



An Analysis of the Navy's Fiscal Year 2023 Shipbuilding Plan



At a Glance

Each year, as directed by the Congress, the Department of Defense submits a report with the President's budget describing the Navy's planned inventory, purchases, deliveries, and retirements of ships in its fleet for the next 30 years. In a departure from all previous shipbuilding plans, the Navy's fiscal year 2023 shipbuilding plan provided three alternative long-range projections of its future fleet rather than one. In this report, the Congressional Budget Office analyzes the alternatives in the 2023 plan and estimates the costs of implementing each of them.

- **Cost.** The three alternatives in the Navy's 2023 plan would require average annual shipbuilding appropriations that were 23 percent to 35 percent more than the average over the past five years. CBO estimates that total shipbuilding costs would average about \$30 billion to \$33 billion (in 2022 dollars) over the next 30 years, which is 14 percent to 18 percent more than the Navy estimates. The Navy's total budget would increase from \$220 billion today to roughly \$290 billion (in 2022 dollars) in 2052.
- **Purchasing Plan.** The Navy would purchase 282 battle force ships under Alternative 1, 294 under Alternative 2, or 340 under Alternative 3. (Battle force ships include aircraft carriers, submarines, surface combatants, amphibious warfare ships, combat logistics ships, and some support ships.) Overall, Alternative 1 places slightly more emphasis on buying large surface combatants than Alternative 2 does. Under Alternative 2, the Navy would buy more submarines than under the other alternatives, although it would purchase more existing classes of submarines and fewer next-generation submarines. Under Alternative 3, the Navy would buy more ships of all types, except for submarines, than under the other alternatives. (The 2023 plan offers few details about the costs or quantities of unmanned surface or undersea vessels.)
- **Fleet Size.** If the Navy adhered to the schedule for purchases and ship retirements outlined in its 2023 plan, by 2052 the number of battle force ships would increase from 292 today to 316 under Alternative 1, 327 under Alternative 2, or 367 under Alternative 3. In all three cases, the fleet would be smaller over the next 10 years than it is today, before increasing in size.
- **Fleet Capabilities.** Under all three alternatives, the Navy would reduce the fleet's firepower over the next decade but would eventually expand its missile capability by increasing the number of missile cells (which are vertical tubes or launchers on surface ships and submarines that carry the Navy's offensive and defensive missiles) and deploying them on more ships than they are deployed on today.

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Unless this report indicates otherwise, all years referred to are federal fiscal years, which run from October 1 to September 30 and are designated by the calendar year in which they end.

In this report, “cost” refers to budget authority, the amount that would need to be appropriated to implement the Administration’s plans; all dollar amounts reflect budget authority in 2022 dollars.

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

Previous editions of this report are available at <https://tinyurl.com/mr24mfff>.

On the cover:

Top left: The Ohio class ballistic missile submarine USS *Maryland* (SSBN-738). U.S. Navy photo by Mass Communication Specialist 1st Class (SW) James Kimber.

Top right: The Virginia class attack submarine USS *California* (SSN-781). U.S. Navy photo by Chris Oxley.

Bottom left: The amphibious transport dock USS *San Antonio* (LPD-17). U.S. Navy photo by Mass Communication Specialist 2nd Class Jason R. Zalasky.

Bottom middle: The aircraft carrier USS *Nimitz* (CVN-68). U.S. Navy photo.

Bottom right: The Arleigh Burke class destroyer USS *Cole* (DDG-67). U.S. Navy photo.

An Analysis of the Navy's Fiscal Year 2023 Shipbuilding Plan

Summary

The Department of Defense (DoD) submitted the Navy's shipbuilding plan for fiscal year 2023 to the Congress on April 20, 2022.¹ The Congressional Budget Office is required by law to analyze that plan and assess its costs.

In a departure from all previous shipbuilding plans, the Navy's 2023 plan comprises three alternative programs instead of one: Alternatives 1 and 2 reflect trade-offs between different types of ships requiring similar amounts of spending, according to the Navy's estimates. Alternative 3 outlines the additional capability the Navy could achieve with more spending (see Table 1). CBO analyzed the three alternatives. Underlying all of them is an effort to build a fleet whose firepower is greater and distributed among more ships than in today's fleet.

The average annual cost of carrying out the Navy's three alternative plans, which cover fiscal years 2023 to 2052, ranges from \$29.7 billion to \$32.7 billion (in 2022 dollars), CBO estimates. (Those estimates include the costs of purchasing ships but not the costs of operating and maintaining them.) The Navy's 2023 plan differs significantly from its 2022 plan because, as is typical in the first year of a new Administration, the latter did not include a 30-year projection of inventories, purchases, retirements, or costs of ships.²

The 2023 plan is in some ways similar to the Navy's December 2020 shipbuilding plan, even though the fleets outlined in the former are smaller than the one envisioned in the latter: In both plans, the Navy would

move toward a larger and more distributed fleet comprising more smaller combat ships and fewer large warships than are in today's fleet.³ Specifically, by 2045—a year the Navy uses as an important benchmark for assessing its shipbuilding goals—Alternative 1 describes a fleet with 36 more small surface combatants and light amphibious warships but with 22 fewer large surface combatants and large amphibious warfare ships (see Table 2). Under Alternative 2, there would be 34 more of those smaller ships and 27 fewer of the large ships. And under Alternative 3, there would be 49 more small surface combatants and light amphibious warships and 13 fewer large surface combatants and large amphibious warfare ships. If fully implemented, any of the alternatives would eventually result in a fleet that was larger than at any time since 2001.

In its previous assessments of the Navy's shipbuilding plans, CBO typically compared a new shipbuilding plan with the previous one and determined how well the new plan would meet the Navy's goal for its inventory of battle force ships. However, the Navy did not publish a complete shipbuilding plan for fiscal years 2021 or 2022 and, in another departure from most other shipbuilding plans, has not adopted a set of inventory goals for the major components of its fleet in its current plan. Instead, in the 2023 plan, the Navy refers to several studies and analytic research on the future battle force that informed the choices it made in formulating the plan's three alternatives. As a result, instead of comparing the 2023 plan with a previous one, CBO focuses on comparing and analyzing the Navy's three alternatives and examining several metrics of naval capability, which are also a new feature of the 2023 plan.

The Three Alternatives in the 2023 Plan Would Expand the Fleet to Between 316 and 367 Battle Force Ships

On November 1, 2022, the Navy's fleet numbered 292 battle force ships—aircraft carriers, submarines,

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1. Department of the Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2023* (April 2022), <https://go.usa.gov/xJtjj> (PDF).
 2. Department of the Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2022* (June 2021), <https://go.usa.gov/xMjGr> (PDF). See also Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2022 Shipbuilding Plan* (September 2021), www.cbo.gov/publication/57414.

3. DoD did not submit a shipbuilding plan for fiscal year 2021.

Table 1.

Emphasis and Cost of the Alternatives in the Navy's 2023 Plan, as Assessed by CBO

	Alternative 1	Alternative 2	Alternative 3
Emphasis	The Navy would buy more large surface combatants and fewer attack submarines than under Alternative 2 but would buy more of both types of next-generation ships. It would buy the fewest large amphibious ships but would build small amphibious ships faster than under Alternative 2.	The Navy would place the most emphasis on undersea warfare by buying more submarines than under the other alternatives. It would buy fewer next-generation submarines and more submarines of existing classes. It would buy more large amphibious ships than under Alternative 1 and fewer small ships than under Alternatives 1 or 3.	The Navy would buy more of all types of ships (and many more support ships), except for submarines, than under the other alternatives. Like Alternative 1, this alternative emphasizes moving to the next generation of major combatants.
Features Common to All Three Alternatives	Under all alternatives, the Navy would seek to maintain a balanced fleet with proportionate mixtures of large and small combatants. A large carrier force would be maintained under each alternative, and the same number of ballistic missile submarines would be purchased.		
Average Annual Cost of All Shipbuilding Activities (Billions of 2022 dollars)	29.7	31.0	32.7

Data source: Congressional Budget Office. See www.cbo.gov/publication/58447#data.

surface combatants, amphibious ships, combat logistics ships, and some support ships. (See the appendix for a description of the major types of ships in the Navy's fleet.) The 2023 plan reflects the Navy's desire to build a larger and more distributed fleet. To achieve that goal, the Navy would buy between 282 and 340 ships over the 2023–2052 period: 230 to 266 combat ships and 52 to 74 combat logistics and support ships (see Table 3). If the Navy adhered to the schedule for retiring ships outlined in the 2023 plan (that schedule is the same for all three alternatives), it would have a fleet of over 300 ships by the mid-2030s (see Figure 1 on page 5). By 2052, the fleet would number 316 ships under Alternative 1, 327 under Alternative 2, or 367 under Alternative 3. However, the fleet would become smaller in the near term under all three alternatives. Over the next five years, the Navy would retire 17 more ships than it would commission, causing the fleet to reach a low of 280 ships in 2027 before growing again.

In contrast to the Navy's December 2020 plan, the 2023 plan does not provide many details about the size or composition of the unmanned vessels the Navy envisions procuring. Over the next five years, the Navy would purchase 6 large unmanned surface vessels (LUSVs) and 6 extra-large unmanned undersea vessels. Although the Navy would probably purchase more unmanned systems beyond the next five years (if it finishes developing the necessary technology), the 2023 plan did not include them.

The Costs of New-Ship Construction Under the 2023 Plan Would Average \$26.5 Billion to \$29.4 Billion per Year

CBO estimates that buying only the new ships specified in the Navy's 2023 plan would cost \$795 billion under Alternative 1, \$834 billion under Alternative 2, and \$881 billion under Alternative 3 (or, over 30 years, an average of \$26.5 billion, \$27.8 billion, and \$29.4 billion per year, respectively—all in 2022 dollars). The Navy's cost estimates are lower than CBO's: \$689 billion for Alternative 1, \$696 billion for Alternative 2, and \$763 billion for Alternative 3 (or, over 30 years, an average of \$23.0 billion, \$23.2 billion, and \$25.4 billion per year, respectively).

The Navy's shipbuilding plan reports only the costs of new-ship construction for battle force ships. It does not report the cost of nuclear refueling or other costs, such as those associated with outfitting new ships or purchasing ships that are not considered part of the battle force (for example, used sealift ships), which are nonetheless typically funded from the Navy's shipbuilding account. If those costs were included, the Navy's average annual shipbuilding costs in the 2023 plan would increase by about \$3 billion, CBO estimates. That increase would add to both the Navy's estimate and CBO's estimate of the cost of new-ship construction.

CBO's estimates of new-ship construction costs are higher than the Navy's because CBO and the Navy made

Table 2.

Difference Between the Number of Ships in Today's Fleet and the Number in 2045 Under the Navy's 2023 Plan

Number of Ships

	Fleet Composition, as of November 1, 2022	Difference From 2022 Fleet		
		Alternative 1	Alternative 2	Alternative 3
Aircraft Carriers	11	-1	-1	0 ^a
Submarines				
Ballistic missile	14	-2	-2	-2
Attack, guided missile, and large payload	54	1	7	6
Large Surface Combatants	88	-13	-18	-8
Small Surface Combatants and Mine Countermeasures Ships	33	11	16	16
Large and Midsize Amphibious Warfare Ships				
LHAs and LHDs	9	-2	-2	0
LPDs and LSDs	22	-7	-7	-5
Light Amphibious Warships	0	25	18	33
Subtotal, Combat Ships	231	12	11	40
Combat Logistics Ships	29	17	22	21
Support Ships	32	-3	-3	10
Subtotal, Logistics and Support Ships	61	14	19	31
Total Battle Force Ships	292	26	30	71

Data source: Congressional Budget Office, using data from the Department of the Navy. See www.cbo.gov/publication/58447#data.

LHAs and LHDs = amphibious assault ships; LPDs = amphibious transport docks; LSDs = dock landing ships.

a. Under Alternative 3, the carrier force would number 10 ships for nearly all years between 2042 and 2052. In 2045, the force would temporarily increase to 11 ships.

different assumptions about the design and capabilities of some future ships, used different estimating methods, and treated growth in the costs of labor and materials for shipbuilding differently. Some of the difference in the estimates stems from uncertainty about the design and capabilities of large ships whose construction would begin in 5 or 10 years—in particular, the next-generation destroyer that would start to replace the Navy's Arleigh Burke class destroyers and the next-generation attack submarine to follow the service's Virginia class submarines. The difference between the estimates also increases over time, in part because the Navy's method of developing constant-dollar estimates (which reflect real costs—that is, costs adjusted to remove the effects of inflation) for most of its shipbuilding programs uses a fixed average real cost per ship; it does not account for the historically faster growth in the costs of labor and materials in the shipbuilding industry than in the economy as a whole. As a result, the Navy's estimates for the future purchases of ships with the capabilities of today's ships do not reflect the same increase in real costs that CBO's estimates reflect.

Average Total Shipbuilding Costs Over the Next 30 Years Would Be About 23 Percent to 35 Percent More Than Average Appropriations Over the Past 5 Years

Even if the Navy received the same amount of funding (in constant dollars) for shipbuilding in each year from 2023 to 2052 that it has received in each of the past five years—a half-decade that saw the highest level of such funding since the 1980s—the service still could not afford any of the three alternatives in its 2023 shipbuilding plan. CBO's estimates of the average annual cost of new-ship construction are considerably more than the recent historical average of appropriations for new-ship construction (\$21.3 billion, in 2022 dollars)—higher by 24 percent for Alternative 1, 30 percent for Alternative 2, and 38 percent for Alternative 3. If funding for all activities supported by the Navy's shipbuilding account is included in the calculation, CBO estimates that the average annual cost of the three alternatives would be \$29.7 billion, \$31.0 billion, and \$32.7 billion, respectively. Those amounts are 23 percent, 28 percent, and



Table 3.

