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Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress

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Summary

The current and planned size and composition of the Navy, the rate of Navy ship procurement, and the prospective affordability of the Navy's shipbuilding plans have been oversight matters for the congressional defense committees for many years.

On December 15, 2016, the Navy released a force-structure goal that calls for achieving and maintaining a fleet of 355 ships of certain types and numbers. The 355-ship force-level goal is the result of a Force Structure Assessment (FSA) conducted by the Navy in 2016. The Navy states that a new FSA is now underway as the successor to the 2016 FSA. This new FSA, Navy officials state, is to be completed by the end of 2019, or possibly sooner.

Navy and Marine Corps officials have suggested in their public remarks that this new FSA could change not only the 355-ship figure, but even more fundamentally, the fleet's architecture, meaning the fleet's basic mix of ship and aircraft types. Some observers, viewing statements by Navy officials, believe the new FSA might shift the Navy's surface force to a more-distributed architecture that includes a reduced proportion of large surface combatants (i.e., cruisers and destroyers), an increased proportion of small surface combatants (i.e., frigates and LCSs), and a newly created third tier of unmanned surface vehicles (USVs). Statements from the Commandant of the Marine Corps suggest that the new FSA might change the Navy's amphibious ship force to an architecture based on a new amphibious lift target and a new mix of amphibious ships. Some observers believe the new FSA might also change the Navy's undersea force to a more-distributed architecture that includes, in addition to attack submarines (SSNs) and bottom-based sensors, a new element of extra-large unmanned underwater vehicles (XLUUVs), which might be thought of as unmanned submarines.

The Navy's proposed FY2020 budget requests funding for the procurement of 12 new ships, including one Gerald R. Ford (CVN-78) class aircraft carrier, three Virginia-class attack submarines, three DDG-51 class Aegis destroyers, one FFG(X) frigate, two John Lewis (TAO-205) class oilers, and two TATS towing, salvage, and rescue ships. The Navy's FY2020 five-year (FY2020-FY2024) shipbuilding plan includes 55 new ships, or an average of 11 new ships per year.

The Navy's FY2020 30-year (FY2020-FY2049) shipbuilding plan includes 304 ships, or an average of about 10 per year. If the FY2020 30-year shipbuilding plan is implemented, the Navy projects that it will achieve a total of 355 ships by FY2034. This is about 20 years sooner than projected under the Navy's FY2019 30-year shipbuilding plan—an acceleration primarily due to a decision announced by the Navy in April 2018, after the FY2019 plan was submitted, to increase the service lives of all DDG-51 destroyers to 45 years. Although the Navy projects that the fleet will reach a total of 355 ships in FY2034, the Navy in that year and subsequent years will not match the composition called for in the FY2016 FSA.

One issue for Congress is whether the new FSA that the Navy is conducting will change the 355-ship force-level objective established by the 2016 FSA and, if so, in what ways. Another oversight issue for Congress concerns the prospective affordability of the Navy's 30-year shipbuilding plan. Decisions that Congress makes regarding Navy force structure and shipbuilding plans can substantially affect Navy capabilities and funding requirements and the U.S. shipbuilding industrial base.

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Introduction

This report presents background information and issues for Congress concerning the Navy's force structure and shipbuilding plans. The current and planned size and composition of the Navy, the rate of Navy ship procurement, and the prospective affordability of the Navy's shipbuilding plans have been oversight matters for the congressional defense committees for many years.

The Navy's proposed FY2020 budget requests funding for the procurement of 12 new ships, including one Gerald R. Ford (CVN-78) class aircraft carrier, three Virginia-class attack submarines, three DDG-51 class Aegis destroyers, one FFG(X) frigate, two John Lewis (TAO-205) class oilers, and two TATS towing, salvage, and rescue ships.

The issue for Congress is whether to approve, reject, or modify the Navy's proposed FY2020 shipbuilding program and the Navy's longer-term shipbuilding plans. Decisions that Congress makes on this issue can substantially affect Navy capabilities and funding requirements, and the U.S. shipbuilding industrial base.

Detailed coverage of certain individual Navy shipbuilding programs can be found in the following CRS reports:

- CRS Report R41129, *Navy Columbia (SSBN-826) Class Ballistic Missile Submarine Program: Background and Issues for Congress*, by Ronald O'Rourke.
- CRS Report RL32418, *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress*, by Ronald O'Rourke.
- CRS Report RS20643, *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*, by Ronald O'Rourke. (This report also covers the issue of the Administration's FY2020 budget proposal, which the Administration withdrew on April 30, to not fund a mid-life refueling overhaul [called a refueling complex overhaul, or RCOH] for the aircraft carrier *Harry S. Truman* [CVN-75], and to retire CVN-75 around FY2024.)
- CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke.
- CRS Report R44972, *Navy Frigate (FFG[X]) Program: Background and Issues for Congress*, by Ronald O'Rourke.
- CRS Report RL33741, *Navy Littoral Combat Ship (LCS) Program: Background and Issues for Congress*, by Ronald O'Rourke.
- CRS Report R43543, *Navy LPD-17 Flight II Amphibious Ship Program: Background and Issues for Congress*, by Ronald O'Rourke. (This report also covers the issue of funding for the procurement of an amphibious assault ship called LHA-9.)
- CRS Report R43546, *Navy John Lewis (TAO-205) Class Oiler Shipbuilding Program: Background and Issues for Congress*, by Ronald O'Rourke.
- CRS Report R45757, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress*, by Ronald O'Rourke.

For a discussion of the strategic and budgetary context in which U.S. Navy force structure and shipbuilding plans may be considered, see **Appendix A**.

Background

Navy's 355-Ship Ship Force-Structure Goal

Introduction

On December 15, 2016, the Navy released a force-structure goal that calls for achieving and maintaining a fleet of 355 ships of certain types and numbers. The 355-ship force-level goal replaced a 308-ship force-level goal that the Navy released in March 2015. The 355-ship force-level goal is the largest force-level goal that the Navy has released since a 375-ship force-level goal that was in place in 2002-2004. In the years between that 375-ship goal and the 355-ship goal, Navy force-level goals were generally in the low 300s (see **Appendix B**). The force level of 355 ships is a goal to be attained in the future; the actual size of the Navy in recent years has generally been between 270 and 290 ships. **Table 1** shows the composition of the 355-ship force-level objective.

Table 1. 355-Ship Force-Level Goal

Ship Category	Number of ships
Ballistic missile submarines (SSBNs)	12
Attack submarines (SSNs)	66
Aircraft carriers (CVNs)	12
Large surface combatants (i.e., cruisers [CGs] and destroyers [DDGs])	104
Small surface combatants (i.e., frigates [FFGs], Littoral Combat Ships, and mine warfare ships)	52
Amphibious ships	38
Combat Logistics Force (CLF) ships (i.e., at-sea resupply ships)	32
Command and support ships	39
TOTAL	**355**

Source: U.S. Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020*, Table A-1 on page 10.

355-Ship Goal Resulted from 2016 Force Structure Assessment (FSA)

The 355-ship force-level goal is the result of a Force Structure Assessment (FSA) conducted by the Navy in 2016. An FSA is an analysis in which the Navy solicits inputs from U.S. regional combatant commanders (CCDRs) regarding the types and amounts of Navy capabilities that CCDRs deem necessary for implementing the Navy's portion of the national military strategy and then translates those CCDR inputs into required numbers of ships, using current and projected Navy ship types. The analysis takes into account Navy capabilities for both warfighting and day-to-day forward-deployed presence.[1] Although the result of the FSA is often reduced for convenience to single number (e.g., 355 ships), FSAs take into account a number of factors, including types and capabilities of Navy ships, aircraft, unmanned vehicles, and weapons, as well as ship homeporting arrangements and operational cycles. The Navy conducts a new FSA or an

[1] For further discussion, see U.S. Navy, *Executive Summary, 2016 Navy Force Structure Assessment (FSA)*, December 15, 2016, pp. 1-2.

update to the existing FSA every few years, as circumstances require, to determine its force-structure goal.

355-Ship Goal Made U.S. Policy by FY2018 NDAA

Section 1025 of the FY2018 National Defense Authorization Act, or NDAA (H.R. 2810/P.L. 115-91 of December 12, 2017), states the following:

> SEC. 1025. Policy of the United States on minimum number of battle force ships.
>
> (a) Policy.—It shall be the policy of the United States to have available, as soon as practicable, not fewer than 355 battle force ships, comprised of the optimal mix of platforms, with funding subject to the availability of appropriations or other funds.
>
> (b) Battle force ships defined.—In this section, the term "battle force ship" has the meaning given the term in Secretary of the Navy Instruction 5030.8C.

The term *battle force ships* in the above provision refers to the ships that count toward the quoted size of the Navy in public policy discussions about the Navy.[2]

Large Unmanned Vehicles and Navy Ship Count

Because large unmanned vehicles can be deployed directly from pier to perform missions that might otherwise be assigned to manned ships and submarines, some observers have a raised a question as to whether the large UVs covered in this report should be included in the top-level count of the number of ships in the Navy. Navy officials state that they have not yet decided whether to modify the top-level count of the number of ships in the Navy to include these large UVs.

Sustainment Costs

Regarding the potential sustainment costs of a larger fleet—a concern that the Navy highlighted in its FY2020 30-year shipbuilding plan[3]—a May 15, 2019, press report states

> The Navy's upcoming force structure assessment won't back away from the service's long-time goal of a 355-ship fleet, a top official said Wednesday [May 15], suggesting that the number may actually inch higher. But the service is also getting some sobering feedback on how much it will cost to sustain a significantly larger fleet— something it hasn't had to do in decades.
>
> As the Navy plans for more ships, Vice Adm. William Merz Deputy Chief Of Naval Operations For Warfare Systems said Wednesday, "we're also coming to realize what that is going to cost, and how you're going to sustain today's fleet while continuing to grow." The planning process is "much more challenging than anyone realized," he said, "but we're much smarter about our business" than just a few years ago.

[2] The battle force ships method for counting the number of ships in the Navy was established in 1981 by agreement between the Secretary of the Navy and the Secretary of Defense, and has been modified somewhat over time, in part by Section 1021 of the Carl Levin and Howard P. "Buck" McKeon National Defense Authorization Act for Fiscal Year 2015 (H.R. 3979/P.L. 113-291 of December 19, 2014).

[3] U.S. Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020*, pp. 19-20. A passage from pages 19-20 is block-quoted later in this report—see the quoted passage that ends with the indicator for footnote 31.

> The much-anticipated Force Structure Assessment, which CNO Adm. John Richardson has said should be released this summer, is expected to lay out the kinds of capabilities the Navy wants in the near-term to meet and deter potential adversaries like China and Russia.
>
> But taking the fleet from under 300 ships to at least 355 is a daunting task, Merz said at the Center for Strategic and International Studies. "We don't have the complex modeling to even understand what all of these costs are going to materialize to over the next 20 years," he said, but the service is "working hard to converge on a model" to sustain the ships over the long haul.[4]

New FSA Now Being Done Could Change 355-Ship Figure and Force Mix

Overview

The Navy states that a new FSA is now underway as the successor to the 2016 FSA, and that this new FSA is to be completed by the end of 2019, or possibly sooner. (On April 29, 2019, Chief of Naval Operations Admiral John Richardson reportedly stated that it could be completed by the "late summer" of 2019.)[5]

The new FSA, Navy officials state, will take into account the Trump Administration's December 2017 National Security Strategy document and its January 2018 National Defense Strategy document, both of which put an emphasis on renewed great power competition with China and Russia, as well as updated information on Chinese and Russian naval and other military capabilities and recent developments in new technologies, including those related to unmanned vehicles (UVs).[6]

Navy and Marine Corps officials have suggested in their public remarks that this new FSA could change not only the 355-ship figure, but even more fundamentally, the fleet's architecture, meaning the fleet's basic mix of ship and aircraft types. As detailed in the sections below, some observers, viewing statements by Navy officials, believe the new FSA might shift the Navy's surface force to a more-distributed architecture that includes a reduced proportion of large surface combatants (i.e., cruisers and destroyers), an increased proportion of small surface combatants (i.e., frigates and LCSs), and a newly created third tier of unmanned surface vehicles (USVs). Statements from the Commandant of the Marine Corps suggest that the new FSA might change the Navy's amphibious ship force to an architecture based on a new amphibious lift target and a new mix of amphibious ships. Some observers believe the new FSA might also change the Navy's undersea force to a more-distributed architecture that includes, in addition to attack submarines (SSNs) and bottom-based sensors, a new element of extra-large unmanned underwater vehicles (XLUUVs), which might be thought of as unmanned submarines.

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[4] Paul McLeary, "Navy Wary of Growing Costs While It Ramps Up Ops," *Breaking Defense*, May 15, 2019.

[5] See Mallory Shelbourne, "Richardson: Navy to Unveil New FSA in 'Late Summer,'" *Inside Defense*, April 29, 2019.

[6] See, for example, Marcus Weisgerber, "US Navy Re-Evaluating 355-Ship Goal," *Defense One*, February 1, 2019l; Paul McLeary, "Navy Rethinks 355-Ship Fleet: CNO Richardson," *Breaking Defense*, February 1, 2019; Mallory Shelbourne, "CNO: Navy Expects New Force-Structure Assessment 'Later This Year,'" *Inside the Navy*, February 4, 2019.

Potential New Surface Combatant Force Architecture

Some observers, viewing statements by Navy officials, believe the new FSA might shift the Navy's surface combatant force to a more-distributed architecture that includes a reduced proportion of large surface combatants (i.e., cruisers and destroyers), an increased proportion of small surface combatants (i.e., frigates and LCSs), and a newly created third tier of unmanned surface vehicles (USVs). In presenting its proposed FY2020 budget, the Navy highlighted its plans for developing and procuring USVs in coming years.

Figure 1 provides, for the surface combatant portion of the Navy,[7] a conceptual comparison of the current fleet architecture (shown on the left as the "ship centric force") and the new, more-distributed architecture (shown on the right as the "distributed/nodal force"). The figure does not depict the entire surface combatant fleet, but rather a representative portion of it.

In the figure, each sphere represents a manned ship or USV. As shown in the color coding, under both the current fleet architecture and the more-distributed architecture, the manned ships (i.e., the LSCs and SSCs) are equipped with a combination of sensors (green), command and control (C2) equipment (red), and payloads other than sensors and C2 equipment, meaning principally weapons (blue).

Under the more-distributed architecture, the manned ships would be on average smaller (because a greater share of them would be SSCs), and this would be possible because some of the surface combatant force's weapons and sensors would be shifted from the manned ships to USVs, with weapon-equipped Large USVs (LUSVs) acting as adjunct weapon magazines and sensor-equipped Medium USVs (MUSVs) contributing to the fleet's sensor network.

As shown in **Figure 1**, under the Navy's current surface combatant force architecture, there are to be 20 LSCs for every 10 SSCs (i.e., a 2:1 ratio of LSCs to SSCs), with no significant contribution from LUSVs and MUSVs. This is consistent with the Navy's current force-level objective, which calls for achieving a 355-ship fleet that includes 104 LSCs and 52 SSCs (a 2:1 ratio). Under the more-distributed architecture, the ratio of LSCs to SSCs would be reversed, with 10 LSCs for every 20 SSCs (a 1:2 ratio), and there would also now be 30 LUSVs and 40 MUSVs. A January 15, 2019, press report states

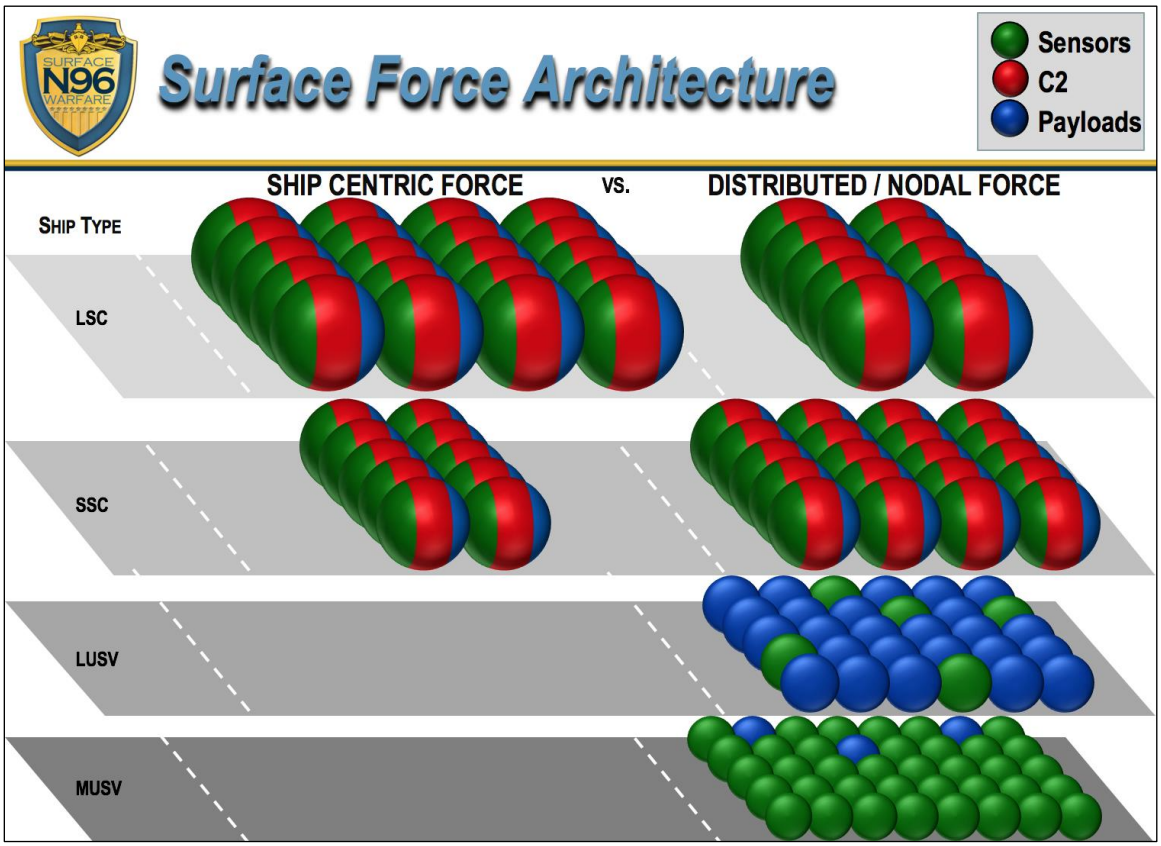
> The Navy plans to spend this year taking the first few steps into a markedly different future, which, if it comes to pass, will upend how the fleet has fought since the Cold War. And it all starts with something that might seem counterintuitive: It's looking to get smaller.
>
> "Today, I have a requirement for 104 large surface combatants in the force structure assessment; [and] I have [a requirement for] 52 small surface combatants," said Surface Warfare Director Rear Adm. Ronald Boxall. "That's a little upside down. Should I push out here and have more small platforms? I think the future fleet architecture study has intimated 'yes,' and our war gaming shows there is value in that."[8]

[7] Other major parts of the Navy include submarines, aircraft carriers, amphibious ships, logistics (resupply) ships, and support ships.

[8] David B. Larter, "US Navy Moves Toward Unleashing Killer Robot Ships on the World's Oceans," *Defense News*, January 15, 2019.

Figure 1. Navy Briefing Slide on Surface Combatant Force Architecture

Each sphere represents a ship or unmanned surface vehicle (USV)



Source: Illustration accompanying Megan Eckstein, "Sea Hunter Unmanned Ship Continues Autonomy Testing as NAVSEA Moves Forward with Draft RFP," *USNI News*, April 29, 2019. The illustration was also included as Slide 2 in a Navy briefing entitled "Designing & Building the Surface Fleet: Unmanned and Small Combatants," by Rear Admiral Casey Moton at a June 20, 2019, conference of the American Society of Naval Engineers (ASNE).

Notes: Each sphere represents a ship or a USV. LSC means large surface combatant (i.e., cruiser or destroyer), and SSC means small surface combatant (i.e., frigate or Littoral Combat Ship). As shown in the color coding, the LSCs and SSCs are equipped with a combination of sensors (green), command and control (C2) equipment (red), and payloads other than sensors and C2 equipment, meaning principally weapons (blue). LUSVs and MUSVs, in contrast, are equipped primarily with weapons (blue) or sensors (green).

Another way of summarizing **Figure 1** would be to say that the surface combatant force architecture (reading vertically down the figure) would change from 20+10+0+0 (i.e., a total of 30 surface combatant platforms, all manned) for a given portion of the surface combatant force, to 10+20+30+40 (i.e., a total of 100 surface combatant platforms, 70 of which would be LUSVs and MUSVs) for a given portion of the surface combatant force. The Navy refers to the more-distributed architecture's combination of LSCs, SSCs, LUSVs, and MUSVs as the Future Surface Combatant Force (FSCF).

Figure 1 is conceptual, so the platform ratios for the more-distributed architecture should be understood as notional or approximate rather than exact. The point of the figure is not that relative platform numbers under the more-distributed architecture would change to the exact ratios shown in the figure, but that they would evolve over time toward something broadly resembling those ratios.

Potential New Amphibious Ship Architecture

Statements from the Commandant of the Marine Corps suggest that the new FSA might change the Navy's amphibious ship force to an architecture based on a new amphibious lift target and a new mix of amphibious ships.

