Congressional Budget Office
Nonpartisan Analysis for the U.S. Congress

An Analysis of the Navy's December 2020 Shipbuilding Plan

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At a Glance

Each year, as directed by the Congress, the Navy submits a report with the President's budget describing the planned inventory, purchases, deliveries, and retirements of the ships in its fleet for the next 30 years. The Navy did not submit its 30-year shipbuilding plan with the fiscal year 2021 budget, but the Department of Defense submitted a plan to the Congress on December 9, 2020, that covers the period 2022 to 2051. In this report, the Congressional Budget Office analyzes that shipbuilding plan and estimates the costs of implementing it.

- **Cost.** The December 2020 plan would require average annual shipbuilding appropriations almost 50 percent larger than the average over the past five years. CBO estimates that total shipbuilding costs, including costs for nuclear refueling and unmanned systems, would average about $34 billion per year (in 2021 dollars), 10 percent more than the Navy estimates. Annual operation and support costs for the fleet would grow from $74 billion today to $113 billion by 2051. The Navy's total budget would increase from about $200 billion today to $279 billion (in 2021 dollars) by 2051.
- **Purchasing Plan.** The Navy plans to purchase 404 new ships between 2022 and 2051—300 combat ships and 104 logistics and support ships. The Navy also plans to purchase 223 unmanned undersea and surface vehicles to supplement its fleet.
- **Fleet Size.** If the Navy adhered to the schedule for purchases and ship retirements outlined in its December 2020 plan, the inventory of manned ships would rise from about 300 today to about 400 by 2038. The force of unmanned systems would rise from just a few prototypes today to about 140 by 2045.

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Unless this report indicates otherwise, all years referred to are federal fiscal years, which run from October 1 to Septemeber 30 and are designated by the calendar year in which they end; all dollar amounts reflect budget authority in 2021 dollars.

In this report, "cost" refers to budget authority, the amount that would need to be appropriated to implement the Administration's plans.

Numbers in the text and tables may not add up to totals because of rounding.

On the cover, clockwise from upper left: The USS *Seawolf*, a nuclear-powered attack submarine; the USS *Bataan*, a Wasp class amphibious assault ship; the USS *Arleigh Burke*, a guided missile destroyer; and the USS *Nimitz*, an aircraft carrier. All photos courtesy of the U.S. Navy.

An Analysis of the Navy's December 2020 Shipbuilding Plan

Each year, as directed by the Congress, the Navy submits an annual report with the President's budget describing the planned inventory, purchases, deliveries, and retirements of the ships in its fleet for the next 30 years. Rather than submitting such a report with the Navy's 2021 budget, on December 9, 2020, the Department of Defense submitted a 30-year shipbuilding plan to the Congress that covers the years 2022 to 2051. In this report, the Congressional Budget Office analyzes that shipbuilding plan and compares it with the Navy's fiscal year (FY) 2020 shipbuilding plan, which was submitted to the Congress in March 2019. The average annual cost of buying the ships and unmanned systems under the plan would be about $34 billion (in 2021 dollars), CBO estimates, $2 billion more than under the previous plan.

Increased Inventory Goals for Battle Force Ships

In its December 2020 shipbuilding plan, the Navy substantially increased its planned inventory for the battle force—the fleet of manned ships used to perform naval missions in defense of national interests. The Navy provided information about the goals underlying those plans in late 2020 in its Future Naval Forces Study (FNFS), which it produced in conjunction with the Office of the Secretary of Defense. The FNFS described a total goal of between 382 and 446 battle force ships of various types. (That range reflects different analytic approaches that the Navy employed to determine the number of each type of ship.)

The range is higher than the goal of 355 in the Navy's 2016 force structure assessment (an earlier evaluation of the Navy's inventory goals). In particular, the Navy increased its goal for the number of small ships, such as small surface combatants and small amphibious ships, and reduced its goal for the number of large ships, such as aircraft carriers, large surface combatants, and large amphibious ships. (For a description of the ship types in the Navy's fleet, see Appendix A.)

The Navy's Inventory Goals as Stated in Its Force Structure Assessments, 2010 to 2020

	2010	2012	2014 Update	2016	2020 FNFS	Memorandum: Today's Fleet
Aircraft Carriers	11	11	11	12	8 to 11	11
Light Carriers	n.a.	n.a.	n.a.	n.a.	0 to 6	0
Submarines						
Ballistic missile	12	12	12	12	12	14
Attack	48	48	48	66	72 to 78	50
Guided missile	4	0	0	0	n.a.	4
Large Surface Combatants	94	88	88	104	73 to 88	92
Small Surface Combatants and Mine Countermeasures Ships	55	52	52	52	60 to 67	31
Large Amphibious Warfare Ships	33	33	34	38	61 to 67	32
Small Amphibious Warfare Ships	0	0	0	0		0
Combat Logistics Ships	10	10	10	10	69 to 87	30
Support Ships	16	23	24	29	27 to 30	33
Total Manned Ships	**313**	**306**	**308**	**355**	**382 to 446**	**297**
Unmanned Surface Vessels	n.a.	n.a.	n.a.	n.a.	119 to 166	n.a.
Unmanned Subsurface Vessels	n.a.	n.a.	n.a.	n.a.	24 to 76	n.a.
Total Unmanned Vessels	n.a.	n.a.	n.a.	n.a.	**143 to 242**	n.a.

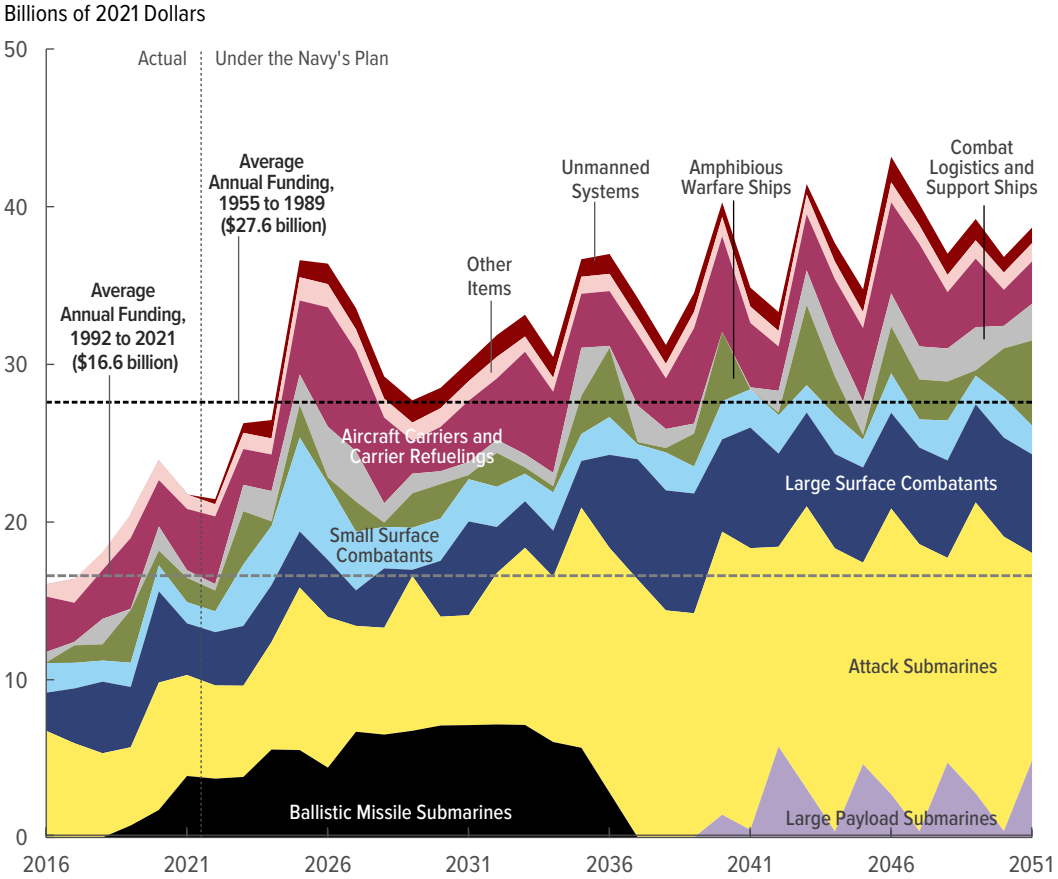
The Navy's inventory goals for its fleet have increased from a little more than 300 ships between 2010 and 2014 to as many as 446 in its 2020 FNFS.

In addition, the 2020 FNFS set a goal for unmanned surface and undersea vehicles to supplement the battle force. In earlier shipbuilding plans, the Navy did not set goals for those or other items marked not applicable (n.a.).

Estimates of Shipbuilding Costs

In CBO's estimation, over the next 30 years, the Navy would spend a total of a little more than $1.0 trillion (in 2021 dollars) building the ships and unmanned systems in its December 2020 plan—an average of $34.1 billion per year. That amount of funding, each year for 30 years, would be unprecedented since World War II. Half of the funding would be for submarines, about one-third would be for aircraft carriers and surface combatants, and the remainder would go toward amphibious ships, combat logistics and support ships, and other items. Although the plan calls for building a significant number of unmanned systems, they represent a small fraction of the overall costs of the plan—an average of about $1.2 billion per year, or 4 percent of all shipbuilding costs.

CBO's Estimates of Annual Shipbuilding Costs Under the December 2020 Plan



The Navy's annual shipbuilding plan would cost more than double what has been appropriated over the past 30 years and 24 percent more than annual appropriations during the Cold War. In the 2040s, funding for submarines alone would exceed average overall funding from 1992 to 2021.

How CBO Estimated Shipbuilding Costs

To estimate ship construction costs, CBO used the cost per thousand tons of lightship displacement, or the weight of the water a ship displaces without its crew, stores, ammunition, and fuel or other liquids. CBO then adjusted its estimates to incorporate the effects of rate (the reduction in average overhead costs that occurs as a shipyard builds multiple ships of the same type simultaneously) and learning (the efficiencies that shipyards gain as they produce additional units of a given type of ship). See Appendix B for more information on CBO's and the Navy's estimates for major shipbuilding programs. CBO's estimates incorporate a projection that labor and materials costs would continue to grow 1.2 percent faster in the naval shipbuilding industry than in the economy as a whole, as they have for the past several decades.

CBO does not yet have a model to estimate construction costs specific to unmanned systems. Therefore, CBO used the Navy's estimates and applied a growth factor based on growth in costs for similar procurement programs in the past.