Comparison of Ship Purchases and Estimated Costs in the Navy's Fiscal Year 2020, December 2020, and Fiscal Year 2023 Shipbuilding Plans

	Fiscal Year 2020 Plan (2020–2049)	December 2020 Plan (2022–2051)	Fiscal Year 2023 Plan (2023–2052)		
			Alternative 1	Alternative 2	Alternative 3
Number of Battle Force Ships Purchased Over 30 Years					
Combat Ships					
Aircraft carriers	7	6	5	5	7
Ballistic missile submarines	12	11	11	11	11
Large payload submarines	5	4	4	6	4
Attack submarines					
Virginia class submarines with the Virginia payload module	28	35	23	33	27
Virginia class submarines	0	0	0	16	0
SSN(X) next-generation attack submarines	33	42	31	17	33
Subtotal	61	77	54	66	60
Large surface combatants					
DDG-51 Flight III destroyers	15	11	16	18	17
DDG(X) next-generation surface combatants	61	44	38	29	47
Subtotal	75	55	54	47	64
Small surface combatants					
FFG-62 frigates	20	25	17	11	17
FFG-62 Flight II frigates	n.a.	n.a.	35	44	40
Future small surface combatants	38	51	n.a.	n.a.	n.a.
Subtotal	58	76	52	55	57
Large and midsize amphibious warfare ships					
LHA-6 amphibious assault	8	7	5 ^a	5 ^a	4 ^a
LPD-17 Flight II	12	6	1	1	1
LPD(X) next-generation amphibious ship	8	3	4	7	9
Subtotal	28	16	10	13	14
Light amphibious warships	n.a.	55	40	34	49
Subtotal, Combat Ships	247	300	230	237	266
Combat Logistics and Support Ships	57	104	52	57	74
Total	304	404	282	294	340
Costs of New-Ship Construction (Billions of 2022 dollars)^b					
Total Cost Over 30 Years					
Navy's estimate	705	872	689	696	763
CBO's estimate	924	946	795	834	881
Average Annual Cost					
Navy's estimate	23.5	29.1	23.0	23.2	25.4
CBO's estimate	30.8	31.5	26.5	27.8	29.4
Average Cost per Ship					
Navy's estimate	2.3	2.2	2.4	2.4	2.2
CBO's estimate	3.0	2.3	2.8	2.8	2.6
Memorandum:					
Average Annual Costs of All Activities Typically Funded From Budget Accounts for Ship Construction					
Navy's estimate	25.8	32.2	26.0	26.3	28.7
CBO's estimate	33.1	35.1	29.7	31.0	32.7

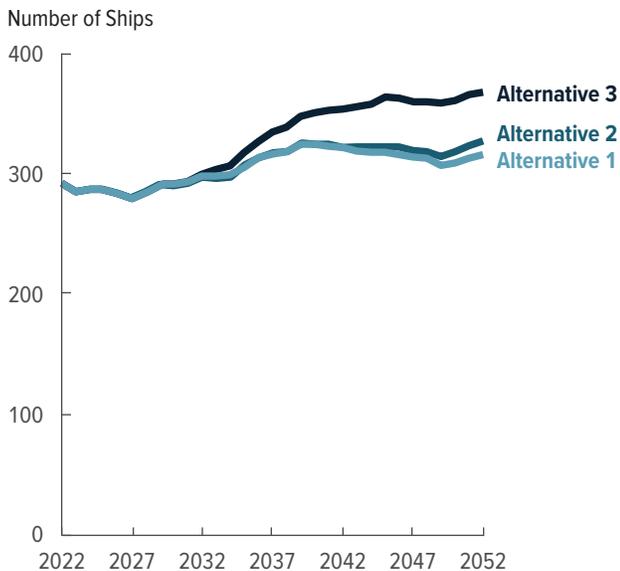
Data source: Congressional Budget Office, using data from the Department of the Navy. See www.cbo.gov/publication/58447#data. n.a. = not applicable.

a. The LHA counted in 2023 was authorized by the Congress in 2020. CBO therefore subtracts the 2023 ship from the number of ships the Navy would purchase under all three alternatives.

b. Costs of new-ship construction include only the costs for purchasing new battle force ships. Thus, they exclude the costs of unmanned systems and ships that are not counted as part of the battle force. Those costs are included elsewhere, as part of all the activities that would be funded in the Navy's shipbuilding accounts. The Navy did not envision buying unmanned systems in its fiscal year 2020 plan. The alternatives in the 2023 plan did not specify the number and type of unmanned platforms that the Navy might buy, so CBO estimated the number of systems the service would purchase.

Figure 1.

Annual Inventories of Battle Force Ships Under the Navy's 2023 Plan



The number of battle force ships would decline over the next 10 years under all three alternatives in the Navy's shipbuilding plan. By 2052, the number of those ships would increase from 292 today to 316 under Alternative 1, 327 under Alternative 2, or 367 under Alternative 3.

Data source: Congressional Budget Office. See www.cbo.gov/publication/58447#data.

35 percent higher, respectively, than the \$24.2 billion the Navy has received in annual appropriations, on average, over the past five years.

The cost of the Navy's 2023 shipbuilding plan is not only high when compared with recent funding, it is high by historical standards. In comparing the plan's costs with average recent funding, CBO is comparing funding during a period that saw the largest appropriations for ship construction since the Reagan Administration's defense buildup in the 1980s. Since 2013, lawmakers have appropriated, on average, \$2.2 billion more per year for shipbuilding than the President has requested, partly because of concerns that the fleet is too small to perform all of its missions (see Figure 2). And the most recent two years of appropriations—2021 and 2022—saw two of the three largest increases by the Congress in the past decade. As a point of comparison, shipbuilding appropriations averaged \$28.9 billion (in 2022 dollars) during the Cold War years of 1955 to 1989, a period of intense competition between the United States and the Soviet Union

in which the Navy faced challenges that look increasingly similar to those it expects to face over the next two decades.⁴ The three alternatives in the Navy's plan would cost between 3 percent and 13 percent more than that.

Each of the 2023 Plan's Alternatives Would Require the Navy's Total Budget to Grow to Operate and Maintain a Larger Fleet

The Department of the Navy's total budget in 2022 is about \$220 billion. As the fleet increased in size, various costs in addition to those for shipbuilding—from operation and support to weapons procurement—would also increase. Fully purchasing, operating, and maintaining any of the larger fleets envisioned in the 2023 plan would increase the Navy's total annual budget by about 30 percent, to roughly \$290 billion, by 2052, CBO estimates. Like shipbuilding costs, operation and support costs have historically increased faster than the economy-wide rate of inflation. Thus, the estimated increase in the Navy's total annual budget is driven both by the costs of acquiring, operating, and maintaining more ships and by annual rates of cost growth that are higher than such rates in the economy as a whole.

The Navy's Uncertain Goals for Shipbuilding

The Navy's specific long-term objectives for its fleet are unclear. Unlike its past plans, the 2023 shipbuilding plan does not include a specific set of inventory goals, organized by ship type, that would allow for a comparison with the procurement, delivery, and retirement schedules set forth in the three alternatives. The Navy intends to develop a new set of force goals aligned with the 2022 National Defense Strategy by the time DoD submits the fiscal year 2024 shipbuilding plan.⁵

In the 2023 plan, the Navy refers to analyses of the future composition of the fleet that it and DoD have performed over the past several years (see Table 4). Most of those analyses point to an eventual increase in the number of attack submarines, small surface combatants, small amphibious ships, combat logistics ships, and unmanned surface and undersea vessels, compared with their numbers in today's fleet. The number and types of

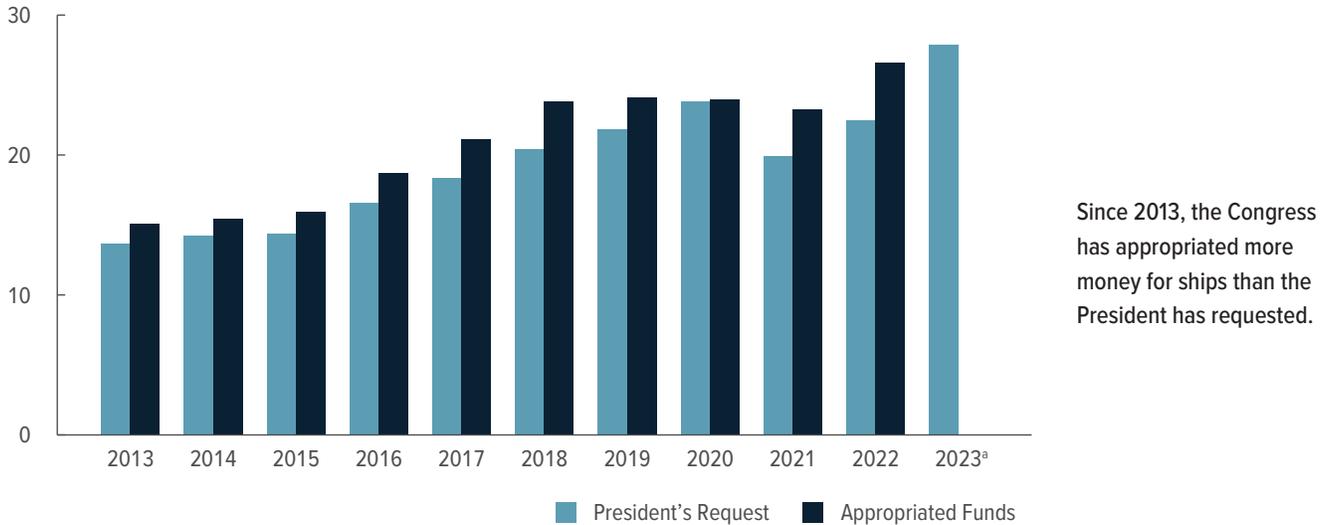
4. CBO's historical data for shipbuilding budgets begins with 1955. The year the Berlin Wall fell, 1989, is widely regarded as the end of the Cold War.

5. Department of the Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2023* (April 2022), p. 6, <https://go.usa.gov/xJtjj> (PDF). DoD normally submits the shipbuilding plan around the time the Administration submits its budget to the Congress.

Figure 2.

Requested and Appropriated Shipbuilding Budgets, 2013 to 2022

Billions of Dollars



Data source: Congressional Budget Office. See www.cbo.gov/publication/58447#data.

a. The 2023 appropriation was not available when this report was published.

amphibious warfare ships would also change; but the precise changes are unclear because the reporting by most of the analyses does not distinguish between midsize amphibious ships, such as LPD-17 amphibious transport docks, and small amphibious ships, such as the light amphibious warship. The analyses suggest that the Navy would purchase a significant number of those small ships to achieve objectives in the Marine Corps's *Force Design 2030*, including distributing small units of Marines, armed with missile batteries, over a theater of operations.⁶

In addition, in July 2022, the Chief of Naval Operations (CNO) released *Navigation Plan 2022*.⁷ That document outlines shipbuilding goals that are different from the ranges expressed in the shipbuilding plan for fiscal year 2022, which, until the CNO's report was released in July, was the most recent expression of the Navy's goals for the composition and size of its fleet. The goals in *Navigation Plan 2022* were not tied to the 2023 shipbuilding plan released two months earlier but were informed by a classified Battle Force Ship Assessment and Requirement sent

to the Congress at the end of July 2022. (The CNO's goals are, however, similar to those in the Navy's 2020 Integrated Force Structure Assessment.) The Navy has stated that those classified goals—and presumably those in *Navigation Plan 2022*—will be revised later this year.⁸

The ranges in the 2022 shipbuilding plan and the goals in *Navigation Plan 2022* target the year 2045 as a benchmark for making changes to the fleet. CBO compared the goals in the 2022 shipbuilding plan and those in the CNO's *Navigation Plan 2022* with the three alternatives in the 2023 plan for the year 2045 (see Table 5). In general, Alternatives 1 and 2 would achieve a fleet similar to the low end of the range in the 2022 shipbuilding plan. Alternative 3 would achieve a fleet similar to the high end of that range and similar to the goals in *Navigation Plan 2022*.

Ship Inventories and Purchases

The Navy's broad goal is to build a larger fleet whose firepower is distributed among more platforms than in today's fleet. The ship purchases and inventories

6. General David H. Berger, Commandant of the Marine Corps, *Force Design 2030: Annual Update* (May 2022), <https://go.usa.gov/xSrhF> (PDF).

7. Chief of Naval Operations, *Navigation Plan 2022* (July 2022), <https://go.usa.gov/xSnc8> (PDF).

8. Sam LaGrone, "New Navy Fleet Study Calls for 373 Ship Battle Force, Details Are Classified," *USNI News* (July 19, 2022), <https://tinyurl.com/2p94k2n5>. See also Lara Seligman, Lee Hudson, and Paul McLeary, "Inside the Pentagon Slugfest Over the Future of the Fleet," *Politico* (July 24, 2022), <https://tinyurl.com/3bra96ex>.

Table 4.

The Navy's Inventory Goals, 2016 to 2022

Number of Platforms

	2016 Force Structure Assessment	2020 Future Naval Forces Study, as Reported in the December 2020 Plan	Navy's 2022 Shipbuilding Plan	2020 Integrated Force Structure Assessment, as Reported in the 2023 Plan	Future Naval Forces Study Future Fleet Architecture, as Reported in the 2023 Plan	Memorandum: Fleet Composition, as of November 1, 2022
Aircraft Carriers	12	8 to 11	9 to 11	12	8 to 11	11
Light Carriers	n.a.	0 to 6	n.a.	0	0 to 6	0
Submarines						
Ballistic missile	12	12	12	12	12	14
Attack, guided missile, and large payload	66	72 to 78	66 to 72	66	58 to 70	54
Large Surface Combatants	104	73 to 88	63 to 65	96	72 to 80	88
Small Surface Combatants and Mine Countermeasures Ships	52	60 to 67	40 to 45	56	47 to 60	33
Large and Midsize Amphibious Warfare Ships						
LHAs and LHDs	] 38	9 to 10	8 to 9	10	6 to 10	9
LPDs and LSDs		] 52 to 57	16 to 19	] 41	] 30 to 43	22
Light Amphibious Warships	0		24 to 35			0
Subtotal, Combat Ships	284	286 to 329	238 to 268	293	233 to 292	231
Combat Logistics Ships	32	69 to 87	56 to 75	45	51 to 85	29
Support Ships	39	27 to 30	27 to 29	52	27 to 51	32
Subtotal, Logistics and Support Ships	71	96 to 117	83 to 104	97	78 to 136	61
Total Manned Battle Force Ships	355	382 to 446	321 to 372	390	337 to 404^a	292
Unmanned Surface Vessels	n.a.	119 to 166	59 to 89	27	81 to 153	0
Unmanned Undersea Vessels	n.a.	24 to 76	18 to 51	18	18 to 50	0
Total Unmanned Vessels	n.a.	143 to 242	77 to 140	45	99 to 203	0
Total Manned Battle Force Ships and Unmanned Vessels	355	525 to 688	398 to 512	435	440 to 540	292

Memorandum:

Time Frame to Achieve the Force Structure Objective	After 2030	2045	2045	After 2030	2045	n.a.