The current 38-ship amphibious ship force-level goal shown in **Table 1** is intended to meet a requirement for having enough amphibious lift to lift the assault echelons of two Marine Expeditionary Brigades (MEBs), a requirement known as the 2.0 MEB lift requirement. Using current types of amphibious ships—LHA/LHD-type amphibious assault ships (also known as "big deck" amphibious ships) and smaller (but still sizeable) LSD/LPD-type amphibious ships—the 2.0 MEB lift requirement translates into a requirement for 12 LHA/LHD-type ships and 26 LPD-type ships, or a total of 38 ships. The 2.0 MEB lift requirement dates to 2006. The translation of this lift requirement into a Marine Corps-preferred force-level goal of 38 ships dates to 2009, and the Navy's formal incorporation of the 38-ship goal (rather than a more fiscally constrained goal of 33 or 34 ships) into the Navy's overall ship force-structure goal dates to the 2016 FSA.[9]

In July 2019, General David H. Berger, the Commandant of the Marine Corps, released a document entitled *Commandant's Planning Guidance* that states (emphasis as in the original):

> **We will no longer use a "2.0 MEB requirement" as the foundation for our arguments regarding amphibious ship building, to determine the requisite capacity of vehicles or other capabilities, or as pertains to the Maritime Prepositioning Force. We will no longer reference the 38-ship requirement memo from 2009, or the 2016 Force Structure Assessment, as the basis for our arguments and force structure justifications.** The ongoing 2019 Force Structure Assessment will inform the amphibious requirements based upon this guidance. The global options for amphibs [types of amphibious ships] include many more options than simply LHAs, LPDs, and LSDs. I will work closely with the Secretary of the Navy and Chief of Naval Operations (CNO) to ensure there are adequate numbers of the right types of ships, with the right capabilities, to meet national requirements.
>
> I do not believe joint forcible entry operations (JFEO) are irrelevant or an operational anachronism; however, we must acknowledge that different approaches are required given the proliferation of anti-access/area denial (A2AD) threat capabilities in mutually contested spaces. Visions of a massed naval armada nine nautical miles off-shore in the South China Sea preparing to launch the landing force in swarms of ACVs [amphibious combat vehicles], LCUs [utility landing craft], and LCACs [air-cushioned landing craft]are impractical and unreasonable. We must accept the realities created by the proliferation of precision long-range fires, mines, and other smart-weapons, and seek innovative ways to overcome those threat capabilities. I encourage experimentation with lethal long-range unmanned systems capable of traveling 200 nautical miles, penetrating into the adversary enemy threat ring, and crossing the shoreline—causing the adversary to allocate resources to eliminate the threat, create dilemmas, and further create opportunities for fleet maneuver.

[9] For additional discussion of the 2.0 MEB lift goal and earlier amphibious lift goals dating back to 1980, see Appendix A of CRS Report RL34476, *Navy LPD-17 Amphibious Ship Procurement: Background, Issues, and Options for Congress*, by Ronald O'Rourke. (Report RL34476 is an archived CRS report on what are now known as the LPD-17 Flight I ships. Report RL34476 was succeeded by a new CRS report that focuses on the LPD-17 Flight II ships that are now being procured: CRS Report R43543, *Navy LPD-17 Flight II Amphibious Ship Program: Background and Issues for Congress*, by Ronald O'Rourke.)

> We cannot wait to identify solutions to our mine countermeasure needs, and must make this a priority for our future force development efforts.[10]

Potential New Undersea Force Architecture

Some observers believe the new FSA might also change the Navy's undersea force to a more-distributed architecture that includes, in addition to attack submarines (SSNs) and bottom-based sensors, a new element of extra-large unmanned underwater vehicles (XLUUVs), which might be thought of as unmanned submarines. In presenting its proposed FY2020 budget, the Navy highlighted its plans for developing and procuring UUVs in coming years.

Rationale for a More-Distributed Fleet Architecture

Some observers have long urged the Navy to shift to a more-distributed fleet architecture, on the grounds that the Navy's current architecture—which concentrates much of the fleet's capability into a relatively limited number of individually larger and more-expensive surface ships—is increasingly vulnerable to attack by the improving maritime anti-access/area-denial (A2/AD) capabilities (particularly anti-ship missiles and their supporting detection and targeting systems) of potential adversaries, particularly China.[11] Shifting to a more-distributed architecture, these observers have argued, would

- complicate an adversary's targeting challenge by presenting the adversary with a larger number of Navy units to detect, identify, and track;
- reduce the loss in aggregate Navy capability that would result from the destruction of an individual Navy platform;
- give U.S. leaders the option of deploying USVs and UUVs in wartime to sea locations that would be tactically advantageous but too risky for manned ships; and
- increase the modularity and reconfigurability of the fleet for adapting to changing mission needs.[12]

For a number of years, Navy leaders acknowledged the views of those observers but continued to support the current fleet architecture. More recently, however, Navy leaders appear to have shifted their thinking, with comments from Navy officials like the one quoted above, Navy briefing slides like **Figure 1**, and the Navy's emphasis on USVs and UUVs in its FY2020 budget submission (see next section) suggesting that Navy leaders now support moving the fleet to a more-distributed architecture. The views of Navy leaders appear to have shifted in favor of a more-distributed architecture because they now appear to believe that such an architecture will be

- increasingly needed—as the observers have long argued—to respond effectively to the improving maritime A2/AD capabilities of other countries, particularly China;

[10] U.S. Marine Corps, *Commandant's Planning Guidance, 38th Commandant of the Marine Corps*, undated, released July 2019, pp. 4-5. See also Megan Eckstein, "New Commandant Berger Sheds 38-Amphib Requirement in Quest to Modernize USMC for High-End Fight," *USNI News*, July 18, 2019.

[11] For more on China's maritime A2/AD capabilities, see CRS Report RL33153, *China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress*, by Ronald O'Rourke.

[12] See, for example, Arthur H. Barber, "Redesign the Fleet," *U.S. Naval Institute Proceedings*, January 2019.

- technically feasible as a result of advances in technologies for UVs and for networking widely distributed maritime forces that include significant numbers of UVs; and
- no more expensive, and possibly less expensive, than the current architecture.

The more-distributed architecture that Navy leaders now appear to support may differ in its details from distributed architectures that the observers have been advocating, but the general idea of shifting to a more-distributed architecture, and of using large UVs as a principal means of achieving that, appears to be similar. The Department of Defense (DOD) states that

> The FY 2020 budget request diversifies and expands sea power strike capacity through procurement of offensively armed Unmanned Surface Vessels (USVs). The USV investment, paired with increased investment in long-range maritime munitions, represents a paradigm shift towards a more balanced, distributed, lethal, survivable, and cost-imposing naval force that will better exploit adversary weaknesses and project power into contested environments.[13]

Distributed Maritime Operations (DMO)

Shifting to a more-distributed force architecture, Navy officials have suggested, could be appropriate for implementing the Navy's new overarching operational concept, called Distributed Maritime Operations (DMO). Observers view DMO as a response to both China's improving maritime anti-access/area denial capabilities (which include advanced weapons for attacking Navy surface ships) and opportunities created by new technologies, including technologies for UVs and for networking Navy ships, aircraft, unmanned vehicles, and sensors into distributed battle networks.

The Navy's FY2020 30-year shipbuilding plan mentions DMO,[14] and a December 2018 document from the Chief of Naval Operations states that the Navy will "Continue to mature the Distributed Maritime Operations (DMO) concept and key supporting concepts" and "Design and implement a comprehensive operational architecture to support DMO."[15] While Navy officials have provided few details in public about DMO, then-Chief of Naval Operations Admiral John Richardson, in explaining DMO, stated in December 2018 that

> Our fundamental force element right now in many instances is the [individual] carrier strike group. We're going to scale up so our fundamental force element for fighting is at the fleet[-wide] level, and the [individual] strike groups plug into those [larger] numbered fleets. And they will be, the strike groups and the fleet together, will be operating in a distributed maritime operations way."[16]

In its FY2020 budget submission, the Navy states that "MUSV and LUSV are key enablers of the Navy's Distributed Maritime Operations (DMO) concept, which includes being able to forward deploy (alone or in teams/swarms), team with individual manned combatants or augment battle

[13] Department of Defense, Office of the Undersecretary of Defense (Comptroller)/Chief Financial Officer, *Defense Budget Overview, United States Department of Defense, Fiscal Year 2020 Budget Request*, March 2019, pp. 4-5 to 4-6.

[14] U.S. Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020*, March 2019, pp. 3, 4, 7, 8, 15, 17, 24.

[15] U.S. Navy, Chief of Naval Operations, *A Design for Maintaining Maritime Superiority, Version 2.0*, December 2018, pp. 8, 10.

[16] (Chief of Naval Operations Admiral John Richardson, as quoted in Megan Eckstein, "Navy Planning for Gray-Zone Conflict; Finalizing Distributed Maritime Operations for High-End Fight," *USNI News*, December 19, 2018.)

groups."[17] The Navy states in its FY2020 budget submission that a Navy research and development effort focusing on concept generation and concept development (CG/CD) will

> Continue CG/CD development efforts that carry-over from FY[20]19: Additional concepts and CONOPs [concepts of operation] to be developed in FY[20]20 will be determined through the CG/CD development process and additional external factors. Concepts under consideration include Unmanned Systems in support of DMO, Command and Control in support of DMO, Offensive Mine Warfare, Targeting in support of DMO, and Advanced Autonomous/Semi-autonomous Sustainment Systems.[18]

The Navy also states in its FY2020 budget submission that a separate Navy research and development effort for fleet experimentation activities will include activities that "address key DMO concept action plan items such as the examination of Fleet Command and Maritime Operation Center (MOC) capabilities and the employment of unmanned systems in support of DMO."[19]

A May 16, 2019, press report states

> The Deputy Chief of Naval Operations for Warfare Systems said Wednesday [May 15] he thinks the upcoming Force Structure Assessment (FSA) will focus on smaller surface combatants as the service looks to build up to a 355-ship Navy.
>
> "I certainly don't see that [FSA fleet] number going down, but it is going to be more reflective of the DMO [Distributed Maritime Operations] construct and it includes not just the battle force ships, but the logistics ships, the trainers, the maritime operations centers, everything that we pull together to keep this machine running," Vice Adm. William Merz said during an event at the Center for Strategic and International Studies.
>
> "What we think is going to happen with this FSA is there will be more emphasis on the smaller surface combatants, mostly because the frigate looks like it's coming along very well and it's going to be more lethal than we had planned," Merz said.
>
> Merz explained the likely outcome by comparing it to how Rear Adm. Ron Boxall, director of surface warfare (N96), talks about how the Navy has too many large surface combatants and needs to get more balanced.
>
> "When you look at the lethality of the frigate, yeah that makes sense. So we'll see how the FSA handles the lethality of that – and then how does that bleed over into the other accounts," Merz said….
>
> Merz revealed there will also be "a hard look at the logistics side" because while some logistics ships count as battle force ships some do not. He said the FSA will make an opinion on the non-battle force logistics vessels as well because it does not limit itself to those strict definitions.

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[17] *Department of Defense, Fiscal Year (FY) 2020 Budget Estimates, Navy Justification Book Volume 2 of 5, Research, Development, Test & Evaluation, Navy, Budget Activity 4*, March 2019, p. 202. See also Kevin Eyer and Steve McJessy, "Operationalizing Distributed Maritime Operations," Center for International Maritime Security (CIMSEC), March 5, 2019; Christopher H. Popa, et al, *Distributed Maritime Operations and Unmanned Systems Tactical Employment*, Naval Postgraduate School, June 2018, 171 pp. (Systems Engineering Capstone Report); Lyla Englehorn, *Distributed Maritime Operations (DMO) Warfare Innovation Continuum (WIC) Workshop September 2017 After Action Report*, Naval Postgraduate School, December 2017, 99 pp.

[18] *Department of Defense, Fiscal Year (FY) 2020 Budget Estimates, Navy Justification Book Volume 2 of 5, Research, Development, Test & Evaluation, Navy, Budget Activity 4*, March 2019, p. 1385. See also pp. 1382, 1384, 1443, 1445.

[19] *Department of Defense, Fiscal Year (FY) 2020 Budget Estimates, Navy Justification Book Volume 4 of 5, Research, Development, Test & Evaluation, Navy Budget Activity 6*, March 2019, p. 290.

> The FSA will also take into account the evolution of the air wing, the length of the air wing, the range of the air wing on carriers and amphibious vessels, and how the Navy will cover its responsibilities.[20]

Expeditionary Advanced Base Operations (EABO)

In parallel with DMO, the Marine Corps has developed a new operational concept, called Expeditionary Advanced Base Operations (EABO), that appears related to the earlier-quoted passage from the *Commandant's Planning Guidance* about changing the amphibious lift goal and the amphibious force architecture. Regarding EABO, the *Commandant's Planning Guidance* states (emphasis as in the original):

> The 2016 *Marine Corps Operating Concept* (MOC) predates the current set of national strategy and guidance documents, but it was prescient in many ways. It directed partnering with the Navy to develop two concepts, Littoral Operations in a Contested Environment (LOCE) and Expeditionary Advanced Base Operations (EABO) that nest exceptionally well with the current strategic guidance. It is time to move beyond the MOC itself, however, and partner with the Navy to complement LOCE and EABO with classified, threat-specific operating concepts that describe how naval forces will conduct the range of missions articulated in our strategic guidance….
>
> **EABO complement the Navy's Distributed Maritime Operations Concept and will inform how we approach missions against peer adversaries**….
>
> EABO are driven by the aforementioned adversary deployment of long-range precision fires designed to support a strategy of "counter-intervention" directed against U.S. and coalition forces. EABO, as an operational concept, enables the naval force to persist forward within the arc of adversary long-range precision fires to support our treaty partners with combat credible forces on a much more resilient and difficult to target forward basing infrastructure. EABO are designed to restore force resiliency and enable the persistent naval forward presence that has long been the hallmark of naval forces. Most significantly, EABO reverse the cost imposition that determined adversaries seek to impose on the joint force. EABO guide an apt and appropriate adjustment in future naval force development to obviate the significant investment our adversaries have made in long-range precision fires. Potential adversaries intend to target our forward fixed and vulnerable bases, as well as deep water ports, long runways, large signature platforms, and ships. By developing a new expeditionary naval force structure that is not dependent on concentrated, vulnerable, and expensive forward infrastructure and platforms, we will frustrate enemy efforts to separate U.S. Forces from our allies and interests. EABO enable naval forces to partner and persist forward to control and deny contested areas where legacy naval forces cannot be prudently employed without accepting disproportionate risk….
>
> In February of 2019, the Commandant and Chief of Naval Operations co-signed the concept for EABO. The ideas contained in this document are foundational to our future force development efforts and are applicable in multiple scenarios.[21]

[20] Rich Abott, "Merz Says FSA To Emphasize Smaller Ships," *Defense Daily*, May 16, 2019.

[21] U.S. Marine Corps, *Commandant's Planning Guidance, 38th Commandant of the Marine Corps*, undated, released July 2019, pp. 9, 11, 19.

Navy's Five-Year and 30-Year Shipbuilding Plans

FY2020 Five-Year (FY2020-FY2024) Shipbuilding Plan

Table 2 shows the Navy's FY2020 five-year (FY2020-FY2024) shipbuilding plan. The table also shows, for reference purposes, the ships funded for procurement in FY2019. The figures in the table reflect a Navy decision to show the aircraft carrier CVN-81 as a ship to be procured in FY2020 rather than a ship that was procured in FY2019. Congress, as part of its action on the Navy's proposed FY2019 budget, authorized the procurement of CVN-81 in FY2019.[22]

Table 2. FY2020 Five-Year (FY2020-FY2024) Shipbuilding Plan

FY2019 shown for reference

	FY19 (enacted)	FY20 (req.)	FY21	FY22	FY23	FY24	FY20-FY24 Total
Columbia (SSBN-826) class ballistic missile submarine			1			1	2
Gerald R. Ford (CVN-78) class aircraft carrier		1					1
Virginia (SSN-774) class attack submarine	*2*	3	2	2	2	2	11
Arleigh Burke (DDG-51) class destroyer	*3*	3	2	2	3	3	13
Littoral Combat Ship (LCS)	*3*						0
FFG(X) frigate		1	2	2	2	2	9
LHA amphibious assault ship						1	1
LPD-17 Fight II amphibious ship			1		1		2
Expeditionary Sea Base (ESB) ship	*1*				1		1
Expeditionary Fast Transport (EPF) ship	*1*						0
John Lewis (TAO-205) class oiler	*2*	2	1	1	2	1	7
TATS towing, salvage, and rescue ship	*1*	2	1	1	1		5
TAGOS(X) ocean surveillance ship				1	1	1	3
TOTAL	***13***	**12**	**10**	**9**	**13**	**11**	**55**

Source: Table prepared by CRS based on FY2020 Navy budget submission.

Notes: Ships shown are battle force ships—ships that count against 355-ship goal. The figures in the table reflect a Navy decision to show the aircraft carrier CVN-81 as a ship to be procured in FY2020 rather than a ship that was procured in FY2019. Congress, as part of its action on the Navy's proposed FY2019 budget, authorized the procurement of CVN-81 in FY2019.

As shown in **Table 2**, the Navy's proposed FY2020 budget requests funding for the procurement of 12 new ships, including one Gerald R. Ford (CVN-78) class aircraft carrier, three Virginia-class attack submarines, three DDG-51 class Aegis destroyers, one FFG(X) frigate, two John Lewis (TAO-205) class oilers, and two TATS towing, salvage, and rescue ships. If the Navy had listed CVN-81 as a ship procured in FY2019 rather than a ship to be procured in FY2020, then the total numbers of ships in FY2019 and FY2020 would be 14 and 11, respectively.

As also shown **Table 2**, the Navy's FY2020 five-year (FY2020-FY2024) shipbuilding plan includes 55 new ships, or an average of 11 new ships per year. The Navy's FY2019 budget submission also included a total of 55 ships in the period FY2020-FY2024, but the mix of ships making up the total of 55 for these years has been changed under the FY2020 budget submission

[22] For further discussion, see CRS Report RS20643, *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*, by Ronald O'Rourke.

to include one additional attack submarine, one additional FFG(X) frigate, and two (rather than four) LPD-17 Flight II amphibious ships over the five-year period. The FY2020 submission also makes some changes within the five-year period to annual procurement quantities for DDG-51 destroyers, ESBs, and TAO-205s without changing the five-year totals for these programs.

Compared to what was projected for FY2020 itself under the FY2019 budget submission, the FY2020 request accelerates from FY2023 to FY2020 the aircraft carrier CVN-81 (as a result of Congress's action to authorize the ship in FY2019), adds a third attack submarine, accelerates from FY2021 into FY2020 a third DDG-51, defers from FY2020 to FY2021 an LPD-17 Flight II amphibious ship to FY2021, defers from FY2020 to FY2023 an ESB ship, and accelerates from FY2021 to FY2020 a second TAO-205 class oiler.

FY2020 30-Year (FY2020-FY2049) Shipbuilding Plan

Table 3 shows the Navy's FY2020-FY2049 30-year shipbuilding plan. In devising a 30-year shipbuilding plan to move the Navy toward its ship force-structure goal, key assumptions and planning factors include but are not limited to ship construction times and service lives, estimated ship procurement costs, projected shipbuilding funding levels, and industrial-base considerations. As shown in **Table 3**, the Navy's FY2020 30-year shipbuilding plan includes 304 new ships, or an average of about 10 per year.

Table 3. FY2020 30-Year (FY2020-FY2049) Shipbuilding Plan

FY	CVNs	LSCs	SSCs	SSNs	LPSs	SSBNs	AWSs	CLFs	Supt	Total
20	1	3	1	3				2	2	**12**
21		2	2	2		1	1	1	1	**10**
22		2	2	2				1	2	**9**
23		3	2	2			1	2	3	**13**
24		3	2	2		1	1	1	1	**11**
25		3	2	2			1	1	2	**11**
26		2	2	2		1	1	1	2	**11**
27		3	2	2		1	2	1	1	**12**
28	1	2	2	2		1	1	1	1	**11**
29		3	2	2		1	1	1	1	**11**
30		2	1	2		1	1	1	2	**10**
31		3	2	2		1	2	1	2	**13**
32	1	2	2	2		1	1	1	2	**12**
33		3	2	2		1	1	1	2	**12**
34		2	2	2		1	2		2	**11**
35		3	2	2		1			1	**9**
36	1	2	2	2	1					**8**
37		3	2	2						**7**
38		2	2	2			1			**7**
39		3	2	2	1					**8**
40	1	2	2	2			1			**8**
41		3	2	2			1			**8**
42		2	2	2	1		1			**8**
43		3	2	2				1		**8**
44	1	2	2	2			1			**8**
45		3	2	2	1		2	2		**12**
46		2	2	2			1	2		**9**
47		3	2	2			1	2		**10**

48	1	2	2	2	1		2	2		**12**
49		3	2	2			1	2	3	**13**
Total	7	76	58	61	5	12	28	27	30	**304**

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

Key: FY = Fiscal Year; **CVNs** = aircraft carriers; **LSCs** = surface combatants (i.e., cruisers and destroyers); **SSCs** = small surface combatants (i.e., Littoral Combat Ships [LCSs] and frigates [FFG(X)s]); **SSNs** = attack submarines; **LPSs** = large payload submarines; **SSBNs** = ballistic missile submarines; **AWSs** = amphibious warfare ships; **CLFs** = combat logistics force (i.e., resupply) ships; **Supt** = support ships.

Projected Force Levels Under FY2020 30-Year Shipbuilding Plan

Overview

Table 4 shows the Navy's projection of ship force levels for FY2020-FY2049 that would result from implementing the FY2020 30-year (FY2020-FY2049) 30-year shipbuilding plan shown in **Table 3**.