Growth in the Navy's Total Annual Budget

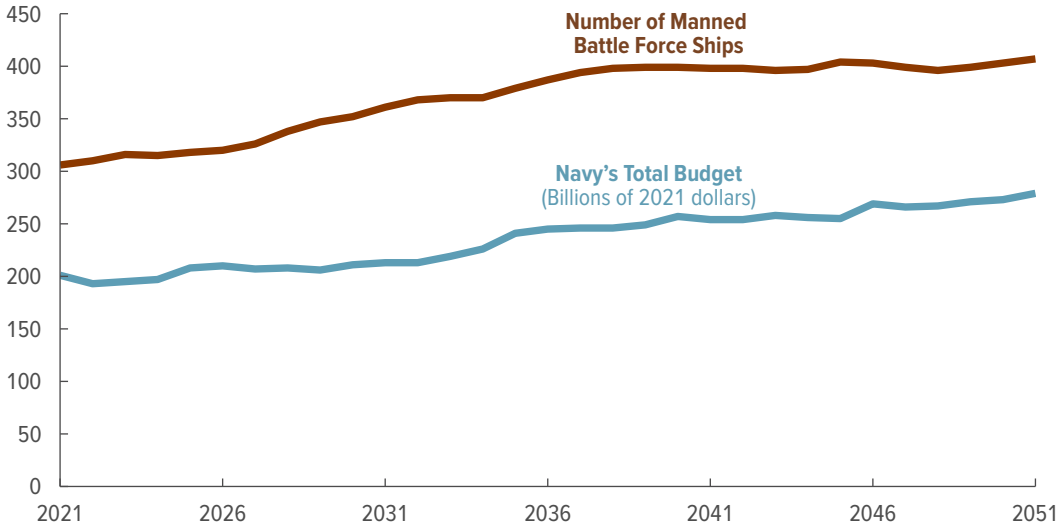
Under the December 2020 plan, the Navy's fleet would grow from about 300 manned ships today to more than 400 by 2051. Fully purchasing, operating, and maintaining that larger fleet would increase the Navy's total annual budget by about 40 percent (in 2021 dollars) by 2051, in CBO's estimation.

To estimate that growth in costs, CBO made independent estimates for each Navy budget account. Specifically, to estimate costs associated with the Navy's shipbuilding and aircraft procurement accounts, CBO first estimated the cost of each ship and aircraft procurement program. Estimates for other items in those accounts as well as the remaining procurement accounts were projected on the basis of historical relationships between those accounts and the shipbuilding and aircraft procurement accounts.

CBO estimated costs for operation and maintenance accounts on the basis of historical relationships between those costs and the size of the fleet, as measured by its total full-load displacement. Estimates for the Navy's military personnel accounts were based on the historical relationship between the total number of sailors serving on ships and the total number of service members. Estimates for Marine Corps military personal were based on historical averages, adjusted for the size of the Corps, which is set in law. Estimates for the remaining accounts, such as military construction, were based on historical averages.

CBO adjusted its estimates to vary with changes over time in the Navy's fleet (ship and aircraft procurement, displacement, and crew size). In addition, most of the Navy's accounts have experienced inflation greater than that in the economy as a whole; those differences are included as real growth in the estimates.

The Size of the Fleet and the Navy's Total Budget Under the December 2020 Plan



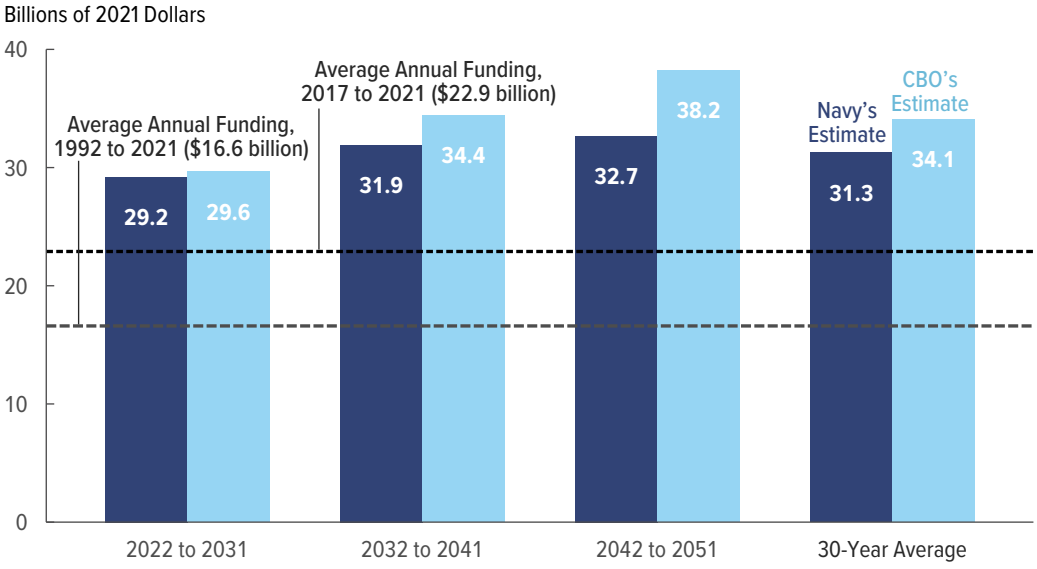
As the fleet grew in size under the December 2020 plan, the Navy's total budget would grow from about $200 billion today to $279 billion by 2051.

Estimates of All Shipbuilding Costs by CBO and by the Navy

In CBO's estimation, the full cost of the December 2020 shipbuilding plan (including new-ship construction, refueling of aircraft carriers, unmanned systems, and other items) would average $34.1 billion per year over the 2022–2051 period—about 10 percent more than the Navy estimates. (CBO's estimate is almost 50 percent larger than the Navy's average annual appropriation for shipbuilding over the past five years.)

The Navy's estimates exclude certain costs that it would need to cover with funds from its shipbuilding account to fully implement the plan, including the refueling of nuclear-powered aircraft carriers and several other items. CBO estimates those costs separately. In addition, it is unclear whether, in the future, the Navy would fund all the unmanned systems from its shipbuilding account; CBO included them in this analysis. Including all of those additional costs adds $2.2 billion to the Navy's estimates, for an average of $31.3 billion per year over 30 years.

Average Annual Costs of All Shipbuilding Activities Under the December 2020 Plan, as Estimated by CBO and the Navy

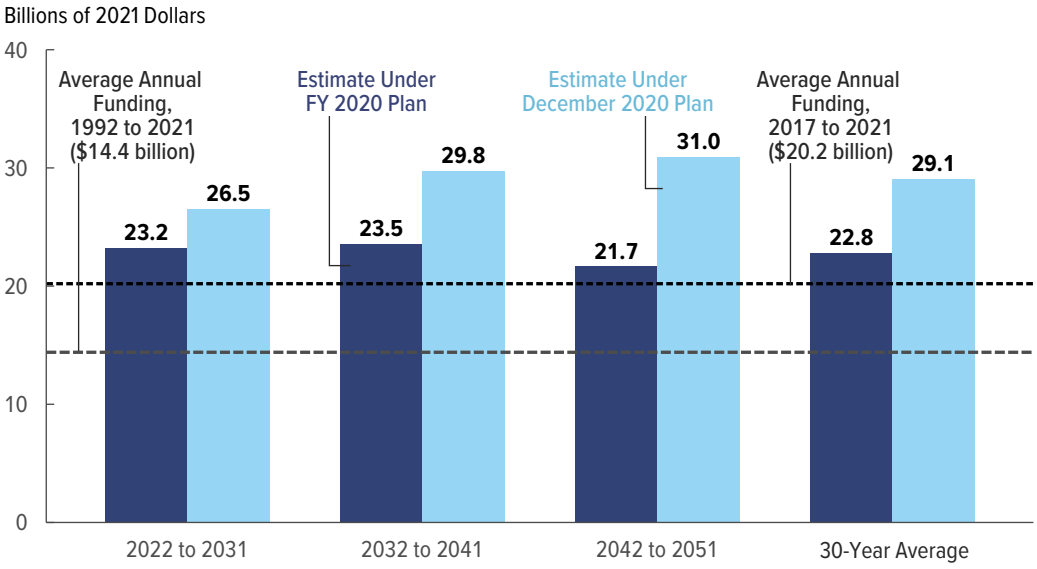


CBO estimates that the Navy's shipbuilding plan would cost more than the Navy anticipates. That gap widens over time.

The Navy's Estimates of New-Ship Construction Costs Under Its Two Most Recent Plans

The Navy expects that costs for new-ship construction would be significantly greater under its December 2020 plan than under its FY 2020 plan. According to the Navy's estimates, new-ship construction under the December 2020 plan would cost an average of $29.1 billion per year over the next 30 years, $6.3 billion more than under the previous plan and $9.0 billion more per year than what has been appropriated, on average, over the past 5 years. Adjusted for inflation, that annual amount would be double what the Navy has received, on average, over the past 30 years and 45 percent more than what the service has received over the past 5 years.

The Navy's Estimates of Average Annual Costs for New-Ship Construction Under Its FY 2020 and December 2020 Plans



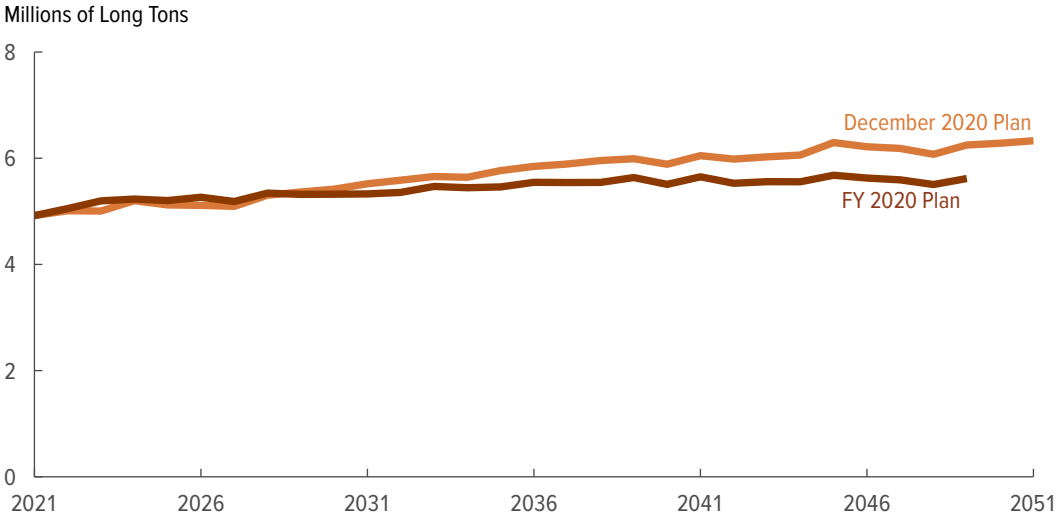
The Navy estimates that average annual new-ship construction costs would be 28 percent larger than under its FY 2020 plan.

Displacement and Crew Size Under the Navy's Two Most Recent Plans

Displacement and crew size are important elements that shape CBO's analysis of various costs of the Navy's plan. Displacement is the weight of water that a ship displaces when floating or (in the case of a submarine) submerged. Generally, with respect to ships of the same type, those with larger displacements will cost more to operate but will also be more capable: They usually have larger crews, carry more weapons, have more systems to maintain, and require more installed power to operate those systems. Crew size is the total number of sailors who serve aboard the Navy's ships or, in the case of unmanned systems, are needed to control and maintain them.