Data source: Congressional Budget Office, using data from the Department of the Navy. See www.cbo.gov/publication/58447#data.

LHAs and LHDs = amphibious assault ships; LPDs = amphibious transport docks; LSDs = dock landing ships; n.a. = not applicable.

a. The total ranges do not represent the sum of the ranges above, but rather possible trade-offs among ship types within a fixed budget amount.

described in the 2023 plan's three alternatives would all attempt to move the future fleet in that direction but in different ways.

The Navy designed Alternatives 1 and 2 to cost about the same in terms of new-ship construction, whereas under Alternative 3, the Navy would spend an additional \$75 billion to build new ships over the 30-year period. Generally, Alternative 1 places more emphasis on large surface combatants and small amphibious ships, and on buying more of the next generation of destroyers and

attack submarines, than Alternative 2 does. In contrast, Alternative 2 emphasizes undersea warfare the most; the Navy would buy more submarines than it would under either Alternative 1 or 3. It would, however, buy about half the number of next-generation attack submarines (known as SSN(X)s) that would be purchased under the other alternatives and would instead buy many more Virginia class attack submarines. With more funding, the Navy would buy more of all types of ships under Alternative 3 than under Alternatives 1 or 2—except for submarines. The 2023 plan does not discuss unmanned



Table 5.

The Composition of the Fleet in 2045 Under the 2023 Plan Compared With the Navy's Most Recent Shipbuilding Goals

	Navy's 2022 Shipbuilding Plan, June 2021	Chief of Naval Operations' <i>Navigation Plan</i> 2022, July 2022	Navy's 2023 Shipbuilding Plan		
			Alternative 1	Alternative 2	Alternative 3
Aircraft Carriers	9 to 11	12	10	10	11 ^a
Submarines					
Ballistic missile	12	12	12	12	12
Attack, guided missile, and large payload	66 to 72	66	55	61	60
Large Surface Combatants	63 to 65	96	75	70	80
Small Surface Combatants and Mine Countermeasures Ships	40 to 45	56	44	49	49
Large and Midsize Amphibious Warfare Ships					
LHAs and LHDs	8 to 9	10	7	7	9
LPDs and LSDs	16 to 19	21	15	15	17
Light Amphibious Warships	24 to 35	18	25	18	33
Subtotal, Combat Ships	238 to 268	291	243	242	271
Combat Logistics Ships	56 to 75	46	46	51	50
Support Ships	27 to 29	36	29	29	42
Subtotal, Logistics and Support Ships	83 to 104	82	75	80	92
Total Battle Force Ships	321 to 372	373	318	322	363
Memorandum:					
Time Frame to Achieve the Force Structure Objective	2045	2045	n.a.	n.a.	n.a.

Data source: Congressional Budget Office, using data from the Department of the Navy. See www.cbo.gov/publication/58447#data.

The Navy's 2022 shipbuilding plan would also include from 77 to 140 unmanned vessels, and the Chief of Naval Operations' *Navigation Plan 2022* would include about 150 unmanned vessels.

LHAs and LHDs = amphibious assault ships; LPDs = amphibious transport docks; LSDs = dock landing ships; n.a. = not applicable.

a. Under Alternative 3, the carrier force would number 10 ships for nearly all years between 2042 and 2052. In 2045, the force would temporarily increase to 11 ships.

vessels in any detail, other than to note their potential contributions to naval capability once they have achieved technological and conceptual maturity.

This report assesses the costs of implementing each of the three alternatives in the Navy's 2023 plan, the alternatives' effects on the force structure, and the capabilities that the alternatives would bring to the fleet. CBO did not evaluate the validity of the Navy's analysis of its future force structure or the fleet's ability to fulfill its missions in the national military strategy.

Combat Ships

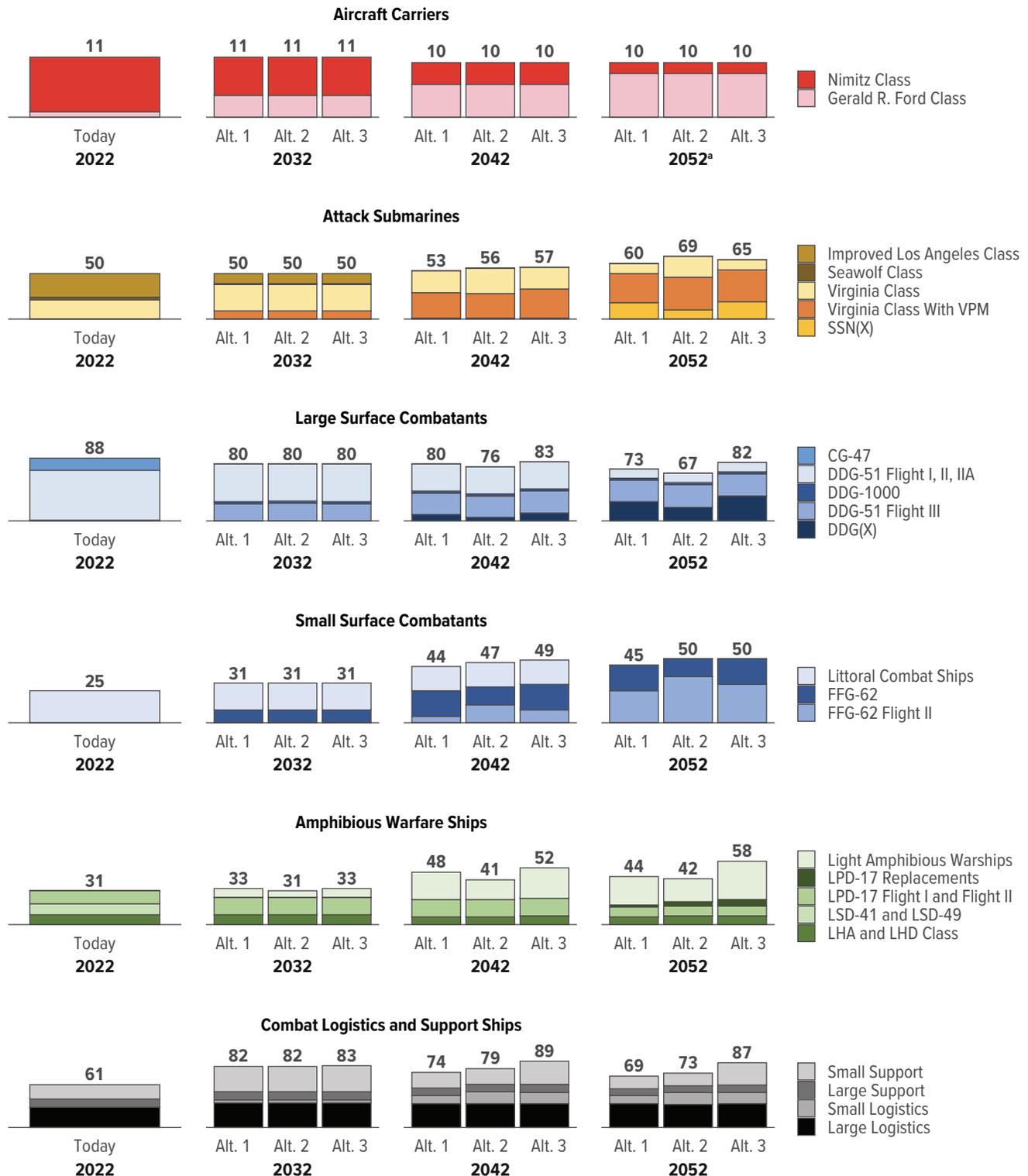
Combat ships include aircraft carriers, submarines, large and small surface combatants, and amphibious warfare ships. Over the next 30 years, the Navy would buy 230 combat ships under Alternative 1, 237 under

Alternative 2, or 266 under Alternative 3. Those purchases would leave the Navy with fewer carriers, large surface combatants, and large amphibious warfare ships than it currently has, but the number of attack submarines (including guided missile and large payload submarines) and small surface combatants would increase. The number of amphibious warfare ships would also increase, although the composition of the amphibious warfare force would differ significantly from that of today's force (see Figure 3).

Aircraft Carriers. Currently, the Navy's carrier force consists of 10 Nimitz class carriers and 1 Gerald R. Ford class ship. Over the next 30 years, the Navy would purchase 5 Ford class aircraft carriers (1 every five years, starting in 2028) under Alternatives 1 and 2 or would purchase 7 of them (one every four years) under Alternative 3 (see Figure 4 on page 11, first panel). All three alternatives would

Figure 3.

Inventories of Selected Categories of Ships Under the Navy's 2023 Plan



Data source: Congressional Budget Office, using data from the Department of the Navy. See www.cbo.gov/publication/58447#data.

CG = guided missile cruiser; DDG = guided missile destroyer; DDG(X) = next-generation destroyer; FFG = guided missile frigate; LHA and LHD = amphibious assault ship; LPD = amphibious transport dock; LSD = dock landing ship; SSN(X) = next-generation attack submarine; VPM = Virginia payload module.

a. Under Alternatives 1 and 2, the carrier force would consist of 9 ships for most of the 2040s and 2050s but would temporarily number 10 ships in 2052.



allow the Navy to maintain the size of its existing force of 11 aircraft carriers through 2039.⁹ After that, under Alternatives 1 and 2, the force would fall to 10 carriers and then, for most years between 2046 and 2052, to 9 carriers. Under Alternative 3, the force would remain at 10 carriers for most years through 2052.

Ballistic Missile Submarines. The plan for the Columbia class ballistic missile submarines (SSBNs), which are slated to replace the Navy's 14 Ohio class submarines as they are retired, is the same under all three alternatives. The Navy ordered the first of the Columbia class ships in 2021; the 2023 plan calls for purchasing another one in 2024 and then 10 more, at a rate of 1 per year, between 2026 and 2035. Unlike the goals for other categories of ships, the force goal for SSBNs is not determined by the Navy's force structure assessments but rather by requirements that stem from the number of submarines needed on station by DoD's Strategic Command and, secondarily, by the operational availability of those ships. Therefore, the Navy's requirement to replace its 14 Ohio class SSBNs with 12 Columbia class ships has been set for many years and remains unchanged.

The Navy estimates that the lead Columbia class submarine (a lead ship is the first ship of its class) will take at least seven years to build, so the first one would be commissioned into the fleet in 2028. Another two or three years would elapse, however, before it went on its first deterrent patrol. Subsequent submarines in the class would take about seven years to build and test. Over the past two years, the Navy has determined that it can extend the service life of 5 Ohio class submarines by two to three years each so that the SSBN force would remain at 12 ships or more for all but three years between 2023 and 2052.

Attack and Large Payload Submarines. The Navy currently has 50 nuclear-powered attack submarines (SSNs): 26 Los Angeles class, 3 Seawolf class, and 21 Virginia class ships.¹⁰ The fleet also includes 4 guided missile

submarines (SSGNs), which are converted ballistic missile submarines that can carry large numbers of conventional missiles and special operations forces. According to the 2023 shipbuilding plan, after an initial decline to 46 SSNs in 2028, the SSN force would become larger and more capable than it is today. Under Alternative 1, the Navy would buy 54 SSNs and would have 60 in the fleet by 2052 (see Figure 3 on page 9, second panel, and see Figure 4). Under Alternative 2, the Navy would buy the most SSNs, purchasing 66 of them over the next 30 years. In that case, the force would reach 60 SSNs by 2045 and 69 by 2052. Under Alternative 3, the Navy would purchase 60 SSNs; its inventory would reach 60 ships by 2046 and 65 ships by 2052.

The composition of the SSN force, however, would be very different depending on which alternative was implemented. Under Alternatives 1 and 3, the Navy would invest more heavily in next-generation SSN(X) submarines, buying nearly twice as many of them as it would under Alternative 2. In contrast, under Alternative 2, the Navy would buy more submarines overall but would continue production of the Virginia class submarines, both with and without the Virginia payload module (VPM), through 2052.¹¹ It would also begin production of the SSN(X) in 2034, as it would under the other two alternatives.

Under the 2023 plan, the Navy would also build a new large payload submarine starting in the 2030s or 2040s, depending on which alternative was implemented. That new ship would be a large-capacity submarine, perhaps built on a Columbia class hull in much the same way the Navy's existing SSGNs are converted Ohio class SSBNs. The new ships would be bought in small numbers, with 1 ship being built every three or four years under each alternative. The Navy would purchase 4 large payload submarines through 2052 under Alternatives 1 and 3 or would purchase 6 of them under Alternative 2.