Table 4. Projected Force Levels Resulting from FY2020 30-Year Shipbuilding Plan

	CVNs	LSCs	SSCs	SSNs	SSGN/LPSs	SSBNs	AWSs	CLFs	Supt	Total
355-ship goal	**12**	**104**	**52**	**66**	**0**	**12**	**38**	**32**	**39**	**355**
FY20	11	94	30	52	4	14	33	29	34	**301**
FY21	11	92	33	53	4	14	34	30	34	**305**
FY22	11	93	33	52	4	14	34	31	39	**311**
FY23	11	95	32	51	4	14	35	31	41	**314**
FY24	11	94	35	47	4	14	36	32	41	**314**
FY25	10	95	35	44	4	14	37	32	42	**313**
FY26	10	96	36	44	2	14	38	31	43	**314**
FY27	9	100	38	42	1	13	37	32	44	**316**
FY28	10	102	41	42		13	38	32	44	**322**
FY29	10	104	43	44		12	36	32	44	**325**
FY30	10	107	45	46		11	36	32	44	**331**
FY31	10	110	47	48		11	36	32	43	**337**
FY32	10	112	49	49		11	36	32	44	**343**
FY33	10	115	50	51		11	38	32	44	**351**
FY34	10	117	52	53		11	36	32	44	**355**
FY35	10	114	55	54		11	34	32	45	**355**
FY36	10	109	57	56		11	35	32	45	**355**
FY37	10	107	58	58		10	35	32	45	**355**
FY38	10	108	59	57		10	35	32	44	**355**
FY39	10	105	61	58		10	37	32	42	**355**
FY40	9	105	62	59		10	37	32	41	**355**
FY41	10	104	61	59		11	37	32	41	**355**
FY42	9	106	60	61		12	36	32	39	**355**
FY43	9	108	57	61	1	12	36	32	39	**355**
FY44	9	109	55	62	1	12	36	32	39	**355**

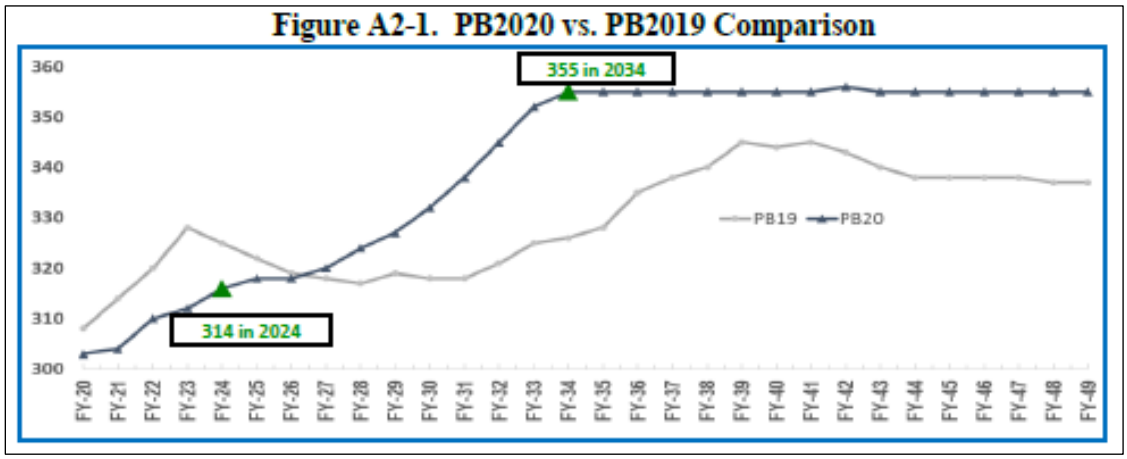
	CVNs	LSCs	SSCs	SSNs	SSGN/LPSs	SSBNs	AWSs	CLFs	Supt	Total
FY45	10	107	55	63	1	12	36	32	39	**355**
FY46	9	106	54	64	2	12	37	32	39	**355**
FY47	9	107	54	65	2	12	35	32	39	**355**
FY48	9	109	51	66	2	12	35	32	39	**355**
FY49	10	108	50	67	3	12	35	31	39	**355**

Source: U.S. Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020*, Table A2-4 on page 13.

Note: Figures for support ships include five JHSVs transferred from the Army to the Navy and operated by the Navy primarily for the performance of Army missions.
Key: FY = Fiscal Year; **CVNs** = aircraft carriers; **LSCs** = surface combatants (i.e., cruisers and destroyers); **SSCs** = small surface combatants (i.e., frigates, Littoral Combat Ships [LCSs], and mine warfare ships); **SSNs** = attack submarines; **SSGNs/LPSs** = cruise missile submarines/large payload submarines; **SSBNs** = ballistic missile submarines; **AWSs** = amphibious warfare ships; **CLFs** = combat logistics force (i.e., resupply) ships; **Supt** = support ships.

As shown in **Table 4**, if the FY2020 30-year shipbuilding plan is implemented, the Navy projects that it will achieve a total of 355 ships by FY2034. This is about 20 years sooner than projected under the Navy's FY2019 30-year shipbuilding plan. This is not primarily because the FY2020 30-year plan includes more ships than did the FY2019 plan: The total of 304 ships in the FY2020 plan is only three ships higher than the total of 301 ships in the FY2019 plan. Instead, it is primarily due to a decision announced by the Navy in April 2018, after the FY2019 budget was submitted, to increase the service lives of all DDG-51 destroyers—both those existing and those to be built in the future—to 45 years. Prior to this decision, the Navy had planned to keep older DDG-51s (referred to as the Flight I/II DDG-51s) in service for 35 years and newer DDG-51s (the Flight II/III DDG-51s) for 40 years. **Figure 2** shows the Navy's projections for the total number of ships in the Navy under the Navy's FY2019 and FY2020 budget submissions. As can be seen in the figure, the Navy projected under the FY2019 plan that the fleet would not reach a total of 355 ships any time during the 30-year period.

Figure 2. Projected Size of Navy Under FY2019 and FY2020 30-Year Shipbuilding Plans



Source: U.S. Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020*, Figure A2-1 on page 14. PB2020 and PB2019 mean President's Budget (i.e., the Administration's proposed budget) for FY2020 and FY2019, respectively.

Adjustment Needed for Withdrawn Proposal Regarding CVN-75 RCOH

The projected number of aircraft carriers in **Table 4**, the projected total number of all ships in **Table 4**, and the line showing the total number of ships under the Navy's FY2020 budget submission in **Figure 2** all reflect the Navy's proposal, under its FY2020 budget submission, to not fund the mid-life nuclear refueling overhaul (called a refueling complex overhaul, or RCOH) of the aircraft carrier *Harry S. Truman* (CVN-75), and to instead retire CVN-75 around FY2024. On April 30, 2019, however, the Administration announced that it was withdrawing this proposal from the Navy's FY2020 budget submission. The Administration now supports funding the CVN-75 RCOH and keeping CVN-75 in service past FY2024.

As a result of the withdrawal of its proposal regarding the CVN-75 RCOH, the projected number of aircraft carriers and consequently the projected total number of all ships are now one ship higher for the period FY2022-FY2047 than what is shown in **Table 4**, and the line in **Figure 2** would be adjusted upward by one ship for those years.[23] (The figures in **Table 4** are left unchanged from what is shown in the FY2020 budget submission so as to accurately reflect what is shown in that budget submission.)

355-Ship Total Attained 20 Years Sooner; Mix Does Not Match FSA Mix

As shown in **Table 4**, although the Navy projects that the fleet will reach a total of 355 ships in FY2034, the Navy in that year and subsequent years will not match the composition called for in the FY2016 FSA. Among other things, the Navy will have more than the required number of large surface combatants (i.e., cruisers and destroyers) from FY2030 through FY2040 (a consequence of the decision to extend the service lives of DDG-51s to 45 years), fewer than the required number of aircraft carriers through the end of the 30-year period, fewer than the required number of attack submarines through FY2047, and fewer than the required number of amphibious ships through the end of the 30-year period. The Navy acknowledges that the mix of ships will not match that called for by the 2016 FSA but states that if the Navy is going to have too many ships of a certain kind, DDG-51s are not a bad type of ship to have too many of, because they are very capable multi-mission ships.

Issues for Congress

Whether New FSA Will Change 355-Ship Goal and, If So, How

One issue for Congress is whether the new FSA that the Navy is conducting will change the 355-ship force-level objective established by the 2016 FSA and, if so, in what ways. As discussed earlier, Navy officials have suggested in their public remarks that this new FSA could shift the Navy toward a more distributed force architecture, which could change the 355-ship figure, the planned mix of ships, or both. The issue for Congress is how to assess the appropriateness of the Navy's FY2020 shipbuilding plans when a key measuring stick for conducting that assessment—the Navy's force-level goal and planned force mix—might soon change.

[23] For additional discussion of the now-withdrawn proposal concerning the CVN-75 RCOH, see CRS Report RS20643, *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*, by Ronald O'Rourke.

Affordability of 30-Year Shipbuilding Plan

Overview

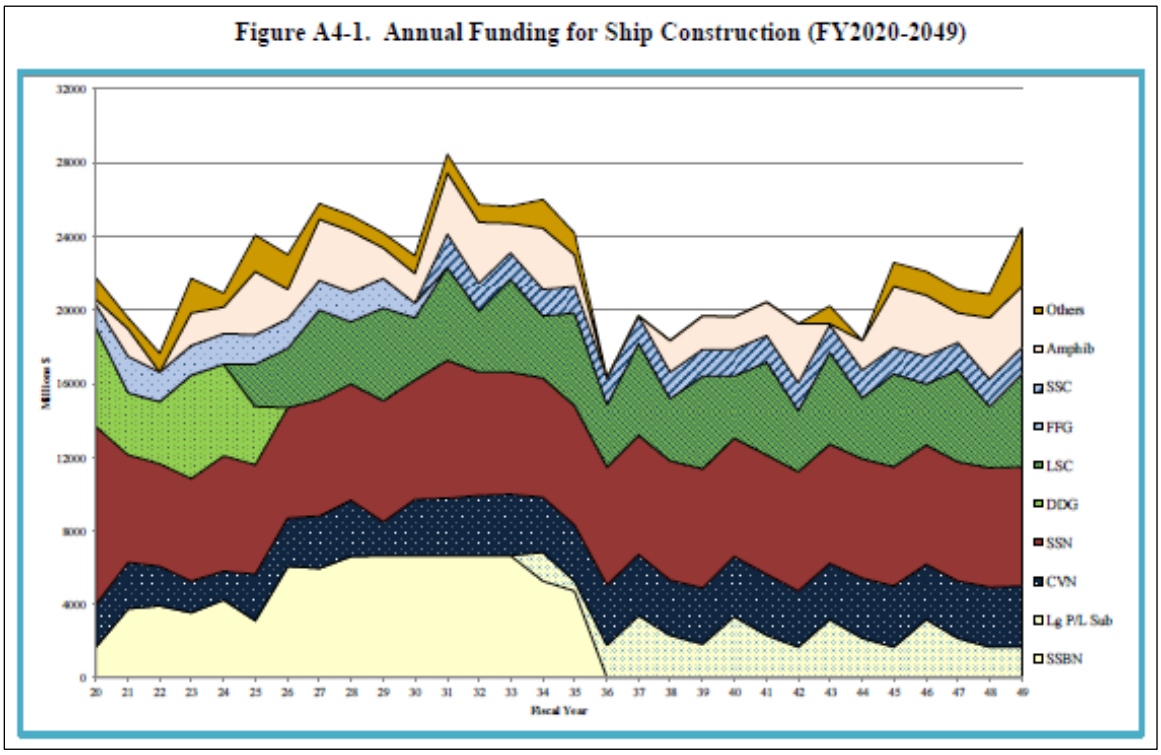
Another oversight issue for Congress concerns the prospective affordability of the Navy's 30-year shipbuilding plan. This issue has been a matter of oversight focus for several years, and particularly since the enactment in 2011 of the Budget Control Act, or BCA (S. 365/P.L. 112-25 of August 2, 2011). Observers have been particularly concerned about the plan's prospective affordability during the decade or so from the mid-2020s through the mid-2030s, when the plan calls for procuring Columbia-class ballistic missile submarines as well as replacements for large numbers of retiring attack submarines, cruisers, and destroyers.[24]

Figure 3 shows, in a graphic form, the Navy's estimate of the annual amounts of funding that would be needed to implement the Navy's FY2020 30-year shipbuilding plan. The figure shows that during the period from the mid-2020s through the mid-2030s, the Navy estimates that implementing the FY2020 30-year shipbuilding plan would require roughly $24 billion per year in shipbuilding funds.

[24] The Navy's 30-year plans in recent years have spotlighted for policymakers the substantial increase in Navy shipbuilding funding that would be required to implement the 30-year plan during the decade or so from the mid-2020s through the mid-2030s. As discussed in CRS testimony in 2011, a key function of the 30-year shipbuilding plan is to alert policymakers well ahead of time to periods of potentially higher funding requirements for Navy shipbuilding. (See Statement of Ronald O'Rourke, Specialist in Naval Affairs, Congressional Research Service, before the House Armed Services Committee, Subcommittee on Oversight and Investigations, hearing on the Department of Defense's 30-Year Aviation and Shipbuilding Plans, June 1, 2011, 8 pp.)

Figure 3. Navy Estimate of Funding Requirements for FY2020 30-Year Plan

Constant FY2019 dollars, in millions



Source: U.S. Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020*, Figure A4-1 on page 18. CBO vs. Navy Estimates of Cost of 30-Year Plan.

Concern Regarding Potential Impact of Columbia-Class Program

As discussed in the CRS report on the Columbia-class program,[25] the Navy since 2013 has identified the Columbia-class program as its top program priority, meaning that it is the Navy's intention to fully fund this program, if necessary at the expense of other Navy programs, including other Navy shipbuilding programs. This led to concerns that in a situation of finite Navy shipbuilding budgets, funding requirements for the Columbia-class program could crowd out funding for procuring other types of Navy ships. These concerns in turn led to the creation by Congress of the National Sea-Based Deterrence Fund (NSBDF), a fund in the DOD budget that is intended in part to encourage policymakers to identify funding for the Columbia-class program from sources across the entire DOD budget rather than from inside the Navy's budget alone.

Several years ago, when concerns arose about the potential impact of the Columbia-class program on funding available for other Navy shipbuilding programs, the Navy's shipbuilding budget was roughly $14 billion per year, and the roughly $7 billion per year that the Columbia-class program is projected to require from the mid-2020s to the mid-2030s (see **Figure 3)** represented roughly one-half of that total. With the Navy's shipbuilding budget having grown in more recent years to a total of roughly $24 billion per year, the $7 billion per year projected to be required by the Columbia-class program during those years does not loom proportionately as large as it once did in the Navy's shipbuilding budget picture. Even so, some concerns remain regarding the potential

[25] CRS Report R41129, *Navy Columbia (SSBN-826) Class Ballistic Missile Submarine Program: Background and Issues for Congress*, by Ronald O'Rourke.

impact of the Columbia-class program on funding available for other Navy shipbuilding programs.

Potential for Cost Growth on Navy Ships

If one or more Navy ship designs turn out to be more expensive to build than the Navy estimates, then the projected funding levels shown in **Figure 3** would not be sufficient to procure all the ships shown in the 30-year shipbuilding plan. As detailed by CBO[26] and GAO,[27] lead ships in Navy shipbuilding programs in many cases have turned out to be more expensive to build than the Navy had estimated. Ship designs that can be viewed as posing a risk of being more expensive to build than the Navy estimates include Gerald R. Ford (CVN-78) class aircraft carriers, Columbia-class ballistic missile submarines, Virginia-class attack submarines equipped with the Virginia Payload Module (VPM), Flight III versions of the DDG-51 destroyer, FFG(X) frigates, LPD-17 Flight II amphibious ships, and John Lewis (TAO-205) class oilers, as well as other new classes of ships that the Navy wants to begin procuring years from now.

CBO Estimate

The statute that requires the Navy to submit a 30-year shipbuilding plan each year (10 U.S.C. 231) also requires CBO to submit its own independent analysis of the potential cost of the 30-year plan (10 U.S.C. 231[d]). CBO is now preparing its estimate of the cost of the Navy's FY2020 30-year shipbuilding plan. In the meantime, **Figure 4** shows, in a graphic form, CBO's estimate of the annual amounts of funding that would be needed to implement the Navy's *FY2019* 30-year shipbuilding plan. This figure might be compared to the Navy's estimate of its FY2020 30-year plan as shown in **Figure 3**, although doing so poses some apples-vs.-oranges issues, as the Navy's FY2019 and FY2020 30-year plans do not cover exactly the same 30-year periods, and for the years they do have in common, there are some differences in types and numbers of ships to be procured in certain years.

CBO analyses of past Navy 30-year shipbuilding plans have generally estimated the cost of implementing those plans to be higher than what the Navy estimated. Consistent with that past pattern, as shown in **Table 5**, CBO's estimate of the cost to implement the Navy's FY2019 30-year (FY2019-FY2048) shipbuilding plan is about 27% higher than the Navy's estimated cost for the FY2019 plan. (**Table 5** does not pose an apples-vs.-oranges issue, because both the Navy and CBO estimates in this table are for the Navy's FY2019 30-year plan.) More specifically, as shown in the table, CBO estimated that the cost of the first 10 years of the FY2019 30-year plan would be about 2% higher than the Navy's estimate; that the cost of the middle 10 years of the plan would be about 13% higher than the Navy's estimate; and that the cost of the final 10 years of the plan would be about 27% higher than the Navy's estimate.[28]

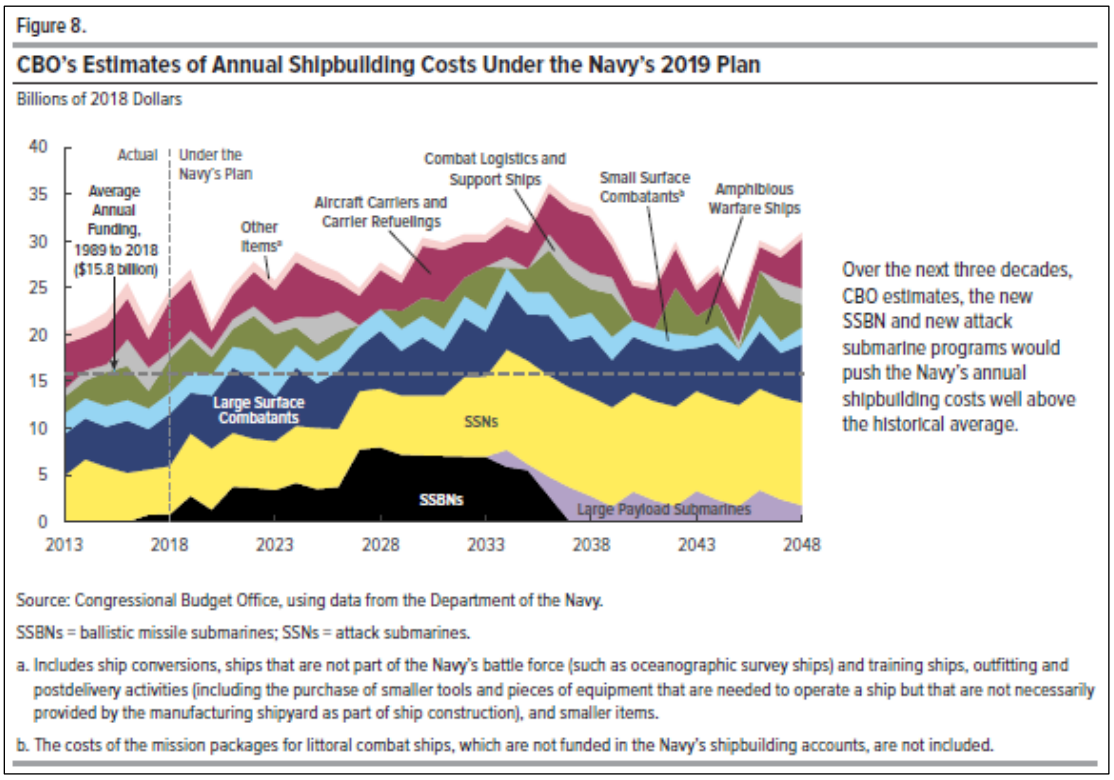
[26] See Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2019 Shipbuilding Plan*, October 2018, p. 25, including Figure 10.

[27] See Government Accountability Office, *Navy Shipbuilding[:] Past Performance Provides Valuable Lessons for Future Investments*, GAO-18-238SP, June 2018, p. 8.

[28] Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2019 Shipbuilding Plan*, October 2018, Table 4 on page 13.

Figure 4. CBO Estimate of Funding Requirements for 30-Year Plan

Constant FY2018 dollars, in millions



Source: Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2019 Shipbuilding Plan*, October 2018, Figure 8 on page 16.

Table 5. Navy and CBO Estimates of Cost of FY2019 30-Year Shipbuilding Plan

Funding for new-construction ships, in billions of constant FY2018 dollars

	First 10 years of the plan	Middle 10 years of the plan	Final 10 years of the plan	Entire 30 years of the plan
Navy estimate	19.7	22.7	21.1	21.0
CBO estimate	20.0	25.7	28.6	26.7
% difference between Navy and CBO estimates	2%	13%	36%	27%

Source: Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2019 Shipbuilding Plan, October 2018*, Table 4 on page 13.

Treatment of Inflation

The growing divergence between CBO's estimate and the Navy's estimate as one moves from the first 10 years of the 30-year plan to the final 10 years of the plan is due in part to a technical difference between CBO and the Navy regarding the treatment of inflation. This difference compounds over time, making it increasingly important as a factor in the difference between CBO's estimates and the Navy's estimates the further one goes into the 30-year period. In other

words, other things held equal, this factor tends to push the CBO and Navy estimates further apart as one proceeds from the earlier years of the plan to the later years of the plan.[29]

Designs of Future Classes of Ships

The growing divergence between CBO's estimate and the Navy's estimate as one moves from the first 10 years of the 30-year plan to the final 10 years of the plan is also due to differences between CBO and the Navy about the costs of certain ship classes, particularly classes that are projected to be procured starting years from now. The designs of these future ship classes are not yet determined, creating more potential for CBO and the Navy to come to differing conclusions regarding their potential cost. For the FY2019 30-year plan, the largest source of difference between CBO and the Navy regarding the costs of individual ship classes was a new class of SSNs that the Navy wants to begin procuring in FY2034 as the successor to the Virginia-class SSN design. This new class of SSN, CBO says, accounted for 42% of the difference between the CBO and Navy estimates for the FY2019 30-year plan, in part because there were a substantial number of these SSNs in the plan, and because those ships occur in the latter years of the plan, where the effects of the technical difference between CBO and the Navy regarding the treatment of inflation show more strongly.