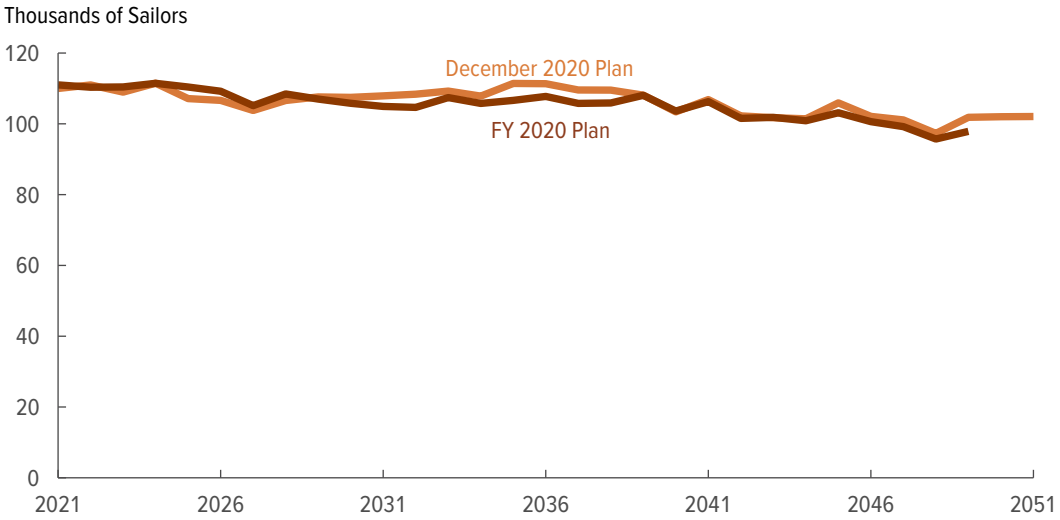
Although the Navy's December 2020 plan would increase the size of the fleet by one-third and add about 140 unmanned systems, fleetwide displacement would be only 28 percent greater than for today's fleet. The total number of sailors serving on the Navy's ships would actually decline by 7 percent. When designing new ships, the Navy seeks to reduce the size of the crews, so the fleet in 2051 would have fewer ships with large crews than today's fleet even though it had more ships overall. If the Navy's plans for designing ships with smaller crews did not succeed, then the number of sailors—and costs—would be higher than estimated here.

Total Displacement of the Navy's Fleet



The larger fleet under the December 2020 plan, relative to the previous plan, would produce a larger fleetwide displacement. But the increase in displacement would be smaller than the increase in fleet size because the new plan calls for more small ships and fewer large ships.

Number of Sailors Serving on Ships and Operating Unmanned Systems



The number of sailors needed to crew the Navy's ships is virtually the same under the old and new shipbuilding plans. A larger number of small crews in the new plan offsets reductions in the number of large crews.

Operation and Support Costs Under the Navy's Two Most Recent Plans

The larger fleet envisioned under the Navy's December 2020 shipbuilding plan would result in greater operation and support costs: More ships would require more maintenance and would consume more fuel and supplies during both training exercises and deployments.

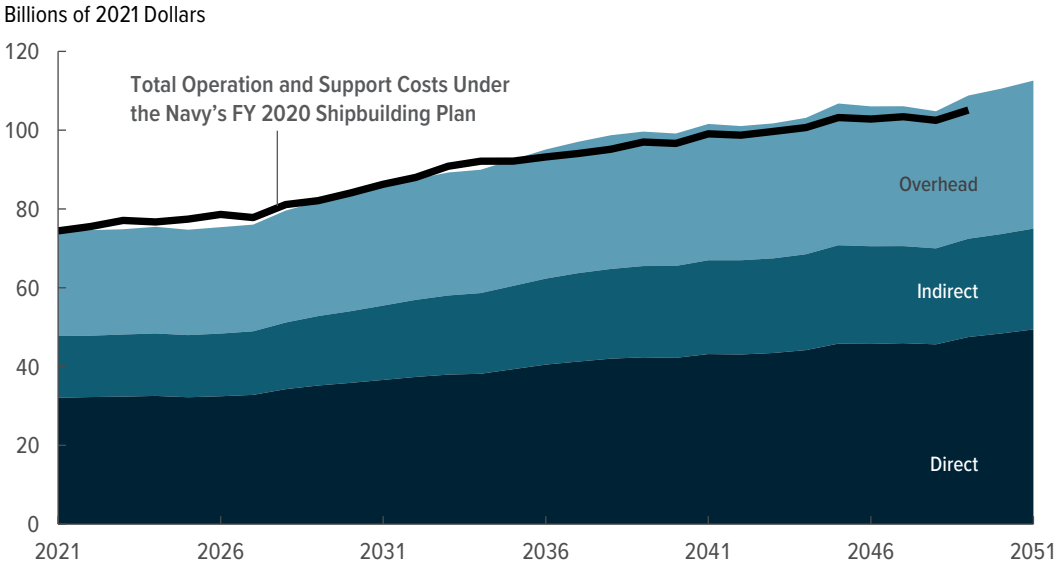
Using information in the President's 2021 budget, CBO estimated operation and support costs in three categories: direct costs, indirect costs, and overhead costs. Direct costs include crew salaries, fuel, supplies, and repairs and maintenance that the crews perform for the Navy's combat ships. Indirect costs include expenditures for various support units and organizations that are necessary for combat units to fight effectively, including combat logistics and support ships. Overhead costs are expenditures for various means of support for combat units, such as recruiting, training, acquisition offices, maintenance, and medical care.

Direct costs for operation and support currently total about $32 billion per year. Those costs would rise in real terms to $49 billion annually by 2051—partly because of the Navy's larger fleet. As with ship construction, the difference of about 1.2 percent per year between inflation in operation and support costs and inflation in the economy as a whole is included as real growth in costs, calculated in 2021 dollars.

Operation and support costs would not be much higher under the December 2020 plan than under the FY 2020 plan. Under the prior plan, the fleet would have been smaller, but it also would have included more large ships, which are more expensive to operate.

The Navy's report includes estimated costs for "sustainment," or what CBO calls operation and support costs, but those estimates are not comparable to CBO's. They reflect programmed spending under the 2021 Future Years Defense Program with 4.6 percent average annual growth and are reported in nominal dollars only. The Navy also categorizes costs differently than CBO does.

Estimated Annual Operation and Support Costs for the Navy's Fleet Under the December 2020 Plan



As the fleet grew to more than 400 ships over the next 30 years, annual operation and support costs would increase from about $74 billion today to $113 billion (in 2021 dollars) in 2051.

Battle Force Ship Purchases and Inventory

Over the next 30 years, total ship purchases would be one-third higher under the December 2020 plan than under the previous one. The Navy envisions buying 300 combat ships, including aircraft carriers, three types of submarines, large and small surface combatants, and large and small amphibious warfare ships. By contrast, the Navy's FY 2020 plan called for the purchase of 247 combat ships. The Navy would also buy 104 combat logistics and support ships under the new plan, almost double the number called for in the FY 2020 plan.

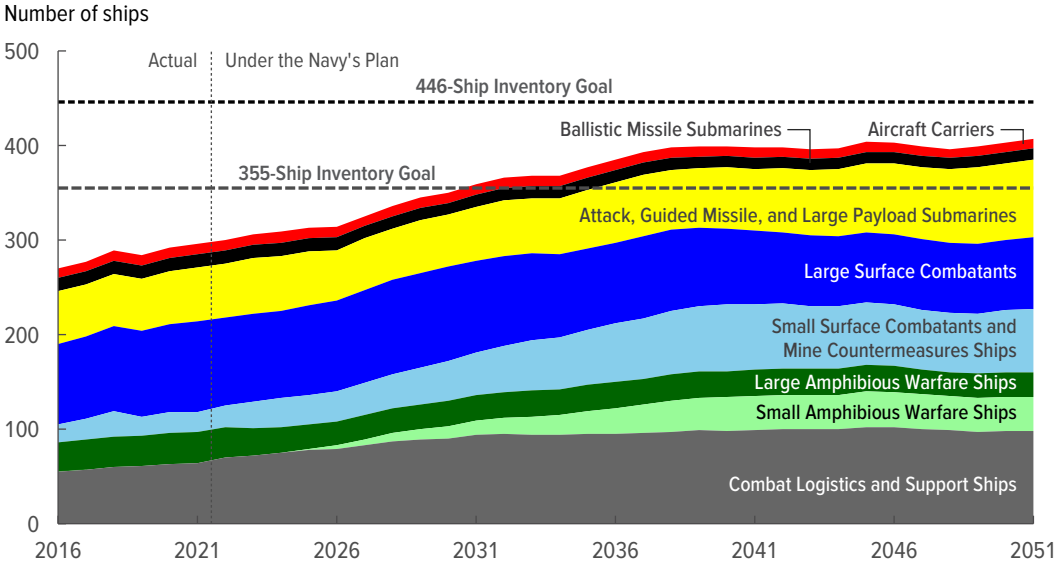
Some types of ships, such as small surface combatants and small amphibious warfare ships, have a service life of less than 30 years. Therefore, the Navy also plans to purchase replacements for those ships as they retire late in the period. Overall, given both ship purchases and planned retirements, the fleet would grow from about 300 ships today to about 400 by 2038.

Total Purchases of Ships and Unmanned Systems

	FY 2020 Plan (2020–2049)	December 2020 Plan (2022–2051)	Change From FY 2020 to December 2020
	Number of Ships Purchased Over 30 Years		
Combat Ships			
Aircraft carriers	7	6	-1
Ballistic missile submarines	12	11	-1
Large payload submarines	5	4	-1
Attack submarines	61	77	16
Large surface combatants	76	55	-21
Small surface combatants	58	76	18
Large Amphibious Warfare Ships	28	16	-12
Small Amphibious Warfare Ships	0	55	55
Subtotal	247	300	53
Combat Logistics and Support Ships	57	104	47
Total	**304**	**404**	**100**
	Number of Unmanned Systems Purchased Over 30 Years		
Large Unmanned Surface Vehicles	0	97	97
Medium Unmanned Surface Vehicles	0	82	82
Extra-Large Undersea Unmanned Vehicles	0	44	44
Total	0	**223**	**223**

Under the December 2020 plan, the Navy would purchase fewer large surface combatants and large amphibious warfare ships but would purchase more submarines, small combatants, small amphibious warfare ships, and combat logistics and support ships.