The plan's implications for the submarine industrial base are considerable, especially under Alternative 2. The Navy currently takes from six to nine years to build a new submarine. As a result, under Alternative 2, five types of submarines (including both SSBNs and large payload submarines) would be in production in the 2030s, and

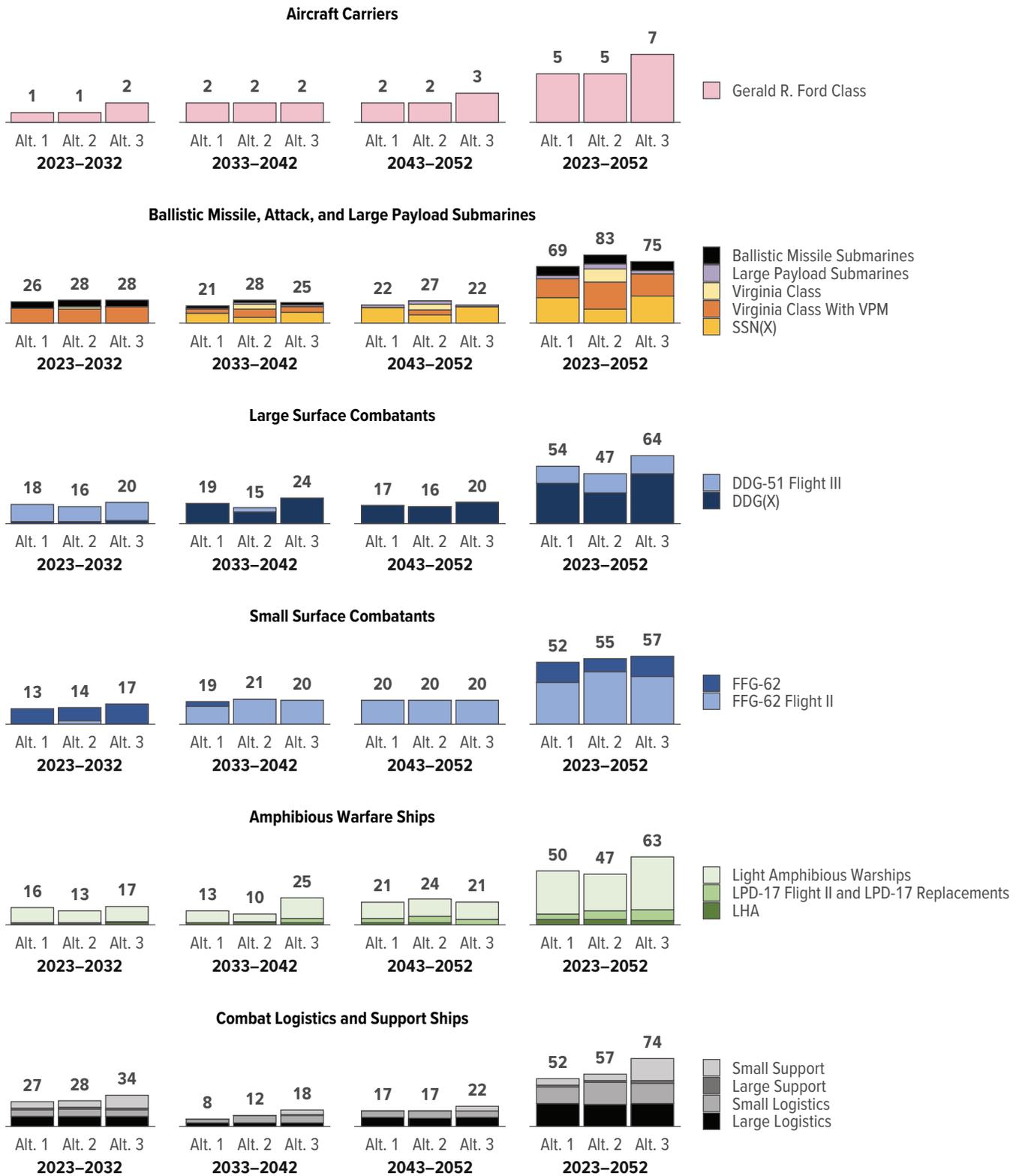
9. Under all 3 alternatives, the carrier force would briefly dip to 10 carriers in 2027, although the Navy is examining whether it can extend the life of a retiring carrier for a short period to keep the force at 11 ships. Under Alternatives 1 and 2, the carrier force would consist of 9 ships for most of the 2040s and 2050s but would temporarily number 10 ships in 2052.

10. For an overview of those programs, see Ronald O'Rourke, *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and Issues for Congress*, Report RL32418, version 229 (Congressional Research Service, August 26, 2022), <https://tinyurl.com/vbhy77ax>, and *Navy Next-Generation Attack Submarine (SSN[X]) Program: Background and Issues for Congress*, Report IF11826, version 18 (Congressional Research Service, August 30, 2022), <https://tinyurl.com/2p8asmm>.

11. The Virginia payload module adds four large-diameter payload tubes to the existing Virginia class submarine; each tube can carry seven Tomahawk missiles or other payloads, such as unmanned underwater vessels. That modification would increase the submerged displacement of the submarine by nearly 30 percent and would increase the number of the Virginia class submarine's Tomahawk-sized vertical-launch weapons from 12 to 40. The submarines would be armed with approximately 25 additional weapons—torpedoes and Tomahawks—in the torpedo room.

Figure 4.

Purchases of Selected Categories of Ships Under the Navy's 2023 Plan



Data source: Congressional Budget Office, using data from the Department of the Navy. See www.cbo.gov/publication/58447#data.

DDG = guided missile destroyer; DDG(X) = next-generation destroyer; FFG = guided missile frigate; LHA = amphibious assault ship; LPD = amphibious transport dock; SSN(X) = next-generation attack submarine; VPM = Virginia payload module.

four types would be in production in the 2040s and beyond. Under Alternatives 1 and 3, four types of submarines would be in production in the 2030s, and just 2 types would be so by about 2045. Today, the Navy has three types of submarines in production (Columbia class, Virginia class, and Virginia class with VPMs), which is proving to be a challenge. With three classes of submarines now under construction, the Navy is experiencing cost overruns, construction delays, and missed delivery dates. Adding more classes of submarines for production could tax the ability of the shipyards and the Navy to manage that production even more.¹²

Large Surface Combatants. The Navy currently has 88 cruisers and destroyers in its fleet. However, all 17 CG-47 Ticonderoga class cruisers are to be retired over the next five years, and the first DDG-51 Arleigh Burke class destroyer is set to be retired in 2027. All three alternatives in the 2023 shipbuilding plan would gradually reduce the number of large surface combatants, consistent with most of the Navy's recent analyses. By 2032, the large surface combatant force would fall from 88 ships today to 80 ships under all three alternatives (see Figure 3 on page 9, third panel). By 2052, the force would range from a low of 67 ships under Alternative 2 to a high of 82 ships under Alternative 3.

Under Alternative 1, the Navy would buy 54 destroyers over the next 30 years at a rate of slightly less than 2 ships per year; under Alternative 2, it would buy 47 ships at a rate of 1 or 2 per year (see Figure 4 on page 11, third panel). The Navy would buy the most large surface combatants—64 ships—under Alternative 3, purchasing slightly more than 2 ships per year over the 30-year period. Under all three alternatives, it would continue to buy DDG-51 Flight III class destroyers in about equal numbers. And—also in all three cases—purchases of the next-generation DDG(X) destroyer would begin in 2030, moving the start date of its construction back to where it was in the 2019 shipbuilding plan and later than in either the fiscal year 2020 or

December 2020 plan.¹³ The number of DDG(X)s purchased under the three alternatives would vary; the Navy would buy the fewest, 29, under Alternative 2 and the most, 47, under the more costly Alternative 3.

Small Surface Combatants. The Navy now has 25 littoral combat ships (LCSs), categorized as small surface combatants, in its fleet and also operates 8 mine countermeasures ships, which it sometimes includes in that category. (CBO does not include mine countermeasures ships in its tally of small surface combatants.) An additional 7 LCSs and 3 FFG-62 Constellation class frigates are being built. Under all three alternatives in the 2023 plan, the number of LCSs would fall in the near term as 11 ships were retired over the next two years; all of the ships to be retired will be less than 10 years old.¹⁴ The Navy would keep just 21 of the 35 ships it will have built until the end of their planned 25-year service life.

According to the 2023 plan, the number of small surface combatants would roughly double, by 2052, to a force of 45 (under Alternative 1) or 50 ships (under Alternatives 2 and 3; see Figure 3 on page 9, fourth panel). That would put the size of the force near the middle of the ranges in the Navy's recent analyses of its future fleet—a larger force, for example, than envisioned in the 2022 shipbuilding plan but a smaller one than in the 2020 Future Naval Forces Study, as reported in the December 2020 plan.

The composition of the small surface combatant force would vary among the three alternatives. Under Alternative 1, the Navy would purchase 17 FFG-62s through 2035 (in addition to the 3 frigates already under construction) before switching to an upgraded design of that ship, designated as the FFG-62 Flight II (see Figure 4, fourth panel). Under Alternative 2, the Navy would buy only 11 FFG-62s before switching to the upgraded version in 2029, buying 44 of the Flight IIs in total. The service would buy 17 FFG-62s under Alternative 3 before switching to the Flight II ship. In

12. Anthony Capaccio, "New U.S. Nuclear-Missile Submarines Hobbled by Billions in Growing Costs and Delays," *Bloomberg* (June 8, 2022), <https://tinyurl.com/bddktdj>; and Megan Eckstein, "Submarine Industrial Base Under Strain as Virginia-Class Parts Wearing Out Early; Implications for Columbia-Class," *USNI News* (April 20, 2021), <https://tinyurl.com/ycf2hfv2>. See also, Congressional Budget Office, *The Capacity of the Navy's Shipyards to Maintain Its Submarines* (March 2021), www.cbo.gov/publication/57026.

13. Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2020 Shipbuilding Plan* (October 2019), www.cbo.gov/publication/55685, and *An Analysis of the Navy's December 2020 Shipbuilding Plan* (April 2021), www.cbo.gov/publication/57091.

14. Thus, some Members of Congress have objected to the Navy's plan; the House Armed Services Committee proposed to prohibit the retirement of 5 of those ships in its version of the 2023 National Defense Authorization Act.

all three cases, ships would be purchased at a rate of 1 or 2 per year through the mid-2030s, then largely at a rate of 2 per year thereafter.

Amphibious Warfare Ships. The Navy's current amphibious warfare force comprises 31 ships: 9 large amphibious assault ships, designated as LHAs or LHDs; 12 midsize amphibious transport docks, or LPDs; and 10 midsize dock landing ships, or LSDs. Under the three alternatives in the 2023 plan, the number of those ships would be reduced and, as first proposed in the Navy's December 2020 plan, a major building program for light amphibious warships (LAWs, which are small amphibious ships) would begin. The number of large and midsize amphibious ships would fall to 25 by 2032 and then to 23 or 24 ships by 2042. By 2052, those ships would number 18, 21, or 23 under Alternatives 1, 2, and 3, respectively (see Figure 3 on page 9, fifth panel). In contrast, the LAW program would slowly grow to 8 ships by 2032 under Alternatives 1 and 3 and to 6 ships under Alternative 2. By 2052, the Navy would have the most LAWs, 35, under Alternative 3 and the fewest, 21, under Alternative 2.

Under Alternative 1, the Navy would buy a total of 10 large and midsize amphibious warfare ships; it would buy 13 under Alternative 2 and 14 under Alternative 3—fewer than envisioned in the service's fiscal year 2020 or December 2020 plans (see Figure 4 on page 11, fifth panel). Under all three alternatives, the Navy would buy 1 or 2 LAWs per year, starting in 2025. But because the LAWs would only have a 20-year service life, the Navy would need to start buying replacements for the first class of ships in the 2040s. Overall, the Navy would buy 40, 34, or 49 LAWs under Alternatives 1, 2, and 3, respectively.

Combat Logistics and Support Ships

The Navy's combat logistics and support ships include large ships, such as T-AO oilers and T-AKE dry cargo ships, which resupply vessels at sea, and smaller ships, such as tug and salvage ships, surveillance craft, and expeditionary fast transports. Under the alternatives in the 2023 plan, the Navy would increase the number of large oilers and begin buying a smaller logistics ship, called the next-generation logistics ship (NGLS) and currently designated as a T-AOL (which has also been called a light oiler), to help resupply a larger fleet with more smaller warships. Overall, the Navy would buy 52 combat logistics and support ships under Alternative 1, 57 under Alternative 2, or 74 under Alternative 3 (see Figure 4 on page 11, sixth panel).

Most of the differences in the three alternatives' plans for combat logistics and support ships are attributable to two types of ships: the T-AOL and the expeditionary fast transport. The Navy would buy 18 T-AOLs under Alternative 1 and 24 of them under Alternative 2. Despite building a larger overall combat fleet under Alternative 3, the Navy would buy only 22 T-AOLs in that case. As was the case for the LAWs, some of those ships would be replacements because the T-AOLs have an expected service life of 20 years. The Navy would maintain a force of 11 T-AOLs under Alternative 1, 16 under Alternative 2, or 15 under Alternative 3. The service would also purchase 14 replacements for its expeditionary fast transports under Alternative 3, whereas, under Alternatives 1 and 2, it would not replace those ships when they were retired.

Unmanned Surface and Undersea Vessels

In the 2023 plan, the Navy discusses the potential of unmanned systems to contribute to its overall capabilities. Specifically, it mentions the value of medium unmanned surface vessels (MUSVs) as sensor platforms, large unmanned surface vessels as “adjunct missile magazines teamed with larger manned multi-mission platforms,” and extra-large unmanned undersea vessels as having “the capability to deliver multiple payloads at extended ranges.”¹⁵ The plan also notes, however, that because those programs are still being developed and their technological success is not completely assured, the future quantities of ships and costs associated with them have not yet been determined. That view contrasts with the December 2020 plan, in which the Navy proposed purchasing more than 220 of those three types of vessels. The Navy has not announced how many MUSVs it would purchase (other than the first prototype), and it is not clear whether those vessels would be purchased using its shipbuilding account or some other account. Thus far, the Navy has purchased unmanned undersea vessels using another procurement account (labeled Other Procurement, Navy) instead of its shipbuilding account.