The second-largest source of difference between CBO and the Navy regarding the costs of individual ship classes was a new class of large surface combatant (i.e., cruiser or destroyer) that the Navy wants to begin procuring in the future, which accounted for 20% of the difference, for reasons that are similar to those mentioned above for the new class of SSNs. The third-largest source of difference was the new class of frigates (FFG[X]s) that the Navy wants to begin procuring in FY2020, which accounts for 9% of the difference. The remaining 29% of difference between the CBO and Navy estimates was accounted for collectively by several other shipbuilding programs, each of which individually accounts for between 1% and 4% of the difference. The Columbia-class program, which accounted for 4%, is one of the programs in this final group.[30]

Sustainment Cost

As mentioned earlier, in addition to the issue of the cost to build new ships, the Navy in its FY2020 30-year shipbuilding plan highlighted a concern over the potential costs to sustain a larger fleet. On this issue, the FY2020 30-year shipbuilding plan states in part

> Coincident with the relatively new dynamic of purchasing more ships to grow the force instead of simply replacing ships or shrinking the force, is the responsibility to "own" the additional inventory when it arrives.
>
> Consistent annual funding in the shipbuilding account is foundational for an efficient industrial base in support of steady growth and long-term maintenance planning, but equally important is the properly phased, additional funding needed for operations and sustainment accounts as each new ship is delivered—the much larger fiscal burden over the life of a ship and the essence of the challenge to remain balanced across the three integral elements of readiness–capability–capacity. Because the Navy [until recently] has been shrinking not growing, and because of the disconnected timespan from purchase to delivery, often five years or more and often beyond the FYDP, there is risk of

[29] For additional discussion of how CBO estimates the costs of new Navy ships, see Congressional Budget Office, *How CBO Estimates the Cost of New Ships*, April 2018, 6 pp.

[30] Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2019 Shipbuilding Plan*, October 2018, Table A-1 on page 27.

underestimating the aggregate sustainment costs looming over the horizon that must now be carefully considered in fiscal forecasting.

For a ship, the rough rule of thumb for cost is 30 percent for procurement and 70 percent for operating and sustainment; for example, a ship that costs $1B to buy costs $3.3B to own, amortized over its lifespan. Accordingly, multi-ship deliveries can add hundreds of millions of dollars to a budget year, and then require the same funding per year thereafter, compounded by additional deliveries in subsequent years and only offset by ship retirements, which lag deliveries when growing the force. A similar dynamic occurs when the life of a ship is extended. Sustainment resources programmed to shift from a retiring ship to a new ship must now stay in place – for the duration of the extension. The burden continues to grow until equilibrium is reached at the desired higher inventory, when deliveries match retirements and all resourcing accounts reach steady-state at a higher, enduring sustainment cost.

For perspective, the current budget, among the largest ever, supports a modern fleet of approximately 300 ships, nearly 20 percent fewer than the goal of 355. The battle force inventory… rises from 301 ships in FY2020 to [a projected figure of] 314 ships in FY2024, and then 355 in FY2034. The programmed sustainment cost… is $24B [billion] in FY2020 and rises to $30B [billion in FY2024 in TY$ [then-year dollars]. When the battle force inventory reaches 355 in FY2034, [the] estimated cost to sustain that fleet will approach $40B (TY$), 32% higher than in FY2024. For now, included in this sustainment estimate are only personnel, planned maintenance, and some operations; representing those costs tied directly to owning and operating a ship, easily modeled today, and already line-item accounted for in the budget. Equally important additional costs, but not yet included in the future estimate, are those not easily associated with individual ships and require complex modeling for long-term forecasting (beyond 3 to 5 years), such as the balance of the operations accounts (market and schedule driven), modernization and ordnance (threat and technology driven), infrastructure and training (services spread across many ships), aviation detachments, networks and cyber support, plus others….

Less of a challenge when shrinking the force, the Navy is now working towards developing the complex model needed to capture indirect costs for growing the force. Until then, macro ratios are helpful in estimating rough orders of magnitude beyond the FYDP and for identifying future areas of concern. Similar to procurement, estimates will be less precise deeper into the plan. Recovering from the long-term investment imbalance has proven to be costly, particularly in the readiness accounts. As readiness becomes more accurately defined, the modeling will improve and so will the ability to more accurately forecast. However, no matter the method, the anticipated cost of sustaining the proper mix of 355 ships is anticipated to be substantial, and reform efforts and balanced scalability will continue to be the drivers going forward.[31]

Legislative Activity for FY2020

CRS Reports Tracking Legislation on Specific Navy Shipbuilding Programs

Detailed coverage of legislative activity on certain Navy shipbuilding programs (including funding levels, legislative provisions, and report language) can be found in the following CRS reports:

[31] U.S. Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2020*, pp. 19-20.

- CRS Report R41129, *Navy Columbia (SSBN-826) Class Ballistic Missile Submarine Program: Background and Issues for Congress*, by Ronald O'Rourke.
- CRS Report RL32418, *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress*, by Ronald O'Rourke.
- CRS Report RS20643, *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*, by Ronald O'Rourke. (This report also covers the issue of the Administration's FY2020 budget proposal, which the Administration withdrew on April 30, to not fund a mid-life refueling overhaul [called a refueling complex overhaul, or RCOH] for the aircraft carrier *Harry S. Truman* [CVN-75], and to retire CVN-75 around FY2024.)
- CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke.
- CRS Report R44972, *Navy Frigate (FFG[X]) Program: Background and Issues for Congress*, by Ronald O'Rourke.
- CRS Report RL33741, *Navy Littoral Combat Ship (LCS) Program: Background and Issues for Congress*, by Ronald O'Rourke.
- CRS Report R43543, *Navy LPD-17 Flight II Amphibious Ship Program: Background and Issues for Congress*, by Ronald O'Rourke. (This report also covers the issue of funding for the procurement of an amphibious assault ship called LHA-9.)
- CRS Report R43546, *Navy John Lewis (TAO-205) Class Oiler Shipbuilding Program: Background and Issues for Congress*, by Ronald O'Rourke.
- CRS Report R45757, *Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress*, by Ronald O'Rourke.

Legislative activity on individual Navy shipbuilding programs that are not covered in detail in the above reports is covered below.

Summary of Congressional Action on FY2020 Funding Request

The Navy's proposed FY2020 budget requests funding for the procurement of 12 new ships:

- 1 Gerald R. Ford (CVN-78) class aircraft carrier;
- 3 Virginia-class attack submarines;
- 3 DDG-51 class Aegis destroyers;
- 1 FFG(X) frigate;
- 2 John Lewis (TAO-205) class oilers; and
- 2 TATS towing, salvage, and rescue ships.

As noted earlier, the above list of 12 ships reflects a Navy decision to show the aircraft carrier CVN-81 as a ship to be procured in FY2020 rather than a ship that was procured in FY2019. Congress, as part of its action on the Navy's proposed FY2019 budget, authorized the procurement of CVN-81 in FY2019.

The Navy's proposed FY2020 shipbuilding budget also requests funding for ships that have been procured in prior fiscal years, and ships that are to be procured in future fiscal years, as well as funding for activities other than the building of new Navy ships.

Table 6 summarizes congressional action on the Navy's FY2020 funding request for Navy shipbuilding. The table shows the amounts requested and congressional changes to those requested amounts. A blank cell in a filled-in column showing congressional changes to requested amounts indicates no change from the requested amount.

Table 6. Summary of Congressional Action on FY2020 Funding Request

Millions of dollars, rounded to nearest tenth; totals may not add due to rounding

			Congressional changes to requested amounts					
			Authorization			Appropriation		
Line number	Program	Request	HASC	SASC	Conf.	HAC	SAC	Conf.
Shipbuilding and Conversion, Navy (SCN) appropriation account								
001	Columbia-class SSBN AP	1,698.9	125.0	125.0		-86.9		
002	CVN-78 aircraft carrier	2,347.0	-395.0			-281.0		
003	Virginia-class SSN	7,155.9	-550.0	-2,464.0		-2,963.6		
004	Virginia-class SSN AP	2,769.6		1,500.0		1,497.0		
005	CVN refueling overhaul	647.9	-211.0	-50.0		20.0		
006	CVN refueling overhaul AP	0	17.0	16.9		16.9		
007	DDG-1000	155.9						
008	DDG-51	5,099.3	-86.0	-20.0		-84.0		
009	DDG-51 AP	224.0		260.0				
010	LCS	0						
011	FFG(X)	1,281.2	-15.0					
012	LPD-17 Flight II	0	100.0	525.0				
013	LPD-17 Flight II AP	247.1	-100.0	-247.1		-247.1		
014	ESB	0						
015	LHA	0		650.0				
016	LHA AP	0						
017	EPF	0	49.0					
018	TAO-205	981.2	-374.0					
019	TAO-205 AP	73.0	-73.0					
020	TATS	150.3						
021	Oceanographic ships	0						
022	LCU 1700 landing craft	85.7				-2.0		
023	Outfitting	754.7	-111.1	-50.0		-18.4		
024	Ship-to-shore connector (SSC)	0	84.8			65		
025	Service craft	56.3		25.5				
026	LCAC landing craft	0						
027	USCG icebreakers AP	0						
028	Completion of prior-year ships	55.7	-30.0	49.0				
029	Ship-to-Shore connector AP	0		40.4				
TOTAL		**23,783.7**	**-1,569.3**	**360.7**		**-2,084.2**		

Source: Table prepared by CRS based on Navy FY2020 budget submission, committee reports, and explanatory statements on the FY2020 National Defense Authorization Act and FY2020 DOD Appropriations Act.

Notes: Millions of dollars, rounded to nearest tenth. A blank cell indicates no change to requested amount. Totals may not add due to rounding. **AP** is advance procurement funding; **HASC** is House Armed Services Committee; **SASC** is Senate Armed Services Committee; **HAC** is House Appropriations Committee; **SAC** is Senate Appropriations Committee; **Conf.** is conference report.

FY2020 National Defense Authorization Act (H.R. 2500/S. 1790)

House

The House Armed Services Committee, in its report (H.Rept. 116-120 of June 19, 2019) on H.R. 2500, recommended the funding levels shown in the HASC column of **Table 6**.

Section 118 of H.R. 2500 as reported by the committee states

> SEC. 118. NATIONAL DEFENSE RESERVE FLEET VESSEL.
>
> (a) In General.--Subject to the availability of appropriations, the Secretary of the Navy, acting through the executive agent described in subsection (e), shall seek to enter into a contract for the construction of one sealift vessel for the National Defense Reserve Fleet.
>
> (b) Delivery Date.--The contract entered into under subsection (a) shall specify a delivery date for the sealift vessel of not later than September 30, 2026.
>
> (c) Design and Construction Requirements.--
>
> (1) Use of existing design.--The design of the sealift vessel shall be based on a domestic or foreign design that exists as of the date of the enactment of this Act.
>
> (2) Commercial standards and practices.--Subject to paragraph (1), the sealift vessel shall be constructed using commercial design standards and commercial construction practices that are consistent with the best interests of the Federal Government.
>
> (3) Domestic shipyard.--The sealift vessel shall be constructed in a shipyard that is located in the United States.
>
> (d) Certificate and Endorsement.--The sealift vessel shall meet the requirements necessary to receive a certificate of documentation and a coastwise endorsement under chapter 121 of tile 46, United States Code, and the Secretary of the Navy shall ensure that the completed vessel receives such a certificate and endorsement.
>
> (e) Executive Agent.--
>
> (1) In general.--The Secretary of the Navy shall seek to enter into a contract or other agreement with a private-sector entity under which the entity shall act as executive agent for the Secretary for purposes of the contract under subsection (a).
>
> (2) Responsibilities.--The executive agent described in paragraph (1) shall be responsible for--
>
> (A) selecting a shipyard for the construction of the sealift vessel;
>
> (B) managing and overseeing the construction of the sealift vessel; and
>
> (C) such other matters as the Secretary of the Navy determines to be appropriate
>
> (f) Use of Incremental Funding.--With respect to the contract entered into under subsection (a), the Secretary of the Navy may use incremental funding to make payments under the contract.
>
> (g) Sealift Vessel Defined.--In this section, the term ``sealift vessel'' means the sealift vessel constructed for the National Defense Reserve Fleet pursuant to the contract entered into under subsection (a).

Section 806 of H.R. 2500 as reported by the committee states

> SEC. 806. REQUIREMENT THAT CERTAIN SHIP COMPONENTS BE MANUFACTURED IN THE NATIONAL TECHNOLOGY AND INDUSTRIAL BASE.

(a) Additional Procurement Limitation.--Section 2534(a) of title 10, United States Code, is amended by adding at the end the following new paragraph:

``(6) Components for auxiliary ships.--Subject to subsection (k), the following components:

``(A) Auxiliary equipment, including pumps, for all shipboard services.

``(B) Propulsion system components, including engines, reduction gears, and propellers.

``(C) Shipboard cranes.

``(D) Spreaders for shipboard cranes.".

(b) Implementation.--Such section is further amended by adding at the end the following new subsection:

``(k) Implementation of Auxiliary Ship Component Limitation.--Subsection (a)(6) applies only with respect to contracts awarded by the Secretary of a military department for new construction of an auxiliary ship after the date of the enactment of the National Defense Authorization Act for Fiscal Year 2020 using funds available for National Defense Sealift Fund programs or Shipbuilding and Conversion, Navy. For purposes of this subsection, the term `auxiliary ship' does not include an icebreaker.".

Section 1022 of H.R. 2500 as reported by the committee states

SEC. 1022. USE OF NATIONAL DEFENSE SEALIFT FUND FOR PROCUREMENT OF TWO USED VESSELS.

Pursuant to section 2218(f)(3) of title 10, United States Code, and using amounts authorized to be appropriated for Operation and Maintenance, Navy, for fiscal year 2020, the Secretary of the Navy shall seek to enter into a contract for the procurement of two used vessels.

Section 1024 of H.R. 2500 as reported by the committee states

SEC. 1024. REPORT ON SHIPBUILDER TRAINING AND THE DEFENSE INDUSTRIAL BASE.

Not later than 180 days after the date of the enactment of this Act, the Secretary of Defense shall submit to the Committees on Armed Services of the Senate and House of Representatives a report on shipbuilder training and hiring requirements necessary to achieve the Navy's 30-year shipbuilding plan and to maintain the shipbuilding readiness of the defense industrial base. Such report shall include each of the following:

(1) An analysis and estimate of the time and investment required for new shipbuilders to gain proficiency in particular shipbuilding occupational specialties, including detailed information about the occupational specialty requirements necessary for construction of naval surface ship and submarine classes to be included in the Navy's 30-year shipbuilding plan.

(2) An analysis of the age demographics and occupational experience level (measured in years of experience) of the shipbuilding defense industrial workforce.

(3) An analysis of the potential time and investment challenges associated with developing and retaining shipbuilding skills in organizations that lack intermediate levels of shipbuilding experience.

(4) Recommendations concerning how to address shipbuilder training during periods of demographic transition, including whether emerging technologies, such as augmented reality, may aid in new shipbuilder training.

(5) Recommendations concerning how to encourage young adults to enter the defense shipbuilding industry and to develop the skills necessary to support the shipbuilding defense industrial base.

Section 3118 of H.R. 2500 as reported by the committee states

SEC. 3118. PROGRAM FOR RESEARCH AND DEVELOPMENT OF ADVANCED NAVAL NUCLEAR FUEL SYSTEM BASED ON LOW-ENRICHED URANIUM.

(a) Establishment.--Not later than 60 days after the date of the enactment of this Act, the Administrator for Nuclear Security shall establish a program to assess the viability of using low-enriched uranium in naval nuclear propulsion reactors, including such reactors located on aircraft carriers and submarines, that meet the requirements of the Navy.

(b) Activities.--In carrying out the program under subsection (a), the Administrator shall carry out activities to develop an advanced naval nuclear fuel system based on low-enriched uranium, including activities relating to--

(1) down-blending of high-enriched uranium into low-enriched uranium;

(2) manufacturing of candidate advanced low-enriched uranium fuels;

(3) irradiation tests and post-irradiation examination of these fuels; and

(4) modification or procurement of equipment and infrastructure relating to such activities.

(c) Report.--Not later than 120 days after the date of the enactment of this Act, the Administrator shall submit to the congressional defense committees a plan outlining the activities the Administrator will carry out under the program established under subsection (a), including the funding requirements associated with developing a low-enriched uranium fuel.

H.Rept. 116-120 states

Future Fleet Architecture

The committee notes that the National Defense Strategy indicates that the United States is in a great powers competition to include the Russian Federation and the People's Republic of China. The committee also believes that this great powers competition will heavily rely on our naval force structure to optimally address Russia and China in both the Pacific and the Arctic, as well as impending tensions with the Iranian regime in the Persian Gulf. The committee believes that it is imperative to include a larger long-term force structure to address these global challenges. The committee also believes that to ensure a continued projection of naval power around the world, the Navy should include in their forthcoming 2019 Force Structure Assessment necessary vessels to address sufficient operations in the Arctic. Therefore, the committee directs the Secretary of the Navy to brief the House Committee on Armed Services by December 31, 2019 regarding the force structure plan to compete with adversaries in the Pacific and Arctic Oceans and the Persian Gulf. This briefing should also address the defense industrial base and any associated maritime sector weaknesses that need to be addressed to support the expanded force structure. (Pages 18-19)

H.Rept. 116-120 also states

Sourcing of Domestic Components for U.S. Navy Ships

The committee is concerned with the sourcing of non-domestic components on U.S. Navy ships. The committee directs the Secretary of the Navy to provide a report to the congressional defense committees by December 1, 2019, on the feasibility of sourcing domestic components such as: auxiliary equipment, including pumps; propulsion system components, including engines, reduction gears, and propellers; shipboard cranes and spreaders for shipboard cranes; and other components on all Navy ships. (Page 186)

H.Rept. 116-120 also states

> *Low-Enriched Uranium Fuel for Naval Reactors*
>
> The committee notes that since September 11, 2001, the U.S. Government has sought to remove weapons-usable highly enriched uranium (HEU) containing 20 percent or more uranium-235 from as many locations as possible because of concerns related to nuclear terrorism. The committee notes that the primary focus of this strategy has been on replacing HEU civilian research reactor fuel and targets used in the production of medical radioisotopes, with non-weapons-usable low-enriched uranium (LEU) fuel and targets. This program to reduce the use of HEU for civilian purposes has been successful in reducing the amount of HEU worldwide that could have been at risk of theft of diversion. However, this effort did not address the use of HEU for military purposes. Naval reactors account for the largest share of global HEU use other than nuclear weapons, and in the United States, the fuel is fabricated in civilian, not military, facilities. The committee has been supportive of efforts to assess the feasibility of using low-enriched uranium for naval reactors as such use would not only benefit nuclear non-proliferation efforts but also maintain the research and development skills necessary to sustain innovation and expertise with regard to naval fuel as research and development efforts on the Columbia-class reactor end. The committee continues to support efforts to assess the feasibility of using LEU in naval reactors to meet military requirements for aircraft carriers and submarines.
>
> The National Defense Authorization Act for Fiscal Year 2018 (Public Law 115–91) required a nuclear submarine study. However, this study lacked sufficient detail to respond to the congressional mandate. Therefore, the committee directs the Administrator for Nuclear Security, in coordination with the Secretary of the Navy, to provide a report to the congressional defense committees not later than December 15, 2019, assessing the feasibility of a design of the reactor module of the Virginia-Class replacement nuclear powered attack submarine that retains the existing hull diameter but leaves sufficient space for an LEU-fueled reactor with a life of the ship core, possibly with an increased module length. If a life of the ship core is unattainable, the report should include the feasibility of a reactor design with the maximum attainable core life and a configuration that enables rapid refueling. (Page 343)

Senate

The Senate Armed Services Committee, in its report (S.Rept. 116-48 of June 11, 2019) on S. 1790, recommended the funding levels shown in the SASC column of **Table 6**. S.Rept. 116-48 states

> **Outfitting**
>
> The budget request included $754.7 million in line number 23 of Shipbuilding and Conversion, Navy (SCN), for outfitting.
>
> Based on planned delivery dates, the committee notes that post-delivery funding is early-to-need for LCS-21 ($5.0 million). The committee also notes the unjustified outfitting cost growth for SSN-793, SSN-794, SSN-795, and SSN-796 ($20.0 million). The committee further notes unjustified post-delivery cost growth for DDG-1000 ($25.0 million).
>
> Therefore, the committee recommends a decrease of $50.0 million in line number 23 of SCN.
>
> **Service craft**
>
> The budget request included $56.3 million in line number 25 of Shipbuilding and Conversion, Navy (SCN), for service craft.

In order to increase training opportunities for Surface Warfare Officer candidates from all accession sources, the committee believes that the Navy should replace the six YP-676 class craft slated for disposal with upgraded YP-703 class craft that incorporate modernization, training, and habitability improvements derived from lessons learned with existing YP-703 craft.

The committee urges the Secretary of the Navy to release a request for proposals for the detail design and construction of upgraded YP-703 class craft not later than fiscal year 2020. The committee notes that the Navy's current cost estimate for acquisition of the first upgraded YP-703 class craft is $25.5 million.

Therefore, the committee recommends an increase of $25.5 million in line number 25 of SCN.