Annual Inventories of Battle Force Ships Under the Navy's December 2020 Plan



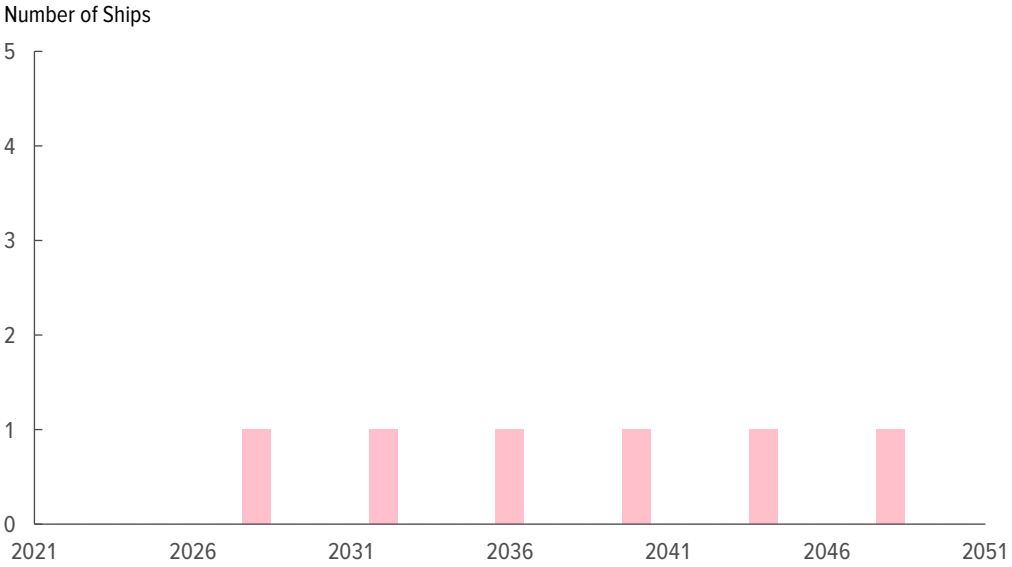
As new ships entered the fleet, its composition would slowly shift. By 2051, the submarine force would be much larger, the number of small surface combatants would almost equal the number of large surface combatants, and small amphibious warfare ships would outnumber the large ones.

The Aircraft Carrier Force

The existing aircraft carrier force comprises 10 Nimitz class CVN-68 nuclear-powered aircraft carriers and one new Gerald R. Ford class CVN-78 aircraft carrier, although the Ford class carrier is still undergoing finishing work and testing and is not yet ready for normal operations. The future carrier force under the December 2020 plan would be similar to that under the previous shipbuilding plan. The Navy would purchase 6 Ford class aircraft carriers between 2022 and 2051. The number of aircraft carriers in the fleet would remain at about 11 through 2040, falling to about 10 through 2051. Aircraft carriers have a service life of 50 years, so to reach and sustain a force of 11 ships—the higher goal in the FNFS and one required by statute—the Navy would need to purchase 1 aircraft carrier every three and a half years between 2028 and 2051.

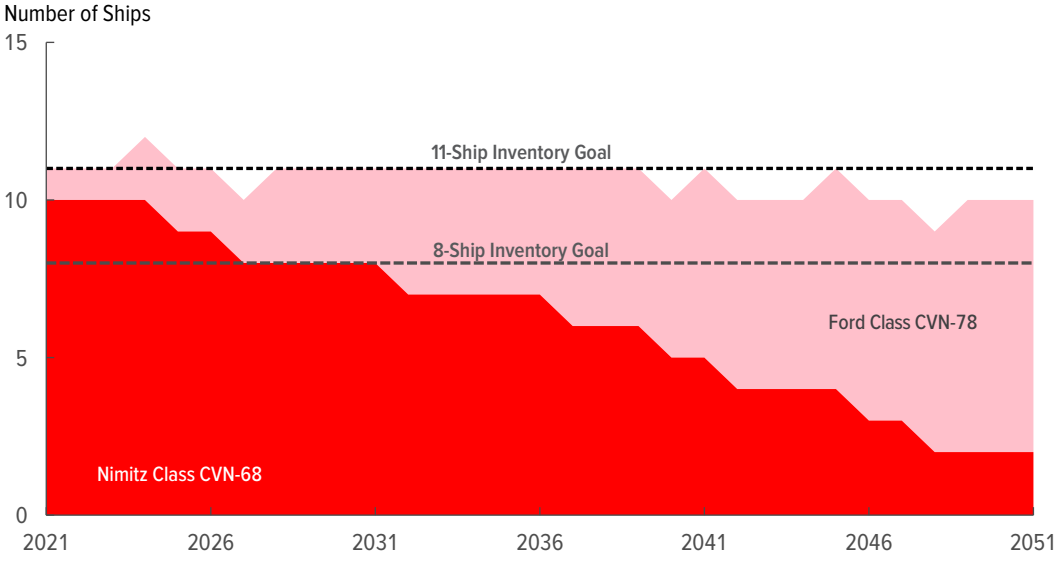
Although the inventory goals of the FNFS include up to 6 light aircraft carriers of an uncertain but presumably conventional (not nuclear-powered) design, the December 2020 shipbuilding plan does not include purchases of light carriers.

Annual Purchases of Aircraft Carriers Under the December 2020 Plan



After purchasing one aircraft carrier in 2018 and another in 2019 (not shown), the Navy would purchase one every four years starting in 2028.

Annual Inventory of Aircraft Carriers Under the December 2020 Plan



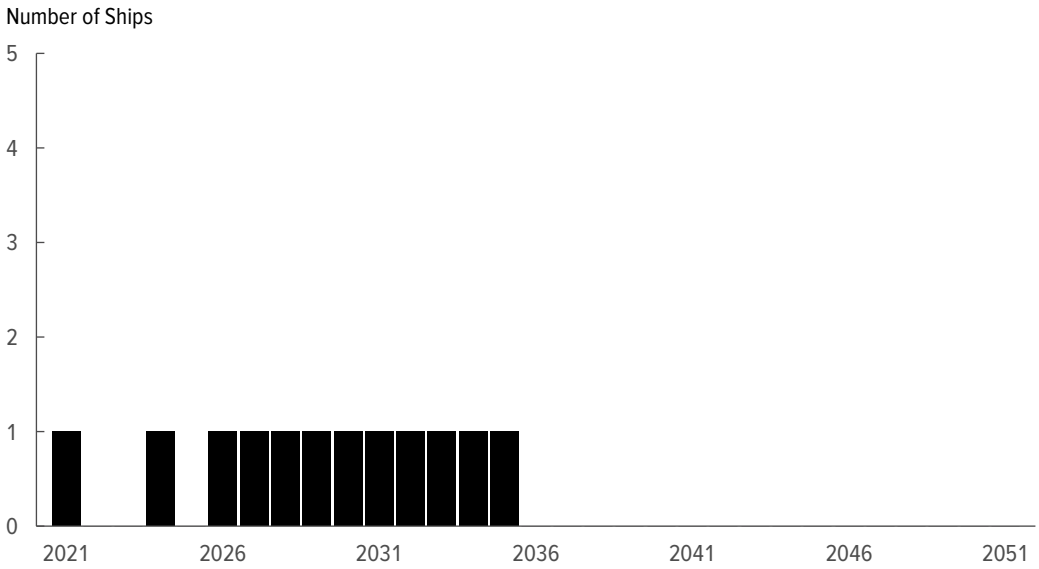
As the 10 Nimitz class carriers built between the 1960s and 1980s were retired, they would be replaced by new Ford class carriers. The force would exceed the lower 8-ship inventory goal but fall below the 11-ship goal in most years after 2040.

The Ballistic Missile Submarine Force

Today's ballistic missile submarine (SSBN) force comprises 14 Ohio class SSBN-726 submarines. SSBNs are one component of the nation's triad of nuclear delivery systems. In 2021, the Navy ordered the first of a new class of 12 SSBNs, the Columbia SSBN-826, to replace retiring Ohio class submarines over the next 20 years. The Navy estimates that the submarines will take 7 years to build and test, so the first Columbia would be commissioned into the fleet in 2028 and go on its first patrol 2 to 3 years later.

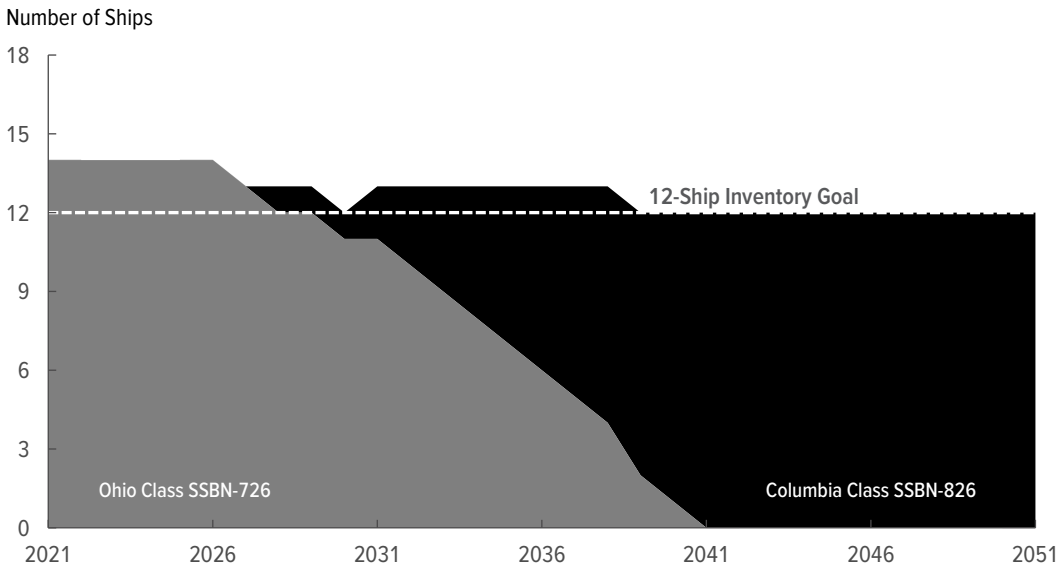
Under the previous shipbuilding plan, the SSBN force would have fallen below the Navy's inventory goal of 12 boats from 2030 to 2041. Under the new plan, the Navy would extend the service life of 5 Ohio class SSBNs by several years, so the force would never fall below that goal.

Annual Ballistic Missile Submarine Purchases Under the December 2020 Plan



The Navy plans to purchase the second Columbia class SSBN in 2024 and then 10 more, at a rate of 1 per year, from 2026 to 2035.

Annual Inventory of Ballistic Missile Submarines Under the December 2020 Plan



As the 14 Ohio class SSBNs built in the 1970s and 1980s were retired, they would be replaced by 12 Columbia class SSBNs. The Navy would meet or exceed its inventory goal in all years of the plan.