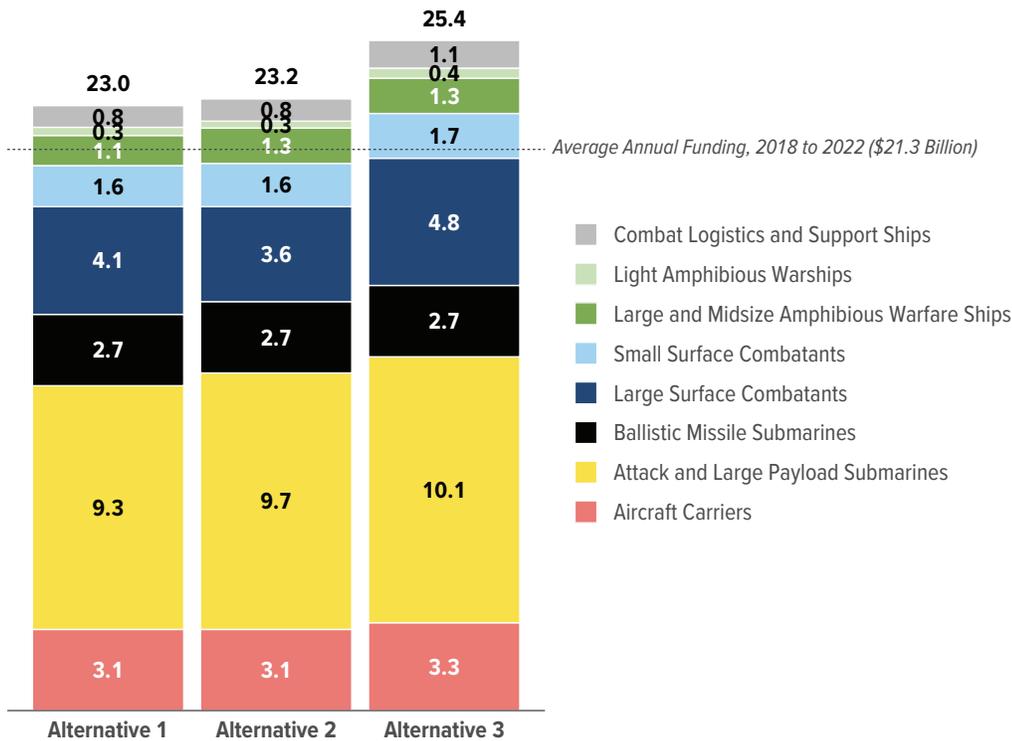
According to DoD's 2023 Future Years Defense Program (a five-year plan), the Navy would purchase 6 LUSVs between 2025 and 2027 using its shipbuilding account. On the basis of that information, CBO estimated for the present analysis that the Navy would build a force of 24 LUSVs under Alternatives 1 and 2 and a force of 30 LUSVs under

15. Department of the Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2023* (April 2022), p. 6, <https://go.usa.gov/xJtjj> (PDF).

Figure 5.

The Navy's Estimates of Average Annual Costs of New-Ship Construction Under Its 2023 Plan, by Ship Type

Billions of 2022 Dollars



The Navy estimates that building new ships would cost \$23 billion to \$25 billion per year, on average, under the three alternatives in its 2023 plan.

Data source: Congressional Budget Office, using data from the Department of the Navy. See www.cbo.gov/publication/58447#data.

Alternative 3, including necessary replacements. CBO did not include any MUSVs in its estimates.

Shipbuilding Costs

According to the Navy's estimates, its planned purchases of new ships from 2023 to 2052 would cost (that is, require appropriations of), on average, \$23.0 billion per year under Alternative 1, \$23.2 billion under Alternative 2, and \$25.4 billion under Alternative 3—all in 2022 dollars (see Figure 5). Those amounts are significantly less than the cost of new ships in the Navy's December 2020 plan but are similar to the cost in its fiscal year 2020 plan.

CBO estimated the costs of the three alternatives in the Navy's 2023 plan using its own models and

assumptions.¹⁶ On average, CBO's estimates of costs for new-ship construction over the 30-year period are higher than the Navy's estimates by \$3.5 billion (or 15 percent) for Alternative 1, \$4.6 billion (or 20 percent) for Alternative 2, and \$4.0 billion (or 16 percent) for Alternative 3. Other activities that the Navy would need to fund from its shipbuilding account add roughly \$3 billion more per year to projected costs. Thus, using the service's estimates for new-ship construction costs and CBO's estimates for other costs, the total average annual cost for all activities typically funded from the Navy's shipbuilding account ranges from \$26.0 billion to \$28.7 billion; using CBO's estimates for both types of costs, the average ranges from \$29.7 billion to \$32.7 billion, about \$4 billion (or 14 percent to 18 percent) more per year.

16. For more information about how the agency estimates shipbuilding costs, see Congressional Budget Office, *How CBO Estimates the Cost of New Ships* (April 2018), www.cbo.gov/publication/53785.



The Navy's Estimates

The Navy's 2023 plan delineates future shipbuilding procurements, retirements, and inventories under all three alternatives. The plan also emphasizes (as have recent shipbuilding plans) the importance of providing steady work to the shipbuilding industry as a way to prevent boom-and-bust cycles, which could jeopardize the financial health of some shipyards and secondary suppliers and create uncertainty about the cost of shipbuilding in the future. The Navy also notes that the quantities and delivery times of new ships in its plan are predicated on the assumption that the production delays plaguing several shipyards today will be resolved, leading to the steady and on-time delivery of new ships in the future.¹⁷

New-Ship Construction Costs. According to estimates in the Navy's 2023 plan, submarine construction would consume the lion's share of shipbuilding funds over the next 30 years—about half of the amount needed for new-ship construction under each alternative. The estimates reflect the fact that, other than aircraft carriers, submarines are the most expensive ships the Navy buys, and it plans to buy many of them regardless of which alternative it might implement. The focus on submarines also reflects the importance of undersea warfare in the service's evolving naval strategy and vision for its future fleet.

Under Alternatives 1 and 2, the Navy would spend about the same percentage of its construction costs on submarines. More submarines would be purchased under Alternative 2, however, because it includes more SSNs, which are less expensive than the next-generation submarines that the Navy would invest more heavily in under Alternative 1. Despite being the costliest option, Alternative 3 would see only \$400 million more per year spent on submarines than Alternative 2 would. And the Navy would spend \$400 million more on submarines under Alternative 2 than it would under Alternative 1.

That spending pattern is reversed in the case of surface combatants. Under Alternative 1, the Navy would spend proportionally more (25 percent of construction costs) on surface combatants than it would under Alternative 2 (23 percent of construction costs)—a difference

amounting to \$400 million per year, on average. Under Alternative 3, it would spend 26 percent of construction costs on surface combatants—about \$900 million more per year than would be spent under Alternative 1 and \$1.3 billion more per year than under Alternative 2.

In general, according to the Navy's estimates, spending on the remaining categories of ships is proportionally about the same under all three alternatives. Amphibious ships represent from 5 percent to 7 percent of new-ship construction costs, and combat logistics and support ships represent 4 percent of such costs.

The balance of the greater overall cost of Alternative 3—\$74 billion more, over 30 years, than Alternative 1 and \$67 billion more than Alternative 2—would be spent on smaller and less expensive ships. The average overall cost of a ship under the Navy's alternatives ranges from \$2.2 billion to \$2.4 billion. The average cost of the *additional* ships that would be purchased under Alternative 3 ranges from \$1.3 billion to \$1.5 billion, according to the Navy's estimates.

Total Shipbuilding Costs. As in all previous shipbuilding plans, estimates in the Navy's 2023 plan exclude certain costs that would need to be paid from the service's shipbuilding account. Specifically, they exclude the costs of refueling nuclear-powered aircraft carriers, purchasing ships that are not part of the battle force (such as oceanographic survey ships or sealift ships), outfitting and post-delivery activities (including the purchase of many small tools and equipment needed to operate a ship but that are not necessarily provided by the shipyard when the ship is built), and other smaller items. In addition, the Navy's estimates do not include the \$2.6 billion needed (because of cost overruns or other increased expenses) to complete ships authorized before 2023, nor do they include the \$1.6 billion in investments in the submarine industrial base. Including all those costs, as estimated by CBO, would add from \$3.0 billion to \$3.2 billion each year to the Navy's estimates. Using both sets of estimates, the total annual costs for all activities funded through the Navy's shipbuilding account would average \$26.0 billion under Alternative 1, \$26.3 billion under Alternative 2, and \$28.7 billion under Alternative 3.

CBO's Estimates

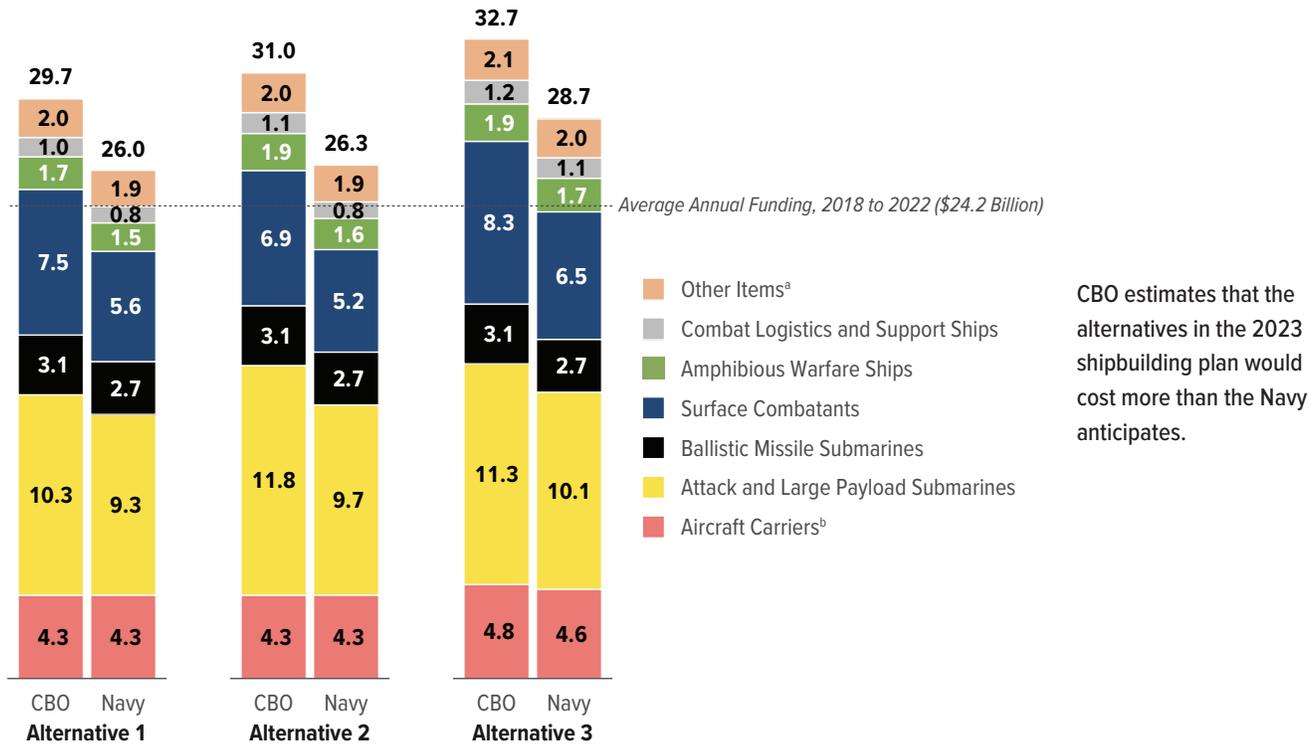
According to CBO's estimates, the full cost of the 2023 shipbuilding plan (including new-ship construction, refueling of aircraft carriers, and other items) over

17. Department of the Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2023* (April 2022), pp. 10–11, <https://go.usa.gov/xJtjj> (PDF). Detailed cost projections are provided in Appendix 6 of the report; that appendix is a limited-distribution document that the Navy made available to CBO.

Figure 6.

Average Annual Total Shipbuilding Costs Under the Navy's 2023 Plan, as Estimated by CBO and the Navy

Billions of 2022 Dollars



CBO estimates that the alternatives in the 2023 shipbuilding plan would cost more than the Navy anticipates.

Data source: Congressional Budget Office, using data from the Department of the Navy. See www.cbo.gov/publication/58447#data.

- a. Includes construction of ships that are not part of the Navy's battle force (such as oceanographic survey ships or sealift ships), outfitting and postdelivery activities (including the purchase of smaller tools and pieces of equipment that are needed to operate a ship but that are not provided by the manufacturing shipyard as part of ship construction), efforts to extend ships' service life, service craft, and smaller items.
- b. Includes funding for building new aircraft carriers as well as refueling the nuclear power plants of aircraft carriers already in the fleet.

the 2023–2052 period would average \$29.7 billion per year under Alternative 1, \$31.0 billion under Alternative 2, and \$32.7 billion under Alternative 3 (see Figure 6). Those amounts are 23 percent to 35 percent more than the average annual funding the Navy has received over the past five years. CBO's estimates (like the Navy's) also reflect the expectation that the production delays plaguing several shipyards today would be resolved over the next decade, leading to the steady and on-time delivery of new ships. If that did not happen, costs for new ships could be higher than the amounts the Navy and CBO estimate, and the delivery of new ships would take longer than anticipated in the 2023 plan.

CBO's and the Navy's estimates are similar over the next 10 years, but the differences widen over time. For

the 2023–2032 period, CBO's estimates of total shipbuilding costs under the 2023 plan are 5 percent to 8 percent higher than the Navy's, but they are 20 percent to 27 percent higher over the 2043–2052 period (see Table 6). The two sets of estimates are similar in the near term because most of the ships the Navy plans to buy are already under construction and their costs are reasonably well known. But CBO and the Navy made different assumptions about the size and capabilities of future ships, which led to differing cost estimates for the midterm and far term. In particular, two large programs—the new attack submarine and the next-generation destroyer—account for more than half of the difference between the Navy's and CBO's estimates of costs under Alternatives 1 and 3, and for slightly less than half of that difference under Alternative 2.

Table 6.

Average Annual Total Shipbuilding Costs Under the Navy's 2023 Plan

	Near Term (2023–2032)	Midterm (2033–2042)	Far Term (2043–2052)	All Three Decades (2023–2052)
Navy's Estimates (Billions of 2022 dollars)^a				
Alternative 1	27.9	23.5	26.7	26.0
Alternative 2	28.1	24.9	25.9	26.3
Alternative 3	30.3	28.5	27.1	28.7
CBO's Estimates (Billions of 2022 dollars)				
Alternative 1	29.4	27.5	32.1	29.7
Alternative 2	30.3	29.9	32.9	31.0
Alternative 3	31.7	34.0	32.4	32.7
Difference Between the Navy's and CBO's Estimates (Percent)				
Alternative 1	5	17	20	14
Alternative 2	8	20	27	18
Alternative 3	5	19	20	14

Data source: Congressional Budget Office, using data from the Department of the Navy. See www.cbo.gov/publication/58447#data.

a. These figures include the Navy's estimates for new-ship construction and for the cost to complete ships purchased in prior years and CBO's estimates for the refueling of nuclear-powered aircraft carriers, ships that are not counted in the battle force, and other items.

