nuclear-powered vessels being barred from 80 percent of the world's ports,' Exon said."[195]

In a floor statement printed in the *Congressional Record* for March 25, 1988, Senator Exon stated

> My specific concern, however, has to do with whether Canada fully recognizes and can afford the extensive infrastructure of training and support facilities to ensure that our transferred technology will be operated safely. Mr. President, more and more ports of the world are being closed to the U.S. Navy for reasons of antinuclear sentiment around the world. From New Zealand to the Philippines to Northern Europe, we are faced with a serious challenge to the continued operation of and support for the necessary presence of the U.S. Navy. In short, in this era of nuclear phobia, we must maintain and enhance our safe standards of shipboard nuclear propulsion.
>
> Our Navy has had over 34 years experience with nuclear-powered ships and we have had no accidents. This is the result of a very careful training program, very stringent operating procedures, and shipyards and workers highly skilled in nuclear technology.
>
> For Canada, nuclear-powered ships will be a new experience. Although the Canadians considered acquiring nuclear subs in the early 1960's and began an exchange program with

[192] John F. Burns, "Canada May Lose Nuclear Sub Plan," *New York Times*, November 27, 1987: 4.

[193] Melvin Price was a Member of Congress from January 3, 1945 until his death on April 22, 1988. He was chairman of the Joint Committee on Atomic Energy in the 93rd Congress (1973-1974) and chairman of the House Armed Services Committee in the 94th through 98th Congresses (1975-1984). (Source: https://bioguide.congress.gov/search/bio/P000522.)

[194] The full text of Representative Price's letter is reprinted in **Appendix G**.

[195] George C Wilson, "Transfer of U.S. Nuclear Sub Technology Considered," *Washington Post*, March 22, 1988, p. 4. The article was published in other editions of the paper with the headline "U.S. Considers Transfer of Secret Sub Technology."

> the United States and Royal Navies on the matter, the proposed submarines would be Canada's first nuclear-powered ships. To be fair, the Canadians do operate nuclear powerplants and their safety record is good. But submarines are different.
>
> Canada's Navy is indeed impressive in its professionalism and technology. Its record is long and admirable. In fact, the Royal Canadian Navy was the third largest navy in the world at the end of World War II. We have worked long and closely with the Canadians in the area of nuclear weapons and defense. That is a sound relationship which could be expanded if it proves prudent to do so.
>
> But Mr. President, I want to be absolutely sure that the Canadians understand the tremendous responsibility they assume when they acquire nuclear submarines.
>
> If they should ever experience a nuclear accident or incident, the blame, rightly or wrongly, could be transferred by the United States. Rightly or wrongly, our Nation as well as Canada, could and probably would bear the consequences. We could see more ports around the world closed to our nuclear powered or nuclear armed ships. This is the heart of my concern. With 40 percent of our naval forces nuclear, any nuclear-powered accident, however minimal, would be blown all out of proportion and we would very likely find a "Not Welcome" sign posted more prominently in more ports where it is vital for our ships to port if they are to perform their critical mission.
>
> So before we either transfer nuclear power technology or allow the British to transfer the technology we initially provided to them, I will pursue this matter very carefully in the hearings in the Armed Services Subcommittee on Strategic Forces and Nuclear Deterrence.[196]

Immediately following the statement from Senator Exon quoted above, the *Congressional Record* for March 25, 1988, includes a floor statement from Senator John Warner, the ranking member of the Senate Armed Services Committee, in which Senator Warner stated

> The U.S. Congress knows from decades of experience that the costs associated with ocean-going nuclear vessels are enormous, encompassing not just development and acquisition, but also constant training and elaborate supporting shore establishment and overhaul facilities. Let there be no misunderstanding: This is an enormously complex and costly matter, and no nation should enter into such an undertaking without an exhaustively thorough appreciation for those complexities and costs. Congress will carry certain responsibilities as assigned by the Atomic Energy Act of 1954, should the Canadians desire the British submarine design. With the benefit of knowledge derived from our own experience, Congress must conscientiously and fairly examine the Canadian proposal, in our own national security interests. We need to know how Canada proposes to institute this program; and how Canada proposes to insure, as my distinguished chairman mentioned, that the standard of nuclear safety of such a fleet will be at least as high as that of the United States and the British in the operation of their fleets.[197]

[196] *Congressional Record*, March 25, 1988, pp. 5293-5294. The full text of Senator Exon's floor statement is reprinted in **Appendix G**.

[197] *Congressional Record*, March 25, 1988, pp. 5294-5295. The full text of Senator Warner's floor statement is reprinted in **Appendix G**.

Appendix J. AUKUS-Related: Projects Characterized as Too Big to Fail

This appendix presents the views of some observers who argue that acquisition projects viewed as too big to fail can be at elevated risk of cost growth that can reduce their achieved cost-effectiveness.