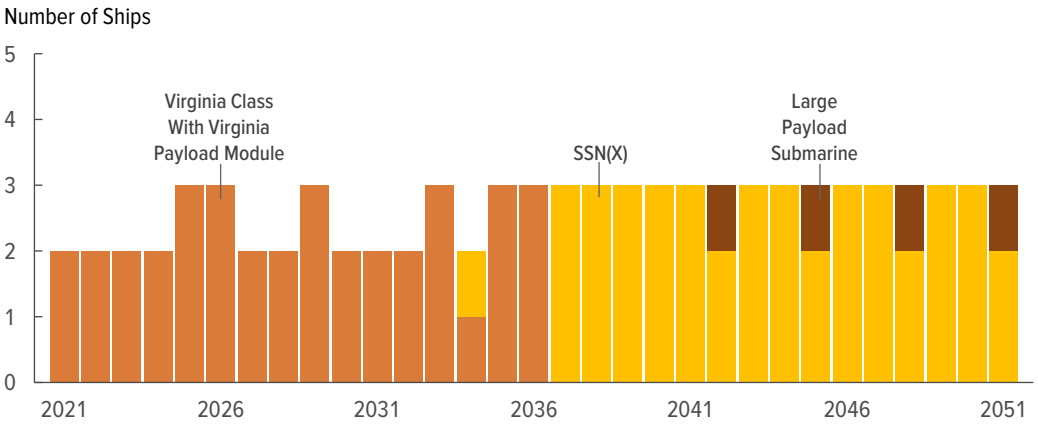
The Attack Submarine Force

Today's nuclear-powered attack submarine (SSN) force comprises 28 Los Angeles class, 3 Seawolf class, and 19 Virginia class ships. Under the December 2020 plan, the Navy would purchase 77 attack submarines over the next 30 years, 16 more than under the previous plan.

Specifically, the Navy would purchase 35 Virginia class SSNs equipped with the Virginia payload module, which increases the missile capacity of the submarine by 28 missiles. In 2034, the Navy would begin purchasing 42 ships of a new class of attack submarine, currently designated as the SSN(X). CBO's assessment of the Navy's plan incorporates the assumption that SSN(X) submarines would be similar to Seawolf class submarines in their size and capabilities, consistent with statements by Navy leaders. The Navy's plan would also extend the service life of many Los Angeles class submarines to maintain a force of 50 or more attack submarines over the next 30 years. Under the FY 2020 plan, the attack submarine force would have fallen to 42 in the late 2020s before growing again.

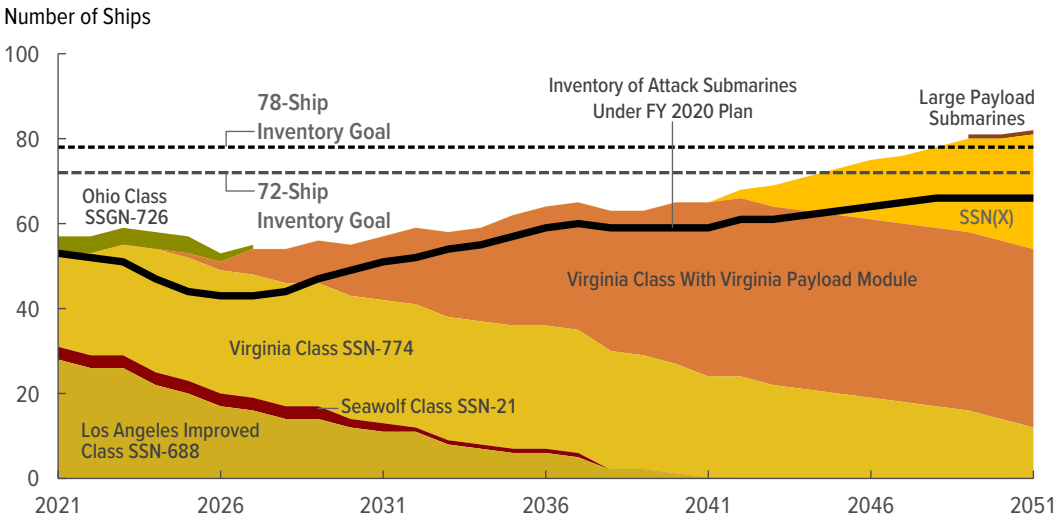
In 2042, the Navy would start purchasing a new type of ship: the large payload submarine. Although not considered an attack submarine, CBO categorized it with attack submarines because it would have the mission of carrying a large number of missiles or special operations forces, not a nuclear-deterrence mission like that of the ballistic missile submarine force. The large payload submarine may be similar in size to the Navy's existing Ohio class SSGN-726 guided missile submarines, which are converted ballistic missile submarines.

Annual Purchases of Attack and Large Payload Submarines Under the December 2020 Plan



The Navy would purchase two or three Virginia class submarines per year through 2036. Through the late 2030s and 2040s, the service would purchase two or three new SSN(X) submarines per year and one large payload submarine every three years in the 2040s.

Annual Inventory of Attack, Guided Missile, and Large Payload Submarines Under the December 2020 Plan



The Navy would reach its goal of having 72 to 78 attack submarines in the fleet in 2045.

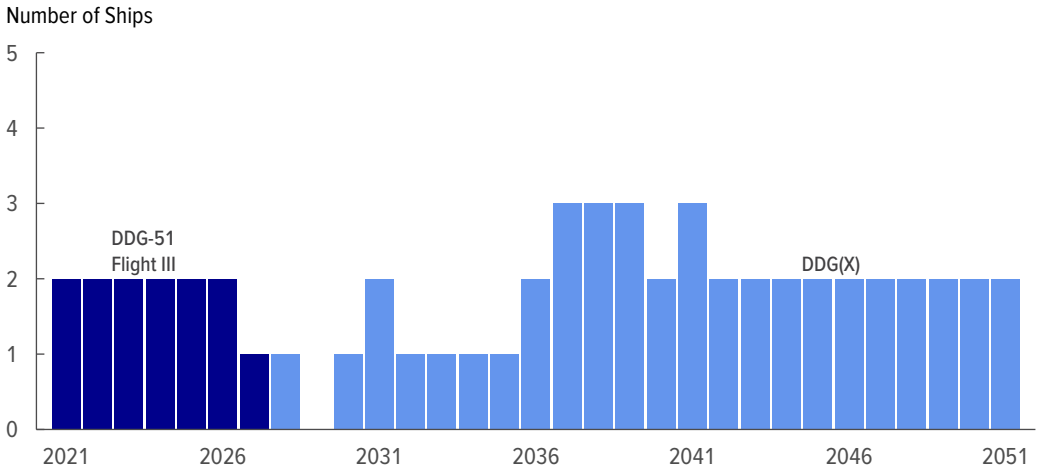
The Large Surface Combatant Force

Today, the Navy's large surface combatant force numbers 92 ships—22 cruisers and 70 destroyers. The December 2020 shipbuilding plan calls for 55 new destroyers, 21 fewer than the previous plan. That change is consistent with the FNFS objective to reduce the proportion of large surface combatants in the fleet.

Under the previous shipbuilding plan, the first new future destroyer, now designated as the DDG(X), would have been purchased in 2025. Under the December 2020 plan, that first purchase is delayed until 2028. The DDG(X) has not yet been designed; according to the Navy, it will carry combat systems similar to those on the DDG-51 Flight III destroyer but will have a larger hull, more power, and more cooling. CBO estimated that the DDG(X) would displace 12,000 tons, which would make it larger than the latest DDG-51 and smaller than the Zumwalt class destroyer.

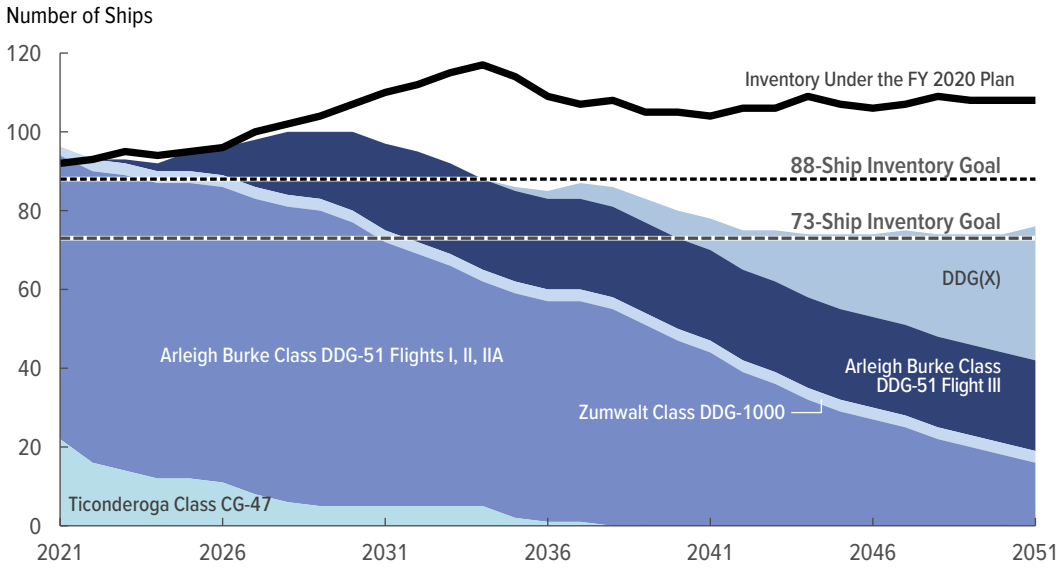
Under the previous plan, the Navy intended to extend the service life of all DDG-51 destroyers to 45 years. In the spring of 2020, the Navy discarded that idea, citing the high cost of maintaining and operating older ships. The Navy now expects that DDG-51s will serve for 35 or 40 years depending on their flight, or variant. The first 28 DDG-51s—Flights I and II—would serve for 35 years; the later ships—Flights IIA and III—would serve for 40 years.

Annual Purchases of Large Surface Combatants Under the December 2020 Plan



The Navy would purchase 11 destroyers based on the existing DDG-51 Flight III design and 44 based on the new DDG(X) design.

Annual Inventory of Large Surface Combatants Under the December 2020 Plan

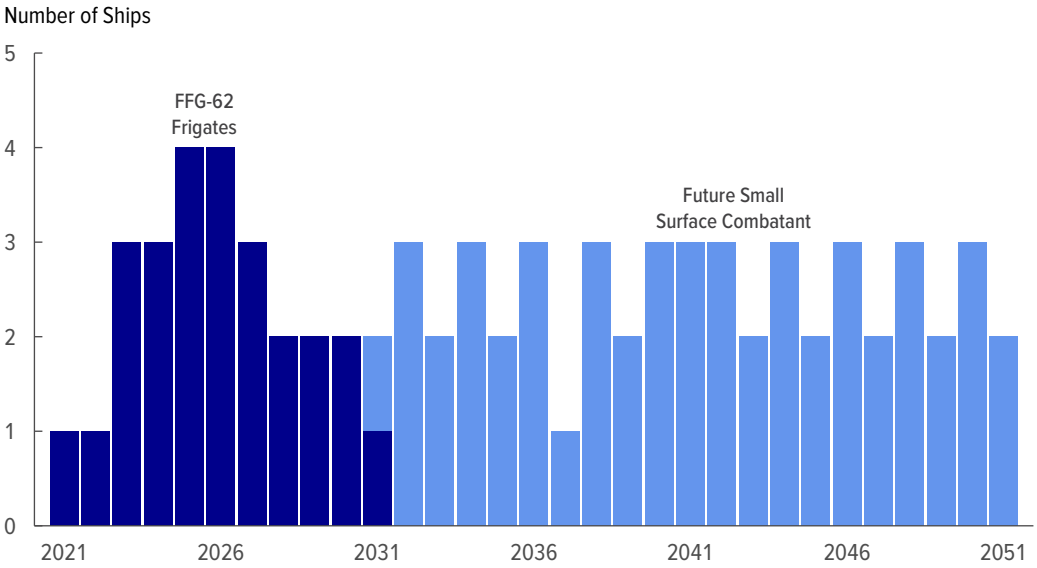


With the purchases and revised retirement timelines in the December 2020 plan, the Navy would have at least 88 large surface combatants through 2033. The force would then decline to 74 by 2051, substantially fewer than under the previous plan.