Expeditionary Fast Transport (T-EPF 14) conversion

The budget request included $55. 7 million in line number 28 of Shipbuilding and Conversion, Navy (SCN), for completion of prior year shipbuilding programs.

The committee notes that the Chief of Naval Operations' unfunded priority list states that additional funding could provide for the conversion of an Expeditionary Fast Transport (T-EPF 14) into an Expeditionary Medical Transport to better fulfill distributed maritime medical requirements.

Therefore, the committee recommends an increase of $49.0 million in line number 28 of SCN.

Ship to shore connector advance procurement

The budget request included no funding in line number 29 of Shipbuilding and Conversion, Navy (SCN), for ship to shore connector advance procurement.

The committee understands that additional funding could provide needed stability for certain suppliers in the ship to shore connector program.

Therefore, the committee recommends an increase of $40.4 million in line number 29 of SCN. (Pages 24-25)

Section 821 of S. 1790 as reported by the committee states

SEC. 821. Naval vessel certification required before Milestone B approval.

Section 2366b(a) of title 10, United States Code, is amended—

(1) in paragraph (3)(O), by striking "; and" and inserting a semicolon;

(2) in paragraph (4), by striking the period at the end and inserting "; and"; and

(3) by adding at the end the following new paragraph:

"(5) in the case of a naval vessel program, certifies compliance with the requirements of section 8669b of this title.".

Section 861 of S. 1790 as reported by the committee states:

SEC. 861. Notification of Navy procurement production disruptions.

(a) In general.—Chapter 137 of title 10, United States Code, is amended by adding at the end the following new section:

"§ 2339b. Notification of Navy procurement production disruptions

"(a) Requirement for contractor To provide notice of delays.—The Secretary of the Navy shall require prime contractors of any Navy procurement program to report within 15 calendar days any stop work order or other manufacturing disruption of 15 calendar days

or more, by the prime contractor or any sub-contractor, to the respective program manager and Navy technical authority.

"(b) Quarterly reports.—The Secretary of the Navy shall submit to the congressional defense committees not later than 15 calendar days after the end of each quarter of a fiscal year a report listing all notifications made pursuant to subsection (a) during the preceding quarter.".

(b) Clerical amendment.—The table of sections at the beginning of chapter 137 of title 10, United States Code, is amended by inserting after the item relating to section 2339a the following new item:

"2339b. Notification of Navy procurement production disruptions.".

Regarding Section 861, S.Rept. 116-48 states

Notification of Navy procurement production disruptions (sec. 861)

The committee recommends a provision that would require the Secretary of the Navy to require prime contractors of any Navy procurement program to report, within 15 calendar days of any contractor or subcontractor stop work order or within 15 days of a contractor or subcontractor manufacturing disruption that has lasted 15 calendar days, to the respective program manager and Navy technical authority. The provision would also require the Secretary of the Navy to provide a quarterly notification of such disruptions to the congressional defense committees.

The committee is concerned by the delay in reporting of recent stop work orders and other manufacturing disruptions to Navy program management officials. The committee notes that multiple shipbuilding programs have been negatively impacted by unacceptable delays in reporting such disruptions. The committee believes that more timely notifications of such disruptions will decrease the time required to initiate and complete corrective actions necessary to resume production. (Page 221)

Section 1016 of S. 1790 as reported by the committee states

SEC. 1016. Modification of authority to purchase vessels using funds in National Defense Sealift Fund.

(a) In general.—Section 2218(f)(3)(E) of title 10, United States Code, is amended—

(1) in clause (i), by striking "ten new sealift vessels" and inserting "ten new vessels that are sealift vessels, auxiliary vessels, or a combination of such vessels"; and

(2) in clause (ii), by striking "sealift".

(b) Effective date.—The amendments made by subsection (a) shall take effect on October 1, 2019, and shall apply with respect to fiscal years beginning on or after that date.

Section 1017 of S. 1790 as reported by the committee states

SEC. 1017. Senior Technical Authority for each naval vessel class.

(a) Senior Technical Authority for each class required.—Chapter 863 of title 10, United States Code, is amended by inserting after section 8669a the following new section:

"§ 8669b. Senior Technical Authority for each naval vessel class

"(a) Senior Technical Authority.—

"(1) DESIGNATION FOR EACH VESSEL CLASS REQUIRED.—The Secretary of the Navy shall designate, in writing, a Senior Technical Authority for each class of naval vessels as follows:

"(A) In the case of a class of vessels which has received Milestone A approval, an approval to enter into technology maturation and risk reduction, or an approval to enter into a subsequent Department of Defense or Department of the Navy acquisition phase as of the date of the enactment of the National Defense Authorization Act for Fiscal Year 2020, not later than 30 days after such date of enactment.

"(B) In the case of any class of vessels which has not received any approval described in subparagraph (A) as of such date of enactment, at or before the first of such approvals.

"(2) PROHIBITION ON DELEGATION.—The Secretary may not delegate designations under paragraph (1).

"(3) INDIVIDUALS ELIGIBLE FOR DESIGNATION.—Each individual designated as a Senior Technical Authority under paragraph (1) shall be an employee of the Navy in the Senior Executive Service in an organization of the Navy that—

"(A) possesses the technical expertise required to carry out the responsibilities specified in subsection (b); and

"(B) operates independently of chains-of-command for acquisition program management.

"(4) TERM.—Each Senior Technical Authority shall be designated for a term, not fewer than six years, specified by the Secretary at the time of designation.

"(5) REMOVAL.—An individual may be removed involuntarily from designation as a Senior Technical Authority only by the Secretary. Not later than 15 days after the involuntary removal of an individual from designation as a Senior Technical Authority, the Secretary shall notify, in writing, the congressional defense committees of the removal, including the reasons for the removal.

"(b) Responsibilities and authority.—Each Senior Technical Authority shall be responsible for, and have the authority to, establish, monitor, and approve technical standards, tools, and processes for the class of naval vessels for which designated under this section in conformance with applicable Department of Defense and Department of the Navy policies, requirements, architectures, and standards.

"(c) Limitation on obligation of funds on lead vessel in vessel class.—

"(1) IN GENERAL.—On or after October 1, 2020, funds authorized to be appropriated for Shipbuilding and Conversion, Navy or Other Procurement, Navy may not be obligated for the first time on the lead vessel in a class of naval vessels unless the Secretary of the Navy certifies as described in paragraph (2).

"(2) CERTIFICATION ELEMENTS.—The certification on a class of naval vessels described in this paragraph is a certification containing each of the following:

"(A) The name of the individual designated as the Senior Technical Authority for such class of vessels, and the qualifications and professional biography of the individual so designated.

"(B) A description by the Senior Technical Authority of the systems engineering, technology, and ship integration risks for such class of vessels.

"(C) The designation by the Senior Technical Authority of each critical hull, mechanical, electrical, propulsion, and combat system of such class of vessels, including systems relating to power generation, power distribution, and key operational mission areas.

"(D) The date on which the Senior Technical Authority approved the systems engineering, engineering development, and land-based engineering and testing plans for such class of vessels.

"(E) A description by the Senior Technical Authority of the key technical knowledge objectives and demonstrated system performance of each plan approved as described in subparagraph (D).

"(F) A determination by the Senior Technical Authority that such plans are sufficient to achieve thorough technical knowledge of critical systems of such class of vessels before the start of detail design and construction.

"(G) A determination by the Senior Technical Authority that actual execution of activities in support of such plans as of the date of the certification have been and continue to be effective and supportive of the acquisition schedule for such class of vessels.

"(H) A description by the Senior Technical Authority of other technology maturation and risk reduction efforts not included in such plans for such class of vessels taken as of the date of the certification.

"(I) A certification by the Senior Technical Authority that each critical system covered by subparagraph (C) has been demonstrated through testing of a prototype or identical component in its final form, fit, and function in a realistic environment.

"(J) A determination by the Secretary that the plans approved as described in subparagraph (D) are fully funded and will be fully funded in the future-years defense program for the fiscal year beginning in the year in which the certification is submitted.

"(K) A determination by the Secretary that the Senior Technical Authority will approve, in writing, the ship specification for such class of vessels before the request for proposals for detail design, construction, or both, as applicable, is released.

"(3) DEADLINE FOR SUBMITTAL OF CERTIFICATION.—The certification required by this subsection with respect to a class of naval vessels shall be submitted, in writing, to the congressional defense committees not fewer than 30 days before the Secretary obligates for the first time funds authorized to be appropriated for Shipbuilding and Conversion, Navy or Other Procurement, Navy for the lead vessel in such class of naval vessels.

"(d) Definitions.—In this section:

"(1) The term 'class of naval vessels'—

"(A) means any group of similar undersea or surface craft procured with Shipbuilding and Conversion, Navy or Other Procurement, Navy funds, including manned, unmanned, and optionally-manned craft; and

"(B) includes—

"(i) a substantially new class of craft (including craft procured using 'new start' procurement); and

"(ii) a class of craft undergoing a significant incremental change in its existing class (such as a next 'flight' of destroyers or next 'block' of attack submarines).

"(2) The term 'future-years defense program' has the meaning given that term in section 221 of this title.

"(3) The term 'Milestone A approval' has the meaning given that term in section 2431a of this title."

(b) Clerical amendment.—The table of sections at the beginning of chapter 863 of such title is amended by inserting after the item relating to section 8669a the following new item:

"8669b. Senior Technical Authority for each naval vessel class.".

Regarding Section 1017, S.Rept. 116-48 states

> **Senior Technical Authority for each naval vessel class (sec. 1017)**
>
> The committee recommends a provision that would require the designation of a Senior Technical Authority for each class of naval vessels.
>
> The committee notes the Government Accountability Office (GAO) published a report on June 6, 2018, titled "Navy Shipbuilding: Past Performance Provides Valuable Lessons for Future Investments" (GA0-18-238SP), which assessed Navy shipbuilding performance over the past 10 years and concluded that "[the Navy] has received $24 billion more in funding than originally planned but has 50 fewer ships in its inventory today, as compared to the goals it first established in [2007.] ... Ship costs exceed[ed] estimates by over $11 billion during this time frame."
>
> This report found that lead ships in new classes of naval vessels regularly failed to meet expectations. For the 8 most recently delivered lead combatant ships (CVN-78, DDG-1000, LCS-1, LCS-2, LHA-6, LPD-17, SSN-774, and SSN-775), the report found that: a total of $8 billion more than the initial budget was required to construct these ships; each lead ship experienced cost growth of at least 10 percent, and 3 lead ships exceeded their initial budgets by 80 percent or more; each lead ship was delivered to the fleet at least 6 months late with 5 lead ships delayed by more than 2 years; and most lead ships had dozens of uncorrected deficiencies when accepted by the Navy.
>
> As this report highlights, a key step in successful shipbuilding programs is technology development: the maturation of key technologies into actual system prototypes and demonstration of them in a realistic environment prior to the detailed design of the lead ship. This type of technology maturation was not performed effectively on the CVN-78, DDG-1000, LCS-1, LCS-2, and LPD-17 programs.
>
> The committee also notes that the Navy is planning the largest fleet expansion in over 30 years with several costly and complex acquisitions planned for the coming years, including the Columbia-class ballistic missile submarines and new classes of guided missile frigates and fast attack submarines. The Chief of Naval Operations has also called for the first Large Surface Combatant, Large Unmanned Surface Vehicle, Future Small Auxiliary, and Future Large Auxiliary (CHAMP) to each be on contract in 2023. Additionally, large and extra large undersea vehicles are projected to transition from research and development to procurement within the next decade.
>
> While recognizing the importance of modernizing the fleet to face growing threats, the committee finds the Comptroller General's findings to be compelling and believes that additional actions are needed to improve shipbuilding cost, schedule, and performance outcomes, particularly of lead ships.
>
> If such outcomes are not improved, the committee is concerned that the trends of the past 10 years will continue and that the Navy battle force could lack the capability and capacity necessary to prevail in great power competition as described in the National Defense Strategy.
>
> Accordingly, this provision would establish a Senior Technical Authority (STA) for each class of naval vessels. Each STA would be responsible for establishing, monitoring, and approving technical standards, tools, and processes for the class of naval vessels for which he or she is designated under this section in conformance with applicable Department of Defense and Department of the Navy policies, requirements, architectures, and standards.
>
> In addition, beginning on October 1, 2020, funds authorized to be appropriated for Shipbuilding and Conversion, Navy, could not be obligated on the lead vessel in a new class of naval vessels until the Secretary of the Navy has submitted a certification containing information from the STA on such class of vessels.

The committee recognizes that implementation of this provision may require additional government employees, including senior executives, in the Naval Systems Engineering Directorate of the Naval Sea Systems Command (SEA 05) and would support such increases as may be warranted. (Pages 239-240)

Section 3115 of S. 1790 as reported by the committee states

SEC. 3115. Prohibition on use of funds for advanced naval nuclear fuel system based on low-enriched uranium.

None of the funds authorized to be appropriated for the National Nuclear Security Administration for fiscal year 2020 or any fiscal year thereafter may be obligated or expended to conduct research and development of an advanced naval nuclear fuel system based on low-enriched uranium until the following certifications are submitted to the congressional defense committees:

(1) A joint certification of the Secretary of Energy and the Secretary of Defense that the determination made by the Secretary of Energy and the Secretary of the Navy pursuant to section 3118(c)(1) of the National Defense Authorization Act for Fiscal Year 2016 (Public Law 114–92; 129 Stat. 1196) and submitted to the congressional defense committees on March 25, 2018, that the United States should not pursue such research and development, no longer reflects the policy of the United States.

(2) A certification of the Secretary of the Navy that an advanced naval nuclear fuel system based on low-enriched uranium would not reduce vessel capability, increase expense, or reduce operational availability as a result of refueling requirements.

Regarding Section 3115, S.Rept. 116-48 states

Prohibition on use of funds for advanced naval nuclear fuel system based on low-enriched uranium (sec. 3115)

The committee recommends a provision that would prohibit the obligation or expenditure of any funds at the National Nuclear Security Administration to conduct research and development of an advanced naval nuclear fuel system based on low-enriched uranium unless the Secretary of Defense, the Secretary of Energy, and the Secretary of the Navy submit certain certifications to the congressional defense committees.

The committee notes that section 3118(c) of the National Defense Authorization Act for Fiscal Year 2016 (P.L. 114-92) required the Secretary of Energy and the Secretary of the Navy to submit a determination as to whether the United States should continue to pursue such research and development. Pursuant to this section, in a letter to the congressional defense committees dated March 25, 2018, the Secretaries of Energy and the Navy stated that such a research and development effort would cost about $1 billion over a 10-to-15 year period, "with success not assured." It would also result in a reactor design that would be "less capable, more expensive, and unlikely to support current life-of-ship submarine reactors," which would reduce operational availability due to mid-life refueling requirements. As a result, the Secretaries of Energy and the Navy determined that the United States should not pursue such research and development. (Page 384)

S.Rept. 116-48 also states

Forward-deployed naval forces in Europe

The committee supports the continued forward-basing of four United States Navy destroyers in Rota, Spain. These ships are among the most dynamically-employed naval forces-performing ballistic missile defense missions, carrying out strikes in Syria, boosting U.S. presence across the European theater in support of allies and partners, and monitoring increasing Russian naval activities. At the same time, these ships have maintained high readiness, in part due to rigorous maintenance practices.

> In a January 14, 2019, interview, the Commander, U.S. Sixth Fleet, stated that the forward presence provided by the four destroyers at Rota "is the bedrock of our ability to reassure allies and respond to any threats that come up." She added, "There is no sub stitute for having that kind of forward presence in Europe." The Commander also observed that the "solid" operational model for these ships has enabled them to maintain "exceptional" readiness as well as their training and certifications. Furthermore, the four ships have been able to "conduct all the intermediate maintenance and the extended maintenance availabilities [needed] to stay ready and stay focused while on patrol."
>
> The committee is concerned about increasing Russian naval activity in the European theater, which is now at its highest level since the Cold War. The committee is also aware of the significant advances in Russian naval capability, especially as it relates to its attack submarines.
>
> Due in part to these developments, the Commander, U.S. European Command, testified to the committee on March 5, 2019, that he has recommended adding two destroyers at Rota, Spain. The Commander stated that, in order "to remain dominant in the maritime domain and particularly under sea," the United States "need[s] greater capability, particularly given the modernization and the growth of the Russian fleets in Europe." Furthermore, the President's nominee to be the next commander of U.S. European Command testified to the committee on April 2, 2019, that he agreed with the current commander's recommendation.
>
> Therefore, not later than October 1, 2019, the committee directs the Chief of Naval Operations and the Commander, U.S. European Command, to provide a joint briefing to the Committees on Armed Services of the Senate and House on the merit and feasibility of basing two additional destroyers at Rota, Spain, including an assessment of whether such an enhancement to U.S. force posture in Europe would enhance the ability of the United States to deter aggression, flexibly and proactively shape the strategic environment, improve readiness to respond to contingencies, and ensure long-term warfighting readiness. (Pages 279-280)

FY2020 DOD Appropriations Act (H.R. 2698)

House

The House Appropriations Committee, in its report (H.Rept. 116-84 of May 23, 2019) on H.R. 2968, recommended the funding levels shown in the HAC column of **Table 6**.

H.Rept. 116-84 states

> EXPEDITIONARY SEA BASE
>
> The Expeditionary Sea Base is a mature, affordable shipbuilding program that provides combatant commanders with the flexibility to respond to immediate threats around the world. The fiscal year 2020 budget request projects procurement funding for the next Expeditionary Sea Base in fiscal years 2022 and 2023, three years later than the fiscal year 2019 budget request and shipbuilding plan had projected. The Committee encourages the Secretary of the Navy to accelerate the procurement of the next Expeditionary Sea Base to achieve the required capability, while allowing for greater affordability and stability for the industrial base. (Page 176)

Appendix A. Strategic and Budgetary Context

This appendix presents some brief comments on elements of the strategic and budgetary context in which U.S. Navy force structure and shipbuilding plans may be considered.

Shift in International Security Environment

World events have led some observers, starting in late 2013, to conclude that the international security environment has undergone a shift over the past several years from the familiar post-Cold War era of the past 20-25 years, also sometimes known as the unipolar moment (with the United States as the unipolar power), to a new and different strategic situation that features, among other things, renewed great power competition with China and Russia, and challenges to elements of the U.S.-led international order that has operated since World War II. This situation is discussed further in another CRS report.[32]

World Geography and U.S. Grand Strategy

Discussion of the above-mentioned shift in the international security environment has led to a renewed emphasis in discussions of U.S. security and foreign policy on grand strategy and geopolitics.[33] From a U.S. perspective on grand strategy and geopolitics, it can be noted that most of the world's people, resources, and economic activity are located not in the Western Hemisphere, but in the other hemisphere, particularly Eurasia. In response to this basic feature of world geography, U.S. policymakers for the past several decades have chosen to pursue, as a key element of U.S. national strategy, a goal of preventing the emergence of a regional hegemon in one part of Eurasia or another, on the grounds that such a hegemon could represent a concentration of power strong enough to threaten core U.S. interests by, for example, denying the United States access to some of the other hemisphere's resources and economic activity. Although U.S. policymakers have not often stated this key national strategic goal explicitly in public, U.S. military (and diplomatic) operations in recent decades—both wartime operations and day-to-day operations—can be viewed as having been carried out in no small part in support of this key goal.

[32] CRS Report R43838, *A Shift in the International Security Environment: Potential Implications for Defense—Issues for Congress*, by Ronald O'Rourke.

[33] The term *grand strategy* generally refers in foreign policy discussions to a country's overall approach for securing its interests and making its way in the world, using all the national instruments at its disposal, including diplomatic, informational, military, and economic tools (sometimes abbreviated in U.S. government parlance as DIME). A country's role in the world can be viewed as a visible expression of its grand strategy. For the United States, grand strategy can be viewed as a design or blueprint at a global or interregional level, as opposed to U.S. approaches for individual regions, countries, or issues.

The term *geopolitics* is often used as a synonym for international politics or for strategy relating to international politics. More specifically, it refers to the influence of basic geographic features on international relations, and to the analysis of international relations from a perspective that places a strong emphasis on the influence of such geographic features. Basic geographic features involved in geopolitical analysis include things such as the relative sizes and locations of countries or land masses; the locations of key resources such as oil or water; geographic barriers such as oceans, deserts, and mountain ranges; and key transportation links such as roads, railways, and waterways.

For additional discussion, see CRS Report R44891, *U.S. Role in the World: Background and Issues for Congress*, by Ronald O'Rourke and Michael Moodie.

U.S. Grand Strategy and U.S. Naval Forces

As noted above, in response to basic world geography, U.S. policymakers for the past several decades have chosen to pursue, as a key element of U.S. national strategy, a goal of preventing the emergence of a regional hegemon in one part of Eurasia or another. The traditional U.S. goal of preventing the emergence of a regional hegemon in one part of Eurasia or another has been a major reason why the U.S. military is structured with force elements that enable it to cross broad expanses of ocean and air space and then conduct sustained, large-scale military operations upon arrival. Force elements associated with this goal include, among other things, an Air Force with significant numbers of long-range bombers, long-range surveillance aircraft, long-range airlift aircraft, and aerial refueling tankers, and a Navy with significant numbers of aircraft carriers, nuclear-powered attack submarines, large surface combatants, large amphibious ships, and underway replenishment ships.[34]

The United States is the only country in the world that has designed its military to cross broad expanses of ocean and air space and then conduct sustained, large-scale military operations upon arrival. The other countries in the Western Hemisphere do not design their forces to do this because they cannot afford to, and because the United States has been, in effect, doing it for them. Countries in the other hemisphere do not design their forces to do this for the very basic reason that they are already in the other hemisphere, and consequently instead spend their defense money on forces that are tailored largely for influencing events in their own local region.