A significant portion of the difference in estimates for those two programs is attributable to CBO's treatment of cost growth greater than inflation in the economy as a whole. When estimating the cost to build a ship in the future that is identical to one already built, the Navy reports the future cost of capabilities purchased as being the same as the cost today. By contrast, CBO projects the cost to build the same ship in the future by accounting for the rising costs of labor and materials used in building naval ships (that is, shipbuilding inflation) compared with the rising costs of other goods and services in the economy. CBO regards that difference between shipbuilding inflation and overall inflation as growth in the constant-dollar cost of building naval ships.

For this report, the agency used the historical difference between shipbuilding inflation and inflation in gross domestic product (GDP) prices, as measured by the GDP price index, to calculate the growth in its constant-dollar estimates of shipbuilding programs. Between 1992 and 2021, shipbuilding inflation outpaced inflation in the economy by an average of 1.12 percent per year. CBO's projections of shipbuilding costs reflect the assumption that that rate of difference would continue between 2022 and 2052. As a result, the agency estimated that a ship that costs \$2.5 billion to build in 2022 would cost \$3.3 billion (in 2022 dollars) in 2045. (However, shipbuilding costs cannot continue to grow faster than the costs of goods and services in the

economy as a whole indefinitely. If that occurred, the price of ships would eventually outstrip the Navy's ability to pay for even a small number of them.)

Growth in the Navy's Total Annual Budget

The larger fleets envisioned under all three alternatives in the 2023 plan would increase costs of other parts of the Navy's budget as the fleets grew. Fully purchasing, operating, and maintaining those larger fleets would, in CBO's estimation, increase the Navy's total annual budget by about 30 percent, from \$220 billion today to roughly \$290 billion (in 2022 dollars) in 2052. Shipbuilding costs would account for 13 percent of that amount for 2052. (Operating and manning the larger fleets envisioned under the Navy's alternatives would represent the largest components of its budget—about 45 percent of the total.) Costs would decrease temporarily in the 2020s, as the number of ships in the fleet declined and as the Navy retired ships that were more expensive to operate than the new ones it would commission. But in the 2030s and beyond, costs would increase (see Figure 7).

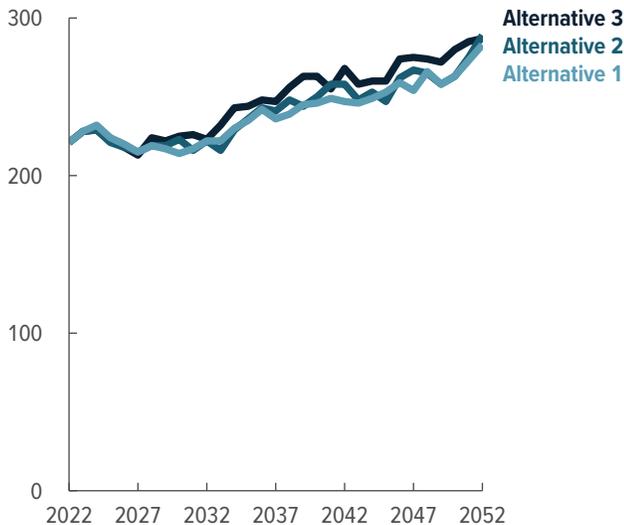
To estimate growth in the Navy's total budget, CBO developed independent estimates for each of the service's budget accounts. Specifically, to estimate costs associated with the shipbuilding and aircraft procurement accounts, CBO first estimated the cost of each ship and aircraft



Figure 7.

CBO's Estimate of the Navy's Total Budget Under Its 2023 Plan

Billions of 2022 Dollars



As the fleet grew in size under the alternatives in the 2023 plan, the Navy's total budget would grow from \$220 billion today to roughly \$290 billion by 2052.

Data source: Congressional Budget Office. See www.cbo.gov/publication/58447#data.

procurement program.¹⁸ Estimates for other items or activities purchased through those accounts, as well as the remaining procurement accounts, were developed on the basis of historical relationships between the 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 Navy's fleet, as measured by its total full-load displacement for surface ships and submerged displacement for submarines. 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 personnel were based on historical averages adjusted for the size of the Corps, which is set by law. Estimates for the remaining accounts, such as the one for military construction, were based on historical averages.

18. The estimates for aircraft are drawn from and are consistent with those published in Congressional Budget Office, *The Cost of Replacing Today's Naval Aviation Fleet* (January 2020), www.cbo.gov/publication/55949.

CBO adjusted its estimates to vary with changes in the Navy's fleet over time (specifically, changes in ship and aircraft procurements, displacements, and crew sizes). In addition, costs paid from most of the Navy's accounts have seen inflation greater than that in the economy as a whole; those differences are included as real growth (that is, growth adjusted to remove the effects of inflation) in the estimates.

Measures of Capability

In the absence of a force structure assessment, the Navy compared its three alternatives using several measures of capability. By emphasizing different types of ships in Alternatives 1 and 2, and by allocating additional resources in Alternative 3, the Navy sought to illustrate several trade-offs in the lethality of its fleet. Specifically, it counted the number of:

- Vertical launch missile cells on surface ships,
- Vertical launch missile cells on submarines,
- Torpedoes on attack submarines, and
- Tactical aircraft sorties launched from the carrier force per day.

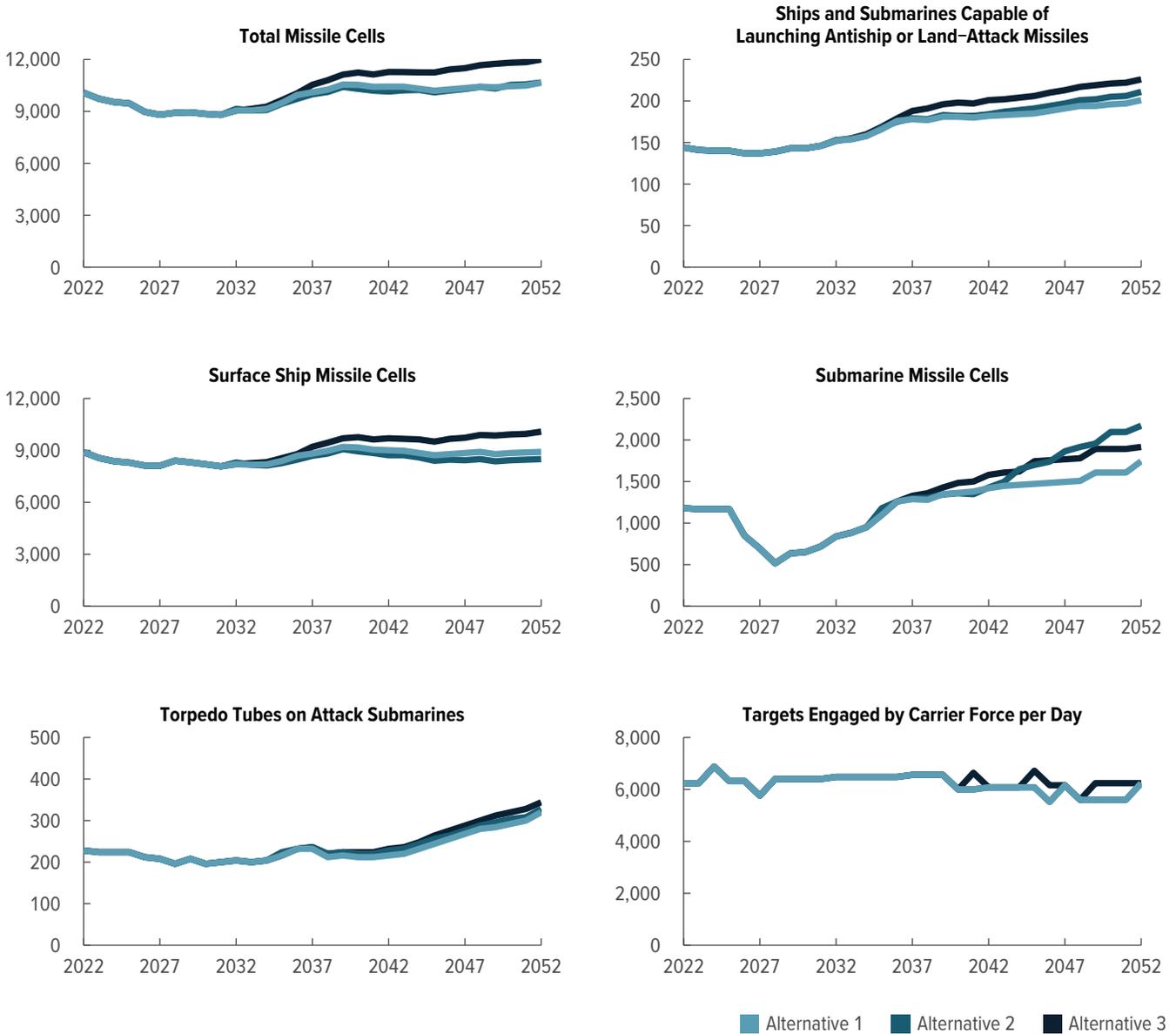
Although those four metrics measure the *lethality* of the fleet, none of them address the *distribution* of its fire-power—an important element of the Navy's Distributed Maritime Operations concept. Thus, to compare the three alternatives, CBO counted the number of ships capable of firing antiship or land-attack missiles. The agency also calculated the total missile capability of the Navy's fleet, combining the vertical launch capability of surface ships and that of submarines.

Under all three alternatives in the 2023 plan, the lethality of the fleet, as measured in part by the total number of missile cells, would decline by 13 percent until 2032 (see Figure 8).¹⁹ That is because the Navy would retire more cruisers, destroyers, and submarines than it would commission over the next 10 years. For example,

19. The number of missile cells refers to the number of vertical launch system (VLS) cells carried by the Navy's surface combatants, submarines, or unmanned systems. Using the number of VLS cells in the fleet as a measure of lethality reflects an assumption that the Navy has sufficient munitions to fill those cells and that the ships carrying them have a reasonable prospect of being effective in performing their missions. In fact, the Navy is planning to increase its missile purchases. For a more thorough discussion of the advantages and disadvantages of using VLS cells as a metric of capability, see Congressional Budget Office, *Comparing a 355-Ship Fleet With Smaller Naval Forces* (March 2018), p. 11, www.cbo.gov/publication/53637.

Figure 8.

Measures of Naval Capability Under the Navy's 2023 Plan



By most measures, the capability of the Navy's fleet would decline during the next decade before increasing beyond that of today's fleet.

Data source: Congressional Budget Office. See www.cbo.gov/publication/58447#data.

undersea missile capacity would decline, as the Navy's 4 guided missile submarines, or SSGNs, which each carry up to 154 land-attack missiles, were retired in the 2020s. That capability is set to be replaced by Virginia class attack submarines modified to carry up to 40 missiles each. However, the first of those submarines would not enter the fleet until November 2028. After 2032, the missile capacity of the fleet would grow again. By

2052, under Alternatives 1 and 2, the fleet would have 6 percent more missile cells than it does today; under Alternative 3, it would have 19 percent more. The other metrics related to missile cells illustrate the trade-offs between missile cells on surface ships and those on submarines. For example, Alternative 1 would provide more missile cells on surface ships than Alternative 2, which would provide more of them on submarines.



With respect to the distribution of that lethality, the Navy's alternatives would fare much better. Through 2027, the fleet would experience a 5 percent decline in the number of ships capable of launching antiship and land-attack missiles, compared with today's fleet. By 2052, however, that number would increase by 40 percent under Alternative 1, by 47 percent under Alternative 2, and by 57 percent under Alternative 3.

The fleet's torpedo tube capacity would substantially increase under all three alternatives because of their emphasis on purchasing submarines. That metric highlights the potential increase in the Navy's ability to conduct undersea warfare between now and 2052. Under all three alternatives, more submarines would be retired than commissioned over the next decade; but after that, the number of torpedo tubes would increase, compared with the number in today's fleet, by 40 percent to 50 percent.

Finally, the number of targets the carrier force could attack each day would not change much under the alternatives in the 2023 plan. The Navy would have the same size carrier force under Alternatives 1 and 2; but under Alternative 3, the fleet would include, on average, 1 additional carrier by the late 2040s—the result of building 1 carrier every 4 years after 2028. Although the Ford class carriers are expected to be capable of launching more daily aircraft sorties than Nimitz class carriers can, the carrier force would decline to 9 or 10 ships under all three alternatives by the 2040s. As a result, the overall capability of the carrier force would not change much or would decline slightly by 2052.

Plans for Specific Ship Programs

To project the costs of implementing the alternatives in the Navy's 2023 shipbuilding plan, CBO estimated the cost of each ship the Navy intends to purchase between 2023 and 2052.²⁰ For ships under construction, the estimates were based in part on the Navy's data about actual costs. For ships yet to be built, CBO based the estimates primarily on information about the cost-to-weight ratio of similar ships acquired in the past.

Specifically, the agency used the cost per thousand tons of lightship displacement, which is the weight of the

water a ship displaces without its crew, stores, ammunition, fuel, or other liquids. CBO then adjusted its estimates to reflect the effects of rate and learning. Rate is the reduction in average overhead costs that occurs as a shipyard builds multiple ships of the same type simultaneously; learning refers to the efficiencies that shipyards gain as they produce additional ships of a given type. Those effects were applied to the estimated cost of the first ship of a class to estimate the costs for all subsequent ships of that class. Thus, CBO's estimate of the cost of the lead ship of a class drove its estimate of the costs of subsequent ships of that class.²¹

For ships that have yet to be designed, CBO developed its estimates on the basis of the ships' likely size and capabilities. All cost estimates for specific ships exclude outfitting and postdelivery costs, which typically add at least 3 percent to a ship's cost (included as "other items" in estimates of total costs). CBO's estimates also reflect the expectation that costs of labor and materials would continue to grow at a rate that is 1.12 percent faster in the naval shipbuilding industry than in the economy as a whole, as such costs have grown for the past several decades.