The Small Surface Combatant Force

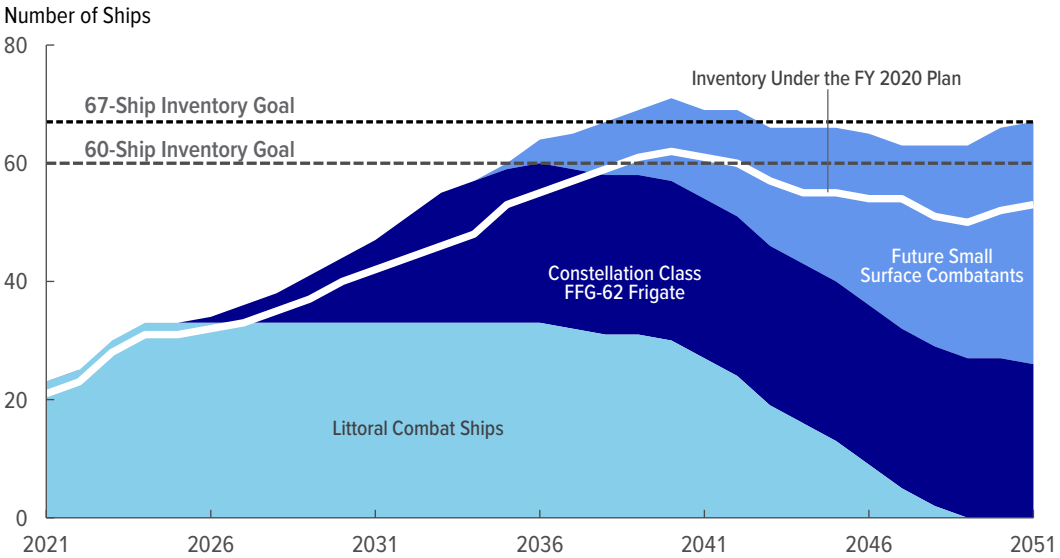
The Navy's small surface combatant force today includes 23 littoral combat ships; the Navy also operates 8 mine countermeasures ships, which it sometimes includes in the small surface combatant category. There are 12 more littoral combat ships and 2 new Constellation class FFG-62 guided missile frigates currently under construction. Under the December 2020 plan, the service would purchase 25 more frigates for a total of 27 (7 more than under the previous plan), as well as 51 future small surface combatants of an undetermined design. In determining the cost of future small surface combatants, CBO estimated that those ships would be similar to frigates—larger than the 3,000-ton littoral combat ship but smaller than the 7,300-ton Constellation class.

Annual Purchases of Small Surface Combatants Under the December 2020 Plan



The Navy would build small surface combatants at a rate of two or three per year throughout most of the next 30 years.

Annual Inventory of Small Surface Combatants Under the December 2020 Plan



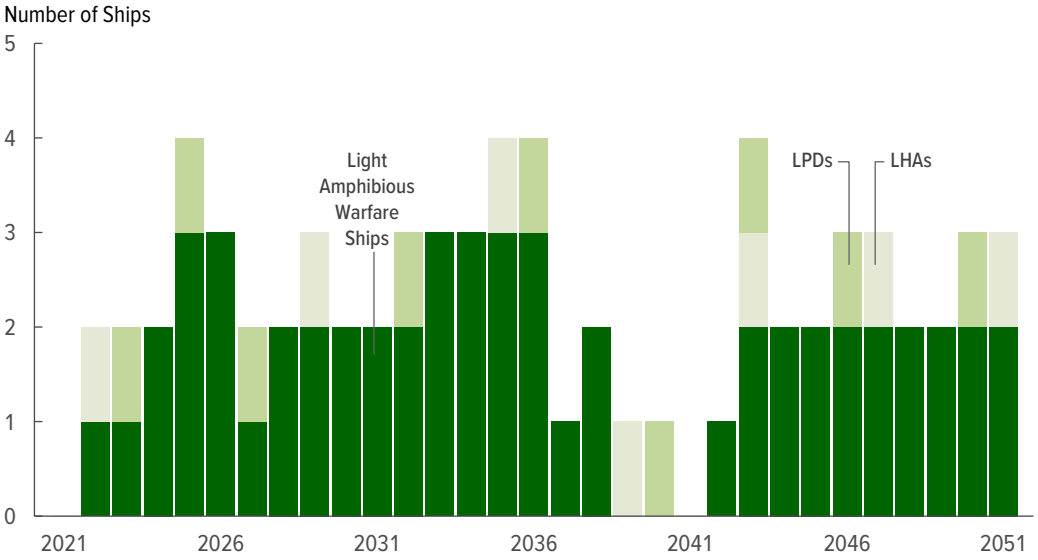
The small surface combatant force would grow steadily under the Navy's new plan, reaching the lower inventory goal (60 ships) by 2035 and exceeding it through 2051. The force would reach the higher goal (67 ships) by 2038 but would fall below that goal between 2040 and 2050.

The Amphibious Warfare Force

The Navy's current amphibious warfare force comprises 32 large ships: 9 amphibious assault ships, designated as LHAs or LHDs; 11 amphibious transport docks, or LPDs; and 12 dock landing ships, or LSDs. Under the December 2020 plan, the Navy would purchase 16 large amphibious ships (LHAs and LPDs), 12 fewer than under the FY 2020 plan, and would begin a major building program for smaller light amphibious warfare ships (LAWs). (The LHA the Navy would purchase in 2022 was authorized by the Congress in 2020.) The first 36 LAWs would be purchased between 2022 and 2038. Because they would have only a 20-year service life, the Navy would start buying replacements in 2042, ultimately purchasing 55.

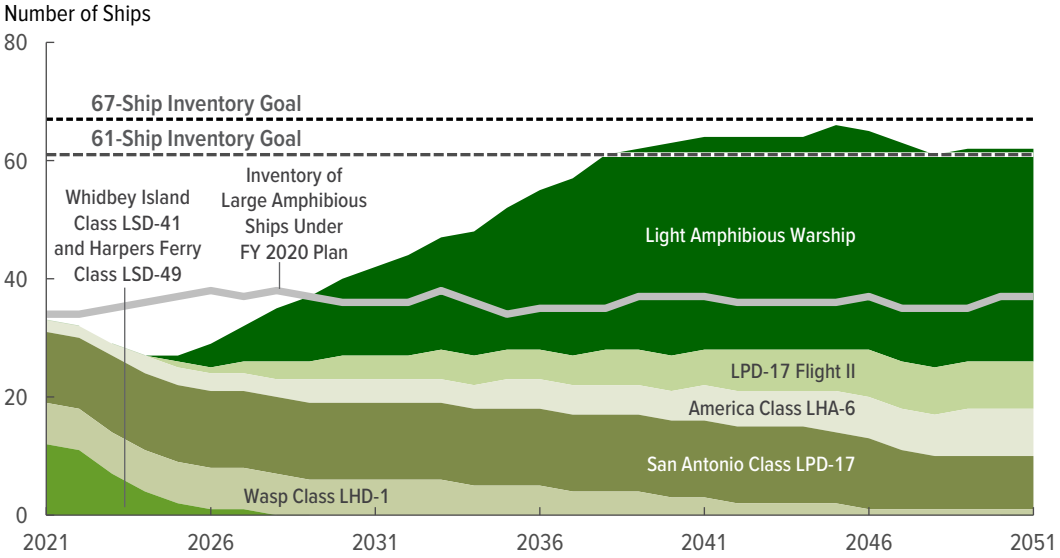
With the building program, the Navy would meet its minimum inventory goal of 61 amphibious ships by 2040. However, the number of large amphibious ships would fall to around 26 by 2024. The Navy's plan does not identify separate goals for LPDs and LAWs, even though the ships are quite different: LPDs displace around 25,000 tons and LAWs are expected to displace 4,000 tons or less.

Annual Purchases of Amphibious Warfare Ships Under the December 2020 Plan



The Navy would purchase about one large LHA or LPD amphibious warfare ship every 2 years. The new light amphibious ships would be purchased at a rate of two or three per year for most of the next 30 years.

Annual Inventory of Amphibious Warfare Ships Under the December 2020 Plan

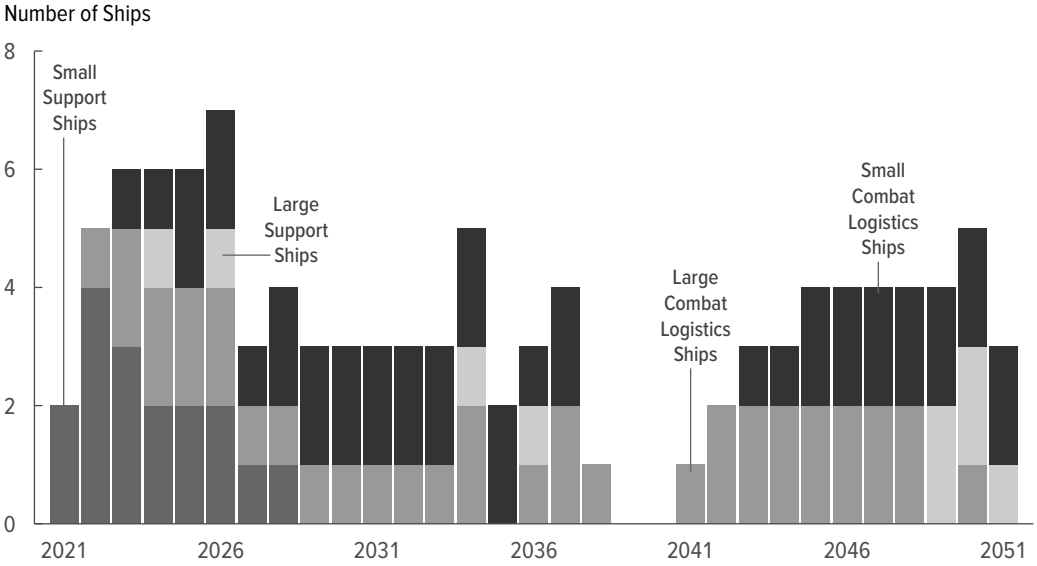


The number of large amphibious ships (LHAs, LPDs, and LSDs) would fall from 32 today to around 27 for most of the next 30 years. A new force of light amphibious warfare ships would grow to 36 by 2040.