The fact that the United States has designed its military to do something that other countries do not design their forces to do—cross broad expanses of ocean and air space and then conduct sustained, large-scale military operations upon arrival—can be important to keep in mind when comparing the U.S. military to the militaries of other nations. For example, in observing that the U.S. Navy has 11 aircraft carriers while other countries have no more than one or two, it can be noted other countries do not need a significant number of aircraft carriers because, unlike the United States, they are not designing their forces to cross broad expanses of ocean and air space and then conduct sustained, large-scale military operations upon arrival.

As another example, it is sometimes noted, in assessing the adequacy of U.S. naval forces, that U.S. naval forces are equal in tonnage to the next dozen or more navies combined, and that most of those next dozen or more navies are the navies of U.S. allies. Those other fleets, however, are mostly of Eurasian countries, which do not design their forces to cross to the other side of the world and then conduct sustained, large-scale military operations upon arrival. The fact that the U.S. Navy is much bigger than allied navies does not necessarily prove that U.S. naval forces are either sufficient or excessive; it simply reflects the differing and generally more limited needs that U.S. allies have for naval forces. (It might also reflect an underinvestment by some of those allies to meet even their more limited naval needs.)

Countries have differing needs for naval and other military forces. The United States, as a country located in the Western Hemisphere that has adopted a goal of preventing the emergence of a regional hegemon in one part of Eurasia or another, has defined a need for naval and other military forces that is quite different from the needs of allies that are located in Eurasia. The sufficiency of U.S. naval and other military forces consequently is best assessed not through comparison to the militaries of other countries, but against U.S. strategic goals.

More generally, from a geopolitical perspective, it can be noted that that U.S. naval forces, while not inexpensive, give the United States the ability to convert the world's oceans—a global

[34] For additional discussion, see CRS In Focus IF10485, *Defense Primer: Geography, Strategy, and U.S. Force Design*, by Ronald O'Rourke.

commons that covers more than two-thirds of the planet's surface—into a medium of maneuver and operations for projecting U.S. power ashore and otherwise defending U.S. interests around the world. The ability to use the world's oceans in this manner—and to deny other countries the use of the world's oceans for taking actions against U.S. interests—constitutes an immense asymmetric advantage for the United States. This point would be less important if less of the world were covered by water, or if the oceans were carved into territorial blocks, like the land. Most of the world, however, is covered by water, and most of those waters are international waters, where naval forces can operate freely. The point, consequently, is not that U.S. naval forces are intrinsically special or privileged—it is that they have a certain value simply as a consequence of the physical and legal organization of the planet.

Uncertainty Regarding Future U.S. Role in the World

The overall U.S. role in the world since the end of World War II in 1945 (i.e., over the past 70 years) is generally described as one of global leadership and significant engagement in international affairs. A key aim of that role has been to promote and defend the open international order that the United States, with the support of its allies, created in the years after World War II. In addition to promoting and defending the open international order, the overall U.S. role is generally described as having been one of promoting freedom, democracy, and human rights, while criticizing and resisting authoritarianism where possible, and opposing the emergence of regional hegemons in Eurasia or a spheres-of-influence world.

Certain statements and actions from the Trump Administration have led to uncertainty about the Administration's intentions regarding the U.S. role in the world. Based on those statements and actions, some observers have speculated that the Trump Administration may want to change the U.S. role in one or more ways. A change in the overall U.S. role could have profound implications for DOD strategy, budgets, plans, and programs, including the planned size and structure of the Navy.[35]

Declining U.S. Technological and Qualitative Edge

DOD officials have expressed concern that the technological and qualitative edge that U.S. military forces have had relative to the military forces of other countries is being narrowed by improving military capabilities in other countries. China's improving military capabilities are a primary contributor to that concern.[36] Russia's rejuvenated military capabilities are an additional contributor. DOD in recent years has taken a number of actions to arrest and reverse the decline in the U.S. technological and qualitative edge.[37]

Challenge to U.S. Sea Control and U.S. Position in Western Pacific

Observers of Chinese and U.S. military forces view China's improving naval capabilities as posing a potential challenge in the Western Pacific to the U.S. Navy's ability to achieve and maintain control of blue-water ocean areas in wartime—the first such challenge the U.S. Navy

[35] For additional discussion, see CRS Report R44891, *U.S. Role in the World: Background and Issues for Congress*, by Ronald O'Rourke and Michael Moodie.

[36] For more on China's naval modernization effort, see CRS Report RL33153, *China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress*, by Ronald O'Rourke.

[37] For more on these initiatives, see CRS Report R43838, *A Shift in the International Security Environment: Potential Implications for Defense—Issues for Congress*, by Ronald O'Rourke.

has faced since the end of the Cold War.[38] More broadly, these observers view China's naval capabilities as a key element of an emerging broader Chinese military challenge to the long-standing status of the United States as the leading military power in the Western Pacific.

Longer Ship Deployments

U.S. Navy officials have testified that fully meeting requests from U.S. regional combatant commanders (CCDRs) for forward-deployed U.S. naval forces would require a Navy much larger than today's fleet. For example, Navy officials testified in March 2014 that a Navy of 450 ships would be required to fully meet CCDR requests for forward-deployed Navy forces.[39] CCDR requests for forward-deployed U.S. Navy forces are adjudicated by DOD through a process called the Global Force Management Allocation Plan. The process essentially makes choices about how best to apportion a finite number forward-deployed U.S. Navy ships among competing CCDR requests for those ships. Even with this process, the Navy has lengthened the deployments of some ships in an attempt to meet policymaker demands for forward-deployed U.S. Navy ships. Although Navy officials are aiming to limit ship deployments to seven months, Navy ships in recent years have frequently been deployed for periods of eight months or more.

Limits on Defense Spending in Budget Control Act of 2011 as Amended

Limits on the "base" portion of the U.S. defense budget established by Budget Control Act of 2011, or BCA (S. 365/P.L. 112-25 of August 2, 2011), as amended, combined with some of the considerations above, have led to discussions among observers about how to balance competing demands for finite U.S. defense funds, and about whether programs for responding to China's military modernization effort can be adequately funded while also adequately funding other defense-spending priorities, such as initiatives for responding to Russia's actions in Ukraine and elsewhere in Europe and U.S. operations for countering the Islamic State organization in the Middle East.[40]

[38] The term "blue-water ocean areas" is used here to mean waters that are away from shore, as opposed to near-shore (i.e., littoral) waters. Iran is viewed as posing a challenge to the U.S. Navy's ability to quickly achieve and maintain sea control in littoral waters in and near the Strait of Hormuz.

[39] Spoken testimony of Admiral Jonathan Greenert at a March 12, 2014, hearing before the House Armed Services Committee on the Department of the Navy's proposed FY2015 budget, as shown in transcript of hearing.

[40] See, for example, Statement of Admiral Jonathan Greenert, U.S. navy, Chief of Naval Operations, Before the Senate Armed Services Committee on the Impact of Sequestration on National Defense, January 28, 2015, particularly page 4 and Table 1, entitled "Mission Impacts to a Sequestered Navy."

Appendix B. Earlier Navy Force-Structure Goals Dating Back to 2001

The table below shows earlier Navy force-structure goals dating back to 2001. The 308-ship force-level goal of March 2015, shown in the first column of the table, is the goal that was replaced by the 355-ship force-level goal released in December 2016.

Table B-1. Earlier Navy Force-Structure Goals Dating Back to 2001

Ship type	308-ship goal of March 2015	306-ship goal of January 2013	~310-316 ship goal of March 2012	Revised 313-ship goal of September 2011	Changes to February 2006 313-ship goal announced through mid-2011	February 2006 Navy goal for 313-ship fleet	Early-2005 Navy goal for fleet of 260-325 ships		2002-2004 Navy goal for 375-ship Navy[a]	2001 QDR goal for 310-ship Navy
							260-ships	325-ships		
Ballistic missile submarines (SSBNs)	12[b]	12[b]	12-14[b]	12[b]	12[b]	14	14	14	14	14
Cruise missile submarines (SSGNs)	0[c]	0[c]	0-4[c]	4[c]	0[c]	4	4	4	4	2 or 4[d]
Attack submarines (SSNs)	48	48	~48	48	48	48	37	41	55	55
Aircraft carriers	11[e]	11[e]	11[e]	11[e]	11[e]	11[f]	10	11	12	12
Cruisers and destroyers	88	88	~90	94	94[g]	88	67	92	104	116
Frigates	0	0	0	0	0	0	0	0	0	
Littoral Combat Ships (LCSs)	52	52	~55	55	55	55	63	82	56	0
Amphibious ships	34	33	~32	33	33[h]	31	17	24	37	36
MPF(F) ships[i]	0[i]	0[i]	0[i]	0[i]	0[i]	12[i]	14[i]	20[i]	0[i]	0[i]
Combat logistics (resupply) ships	29	29	~29	30	30	30	24	26	42	34
Dedicated mine warfare ships	0	0	0	0	0	0	0	0	26[k]	16
Joint High Speed Vessels (JHSVs)	10[l]	10[l]	10[l]	10[l]	21[l]	3	0	0	0	0
Other[m]	24	23	~23	16	24[n]	17	10	11	25	25
Total battle force ships	**308**	**306**	**~310-316**	**313**	**328**	**313**	**260**	**325**	**375**	**310 or 312**

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

Notes: QDR is Quadrennial Defense Review. The "~" symbol means approximately.

a. Initial composition. Composition was subsequently modified.

b. The Navy plans to replace the 14 current Ohio-class SSBNs with a new class of 12 next-generation SSBNs. For further discussion, see CRS Report R41129, *Navy Columbia (SSBN-826) Class Ballistic Missile Submarine Program: Background and Issues for Congress*, by Ronald O'Rourke.

c. Although the Navy plans to continue operating its four SSGNs until they reach retirement age in the late 2020s, the Navy does not plan to replace these ships when they retire. This situation can be expressed in a table like this one with either a 4 or a 0.

d. The report on the 2001 QDR did not mention a specific figure for SSGNs. The Administration's proposed FY2001 DOD budget requested funding to support the conversion of two available Trident SSBNs into SSGNs, and the retirement of two other Trident SSBNs. Congress, in marking up this request, supported a plan to convert all four available SSBNs into SSGNs.

e. With congressional approval, the goal has been temporarily be reduced to 10 carriers for the period between the retirement of the carrier *Enterprise* (CVN-65) in December 2012 and entry into service of the carrier *Gerald R. Ford* (CVN-78), currently scheduled for September 2015.

f. For a time, the Navy characterized the goal as 11 carriers in the nearer term, and eventually 12 carriers.

g. The 94-ship goal was announced by the Navy in an April 2011 report to Congress on naval force structure and missile defense.

h. The Navy acknowledged that meeting a requirement for being able to lift the assault echelons of 2.0 Marine Expeditionary Brigades (MEBs) would require a minimum of 33 amphibious ships rather than the 31 ships shown in the February 2006 plan. For further discussion, see CRS Report RL34476, *Navy LPD-17 Amphibious Ship Procurement: Background, Issues, and Options for Congress*, by Ronald O'Rourke.

i. Today's Maritime Prepositioning Force (MPF) ships are intended primarily to support Marine Corps operations ashore, rather than Navy combat operations, and thus are not counted as Navy battle force ships. The planned MPF (Future) ships, however, would have contributed to Navy combat capabilities (for example, by supporting Navy aircraft operations). For this reason, the ships in the planned MPF(F) squadron were counted by the Navy as battle force ships. The planned MPF(F) squadron was subsequently restructured into a different set of initiatives for enhancing the existing MPF squadrons; the Navy no longer plans to acquire an MPF(F) squadron.

j. The Navy no longer plans to acquire an MPF(F) squadron. The Navy, however, has procured or plans to procure some of the ships that were previously planned for the squadron—specifically, TAKE-1 class cargo ships, and Mobile Landing Platform (MLP)/Afloat Forward Staging Base (AFSB) ships. These ships are included in the total shown for "Other" ships. AFSBs are now called Expeditionary Support Base ships (ESBs).

k. The figure of 26 dedicated mine warfare ships included 10 ships maintained in a reduced mobilization status called Mobilization Category B. Ships in this status are not readily deployable and thus do not count as battle force ships. The 375-ship proposal thus implied transferring these 10 ships to a higher readiness status.

l. Totals shown include 5 ships transferred from the Army to the Navy and operated by the Navy primarily for the performance of Army missions.

m. This category includes, among other things, command ships and support ships.

n. The increase in this category from 17 ships under the February 2006 313-ship goal to 24 ships under the apparent 328-ship goal included the addition of one TAGOS ocean surveillance ship and the transfer into this category of six ships—three modified TAKE-1 class cargo ships, and three Mobile Landing Platform (MLP) ships—that were previously intended for the planned (but now canceled) MPF(F) squadron.

Appendix C. Comparing Past Ship Force Levels to Current or Potential Future Ship Force Levels

In assessing the appropriateness of the current or potential future number of ships in the Navy, observers sometimes compare that number to historical figures for total Navy fleet size. Historical figures for total fleet size, however, can be a problematic yardstick for assessing the appropriateness of the current or potential future number of ships in the Navy, particularly if the historical figures are more than a few years old, because

- the missions to be performed by the Navy, the mix of ships that make up the Navy, and the technologies that are available to Navy ships for performing missions all change over time; and
- the number of ships in the fleet in an earlier year might itself have been inappropriate (i.e., not enough or more than enough) for meeting the Navy's mission requirements in that year.

Regarding the first bullet point above, the Navy, for example, reached a late-Cold War peak of 568 battle force ships at the end of FY1987,[41] and as of May 7, 2019, included a total of 289 battle force ships. The FY1987 fleet, however, was intended to meet a set of mission requirements that focused on countering Soviet naval forces at sea during a potential multitheater NATO-Warsaw Pact conflict, while the May 2019 fleet is intended to meet a considerably different set of mission requirements centered on influencing events ashore by countering both land- and sea-based military forces of China, Russia, North Korea, and Iran, as well as nonstate terrorist organizations. In addition, the Navy of FY1987 differed substantially from the May 2019 fleet in areas such as profusion of precision-guided air-delivered weapons, numbers of Tomahawk-capable ships, and the sophistication of C4ISR systems and networking capabilities.[42]

In coming years, Navy missions may shift again, and the capabilities of Navy ships will likely have changed further by that time due to developments such as more comprehensive implementation of networking technology, increased use of ship-based unmanned vehicles, and the potential fielding of new types of weapons such as lasers or electromagnetic rail guns.

The 568-ship fleet of FY1987 may or may not have been capable of performing its stated missions; the 289-ship fleet of May 2019 may or may not be capable of performing its stated missions; and a fleet years from now with a certain number of ships may or may not be capable of performing its stated missions. Given changes over time in mission requirements, ship mixes, and technologies, however, these three issues are to a substantial degree independent of one another.

For similar reasons, trends over time in the total number of ships in the Navy are not necessarily a reliable indicator of the direction of change in the fleet's ability to perform its stated missions. An

[41] Some publications have stated that the Navy reached a peak of 594 ships at the end of FY1987. This figure, however, is the total number of active ships in the fleet, which is not the same as the total number of battle force ships. The battle force ships figure is the number used in government discussions of the size of the Navy. In recent years, the total number of active ships has been larger than the total number of battle force ships. For example, the Naval History and Heritage Command (formerly the Naval Historical Center) states that as of November 16, 2001, the Navy included a total of 337 active ships, while the Navy states that as of November 19, 2001, the Navy included a total of 317 battle force ships. Comparing the total number of active ships in one year to the total number of battle force ships in another year is thus an apples-to-oranges comparison that in this case overstates the decline since FY1987 in the number of ships in the Navy. As a general rule to avoid potential statistical distortions, comparisons of the number of ships in the Navy over time should use, whenever possible, a single counting method.

[42] C4ISR stands for command and control, communications, computers, intelligence, surveillance, and reconnaissance.

increasing number of ships in the fleet might not necessarily mean that the fleet's ability to perform its stated missions is increasing, because the fleet's mission requirements might be increasing more rapidly than ship numbers and average ship capability. Similarly, a decreasing number of ships in the fleet might not necessarily mean that the fleet's ability to perform stated missions is decreasing, because the fleet's mission requirements might be declining more rapidly than numbers of ships, or because average ship capability and the percentage of time that ships are in deployed locations might be increasing quickly enough to more than offset reductions in total ship numbers.

Regarding the second of the two bullet points above, it can be noted that comparisons of the size of the fleet today with the size of the fleet in earlier years rarely appear to consider whether the fleet was appropriately sized in those earlier years (and therefore potentially suitable as a yardstick of comparison), even though it is quite possible that the fleet in those earlier years might not have been appropriately sized, and even though there might have been differences of opinion among observers at that time regarding that question. Just as it might not be prudent for observers years from now to tacitly assume that the 286-ship Navy of September 2018 was appropriately sized for meeting the mission requirements of 2018, even though there were differences of opinion among observers on that question, simply because a figure of 286 ships appears in the historical records for 2016, so, too, might it not be prudent for observers today to tacitly assume that the number of ships of the Navy in an earlier year was appropriate for meeting the Navy's mission requirements that year, even though there might have been differences of opinion among observers at that time regarding that question, simply because the size of the Navy in that year appears in a table like **Table H-1**.

Previous Navy force structure plans, such as those shown in **Table B-1**, might provide some insight into the potential adequacy of a proposed new force-structure plan, but changes over time in mission requirements, technologies available to ships for performing missions, and other force-planning factors, as well as the possibility that earlier force-structure plans might not have been appropriate for meeting the mission demands of their times, suggest that some caution should be applied in using past force structure plans for this purpose, particularly if those past force structure plans are more than a few years old. The Reagan-era goal for a 600-ship Navy, for example, was designed for a Cold War set of missions focusing on countering Soviet naval forces at sea, which is not an appropriate basis for planning the Navy today, and there was considerable debate during those years as to the appropriateness of the 600-ship goal.[43]

[43] Navy force structure plans that predate those shown in **Table B-1** include the Reagan-era 600-ship goal of the 1980s, the Base Force fleet of more than 400 ships planned during the final two years of the George H. W. Bush Administration, the 346-ship fleet from the Clinton Administration's 1993 Bottom-Up Review (or BUR, sometimes also called Base Force II), and the 310-ship fleet of the Clinton Administration's 1997 QDR. The table below summarizes some key features of these plans.

Features of Recent Navy Force Structure Plans

Plan	600-ship	Base Force	1993 BUR	1997 QDR
Total ships	~600	~450/416[a]	346	~305/310[b]
Attack submarines	100	80/~55[c]	45-55	50/55[d]
Aircraft carriers	15[e]	12	11+1[f]	11+1[f]
Surface combatants	242/228[g]	~150	~124	116
Amphibious ships	~75[h]	51[i]	41[i]	36[i]

Source: Prepared by CRS based on DOD and U.S. Navy data.

a. Commonly referred to as 450-ship goal, but called for decreasing to 416 ships by end of FY1999.

b. Original total of about 305 ships was increased to about 310 due to increase in number of attack submarines to 55 from 50.
c. Plan originally included 80 attack submarines, but this was later reduced to about 55.
d. Plan originally included 50 attack submarines but this was later increased to 55.
e. Plus one additional aircraft carrier in the service life extension program (SLEP).
f. Eleven active carriers plus one operational reserve carrier.
g. Plan originally included 242 surface combatants but this was later reduced to 228.
h. Number needed to lift assault echelons of one Marine Expeditionary Force (MEF) plus one Marine Expeditionary Brigade (MEB).
i. Number needed to lift assault echelons of 2.5 MEBs. Changing numbers needed to meet this goal reflect in part changes in the design and capabilities of amphibious ships.

Appendix D. Industrial Base Ability for, and Employment Impact of, Additional Shipbuilding Work

This appendix presents background information on the ability of the industrial base to take on the additional shipbuilding work associated with achieving and maintaining the Navy's 355-ship force-level goal and on the employment impact of additional shipbuilding work.

Industrial Base Ability

The U.S. shipbuilding industrial base has some unused capacity to take on increased Navy shipbuilding work, particularly for certain kinds of surface ships, and its capacity could be increased further over time to support higher Navy shipbuilding rates. Navy shipbuilding rates could not be increased steeply across the board overnight—time (and investment) would be needed to hire and train additional workers and increase production facilities at shipyards and supplier firms, particularly for supporting higher rates of submarine production. Depending on their specialties, newly hired workers could be initially less productive per unit of time worked than more experienced workers.

Some parts of the shipbuilding industrial base, such as the submarine construction industrial base, could face more challenges than others in ramping up to the higher production rates required to build the various parts of the 355-ship fleet. Over a period of a few to several years, with investment and management attention, Navy shipbuilding could ramp up to higher rates for achieving a 355-ship fleet over a period of 20-30 years.

An April 2017 CBO report stated that

> all seven shipyards [currently involved in building the Navy's major ships] would need to increase their workforces and several would need to make improvements to their infrastructure in order to build ships at a faster rate. However, certain sectors face greater obstacles in constructing ships at faster rates than others: Building more submarines to meet the goals of the 2016 force structure assessment would pose the greatest challenge to the shipbuilding industry. Increasing the number of aircraft carriers and surface combatants would pose a small to moderate challenge to builders of those vessels. Finally, building more amphibious ships and combat logistics and support ships would be the least problematic for the shipyards. The workforces across those yards would need to increase by about 40 percent over the next 5 to 10 years. Managing the growth and training of those new workforces while maintaining the current standard of quality and efficiency would represent the most significant industrywide challenge. In addition, industry and Navy sources indicate that as much as $4 billion would need to be invested in the physical infrastructure of the shipyards to achieve the higher production rates required under the [notional] 15-year and 20-year [buildup scenarios examined by CBO]. Less investment would be needed for the [notional] 25-year or 30-year [buildup scenarios examined by CBO].[44]

A January 13, 2017, press report states the following:

> The Navy's production lines are hot and the work to prepare them for the possibility of building out a much larger fleet would be manageable, the service's head of acquisition said Thursday.