Aircraft Carriers

Over the 2023–2052 period, the Navy would buy 5 CVN-78 Ford class aircraft carriers under Alternatives 1 and 2 or would buy 7 of them under Alternative 3. To project the costs of those ships, CBO considered the costs of the first 4 carriers of the class, which have already received some or all of their funding.

The first ship of the class, the USS *Gerald R. Ford* (CVN-78), cost \$13.3 billion in nominal dollars appropriated between 2001 and 2018.²² CBO used the Navy's inflation index for naval shipbuilding to convert that amount to \$17.3 billion (in 2022 dollars)—which is 25 percent more than the Navy's corresponding estimate when the ship was first authorized in 2008.²³ Neither the Navy's nor CBO's estimate includes the \$6 billion in research

20. In this section of its past reports on the Navy's shipbuilding plans, CBO discussed every major shipbuilding program in some detail. In this report, however, the agency focuses on the most important shipbuilding programs, as measured by cost or quantity, and on those programs for which there is a significant difference between the Navy's and CBO's estimates.

21. For an explanation of how CBO combines the different factors in its cost model, as well as a detailed example of that process applied to a particular ship, see Congressional Budget Office, *How CBO Estimates the Cost of New Ships* (April 2018), www.cbo.gov/publication/53785.

22. That amount does not include costs paid from other Navy accounts to make the ship operational after it was commissioned.

23. For more information about calculating the costs of aircraft carriers, see Congressional Budget Office, *Inflation in the Costs of Building Aircraft Carriers* (April 2016), www.cbo.gov/publication/51469.

and development costs for the entire class of ships. Because construction of the lead ship is finished, CBO used the end cost for that ship to estimate the cost of successive ships in the class.

The next carrier slated for delivery, the *John F. Kennedy* (CVN-79), is expected to be completed in 2024 and deployed in 2026. The Congress first appropriated advance procurement funding for the ship in 2007, officially authorizing its construction in 2013. As a result of cost overruns, the planned appropriations for the ship are expected to be completed in 2024. (Under the 2020 shipbuilding plan, the Navy had not anticipated that additional funding would be necessary after 2018.) The Navy estimates that the ship will cost \$13.9 billion (in 2022 dollars, or \$12.7 billion in nominal dollars). The cost overruns that have arisen over the past three years have now pushed the Navy's estimate slightly beyond what CBO's cost model predicts, which is \$13.8 billion (in 2022 dollars). (In its report on the fiscal year 2020 shipbuilding plan, CBO's estimate was 9 percent higher than the Navy's.)²⁴

In 2018, the Congress authorized the third carrier of the class, the *Enterprise* (CVN-80). Appropriations for that ship began in 2016 and are expected to be complete by 2025. In 2019, the Congress authorized the Navy to purchase materials jointly for the CVN-80 and the next ship, the CVN-81, to save money by buying in greater quantities. It also authorized the Navy to change the sequencing involved in building the ships to gain greater efficiencies in their construction. Although that legislative action is known as a two-carrier buy, the ships would not be built at exactly the same time. Purchasing the two ships together would accelerate the CVN-81's construction by only one year, compared with buying them individually.

In the 2023 budget, the Navy estimated that the CVN-80 will cost \$12.3 billion (in 2022 dollars, or \$12.6 billion in nominal dollars). In contrast, CBO estimates that the CVN-80 will cost \$13.0 billion (in 2022 dollars), about 6 percent more than the Navy's estimate. In information provided to CBO when the Navy implemented the two-ship buy strategy, the Navy indicated that there is about an 80 percent chance that the final cost will be more than it estimated. On the basis of the history of cost growth

in the carrier program thus far, the savings that the Navy estimated would result from the two-carrier approach appears more likely to increase the risk of future cost growth than to yield budgetary savings. (In fact, in its December 2021 Selected Acquisition Report on the CVN-78 program, the Navy reports that procurement costs have grown by \$1.3 billion since the December 2019 report was completed. Almost all of that increase is attributable to the CVN-79, CVN-80, and CVN-81.)

Estimates for the CVN-81 show a similar pattern. In the 2023 budget, the Navy estimated that the ship will cost \$11.8 billion (in 2022 dollars, or \$12.9 billion in nominal dollars) using the two-carrier buy strategy but also indicated that there is a 60 percent chance that the final cost will be higher than that estimate. CBO estimates that the CVN-81 will cost \$12.5 billion (in 2022 dollars), which is 6 percent more than the Navy's estimate. (In its report on the fiscal year 2020 shipbuilding plan, CBO's estimate was 14 percent more than the Navy's estimate, which has increased since then.)

In the 2023 shipbuilding plan, the Navy estimates that the 5 carriers purchased under Alternatives 1 and 2 would each cost about \$16 billion (in 2022 dollars), on average, and the 7 carriers purchased under Alternative 3 would each cost about \$14 billion (see Table 7). Under that third alternative, the Navy expects substantial savings from purchasing 1 carrier every four years and repeatedly using the two-carrier buy strategy over the next 30 years. Nevertheless, those amounts represent a substantial increase compared with the Navy's estimates in its fiscal year 2020 and December 2020 shipbuilding plans. In contrast, CBO estimates that under the first two alternatives, carriers would cost, on average, \$15.7 billion—3 percent less than the Navy's estimate. CBO's estimate for carrier purchases under the third alternative is \$15.1 billion per ship—8 percent more than the Navy's estimate. Although using the two-carrier buy strategy should generate savings, it is not clear that the large savings the Navy anticipates would occur. Realized savings will be better understood once the CVN-80 and CVN-81 are complete.

Submarines

Under all three alternatives in the 2023 plan, the Navy would buy 11 new Columbia class submarines over the next 15 years. (The first Columbia class ship was ordered in 2021.) In addition, the service plans to purchase 4 or 6 large payload submarines (depending on which

24. Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2020 Shipbuilding Plan* (October 2019), p. 18, www.cbo.gov/publication/55685.

Table 7.

Comparison of the Navy's and CBO's Estimates of the Construction Costs of Major New Ships Under the Navy's 2023 Plan

Billions of 2022 Dollars

Ship Class	Number of Ships Purchased	Total Costs per Class Over the 2023–2052 Period		Average Costs per Ship Over the 2023–2052 Period	
		Navy's Estimates	CBO's Estimates	Navy's Estimates	CBO's Estimates
Alternative 1					
CVN-78 Gerald R. Ford Class Aircraft Carriers ^a	5	92	93	16.0	15.7
SSBN-826 Columbia Class Ballistic Missile Submarines ^b	11	81	92	8.1	8.8
Large Payload Submarines ^c	4	28	34	7.2	8.6
SSN-774 Virginia Class Attack Submarines With VPMs	23	76	78	3.3	3.3
SSN(X) Next-Generation Attack Submarines	31	173	196	5.6	6.3
DDG-51 Flight III Arleigh Burke Class Destroyers	16	34	34	2.1	2.1
DDG(X) Next-Generation Destroyers	38	89	125	2.3	3.3
FFG-62 Constellation Class Frigates	17	16	21	0.9	1.2
FFG-62 Flight II Frigates	35	31	43	0.9	1.2
LHA-6 America Class Amphibious Assault Ships	5 ^d	24	27	4.3	4.5
LPD(X) Next-Generation Amphibious Ships	4	8	11	2.1	2.8
Light Amphibious Warships	40	9	10	0.2	0.3
T-AO-205 John Lewis Class Oilers	13	9	10	0.7	0.7
T-AOL Next-Generation Logistics Ships	18	3	3	0.1	0.2
T-AKE(X) Replenishment Ships	12	9	12	0.7	1.0
Alternative 2					
CVN-78 Gerald R. Ford Class Aircraft Carriers ^a	5	92	93	16.0	15.7
SSBN-826 Columbia Class Ballistic Missile Submarines ^b	11	81	92	8.1	8.8
Large Payload Submarines ^c	6	41	47	7.1	7.9
SSN-774 Virginia Class Attack Submarines With VPMs	33	110	123	3.3	3.7
SSN-774 Virginia Class Attack Submarines	16	45	60	2.8	3.7
SSN(X) Next-Generation Attack Submarines	17	96	126	5.6	7.2
DDG-51 Flight III Arleigh Burke Class Destroyers	18	38	41	2.1	2.1
DDG(X) Next-Generation Destroyers	29	70	99	2.4	3.4
FFG-62 Constellation Class Frigates	11	10	13	0.9	1.2
FFG-62 Flight II Frigates	44	39	53	0.9	1.2
LHA-6 America Class Amphibious Assault Ships	5 ^d	24	27	4.3	4.5
LPD(X) Next-Generation Amphibious Ships	7 ^e	15	19	2.1	2.7
Light Amphibious Warships	34	8	9	0.2	0.3
T-AO-205 John Lewis Class Oilers	13	9	10	0.7	0.7
T-AOL Next-Generation Logistics Ships	24	3	5	0.1	0.2
T-AKE(X) Replenishment Ships	11	8	11	0.7	1.0

Continued

alternative is implemented) that could carry large numbers of missiles or special operations forces.

By far the greatest difference among the three alternatives is in the category of attack submarines. Under Alternative 1, the Navy would continue to buy Virginia class submarines with the Virginia payload module until 2036 and would begin construction of a new and much more capable next-generation attack submarine, designated as the SSN(X), in 2034. The Navy would do the same under Alternative 3, although it would buy slightly more of each type of submarine. Alternative 2, however, significantly

departs from that pattern: The Navy would continue to buy Virginia class submarines with VPMs, resume purchases of Virginia class submarines without VPMs in 2030, and start buying the SSN(X) in 2034, keeping all of those types of submarines in production through 2052.

Ballistic Missile Submarines. SSBNs, which carry Trident ballistic missiles, constitute the sea-based component of the United States' strategic nuclear triad. (The other two components are land-based intercontinental ballistic missiles and strategic bombers.) The cost of the 11 Columbia class submarines included in the



Table 7.

Continued

Comparison of the Navy's and CBO's Estimates of the Construction Costs of Major New Ships Under the Navy's 2023 Plan

Billions of 2022 Dollars

Ship Class	Number of Ships Purchased	Total Costs per Class Over the 2023–2052 Period		Average Costs per Ship Over the 2023–2052 Period	
		Navy's Estimates	CBO's Estimates	Navy's Estimates	CBO's Estimates
Alternative 3					
CVN-78 Gerald R. Ford Class Aircraft Carriers ^a	7	100	108	14.0	15.1
SSBN-826 Columbia Class Ballistic Missile Submarines ^b	11	81	92	8.1	8.8
Large Payload Submarines ^c	4	30	33	7.2	8.3
SSN-774 Virginia Class Attack Submarines With VPMs	27	89	93	3.3	3.3
SSN(X) Next-Generation Attack Submarines	33	184	206	5.6	6.2
DDG-51 Flight III Arleigh Burke Class Destroyers	17	36	36	2.1	2.1
DDG(X) Next-Generation Destroyers	47	109	146	2.3	3.1
FFG-62 Constellation Class Frigates	17	15	20	0.9	1.2
FFG-62 Flight II Frigates	40	36	47	0.9	1.2
LHA-6 America Class Amphibious Assault Ships	4 ^d	20	20	4.3	4.2
LPD(X) Next-Generation Amphibious Ships	9	19	23	2.1	2.5
Light Amphibious Warships	49	11	13	0.2	0.3
T-AO-205 John Lewis Class Oilers	13	9	10	0.7	0.7
T-AOL Next-Generation Logistics Ships	22	3	4	0.1	0.2
T-AKE(X) Replenishment Ships	12	9	12	0.7	1.0

Data source: Congressional Budget Office, using data from the Department of the Navy. See www.cbo.gov/publication/58447#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; T-AOL = light oiler or next-generation logistics ship; VPMs = Virginia payload modules.

- a. In CBO's and the Navy's estimates for aircraft carriers, total costs per class under all three alternatives include remaining funding for the CVN-80 and CVN-81 authorized before 2022 but, under Alternative 3, exclude some funding for the carrier the Navy would purchase in 2052 because that money would not be budgeted until 2053 or later. Estimates for the average cost per ship exclude the CVN-80 and CVN-81 but include all funding for the carrier that would be bought in 2052 under Alternative 3.
- b. In CBO's and the Navy's estimates for ballistic missile submarines, total costs exclude \$15.6 billion in funding appropriated before 2023 for the first and second ships of the class, but average costs per ship include that funding. Both the Navy's and CBO's estimates for the program also include funding to improve the submarine industrial base, but the average unit cost does not include it.
- c. In CBO's and the Navy's estimates for large payload submarines, total costs exclude some funding for ships that would be authorized in 2051 or 2052 but would not be budgeted until 2053 or later, but average costs per ship include that funding.
- d. The LHA counted in 2023 was authorized by the Congress in 2020. CBO therefore subtracts the 2023 ship from the number of ships the Navy would purchase under all three alternatives.
- e. Under Alternative 2, the Navy accidentally omitted from its ship count the LPD-17 replacement it would purchase in 2052. CBO counted that ship.

2023 shipbuilding plan is one of the most significant uncertainties in the Navy's and CBO's analyses of future shipbuilding costs. Under the 2023 plan, the second Columbia class ship would be purchased in 2024; 1 ship per year would then be purchased from 2026 to 2035.²⁵

The Navy currently estimates that the first Columbia class ship will cost \$15.3 billion (in 2022 dollars) and that subsequent ships in that class would cost \$7.4 billion, on average. The total procurement cost for the 12 submarines would be \$96.7 billion (which includes appropriations of \$15.5 billion from 2017 to 2022), or \$8.1 billion per ship, on average.

25. For additional information, see Ronald O'Rourke, *Navy Columbia (SSBN-826) Class Ballistic Missile Submarine Program: Background and Issues for Congress*, Report R41129, version 232 (Congressional Research Service, August 25, 2022), <https://go.usa.gov/xSvDe>.