The Combat Logistics Force and Support Ships

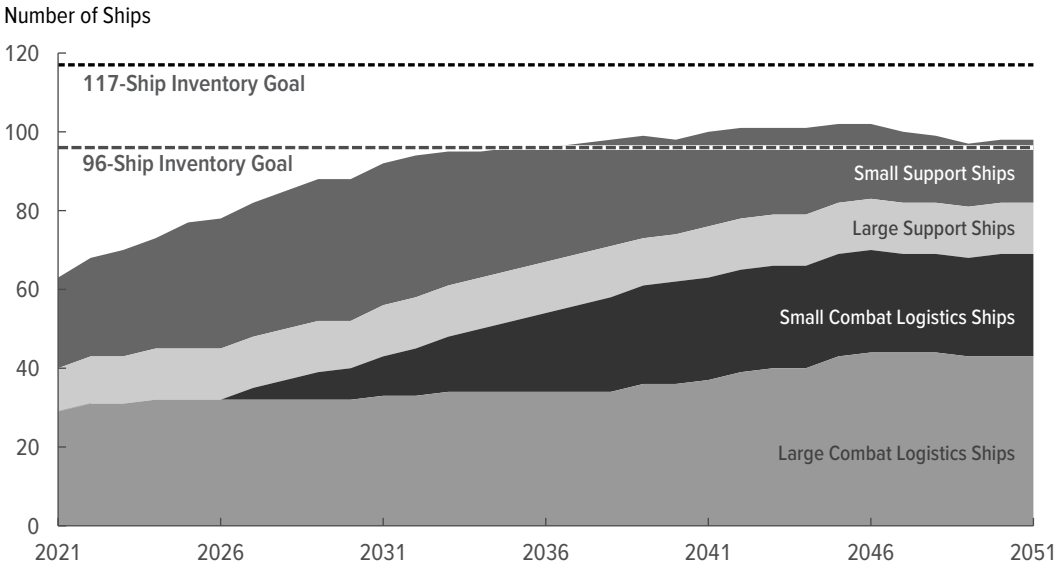
Under the December 2020 plan, the Navy would buy 104 new combat logistics and support ships, 47 more than under the previous plan. Combat logistics ships operate with or directly resupply combat ships that are at sea. The December 2020 plan calls for the purchase of 38 large combat logistics ships—22 T-AO oilers and 16 T-AKE dry cargo ships—and 42 new, smaller T-AOL oilers to help resupply a larger fleet with a greater proportion of smaller ships. Of the 24 support ships, 9 would be large ships (2 tenders, 2 command ships, 2 expeditionary transfer docks, 2 T-AKEs for the Navy's maritime prepositioning squadrons, and 1 expeditionary sea base) and 15 would be small ships (7 surveillance ships, 6 expeditionary fast transports, and 2 salvage/fleet tugs).

Annual Purchases of Combat Logistics and Support Ships Under the December 2020 Plan



To support a larger fleet, the Navy would purchase large numbers of new logistics and support ships.

Annual Inventory of Combat Logistics and Support Ships Under the December 2020 Plan

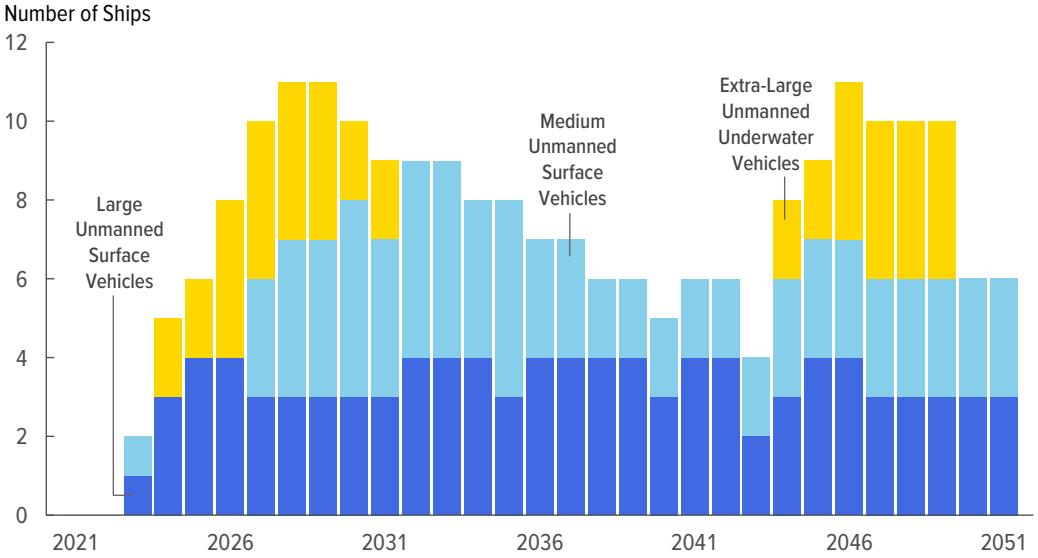


The number of combat logistics and support ships would reach the Navy's lower inventory goal by the early 2030s. It would not reach the higher goal.

Unmanned Systems

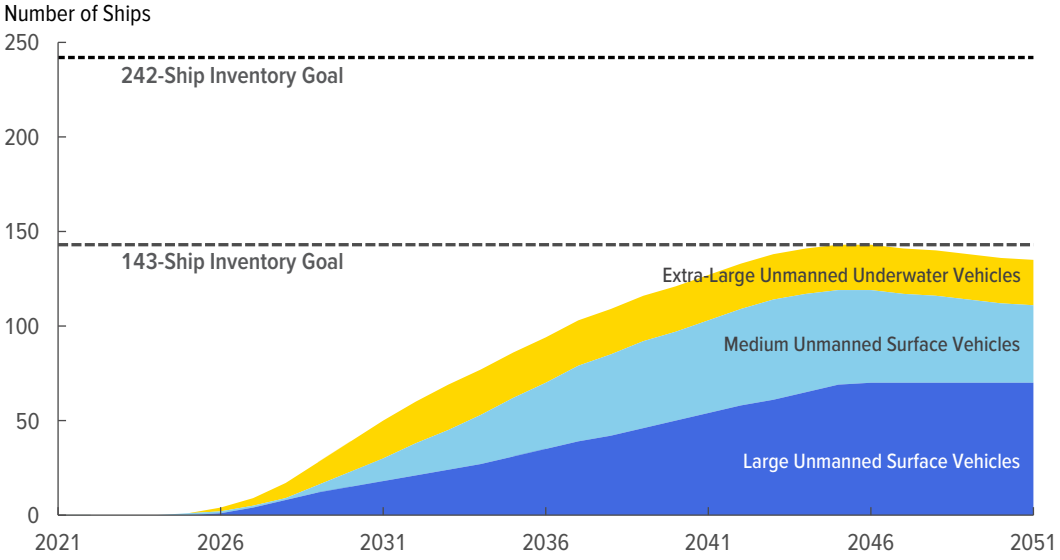
Unlike the Navy's FY 2020 shipbuilding plan, the new plan would incorporate large numbers of unmanned undersea and surface vehicles into the fleet. The FNFS included inventory goals of 119 to 166 unmanned medium surface vehicles (MUSVs) and large surface vehicles (LUSVs) and 24 to 76 extra-large unmanned undersea vehicles (XLUUVs), for a total of 143 to 242 systems. The LUSVs would operate in conjunction with other ships, carrying offensive and defensive missiles that manned ships could employ as needed. MUSVs would serve as sensor or command and control platforms, providing information about opponents to other ships in the Navy's fleet. Although the Navy's plan is less specific with respect to XLUUVs, they could carry a variety of payloads to support naval operations. The Navy is still developing its concepts of operations for unmanned systems, which increases the risk for both cost growth and delays in their construction and operations.

Annual Purchases of Unmanned Systems Under the December 2020 Plan



To supplement its manned battle force, the Navy plans to purchase 97 LSUVs, 82 MUSVs, and 44 XLUUVs over the next 30 years and to replace them as they are retired after a 20-year service life.

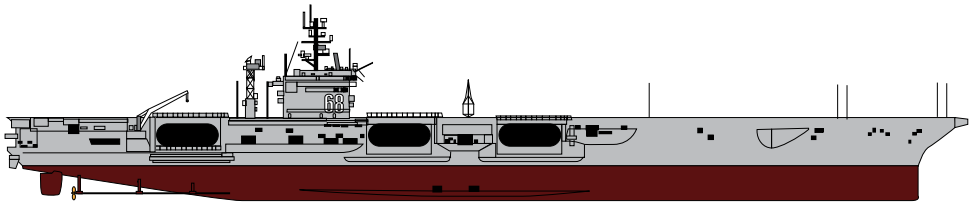
Annual Inventory of Unmanned Systems Under the December 2020 Plan



The Navy's plan would grow the LUSV force to 70 systems by 2046, the MUSV force to about 50 by 2042, and the XLUUV force to 24 by 2033. The Navy would meet its lower goal in the 2040s before falling below it again.

Appendix A: Major Types of Ships in the Navy's Fleet

Aircraft Carriers



Nimitz Class CVN-68

The Navy's 11 aircraft carriers are the heart of the battle force. Each carries an air wing of about 60 aircraft, which can attack hundreds of targets per day (based on 12 hours of flight operations) for up to a month before needing to rest. Carriers are the largest ships in the fleet, with a displacement of about 100,000 tons. (A ship's displacement is the weight of water that it displaces when floating or, for a submarine, when submerged.) Ten of the current carriers belong to the Nimitz class. The Navy commissioned the first of a new class, the *Gerald R. Ford*, in 2017.

Strategic Ballistic Missile Submarines

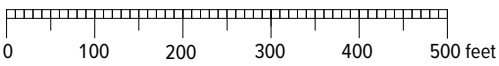
Ohio Class SSBN-726

Strategic ballistic missile submarines are one component of the U.S. nuclear triad. Each submarine carries up to 20 Trident missiles armed with 1 to 8 nuclear warheads apiece. (Originally, they were built with 24 missile tubes, but arms control treaties now limit them to 20 operational tubes.) The Navy has 14 Ohio class ballistic missile submarines, each of which displaces about 19,000 tons when submerged. The service has 4 other submarines of that class that it converted to a conventional guided missile (SSGN) configuration. Those SSGNs carry up to 154 Tomahawk missiles as well as special operations forces.

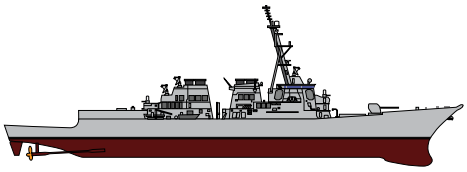
Attack Submarines

Virginia Class SSN-774

Attack submarines are the Navy's premier undersea warfare and antisubmarine weapons. Since the end of the Cold War, however, they have mainly been used for covert intelligence gathering. They can also launch Tomahawk missiles at land targets, frequently in the early stages of a conflict in an effort to destroy enemy air defense systems. Of the Navy's 50 attack submarines, 28 belong to the Los Angeles class. Displacing 7,000 tons when submerged, they are less than half the size of ballistic missile submarines. Virginia class attack submarines are a little larger, at 7,800 tons.