[44] Congressional Budget Office, *Costs of Building a 355-Ship Navy*, April 2017, pp. 9-10.

> From a logistics perspective, building the fleet from its current 274 ships to 355, as recommended in the Navy's newest force structure assessment in December, would be straightforward, Assistant Secretary of the Navy for Research, Development and Acquisition Sean Stackley told reporters at the Surface Navy Association's annual symposium.
>
> "By virtue of maintaining these hot production lines, frankly, over the last eight years, our facilities are in pretty good shape," Stackley said. "In fact, if you talked to industry, they would say we're underutilizing the facilities that we have."
>
> The areas where the Navy would likely have to adjust "tooling" to answer demand for a larger fleet would likely be in Virginia-class attack submarines and large surface combatants, the DDG-51 guided missile destroyers—two ship classes likely to surge if the Navy gets funding to build to 355 ships, he said.
>
> "Industry's going to have to go out and procure special tooling associated with going from current production rates to a higher rate, but I would say that's easily done," he said.
>
> Another key, Stackley said, is maintaining skilled workers—both the builders in the yards and the critical supply-chain vendors who provide major equipment needed for ship construction. And, he suggested, it would help to avoid budget cuts and other events that would force workforce layoffs.
>
> "We're already prepared to ramp up," he said. "In certain cases, that means not laying off the skilled workforce we want to retain."[45]

A January 17, 2017, press report states the following:

> Building stable designs with active production lines is central to the Navy's plan to grow to 355 ships. "if you look at the 355-ship number, and you study the ship classes (desired), the big surge is in attack submarines and large surface combatants, which today are DDG-51 (destroyers)," the Assistant Secretary of the Navy, Sean Stackley, told reporters at last week's Surface Navy Association conference. Those programs have proven themselves reliable performers both at sea and in the shipyards.
>
> From today's fleet of 274 ships, "we're on an irreversible path to 308 by 2021. Those ships are already in construction," said Stackley. "To go from there to 355, virtually all those ships are currently in production, with some exceptions: Ohio Replacement, (we) just got done the Milestone B there (to move from R&D into detailed design); and then upgrades to existing platforms. So we have hot production lines that will take us to that 355-ship Navy."[46]

A January 24, 2017, press report states the following:

> Navy officials say a recently determined plan to increase its fleet size by adding more new submarines, carriers and destroyers is "executable" and that early conceptual work toward this end is already underway....
>
> Although various benchmarks will need to be reached in order for this new plan to come to fruition, such as Congressional budget allocations, Navy officials do tell Scout Warrior that the service is already working—at least in concept—on plans to vastly enlarge the fleet. Findings from this study are expected to inform an upcoming 2018 Navy Shipbuilding Plan, service officials said.[47]

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[45] Hope Hodge Seck, "Navy Acquisition Chief: Surge to 355 Ships 'Easily Done,'" *DoD Buzz*, January 13, 2017.

[46] Sydney J. Freedberg Jr., "Build More Ships, But Not New Designs: CNO Richardson To McCain," *Breaking Defense*, January 17, 2017.

[47] Kris Osborn, "Navy: Larger 355-Ship Fleet—'Executable,'" *Scout Warrior*, January 24, 2017.

A January 12, 2017, press report states the following:

> Brian Cuccias, president of Ingalls Shipbuilding [a shipyard owned by Huntington Ingalls Industries (HII) that builds Navy destroyers and amphibious ships as well as Coast Guard cutters], said Ingalls, which is currently building 10 ships for four Navy and Coast Guard programs at its 800-acre facility in Pascagoula, Miss., could build more because it is using only 70 to 75 percent of its capacity.[48]

A March 2017 press report states the following:

> As the Navy calls for a larger fleet, shipbuilders are looking toward new contracts and ramping up their yards to full capacity....
>
> The Navy is confident that U.S. shipbuilders will be able to meet an increased demand, said Ray Mabus, then-secretary of the Navy, during a speech at the Surface Navy Association's annual conference in Arlington, Virginia.
>
> They have the capacity to "get there because of the ships we are building today," Mabus said. "I don't think we could have seven years ago."
>
> Shipbuilders around the United States have "hot" production lines and are manufacturing vessels on multi-year or block buy contracts, he added. The yards have made investments in infrastructure and in the training of their workers.
>
> "We now have the basis ... [to] get to that much larger fleet," he said....
>
> Shipbuilders have said they are prepared for more work.
>
> At Ingalls Shipbuilding—a subsidiary of Huntington Ingalls Industries—10 ships are under construction at its Pascagoula, Mississippi, yard, but it is under capacity, said Brian Cuccias, the company's president.
>
> The shipbuilder is currently constructing five guided-missile destroyers, the latest San Antonio-class amphibious transport dock ship, and two national security cutters for the Coast Guard.
>
> "Ingalls is a very successful production line right now, but it has the ability to actually produce a lot more in the future," he said during a briefing with reporters in January.
>
> The company's facility is currently operating at 75 percent capacity, he noted....
>
> Austal USA—the builder of the Independence-variant of the littoral combat ship and the expeditionary fast transport vessel—is also ready to increase its capacity should the Navy require it, said Craig Perciavalle, the company's president.
>
> The latest discussions are "certainly something that a shipbuilder wants to hear," he said. "We do have the capability of increasing throughput if the need and demand were to arise, and then we also have the ability with the present workforce and facility to meet a different mix that could arise as well."
>
> Austal could build fewer expeditionary fast transport vessels and more littoral combat ships, or vice versa, he added.
>
> "The key thing for us is to keep the manufacturing lines hot and really leverage the momentum that we've gained on both of the programs," he said.

[48] Marc Selinger, "Navy Needs More Aircraft to Match Ship Increase, Secretary [of the Navy] Says," *Defense Daily*, January 12, 2017. See also Lee Hudson, "Ingalls Operating at About 75 Percent Capacity, Provided Info to Trump Team," *Inside the Navy*, January 16, 2017.

> The company—which has a 164-acre yard in Mobile, Alabama—is focused on the extension of the LCS and expeditionary fast transport ship program, but Perciavalle noted that it could look into manufacturing other types of vessels.
>
> "We do have excess capacity to even build smaller vessels … if that opportunity were to arise and we're pursuing that," he said.
>
> Bryan Clark, a naval analyst at the Center for Strategic and Budgetary Assessments, a Washington, D.C.-based think tank, said shipbuilders are on average running between 70 and 80 percent capacity. While they may be ready to meet an increased demand for ships, it would take time to ramp up their workforces.
>
> However, the bigger challenge is the supplier industrial base, he said.
>
> "Shipyards may be able to build ships but the supplier base that builds the pumps … and the radars and the radios and all those other things, they don't necessarily have that ability to ramp up," he said. "You would need to put some money into building up their capacity."
>
> That has to happen now, he added.
>
> Rear Adm. William Gallinis, program manager for program executive office ships, said what the Navy must be "mindful of is probably our vendor base that support the shipyards."
>
> Smaller companies that supply power electronics and switchboards could be challenged, he said.
>
> "Do we need to re-sequence some of the funding to provide some of the facility improvements for some of the vendors that may be challenged? My sense is that the industrial base will size to the demand signal. We just need to be mindful of how we transition to that increased demand signal," he said.
>
> The acquisition workforce may also see an increased amount of stress, Gallinis noted. "It takes a fair amount of experience and training to get a good contracting officer to the point to be [able to] manage contracts or procure contracts."
>
> "But I don't see anything that is insurmountable," he added.[49]

At a May 24, 2017, hearing before the Seapower subcommittee of the Senate Armed Services Committee on the industrial-base aspects of the Navy's 355-ship goal, John P. Casey, executive vice president–marine systems, General Dynamics Corporation (one of the country's two principal builders of Navy ships) stated the following:

> It is our belief that the Nation's shipbuilding industrial base can scale-up hot production lines for existing ships and mobilize additional resources to accomplish the significant challenge of achieving the 355-ship Navy as quickly as possible....
>
> Supporting a plan to achieve a 355-ship Navy will be the most challenging for the nuclear submarine enterprise. Much of the shipyard and industrial base capacity was eliminated following the steep drop-off in submarine production that occurred with the cancellation of the Seawolf Program in 1992. The entire submarine industrial base at all levels of the supply chain will likely need to recapitalize some portion of its facilities, workforce, and supply chain just to support the current plan to build the Columbia Class SSBN program, while concurrently building Virginia Class SSNs. Additional SSN procurement will require industry to expand its plans and associated investment beyond the level today....
>
> Shipyard labor resources include the skilled trades needed to fabricate, build and outfit major modules, perform assembly, test and launch of submarines, and associated support organizations that include planning, material procurement, inspection, quality assurance, and ship certification. Since there is no commercial equivalency for Naval nuclear

[49] Yasmin Tadjdeh, "Navy Shipbuilders Prepared for Proposed Fleet Buildup," *National Defense*, March 2017.

submarine shipbuilding, these trade resources cannot be easily acquired in large numbers from other industries. Rather, these shipyard resources must be acquired and developed over time to ensure the unique knowledge and know-how associated with nuclear submarine shipbuilding is passed on to the next generation of shipbuilders. The mechanisms of knowledge transfer require sufficient lead time to create the proficient, skilled craftsmen in each key trade including welding, electrical, machining, shipfitting, pipe welding, painting, and carpentry, which are among the largest trades that would need to grow to support increased demand. These trades will need to be hired in the numbers required to support the increased workload. Both shipyards have scalable processes in place to acquire, train, and develop the skilled workforce they need to build nuclear ships. These processes and associated training facilities need to be expanded to support the increased demand. As with the shipyards, the same limiting factors associated with facilities, workforce, and supply chain also limit the submarine unique first tier suppliers and sub-tiers in the industrial base for which there is no commercial equivalency....

The supply base is the third resource that will need to be expanded to meet the increased demand over the next 20 years. During the OHIO, 688 and SEAWOLF construction programs, there were over 17,000 suppliers supporting submarine construction programs. That resource base was "rationalized" during submarine low rate production over the last 20 years. The current submarine industrial base reflects about 5,000 suppliers, of which about 3,000 are currently active (i.e., orders placed within the last 5 years), 80% of which are single or sole source (based on $). It will take roughly 20 years to build the 12 Columbia Class submarines that starts construction in FY21. The shipyards are expanding strategic sourcing of appropriate non-core products (e.g., decks, tanks, etc.) in order to focus on core work at each shipyard facility (e.g., module outfitting and assembly). Strategic sourcing will move demand into the supply base where capacity may exist or where it can be developed more easily. This approach could offer the potential for cost savings by competition or shifting work to lower cost work centers throughout the country. Each shipyard has a process to assess their current supply base capacity and capability and to determine where it would be most advantageous to perform work in the supply base....

Achieving the increased rate of production and reducing the cost of submarines will require the Shipbuilders to rely on the supply base for more non-core products such as structural fabrication, sheet metal, machining, electrical, and standard parts. The supply base must be made ready to execute work with submarine-specific requirements at a rate and volume that they are not currently prepared to perform. Preparing the supply base to execute increased demand requires early non-recurring funding to support cross-program construction readiness and EOQ funding to procure material in a manner that does not hold up existing ship construction schedules should problems arise in supplier qualification programs. This requires longer lead times (estimates of three years to create a new qualified, critical supplier) than the current funding profile supports....

We need to rely on market principles to allow suppliers, the shipyards and GFE material providers to sort through the complicated demand equation across the multiple ship programs. Supplier development funding previously mentioned would support non-recurring efforts which are needed to place increased orders for material in multiple market spaces. Examples would include valves, build-to-print fabrication work, commodities, specialty material, engineering components, etc. We are engaging our marine industry associations to help foster innovative approaches that could reduce costs and gain efficiency for this increased volume....

Supporting the 355-ship Navy will require Industry to add capability and capacity across the entire Navy Shipbuilding value chain. Industry will need to make investment decisions for additional capital spend starting now in order to meet a step change in demand that would begin in FY19 or FY20. For the submarine enterprise, the step change was already envisioned and investment plans that embraced a growth trajectory were already being formulated. Increasing demand by adding additional submarines will require scaling

facility and workforce development plans to operate at a higher rate of production. The nuclear shipyards would also look to increase material procurement proportionally to the increased demand. In some cases, the shipyard facilities may be constrained with existing capacity and may look to source additional work in the supply base where capacity exists or where there are competitive business advantages to be realized. Creating additional capacity in the supply base will require non-recurring investment in supplier qualification, facilities, capital equipment and workforce training and development.

Industry is more likely to increase investment in new capability and capacity if there is certainty that the Navy will proceed with a stable shipbuilding plan. Positive signals of commitment from the Government must go beyond a published 30-year Navy Shipbuilding Plan and line items in the Future Years Defense Plan (FYDP) and should include

- Multi-year contracting for Block procurement which provides stability in the industrial base and encourages investment in facilities and workforce development
- Funding for supplier development to support training, qualification, and facilitization efforts—Electric Boat and Newport News have recommended to the Navy funding of $400M over a three-year period starting in 2018 to support supplier development for the Submarine Industrial Base as part of an Integrated Enterprise Plan Extended Enterprise initiative
- Acceleration of Advance Procurement and/or Economic Order Quantities (EOQ) procurement from FY19 to FY18 for Virginia Block V
- Government incentives for construction readiness and facilities / special tooling for shipyard and supplier facilities, which help cash flow capital investment ahead of construction contract awards
- Procurement of additional production back-up (PBU) material to help ensure a ready supply of material to mitigate construction schedule risk....

So far, this testimony has focused on the Submarine Industrial Base, but the General Dynamics Marine Systems portfolio also includes surface ship construction. Unlike Electric Boat, Bath Iron Works and NASSCO are able to support increased demand without a significant increase in resources.....

Bath Iron Works is well positioned to support the Administration's announced goal of increasing the size of the Navy fleet to 355 ships. For BIW that would mean increasing the total current procurement rate of two DDG 51s per year to as many as four DDGs per year, allocated equally between BIW and HII. This is the same rate that the surface combatant industrial base sustained over the first decade of full rate production of the DDG 51 Class (1989-1999)....

No significant capital investment in new facilities is required to accommodate delivering two DDGs per year. However, additional funding will be required to train future shipbuilders and maintain equipment. Current hiring and training processes support the projected need, and have proven to be successful in the recent past. BIW has invested significantly in its training programs since 2014 with the restart of the DDG 51 program and given these investments and the current market in Maine, there is little concern of meeting the increase in resources required under the projected plans.

A predictable and sustainable Navy workload is essential to justify expanding hiring/training programs. BIW would need the Navy's commitment that the Navy's plan will not change before it would proceed with additional hiring and training to support increased production.

BIW's supply chain is prepared to support a procurement rate increase of up to four DDG 51s per year for the DDG 51 Program. BIW has long-term purchasing agreements in place

> for all major equipment and material for the DDG 51 Program. These agreements provide for material lead time and pricing, and are not constrained by the number of ships ordered in a year. BIW confirmed with all of its critical suppliers that they can support this increased procurement rate....
>
> The Navy's Force Structure Assessment calls for three additional ESBs. Additionally, NASSCO has been asked by the Navy and the Congressional Budget Office (CBO) to evaluate its ability to increase the production rate of T-AOs to two ships per year. NASSCO has the capacity to build three more ESBs at a rate of one ship per year while building two T-AOs per year. The most cost effective funding profile requires funding ESB 6 in FY18 and the following ships in subsequent fiscal years to avoid increased cost resulting from a break in the production line. The most cost effective funding profile to enable a production rate of two T-AO ships per year requires funding an additional long lead time equipment set beginning in FY19 and an additional ship each year beginning in FY20.
>
> NASSCO must now reduce its employment levels due to completion of a series of commercial programs which resulted in the delivery of six ships in 2016. The proposed increase in Navy shipbuilding stabilizes NASSCO's workload and workforce to levels that were readily demonstrated over the last several years.
>
> Some moderate investment in the NASSCO shipyard will be needed to reach this level of production. The recent CBO report on the costs of building a 355-ship Navy accurately summarized NASSCO's ability to reach the above production rate stating, "building more … combat logistics and support ships would be the least problematic for the shipyards."[50]

At the same hearing, Brian Cuccias, president, Ingalls Shipbuilding, Huntington Ingalls Industries (the country's other principal builder of Navy ships) stated the following:

> Qualifying to be a supplier is a difficult process. Depending on the commodity, it may take up to 36 months. That is a big burden on some of these small businesses. This is why creating sufficient volume and exercising early contractual authorization and advance procurement funding is necessary to grow the supplier base, and not just for traditional long-lead time components; that effort needs to expand to critical components and commodities that today are controlling the build rate of submarines and carriers alike. Many of our suppliers are small businesses and can only make decisions to invest in people, plant and tooling when they are awarded a purchase order. We need to consider how we can make commitments to suppliers early enough to ensure material readiness and availability when construction schedules demand it.
>
> With questions about the industry's ability to support an increase in shipbuilding, both Newport News and Ingalls have undertaken an extensive inventory of our suppliers and assessed their ability to ramp up their capacity. We have engaged many of our key suppliers to assess their ability to respond to an increase in production.
>
> The fortunes of related industries also impact our suppliers, and an increase in demand from the oil and gas industry may stretch our supply base. Although some low to moderate risk remains, I am convinced that our suppliers will be able to meet the forecasted Navy demand....
>
> I strongly believe that the fastest results can come from leveraging successful platforms on current hot production lines. We commend the Navy's decision in 2014 to use the existing LPD 17 hull form for the LX(R), which will replace the LSD-class amphibious dock landing ships scheduled to retire in the coming years. However, we also recommend that the concept of commonality be taken even further to best optimize efficiency, affordability

[50] John P. Casey, Executive Vice President – Marine Systems, General Dynamics Corporation, Testimony before the Senate Armed Services Committee, Subcommittee on Seapower, 115th Congress, Supporting the 355-Ship Navy with Focus on Submarine Industrial Base, Washington, DC, May 24, 2017, pp. 3-18. See also Marjorie Censer, "BWX Technologies Weighs When To Ready for Additional Submarines," *Inside the Navy*, May 29, 2017.

> and capability. Specifically, rather than continuing with a new design for LX(R) within the "walls" of the LPD hull, we can leverage our hot production line and supply chain and offer the Navy a variant of the existing LPD design that satisfies the aggressive cost targets of the LX(R) program while delivering more capability and survivability to the fleet at a significantly faster pace than the current program. As much as 10-15 percent material savings can be realized across the LX(R) program by purchasing respective blocks of at least five ships each under a multi-year procurement (MYP) approach. In the aggregate, continuing production with LPD 30 in FY18, coupled with successive MYP contracts for the balance of ships, may yield savings greater than $1 billion across an 11-ship LX(R) program. Additionally, we can deliver five LX(R)s to the Navy and Marine Corps in the same timeframe that the current plan would deliver two, helping to reduce the shortfall in amphibious warships against the stated force requirement of 38 ships.
>
> Multi-ship procurements, whether a formal MYP or a block-buy, are a proven way to reduce the price of ships. The Navy took advantage of these tools on both Virginia-class submarines and Arleigh Burke-class destroyers. In addition to the LX(R) program mentioned above, expanding multi-ship procurements to other ship classes makes sense....
>
> The most efficient approach to lower the cost of the Ford class and meet the goal of an increased CVN fleet size is also to employ a multi-ship procurement strategy and construct these ships at three-year intervals. This approach would maximize the material procurement savings benefit through economic order quantities procurement and provide labor efficiencies to enable rapid acquisition of a 12-ship CVN fleet. This three-ship approach would save at least $1.5 billion, not including additional savings that could be achieved from government-furnished equipment. As part of its Integrated Enterprise Plan, we commend the Navy's efforts to explore the prospect of material economic order quantity purchasing across carrier and submarine programs.[51]

At the same hearing, Matthew O. Paxton, president, Shipbuilders Council of America (SCA)—a trade association representing shipbuilders, suppliers, and associated firms—stated the following:

> To increase the Navy's Fleet to 355 ships, a substantial and sustained investment is required in both procurement and readiness. However, let me be clear: building and sustaining the larger required Fleet is achievable and our industry stands ready to help achieve that important national security objective.
>
> To meet the demand for increased vessel construction while sustaining the vessels we currently have will require U.S. shipyards to expand their work forces and improve their infrastructure in varying degrees depending on ship type and ship mix – a requirement our Nation's shipyards are eager to meet. But first, in order to build these ships in as timely and affordable manner as possible, stable and robust funding is necessary to sustain those industrial capabilities which support Navy shipbuilding and ship maintenance and modernization....
>
> Beyond providing for the building of a 355-ship Navy, there must also be provision to fund the "tail," the maintenance of the current and new ships entering the fleet. Target fleet size cannot be reached if existing ships are not maintained to their full service lives, while building those new ships. Maintenance has been deferred in the last few years because of across-the-board budget cuts....
>
> The domestic shipyard industry certainly has the capability and know-how to build and maintain a 355-ship Navy. The Maritime Administration determined in a recent study on the Economic Benefits of the U.S. Shipyard Industry that there are nearly 110,000 skilled men and women in the Nation's private shipyards building, repairing and maintaining America's military and commercial fleets.1 The report found the U.S. shipbuilding

[51] Statement of Brian Cuccias, President, Ingalls Shipbuilding, Huntington Ingalls Industries, Subcommittee on Seapower, Senate Armed Services Committee, May 24, 2017, pp. 4-11.