A 2020 article on the causes and cures of poor performance in large-scale projects states the following regarding the concept of escalating commitment, in which "executives continue to follow the pattern of behavior leading to unsuccessful outcomes rather than follow an alternative course of action":

> The primary cause connected to escalating commitment is the overall perception, which mostly works as a norm, that, once started, a megaproject is too big to fail and too costly to stop. Managers allocate resources in order to complete the project, even when subsequent assessments and audits indicate a decision in another direction, where the final benefits are no longer superior to the necessary investment.[198]

At a June 14, 2018, hearing entitled "NASA Cost and Schedule Overruns: Acquisition and Program Management Challenges" before the Space subcommittee of the House Science, Space, and Technology Committee, NASA Inspector General Paul K. Martin testified that

> many [NASA] project managers admitted to an expectation that projects that fail to meet initial cost and schedule goals, especially the larger projects, will receive additional funding and that subsequent scientific and technological success will overshadow budgetary and schedule problems. Past examples of this phenomena include [the] Hubble [Space Telescope], while current examples include JWST [James Webb Space Telescope], the Orion crew capsule, and the SLS [Space Launch System] rocket. Although a few projects in NASA's recent past were cancelled because of poor cost and schedule performance, a "too big to fail" mentality pervades Agency thinking when it comes to NASA's larger and most important missions. While understandable given the heavy investment of Agency resources, these cost overruns can result in delays to other NASA missions as funding is reprioritized.[199]

A 2012 review by one observer of a report from Australia's Defence Materiel Organisation (DMO) on major Australian defense acquisition programs stated the following in connection with an Australian program to acquire F-35 Joint Strike Fighters:

> Since the inception of this project, [the Australian Department of] Defence has accepted, seemingly without question, the marketing that has been generated by the [F-35] manufacturer and the US Project Office. Despite a series of increasingly critical reports coming from various US Governance authorities, Australia's commitment to the JSF has been unwavering and unquestioning. As the pressures from such reports increased, both US and Australian Defence and Military bureaucrats have retreated to the defence of 'The project is too big to fail', and 'There is no alternative', neither of which is true.

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[198] Juliano Denicol, Andrew Davies, and Ilias Krystallis, "What Are the Causes and Cures of Poor Megaproject Performance? A Systematic Literature Review and Research Agenda," *Project Management Journal*, February 2020.

[199] Statement of Paul K. Martin, Inspector General, National Aeronautics and Space Administration, before the Subcommittee on Space, [House] Committee on Science, Space, and Technology, hearing on NASA Cost and Schedule Overruns: Acquisitions and Program Management Challenges, June 14, 2018, p. 2. See also Robert N. Charette, "4 Reasons Why NASA Projects Miss Deadlines and Blow Budgets, Managers Think Their Projects Are 'Too Big to Fail,' and Believe Future Scientific Progress Will Excuse Any Delays or Cost Overruns," IEEE Spectrum, June 22, 2018.

> The outcome of the JSF Project will be determined by the laws of physics, not by any political/commercial/bureaucratic imperatives. The A12 Avenger [attack aircraft] Project was also 'too big to fail', but it did, and for much the same reasons that now threaten the JSF Project. Furthermore, both Defence and the DMO have been provided with independent and robust analyses of the JSF Project, but these seem to have all fallen within the Major JSF Project Challenge of "Appropriately manage JSF misinformation in the media". Certainly, all attempts to raise questions about the project have been ignored or rebuffed.
>
> The JSF Project demanded competent and robust project and systems engineering analysis and management from its inception, much along the lines that the Air Member for Technical Services at the time provided for the F-111 Project. His independent evaluation of that project and the critical problems that beset it enabled the early identification and successful management of the risks involved. Because that capability was stripped from the RAAF [Royal Australian Air Force] under the DRP/CSP [Defence Reform Program/Commercial Support Program], the risks associated with the JSF project are now all maturing.[200]

A 2008 Organisation for Economic Co-operation and Development (OECD) report on public-private partnerships stated

> Moral hazard – The more a project embodies a public good, the less the government will be able to let it fail, regardless of formal allocations of risks in contracts. In particular, when demand shortfalls occur, government has stepped in to bail out projects that have become financially unviable for the private partner. This undermines efficiency in several ways: (1) governments lose leverage since private partners know that government will provide a safety net under projects; (2) private partners' can shirk their responsibilities and avoid making tough decisions in the interests of efficiency, safe in the knowledge that government will not let them or the project fail….
>
> When a project is too big or important for government to let fail, a fundamental market discipline which causes private firms to be more efficient—the prospects of market failure—may not longer be influential. If government is perceived to stand behind the venture, then the project is really public, rather than private and a moral hazard could be induced as the private firm realizes its faces no liability from demand failures. It has been said that public private partnerships have the effect of privatizing profits while socializing losses….
>
> In effect, the boundaries between public and private become blurred. As government becomes more reliant on the private partner to deliver essential public services, the relationship becomes more of a collaborative one of mutual dependence than a competitive or arms length relationship that one finds in traditional procurement. The private firms become dependent on a steady payment stream and business opportunity while government becomes dependent on the firm as a monopolistic service provider. While both parties can gain, each also loses some of the value that makes them unique and valuable partners. Government loses control over the production of public value, surrendering a portion of control to the private firm that has different interests than government agencies. Private firms lose their competitive edge, as they no longer have to face the discipline of the market. At some point, the private firm becomes functionally similar to a government agency, particularly if it is "too big to fail".[201]

[200] E. J. Bushell, *Review of Defence Materiel Organisation (DMO) Major Projects Report (MPR) 2010-11*, February 2, 2012, p. 52, with cover letter dated February 2, 2012, addressed to Committee Secretary, JCPAA (Joint Committee of Public Accounts and Audit), Department of the House of Representatives, Parliament House, Canberra.

[201] Organisation for Economic Co-operation and Development, *Public-Private Partnerships: The Relevance of Budgeting*, May 28, 2008 (Public Governance and Territorial Development Directorate, Public Governance Committee, (continued...)

Working Party of Senior Budget Officials, 29th Annual Meeting of Senior Budget Officials, Vienna, Austria, June 2-3, June 2008, document written by Paul Posner, Shin Kue Ryu, and Ann Tkachenko), pp. 15, 16.

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