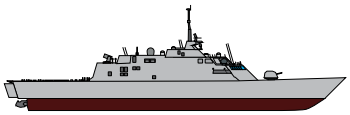
Large Surface Combatants



Arleigh Burke Class DDG-51 Destroyer

Large surface combatants, which include cruisers and destroyers, are the workhorses of the fleet. They provide ballistic missile defense for the fleet and for overseas regions. They defend aircraft carriers and amphibious warfare ships against other surface ships, aircraft, and submarines, and they perform such day-to-day missions as patrolling sea lanes, providing an overseas presence, and conducting exercises with allies. They can also launch Tomahawk missiles to strike land targets. Most of the Navy's surface combatants displace about 9,000 to 10,000 tons.

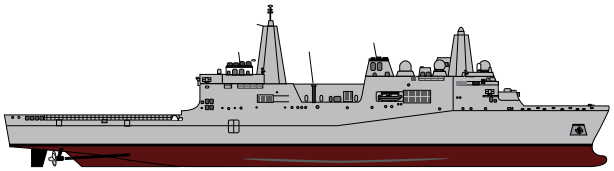
Small Surface Combatants



Freedom Class LCS-1 Littoral Combat Ship

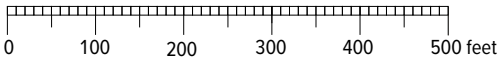
Small surface combatants include littoral combat ships (LCSs) and frigates. LCSs, which are built in two variants, are intended to counter mines, small boats, and diesel-electric submarines in the world's coastal regions. The Navy's new frigates, which it began building in 2020, are designed to be multimission ships, capable of performing many of the missions of the LCS but also carrying robust antiship capabilities as well as being able to defend against threats in the immediate area. More routinely, LCSs and frigates—like their counterparts, the large surface combatants—patrol sea lanes, provide an overseas presence, and conduct exercises with allies. They range in size from 3,000 to 7,000 tons. The Navy currently has no frigate because it retired all of its Oliver Hazard Perry frigates as of 2015.

Amphibious Warfare Ships

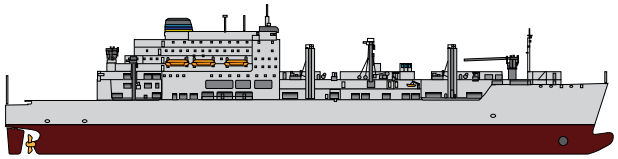


San Antonio Class LPD-17

The Navy has five classes of amphibious warfare ships. The two classes referred to as amphibious assault ships (also known as large-deck amphibious ships or helicopter carriers) are the second-largest types of combat ships in the fleet, displacing between 40,000 and 45,000 tons. With capacity for about half the troops and equipment of a Marine expeditionary unit, the amphibious assault ship is the centerpiece of the amphibious ready group. In addition to troops, each ship can carry as many as 30 helicopters and 6 fixed-wing Harrier jump jets or short takeoff and landing versions of the Joint Strike Fighters (F-35Bs), or up to 20 of those fixed-wing aircraft. The other three classes are divided into two types: amphibious transport docks and dock landing ships. Two of those ships together provide the remaining transport capacity for a Marine expeditionary unit in an amphibious ready group. They range in size from 16,000 to 25,000 tons.

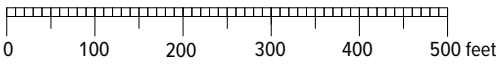


Combat Logistics and Support Ships



Lewis and Clark Class T-AKE-1

The many combat logistics and support ships in the Navy's fleet provide the means to resupply, repair, salvage, or tow combat ships. The most prominent of those vessels are fast combat support ships, which resupply carrier strike groups with fuel, dry cargo (such as food), and ammunition. Logistics and support ships can be as small as 2,300 tons for an oceangoing tug or as large as 90,000 tons for an expeditionary sea base.



Appendix B: The Difference Between the Navy's and CBO's Estimates for the Cost of New Ships

Each year, the Navy provides estimates of the costs of building each class of ship in its 30-year shipbuilding plan. The Congressional Budget Office also produces estimates of those costs. For a comparison of the Navy's and CBO's estimates for the total and average unit costs of major shipbuilding programs under the Navy's December 9, 2020, plan, see Table B-1. For a comparison of the two sets of estimates for the eight most recent 30-year plans, see Table B-2. For the December 2020 plan, two classes of ships account for half of the $78 billion difference between the Navy's and CBO's estimates of the total cost of the plan: the future attack submarine and future large surface combatant. Those two classes of ships have been a significant source of differences between the two sets of estimates in recent years.

Table B-1.

The Navy's and CBO's Estimates for the Construction of Major New Ships Under the Navy's December 2020 Plan

Billions of 2021 Dollars

		Total Costs per Class Over the 2022–2051 Period		Average Cost per Ship Over the 2022–2051 Period	
	Number of New Ships Purchased Under the December 2020 Plan	Navy's Estimates	CBO's Estimates	Navy's Estimates	CBO's Estimates
CVN-78 Gerald R. Ford Class Aircraft Carriers	6	90[a]	94[a]	13.0[a]	13.0[a]
SSBN-826 Columbia Class Ballistic Missile Submarines	11	85[b]	86[b]	7.9[b]	8.0[b]
Large Payload Submarines	4	23[c]	32[c]	6.5[c]	8.3[c]
SSN-774 Virginia Class Attack Submarines With VPM	35	118	118	3.4	3.4
SSN(X) Future Attack Submarines	42	245	261	5.8	6.2
DDG-51 Flight III Arleigh Burke Class Destroyers	11	21	20	1.9	1.8
Future Large Surface Combatants	44	107	129	2.4	2.9
FFG(X) Frigates	25	24	33	0.9	1.3
Future Small Surface Combatants	51	40	43	0.8	0.9
LHA-6 America Class Amphibious Assault Ships	7	24[d]	26[d]	3.4[d]	4.1[d]
LPD-17 Flight II San Antonio Class Amphibious Ships	6	11	11	1.8	1.9
LPD-17 Replacements	3	6	11	1.9	2.8
T-AO-205 John Lewis Class Oilers	22	13	13	0.6	0.6
T-AKE(X) Replenishment Ships	16	10	15	0.6	0.9

Data source: Congressional Budget Office, using data from the Department of the Navy. See www.cbo.gov/publication/57091#data.

Amounts shown in this table exclude funding for research and development.

CVN = nuclear-powered aircraft carrier; DDG = guided missile destroyer; FFG = guided missile frigate; LHA = amphibious assault ship; LPD = amphibious transport dock; SSBN = ballistic missile submarine; SSN = attack submarine; T-AKE(X) = future dry cargo ship; T-AO = oiler; VPM = Virginia payload module.

a. In CBO's and Navy's estimates for aircraft carriers, total costs per class include remaining funding for the CVN-80 and CVN-81 authorized before 2022 but exclude some funding for the carrier the Navy plans to purchase in 2048 because that money would not be budgeted until 2052 or later. Estimates of the average cost per ship include all funding for all three of those carriers.

b. In CBO's and the Navy's estimates for ballistic missile submarines, total costs exclude $10.5 billion in funding appropriated before 2022 for the first and second ships of the class, but average costs per ship include that funding.

c. In CBO's and the Navy's estimates for large payload submarines, total costs exclude some funding for the fourth ship, which would not be budgeted until 2052 or later, but average costs per ship include that funding.

d. In CBO's and the Navy's estimates for amphibious assault ships, total costs exclude some funding for the ship that the Navy plans to purchase in 2051 because that money would not be budgeted until 2052 or later, but average costs per ship include that funding.

Table B-2.

Share of the Difference Between the Navy's and CBO's Estimates of Shipbuilding Costs, by Program

Percent

	2012 Plan	2013 Plan	2014 Plan	2015 Plan	2016 Plan	2017 Plan	2019 Plan	2020 Plan	December 2020 Plan
CVN-78 Gerald R. Ford Class Aircraft Carriers	18	13	3	3	9	6	1	2	5
SSBN-826 Columbia Class Ballistic Missile Submarines	15	13	12	20	22	20	4	4	1
Large Payload Submarines	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2	2	12
SSN-774 Virginia Class Attack Submarines	1	1	-1	3	3	8	4	2	0
SSN(X) Future Attack Submarines	3	4	-3	8	2	-14	42	34	20
DDG-51 Flight III Arleigh Burke Class Destroyers	-7	11	7	11	12	10	4	0	-1
Future Large Surface Combatants	41	34	58	38	29	30	20	33	28
LCS-1 Freedom Class Littoral Combat Ships	1	3	4	5	2	0	n.a.	n.a.	n.a.
FFG(X) Guided Missile Frigates	n.a.	n.a.	n.a.	n.a.	0	0	4	3	12
Future Small Surface Combatants	5	4	7	0	5	18	9	10	4
LHA-6 America Class Amphibious Assault Ships	7	5	5	3	3	6	3	2	3
LPD-17 Flight II San Antonio Class Amphibious Warfare Ships	5	4	4	5	3	4	3	1	0
LPD-17 Amphibious Warfare Ship Replacements	n.a.	n.a.	n.a.	n.a.	5	4	2	4	6
T-AO-205 John Lewis Class Oilers	0	0	1	1	3	4	0	0	0
T-AKE(X) Replenishment Ship Replacements	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2	6
Other Ships	8	7	4	4	2	2	1	2	1
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Memorandum:									
Difference in Billions of Dollars[a]	74	94	76	66	58	50	170	205	78

Data source: Congressional Budget Office. See www.cbo.gov/publication/57091#data.

Numbers reflect the percentage that each ship program contributes to the total difference in cost between the Navy's and CBO's estimates for each plan. Positive values indicate instances in which CBO's estimate is higher; negative values indicate instances in which the Navy's estimate is higher.

CVN = nuclear-powered aircraft carrier; DDG = guided missile destroyer; FFG = guided missile frigate; LHA = amphibious assault ship; LPD = amphibious transport dock; SSBN = ballistic missile submarine; SSN = attack submarine; T-AKE(X) = future dry cargo ship; T-AO = oiler; n.a. = not applicable.

a. For each plan, the difference is expressed in constant dollars from the preceding year. For example, the difference for the 2012 plan ($74 billion) is calculated in 2011 dollars, the difference for the 2016 plan ($58 billion) is calculated in 2015 dollars, and so on.

About This Document

This Congressional Budget Office report was prepared as required by the National Defense Authorization Act for Fiscal Year 2012 (Public Law 112-81). In accordance with CBO's mandate to provide objective, impartial analysis, the report makes no recommendations.

Eric J. Labs prepared the report with guidance from David Mosher and Edward G. Keating. Christina Hawley Anthony provided useful comments, as did Mandy Smithberger of the Project on Government Oversight and Bryan Clark of the Hudson Institute. (The assistance of external reviewers implies no responsibility for the final product, which rests solely with CBO.)

Jeffrey Kling and Robert Sunshine reviewed the report, Christine Browne and Caitlin Verboon were the editors, and R. L. Rebach was the graphics editor. This report is available on CBO's website (www.cbo.gov/publication/57091).

CBO continually seeks feedback to make its work as useful as possible. Please send any comments to communications@cbo.gov.

Phillip L. Swagel
Director
April 2021