> industry supports nearly 400,000 jobs across the country and generates $25.1 billion in income and $37.3 billion worth of goods and services each year. In fact, the MARAD report found that the shipyard industry creates direct and induced employment in every State and Congressional District and each job in the private shipbuilding and repairing industry supports another 2.6 jobs nationally.
>
> This data confirms the significant economic impact of this manufacturing sector, but also that the skilled workforce and industrial base exists domestically to build these ships. Long-term, there needs to be a workforce expansion and some shipyards will need to reconfigure or expand production lines. This can and will be done as required to meet the need if adequate, stable budgets and procurement plans are established and sustained for the long-term. Funding predictability and sustainability will allow industry to invest in facilities and more effectively grow its skilled workforce. The development of that critical workforce will take time and a concerted effort in a partnership between industry and the federal government.
>
> U.S. shipyards pride themselves on implementing state of the art training and apprenticeship programs to develop skilled men and women that can cut, weld, and bend steel and aluminum and who can design, build and maintain the best Navy in the world. However, the shipbuilding industry, like so many other manufacturing sectors, faces an aging workforce. Attracting and retaining the next generation shipyard worker for an industry career is critical. Working together with the Navy, and local and state resources, our association is committed to building a robust training and development pipeline for skilled shipyard workers. In addition to repealing sequestration and stabilizing funding the continued development of a skilled workforce also needs to be included in our national maritime strategy....
>
> In conclusion, the U.S. shipyard industry is certainly up to the task of building a 355-ship Navy and has the expertise, the capability, the critical capacity and the unmatched skilled workforce to build these national assets. Meeting the Navy's goal of a 355-ship fleet and securing America's naval dominance for the decades ahead will require sustained investment by Congress and Navy's partnership with a defense industrial base that can further attract and retain a highly-skilled workforce with critical skill sets. Again, I would like to thank this Subcommittee for inviting me to testify alongside such distinguished witnesses. As a representative of our nation's private shipyards, I can say, with confidence and certainty, that our domestic shipyards and skilled workers are ready, willing and able to build and maintain the Navy's 355-ship Fleet.[52]

Employment Impact

Building the additional ships that would be needed to achieve and maintain the 355-ship fleet could create many additional manufacturing and other jobs at shipyards, associated supplier firms, and elsewhere in the U.S. economy. A 2015 Maritime Administration (MARAD) report states

> Considering the indirect and induced impacts, each direct job in the shipbuilding and repairing industry is associated with another 2.6 jobs in other parts of the US economy; each dollar of direct labor income and GDP in the shipbuilding and repairing industry is associated with another $1.74 in labor income and $2.49 in GDP, respectively, in other parts of the US economy.[53]

[52] Testimony of Matthew O. Paxton, President, Shipbuilders Council of America, before the United States Senate Committee on Armed Services, Subcommittee on Seapower, [on] Industry Perspectives on Options and Considerations for Achieving a 355-Ship Navy, May 24, 2017, pp. 3-8.

[53] MARAD, *The Economic Importance of the U.S. Shipbuilding and Repairing Industry*, November 2015, pp. E-3, E-4,

A March 2017 press report states, "Based on a 2015 economic impact study, the Shipbuilders Council of America [a trade association for U.S. shipbuilders and associated supplier firms] believes that a 355-ship Navy could add more than 50,000 jobs nationwide."[54] The 2015 economic impact study referred to in that quote might be the 2015 MARAD study discussed in the previous paragraph. An estimate of more than 50,000 additional jobs nationwide might be viewed as a higher-end estimate; other estimates might be lower. A June 14, 2017, press report states the following: "The shipbuilding industry will need to add between 18,000 and 25,000 jobs to build to a 350-ship Navy, according to Matthew Paxton, president of the Shipbuilders Council of America, a trade association representing the shipbuilding industrial base. Including indirect jobs like suppliers, the ramp-up may require a boost of 50,000 workers."[55]

For another perspective on the issue of the impact of shipbuilding on the broader economy, see Edward G. Keating et al., *The Economic Consequences of Investing in Shipbuilding, Case Studies in the United States and Sweden*, RAND Corporation, 2015.

[54] Yasmin Tadjdeh, "Navy Shipbuilders Prepared for Proposed Fleet Buildup," *National Defense*, March 2017. Similarly, another press report states: "The Navy envisioned by Trump could create more than 50,000 jobs, the Shipbuilders Council of America, a trade group representing U.S. shipbuilders, repairers and suppliers, told Reuters." (Mike Stone, "Missing from Trump's Grand Navy Plan: Skilled Workers to Build the Fleet," *Reuters*, March 17, 2017.)

[55] Jaqueline Klimas, "Growing Shipbuilding Workforce Seen as Major Challenge for Trump's Navy Buildup," *Politico*, June 14, 2017.

Appendix E. A Summary of Some Acquisition Lessons Learned for Navy Shipbuilding

This appendix presents a general summary of lessons learned in Navy shipbuilding, reflecting comments made repeatedly by various sources over the years. These lessons learned include the following:

- **At the outset, get the operational requirements for the program right.** Properly identify the program's operational requirements at the outset. Manage risk by not trying to do too much in terms of the program's operational requirements, and perhaps seek a so-called 70%-to-80% solution (i.e., a design that is intended to provide 70%-80% of desired or ideal capabilities). Achieve a realistic balance up front between operational requirements, risks, and estimated costs.
- **Impose cost discipline up front.** Use realistic price estimates, and consider not only development and procurement costs, but life-cycle operation and support (O&S) costs.
- **Employ competition** where possible in the awarding of design and construction contracts.
- **Use a contract type that is appropriate for the amount of risk involved**, and structure its terms to align incentives with desired outcomes.
- **Minimize design/construction concurrency** by developing the design to a high level of completion before starting construction and by resisting changes in requirements (and consequent design changes) during construction.
- **Properly supervise construction work.** Maintain an adequate number of properly trained Supervisor of Shipbuilding (SUPSHIP) personnel.
- **Provide stability for industry**, in part by using, where possible, multiyear procurement (MYP) or block buy contracting.
- **Maintain a capable government acquisition workforce** that understands what it is buying, as well as the above points.

Identifying these lessons is arguably not the hard part—most if not all these points have been cited for years. The hard part, arguably, is living up to them without letting circumstances lead program-execution efforts away from these guidelines.

Appendix F. Some Considerations Relating to Warranties in Shipbuilding and Other Defense Acquisition

This appendix presents some considerations relating to warranties in shipbuilding and other defense acquisition.

In discussions of Navy (and also Coast Guard) shipbuilding, one question that sometimes arises is whether including a warranty in a shipbuilding contract is preferable to not including one. The question can arise, for example, in connection with a GAO finding that "the Navy structures shipbuilding contracts so that it pays shipbuilders to build ships as part of the construction process and then pays the same shipbuilders a second time to repair the ship when construction defects are discovered."[56]

Including a warranty in a shipbuilding contract (or a contract for building some other kind of defense end item), while potentially valuable, might not always be preferable to not including one—it depends on the circumstances of the acquisition, and it is not necessarily a valid criticism of an acquisition program to state that it is using a contract that does not include a warranty (or a weaker form of a warranty rather than a stronger one).

Including a warranty generally shifts to the contractor the risk of having to pay for fixing problems with earlier work. Although that in itself could be deemed desirable from the government's standpoint, a contractor negotiating a contract that will have a warranty will incorporate that risk into its price, and depending on how much the contractor might charge for doing that, it is possible that the government could wind up paying more in total for acquiring the item (including fixing problems with earlier work on that item) than it would have under a contract without a warranty.

When a warranty is not included in the contract and the government pays later on to fix problems with earlier work, those payments can be very visible, which can invite critical comments from observers. But that does not mean that including a warranty in the contract somehow frees the government from paying to fix problems with earlier work. In a contract that includes a warranty, the government will indeed pay something to fix problems with earlier work—but it will make the payment in the less-visible (but still very real) form of the up-front charge for including the warranty, and that charge might be more than what it would have cost the government, under a contract without a warranty, to pay later on for fixing those problems.

From a cost standpoint, including a warranty in the contract might or might not be preferable, depending on the risk that there will be problems with earlier work that need fixing, the potential cost of fixing such problems, and the cost of including the warranty in the contract. The point is that the goal of avoiding highly visible payments for fixing problems with earlier work and the goal of minimizing the cost to the government of fixing problems with earlier work are separate

[56] See Government Accountability Office, *Navy Shipbuilding[:] Past Performance Provides Valuable Lessons for Future Investments*, GAO-18-238SP, June 2018, p. 21. A graphic on page 21 shows a GAO finding that the government was financially responsible for shipbuilder deficiencies in 96% of the cases examined by GAO, and that the shipbuilder was financially responsible for shipbuilder deficiencies in 4% of the cases.

and different goals, and that pursuing the first goal can sometimes work against achieving the second goal.[57]

The Department of Defense's guide on the use of warranties states the following:

> Federal Acquisition Regulation (FAR) 46.7 states that "the use of warranties is not mandatory." However, if the benefits to be derived from the warranty are commensurate with the cost of the warranty, the CO [contracting officer] should consider placing it in the contract. In determining whether a warranty is appropriate for a specific acquisition, FAR Subpart 46.703 requires the CO to consider the nature and use of the supplies and services, the cost, the administration and enforcement, trade practices, and reduced requirements. The rationale for using a warranty should be documented in the contract file....
>
> In determining the value of a warranty, a CBA [cost-benefit analysis] is used to measure the life cycle costs of the system with and without the warranty. A CBA is required to determine if the warranty will be cost beneficial. CBA is an economic analysis, which basically compares the Life Cycle Costs (LCC) of the system with and without the warranty to determine if warranty coverage will improve the LCCs. In general, five key factors will drive the results of the CBA: cost of the warranty + cost of warranty administration + compatibility with total program efforts + cost of overlap with Contractor support + intangible savings. Effective warranties integrate reliability, maintainability, supportability, availability, and life-cycle costs. Decision factors that must be evaluated include the state of the weapon system technology, the size of the warranted population, the likelihood that field performance requirements can be achieved, and the warranty period of performance.[58]

[57] It can also be noted that the country's two largest builders of Navy ships—General Dynamics (GD) and Huntington Ingalls Industries (HII)—derive about 60% and 96%, respectively, of their revenues from U.S. government work. (See General Dynamics, *2016 Annual Report*, page 9 of Form 10-K [PDF page 15 of 88]) and Huntington Ingalls Industries, *2016 Annual Report*, page 5 of Form 10-K [PDF page 19 of 134]). These two shipbuilders operate the only U.S. shipyards currently capable of building several major types of Navy ships, including submarines, aircraft carriers, large surface combatants, and amphibious ships. Thus, even if a warranty in a shipbuilding contract with one of these firms were to somehow mean that the government did not have pay under the terms of that contract—either up front or later on—for fixing problems with earlier work done under that contract, there would still be a question as to whether the government would nevertheless wind up eventually paying much of that cost as part of the price of one or more future contracts the government may have that firm.

[58] Department of Defense, *Department of Defense Warranty Guide*, Version 1.0, September 2009, accessed July 13, 2017, at https://www.acq.osd.mil/dpap/pdi/uid/docs/departmentofdefensewarrantyguide[1].doc.

Appendix G. Some Considerations Relating to Avoiding Procurement Cost Growth vs. Minimizing Procurement Costs

This appendix presents some considerations relating to avoiding procurement cost growth vs. minimizing procurement costs in shipbuilding and other defense acquisition.

The affordability challenge posed by the Navy's shipbuilding plans can reinforce the strong oversight focus on preventing or minimizing procurement cost growth in Navy shipbuilding programs, which is one expression of a strong oversight focus on preventing or minimizing cost growth in DOD acquisition programs in general. This oversight focus may reflect in part an assumption that avoiding or minimizing procurement cost growth is always synonymous with minimizing procurement cost. It is important to note, however, that as paradoxical as it may seem, avoiding or minimizing procurement cost growth is not always synonymous with minimizing procurement cost, and that a sustained, singular focus on avoiding or minimizing procurement cost growth might sometimes lead to higher procurement costs for the government.

How could this be? Consider the example of a design for the lead ship of a new class of Navy ships. The construction cost of this new design is uncertain, but is estimated to be likely somewhere between Point A (a minimum possible figure) and Point D (a maximum possible figure). (Point D, in other words, would represent a cost estimate with a 100% confidence factor, meaning there is a 100% chance that the cost would come in at or below that level.) If the Navy wanted to avoid cost growth on this ship, it could simply set the ship's procurement cost at Point D. Industry would likely be happy with this arrangement, and there likely would be no cost growth on the ship.

The alternative strategy open to the Navy is to set the ship's target procurement cost at some figure between Points A and D—call it Point B—and then use that more challenging target cost to place pressure on industry to sharpen its pencils so as to find ways to produce the ship at that lower cost. (Navy officials sometimes refer to this as "pressurizing" industry.) In this example, it might turn out that industry efforts to reduce production costs are not successful enough to build the ship at the Point B cost. As a result, the ship experiences one or more rounds of procurement cost growth, and the ship's procurement cost rises over time from Point B to some higher figure—call it Point C.

Here is the rub: Point C, in spite of incorporating one or more rounds of cost growth, might nevertheless turn out to be lower than Point D, because Point C reflected efforts by the shipbuilder to find ways to reduce production costs that the shipbuilder might have put less energy into pursuing if the Navy had simply set the ship's procurement cost initially at Point D.

Setting the ship's cost at Point D, in other words, may eliminate the risk of cost growth on the ship, but does so at the expense of creating a risk of the government paying more for the ship than was actually necessary. DOD could avoid cost growth on new procurement programs starting tomorrow by simply setting costs for those programs at each program's equivalent of Point D. But as a result of this strategy, DOD could well wind up leaving money on the table in some instances—of not, in other words, minimizing procurement costs.

DOD does not have to set a cost precisely at Point D to create a potential risk in this regard. A risk of leaving money on the table, for example, is a possible downside of requiring DOD to budget for its acquisition programs at something like an 80% confidence factor—an approach that some

observers have recommended—because a cost at the 80% confidence factor is a cost that is likely fairly close to Point D.

Procurement cost growth is often embarrassing for DOD and industry, and can damage their credibility in connection with future procurement efforts. Procurement cost growth can also disrupt congressional budgeting by requiring additional appropriations to pay for something Congress thought it had fully funded in a prior year. For this reason, there is a legitimate public policy value to pursuing a goal of having less rather than more procurement cost growth.

Procurement cost growth, however, can sometimes be in part the result of DOD efforts to use lower initial cost targets as a means of pressuring industry to reduce production costs—efforts that, notwithstanding the cost growth, might be partially successful. A sustained, singular focus on avoiding or minimizing cost growth, and of punishing DOD for all instances of cost growth, could discourage DOD from using lower initial cost targets as a means of pressurizing industry, which could deprive DOD of a tool for controlling procurement costs.

The point here is not to excuse away cost growth, because cost growth can occur in a program for reasons other than DOD's attempt to pressurize industry. Nor is the point to abandon the goal of seeking lower rather than higher procurement cost growth, because, as noted above, there is a legitimate public policy value in pursuing this goal. The point, rather, is to recognize that this goal is not always synonymous with minimizing procurement cost, and that a possibility of some amount of cost growth might be expected as part of an optimal government strategy for minimizing procurement cost. Recognizing that the goals of seeking lower rather than higher cost growth and of minimizing procurement cost can sometimes be in tension with one another can lead to an approach that takes both goals into consideration. In contrast, an approach that is instead characterized by a sustained, singular focus on avoiding and minimizing cost growth may appear virtuous, but in the end may wind up costing the government more.

Appendix H. Size of the Navy and Navy Shipbuilding Rate

Size of the Navy

Table H-1 shows the size of the Navy in terms of total number of ships since FY1948; the numbers shown in the table reflect changes over time in the rules specifying which ships count toward the total. Differing counting rules result in differing totals, and for certain years, figures reflecting more than one set of counting rules are available. Figures in the table for FY1978 and subsequent years reflect the battle force ships counting method, which is the set of counting rules established in the early 1980s for public policy discussions of the size of the Navy.

As shown in the table, the total number of battle force ships in the Navy reached a late-Cold War peak of 568 at the end of FY1987 and began declining thereafter.[59] The Navy fell below 300 battle force ships in August 2003 and as of April 26, 2019, included 289 battle force ships.

As discussed in **Appendix C**, historical figures for total fleet size might not be a reliable yardstick for assessing the appropriateness of proposals for the future size and structure of the Navy, particularly if the historical figures are more than a few years old, because the missions to be performed by the Navy, the mix of ships that make up the Navy, and the technologies that are available to Navy ships for performing missions all change over time, and because the number of ships in the fleet in an earlier year might itself have been inappropriate (i.e., not enough or more than enough) for meeting the Navy's mission requirements in that year.

For similar reasons, trends over time in the total number of ships in the Navy are not necessarily a reliable indicator of the direction of change in the fleet's ability to perform its stated missions. An increasing number of ships in the fleet might not necessarily mean that the fleet's ability to perform its stated missions is increasing, because the fleet's mission requirements might be increasing more rapidly than ship numbers and average ship capability. Similarly, a decreasing number of ships in the fleet might not necessarily mean that the fleet's ability to perform stated missions is decreasing, because the fleet's mission requirements might be declining more rapidly than numbers of ships, or because average ship capability and the percentage of time that ships are in deployed locations might be increasing quickly enough to more than offset reductions in total ship numbers.

[59] Some publications have stated that the Navy reached a peak of 594 ships at the end of FY1987. This figure, however, is the total number of active ships in the fleet, which is not the same as the total number of battle force ships. The battle force ships figure is the number used in government discussions of the size of the Navy. In recent years, the total number of active ships has been larger than the total number of battle force ships. For example, the Naval History and Heritage Command (formerly the Naval Historical Center) states that as of November 16, 2001, the Navy included a total of 337 active ships, while the Navy states that as of November 19, 2001, the Navy included a total of 317 battle force ships. Comparing the total number of active ships in one year to the total number of battle force ships in another year is thus an apples-to-oranges comparison that in this case overstates the decline since FY1987 in the number of ships in the Navy. As a general rule to avoid potential statistical distortions, comparisons of the number of ships in the Navy over time should use, whenever possible, a single counting method.

Table H-1. Total Number of Ships in Navy Since FY1948

FY[a]	Number	FY[a]	Number	FY[a]	Number	FY[a]	Number
1948	737	1970	769	1992	466	2014	289
1949	690	1971	702	1993	435	2015	271
1950	634	1972	654	1994	391	2016	275
1951	980	1973	584	1995	373	2017	279
1952	1,097	1974	512	1996	356	2018	286
1953	1,122	1975	496	1997	354		
1954	1,113	1976	476	1998	333		
1955	1,030	1977	464	1999	317		
1956	973	1978	468	2000	318		
1957	967	1979	471	2001	316		
1958	890	1980	477	2002	313		
1959	860	1981	490	2003	297		
1960	812	1982	513	2004	291		
1961	897	1983	514	2005	282		
1962	959	1984	524	2006	281		
1963	916	1985	541	2007	279		
1964	917	1986	556	2008	282		
1965	936	1987	568	2009	285		
1966	947	1988	565	2010	288		
1967	973	1989	566	2011	284		
1968	976	1990	547	2012	287		
1969	926	1991	526	2013	285		

Source: Compiled by CRS using U.S. Navy data. Numbers shown reflect changes over time in the rules specifying which ships count toward the total. Figures for FY1978 and subsequent years reflect the battle force ships counting method, which is the set of counting rules established in the early 1980s for public policy discussions of the size of the Navy.

a. Data for earlier years in the table may be for the end of the calendar year (or for some other point during the year), rather than for the end of the fiscal year.

Shipbuilding Rate

Table H-2 shows past (FY1982-FY2019) and requested or programmed (FY2020-FY2024) rates of Navy ship procurement.

Table H-2. Battle Force Ships Procured or Requested, FY1982-FY2024

(Procured in FY1982-FY2019; *requested for FY2020, and programmed for FY2021-FY2024*)

82	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**00**
17	14	16	19	20	17	15	19	15	11	11	7	4	4	5	4	5	5	6
01	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	***18***	***19***
6	6	5	7	8	4	5	3	8	7	10	11	11	8	8	9	9	*9*	*13*
20	***21***	***22***	***23***	***24***														
12	*10*	*9*	*13*	*11*														

Source: CRS compilation based on Navy budget data and examination of defense authorization and appropriation committee and conference reports for each fiscal year. The table excludes nonbattle force ships that do not count toward the 355-ship goal, such as certain sealift and prepositioning ships operated by the Military Sealift Command and oceanographic ships operated by agencies such as the National Oceanic and Atmospheric Administration (NOAA).

Notes: (1) **The totals shown for FY2006, FY2007, and FY2008**, reflect the cancellation two LCSs funded in FY2006, another two LCSs funded in FY2007, and an LCS funded in FY2008.

(2) **The total shown for FY2012** includes two JHSVs—one that was included in the Navy's FY2012 budget submission, and one that was included in the Army's FY2012 budget submission. Until FY2012, JHSVs were being procured by both the Navy and the Army. The Army was to procure its fifth and final JHSV in FY2012, and this ship was included in the Army's FY2012 budget submission. In May 2011, the Navy and Army signed a Memorandum of Agreement (MOA) transferring the Army's JHSVs to the Navy. In the FY2012 DOD Appropriations Act (Division A of H.R. 2055/P.L. 112-74 of December 23, 2011), the JHSV that was in the Army's FY2012 budget submission was funded through the Shipbuilding and Conversion, Navy (SCN) appropriation account, along with the JHSV that the Navy had included in its FY0212 budget submission. The four JHSVs that were procured through the Army's budget prior to FY2012, however, are not included in the annual totals shown in this table.

(3) **The figures shown for FY2019 and FY2020** reflect a Navy decision to show the aircraft carrier CVN-81 as a ship to be procured in FY2020 rather than a ship that was procured in FY2019. Congress, as part of its action on the Navy's proposed FY2019 budget, authorized the procurement of CVN-81 in FY2019.

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