According to the Navy's estimate, the cost per thousand tons of displacement for the first Columbia class ship



would be 11 percent less than that of the first Virginia class attack submarine. (In its fiscal year 2020 shipbuilding plan, the Navy estimated that the difference would be 14 percent.) The costs of lead ships of new classes of submarines built in the 1970s and 1980s provide little evidence that ballistic missile submarines are cheaper to build, per ton, than attack submarines, and the Navy has stated that there is a 50 percent chance that the cost of the first Columbia class submarine and subsequent ships of the class will exceed its estimates.²⁶

Overall, CBO's estimates for the entire Columbia class program are 9 percent greater than the Navy's. CBO estimates that purchasing the first Columbia class submarine would cost \$16.0 billion—\$700 million more than the Navy estimates. Including appropriations from 2017 to 2022, CBO estimates that, all told, 12 Columbia class submarines would cost \$105 billion (of which \$92 billion would be appropriated between 2023 and 2036), or \$8.8 billion each, on average—\$700 million more per submarine than the Navy estimates. That average cost is based on the \$16.0 billion estimated cost of the lead submarine and an average estimated cost of \$8.1 billion per ship for the remaining 11 submarines.

Costs for the Columbia class submarines could, however, exceed both the Navy's and CBO's estimates. The new SSBN will be the largest submarine the United States has ever built. It is expected to reuse some technology and components from the Virginia class submarine, but it would also include many new elements, such as an all-electric drive system, an X-stern ship control system (in which the rear rudders and dive planes are shaped like an 'X' rather than a '+', as they are on the Ohio class submarines), a new missile compartment, and a nuclear reactor designed to last the entire 42-year service life of the submarine. Production of the new SSBN has already faced one unforeseen challenge: Many of the welds on its missile tubes have had to be repeated, further tightening the production schedule. Such challenges are not uncommon with lead ships, and they may indicate future difficulties with the first Columbia class ship when it enters more complicated phases of construction.

Large Payload Submarines. As with previous shipbuilding plans, the alternatives in the 2023 plan include a

program to buy "large payload-based submarines."²⁷ The ships would probably perform missions similar to those currently conducted by SSGNs (guided missile submarines) and, in the future, by Virginia class ships with VPMs, as well as other missions. The first ship would be ordered after production of the Columbia class ceased—in 2042 under Alternative 1, in 2037 under Alternative 2, or in 2038 under Alternative 3. The Navy would then purchase 1 ship every three or four years through 2052, for a total of 4 ships under Alternatives 1 and 3, or 6 ships under Alternative 2.

The Navy's plan provides little information about the size and capabilities of the large payload submarine. CBO's and the Navy's estimates reflect the expectation that the ship would be based on the Columbia class hull with its missile tube section reconfigured to perform various missions and that other sections of the ship would receive the necessary equipment and modifications to support the payloads the submarine might carry. The Navy estimates that each ship would cost \$7.2 billion, on average, under Alternatives 1 and 3, and \$7.1 billion under Alternative 2; CBO estimates they would each cost \$8.6 billion, on average, under Alternative 1, \$7.9 billion under Alternative 2, and \$8.3 billion under Alternative 3.

Attack Submarines. The alternatives in the 2023 shipbuilding plan take substantially different approaches to the future of the attack submarine force. Under Alternatives 1 and 3, the Navy would continue to buy Virginia class ships with VPMs through 2036 but would also purchase the first new SSN(X) in 2034 and then put that ship into serial production in 2037. Overall, under Alternative 1, the Navy would buy 23 Virginia class ships with VPMs and 31 SSN(X)s. Under Alternative 3, with more money to spend, it would purchase 27 Virginia class submarines with VPMs and then 33 SSN(X)s. The Navy would buy both types of submarines at roughly the rate of 2 per year over the next three decades.

In contrast, Alternative 2 offers the largest and most challenging program for constructing attack submarines: The Navy would buy 33 Virginia class ships with VPMs, 16 of them without VPMs, and 17 SSN(X)s—about half the number of next-generation submarines that would be purchased under the other alternatives. It would buy those submarines mostly at a rate of 2 per year, although

26. Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2020 Shipbuilding Plan* (October 2019), pp. 19–22, www.cbo.gov/publication/55685.

27. Department of the Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2023* (April 2022), p. 15, <https://go.usa.gov/xjtjj> (PDF).

it would sometimes buy 3 per year. Critically, under Alternative 2, all three classes of attack submarines would remain in production through 2052. That could pose substantial challenges for the submarine industrial base, which would be finishing production of the Columbia class at about the same time (in the 2030s) that production of large payload submarines would begin (see Figure 9).

CBO's and the Navy's cost estimates for the Virginia class ships (all with VPMs) are the same for Alternatives 1 and 3—\$3.3 billion, on average, for each ship—but the estimates for ships diverge substantially for Alternative 2 (see Table 7 on page 22). The Navy estimates that Virginia class ships with VPMs would each cost \$3.3 billion under all of the alternatives, whereas the cost under Alternative 2 for ships without VPMs would be \$2.8 billion. CBO's estimates are higher under Alternative 2: Because Virginia class ships would continue in production through 2052 under that alternative, and the real growth in their production costs would thus compound over a longer period, CBO estimates that both types of ships would cost \$3.7 billion each, on average. Even though Virginia class ships with VPMs are much larger than ordinary ships of that class, the effects of rate, learning, and real cost growth would cause the average price of both types of submarines to be the same over the 30-year period. Ships with VPMs are nonetheless fundamentally more expensive than those without them. A Virginia class submarine with a VPM would cost \$4.4 billion in 2051, for example, but without a VPM would cost \$4.0 billion that year, CBO estimates.

Estimating the costs of the SSN(X) is difficult because the Navy has not yet determined its capabilities or size. In the past, the Navy has indicated that, like the Seawolf class submarine, the next-generation attack submarine should be faster, stealthier, and able to carry more torpedoes than Virginia class ships. The service has also indicated that it wants the SSN(X) to have vertical launch capability, an attribute of the Improved Los Angeles class submarine and the original Virginia class submarine. CBO's cost estimates therefore reflect the assumption that the SSN(X) would be similar to a Seawolf class submarine but would have an entirely new design. The submarine's advanced features would make it as quiet and stealthy as possible; it could launch missiles from missile cells and would contain a torpedo room the size of those on Seawolf class submarines.

As a result, CBO estimated the size of the SSN(X) to be 10,100 tons of displacement when fully submerged—about 11 percent larger than a Seawolf class ship. The agency estimated the amount of the increase by comparing the displacements of the original Los Angeles class submarine and the Virginia class submarine. In that example, the combined effect of a new generation of submarine technology and a vertical missile capability caused an 11 percent increase in displacement for the Virginia class ships compared with the Los Angeles class. Another way of estimating the size of the SSN(X) is to compare the change in displacement between the Ohio class SSBN and the Columbia class SSBN. The new generation of submarine technology included on the latter increased its displacement by about 21 percent.²⁸ CBO used the smaller estimate (11 percent) because it is based on displacements of attack submarines rather than ballistic missile submarines.

On the basis of that analysis, CBO estimates that the average cost of each SSN(X) would range from \$6.2 billion to \$7.2 billion under the Navy's alternatives. The Navy estimates that each SSN(X) would cost \$5.6 billion under all three alternatives. The range of CBO's estimates reflects the different construction schedules for the SSN(X) in the Navy's plan. Under Alternatives 1 and 3, the SSN(X) would be built in similar quantities and mostly at a rate of 2 per year from 2037 to 2052. Under Alternative 2, however, only half that number of SSN(X)s would be built, resulting in less savings from the learning effect and less cost reduction for the program over the 30-year period.

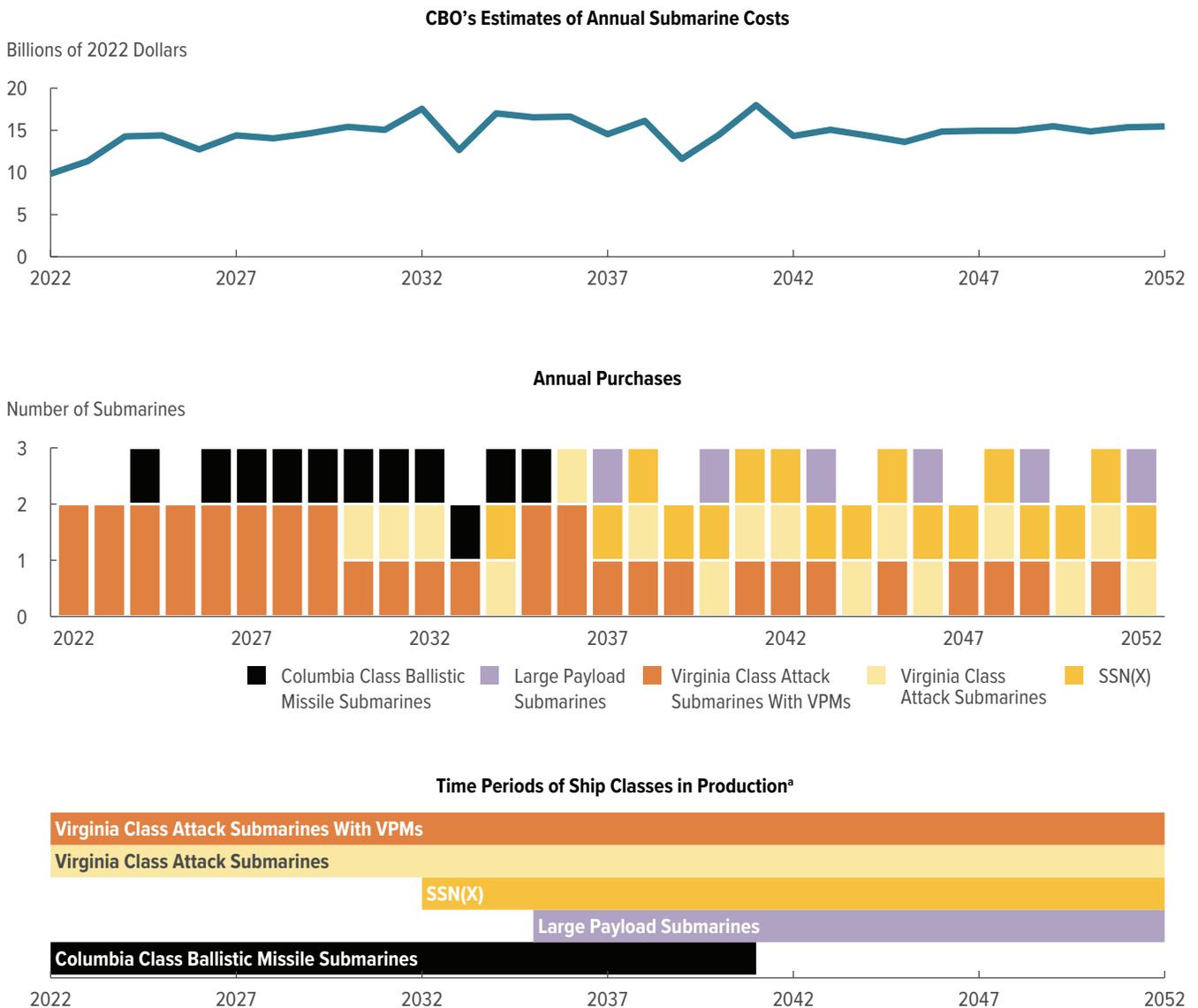
Large Surface Combatants

The alternatives in the Navy's 2023 plan call for the purchase of the same types of destroyers as several previous plans did but in different quantities and on different schedules. Currently, the Navy's fleet includes 70 DDG-51 destroyers consisting of three variants designated as Flight I, Flight II, and Flight IIA. Additionally, 5 Flight IIAs and 14 Flight IIIs (an upgraded design) are being built or have been authorized for construction by the Congress. Under Alternatives 1 and 3, the service would

28. In a personal communication, Ronald O'Rourke, a naval affairs analyst with the Congressional Research Service, suggested comparing displacements of Ohio class and Columbia class ships as an additional way to estimate the size of the SSN(X). To compare displacements of Ohio class and Columbia class submarines, CBO adjusted its calculations to account for the fact that an Ohio class ship carries 24 sea-launched ballistic missiles, whereas a Columbia class ship carries 16 of them.

Figure 9.

Submarine Procurement Under Alternative 2 in the Navy's 2023 Plan



Data source: Congressional Budget Office, using data from the Department of the Navy. See www.cbo.gov/publication/58447#data.

SSN(X) = next-generation attack submarine; VPMs = Virginia payload modules.

a. For new classes of ships, CBO marks the beginning of production with the appropriation of advance procurement funding, which typically occurs two years before the lead ship (the first ship of the class) is authorized by the Congress. Advance procurement funding is used for items with long lead times, such as a ship's nuclear propulsion plant.

purchase 16 or 17 more DDG-51 Flight IIIs by 2032; under Alternative 2, the Navy would acquire 18 and intermittent production would continue through 2039. In all three cases, construction of the next-generation destroyer, designated as DDG(X), would commence in 2030.

DDG-51 Flight III Destroyers. To improve future ballistic missile defense capabilities beyond those provided by

existing DDG-51s—and to replace its Ticonderoga class cruisers when they are retired in the 2020s—the Navy is modifying the design of the DDG-51 Flight IIA destroyer to create a Flight III configuration. That modification will incorporate the new Air and Missile Defense Radar (AMDR, also known as SPY-6), which will be larger and, according to recent testing, nearly 100 times more powerful than the radar on current



DDG-51s.²⁹ For the AMDR to operate effectively in the new Flight III configuration, however, the ships must have a greater capacity to generate electrical power and cool major systems.³⁰

CBO estimates that, with those improvements incorporated into the Flight III's design, and with the associated increases in its displacement, the average cost of each ship, under any of the alternatives in the 2023 plan, would be \$2.1 billion—the same as the Navy's estimate. Compared with estimates based on prior shipbuilding plans, both CBO's and the Navy's cost estimates for Flight IIIs have increased because of higher actual production costs for those ships.

DDG(X) Next-Generation Destroyers. According to the 2023 plan, production of the next-generation class of destroyers would start in 2030, two years later than envisioned in the December 2020 plan and five years later than in the fiscal year 2020 plan. The Navy would buy 38 ships under Alternative 1, 29 under Alternative 2, or 47 under Alternative 3. Under Alternatives 1 and 3, it would buy 2 ships per year beginning in 2033, and purchases would continue at that rate for most of the time through 2052. (The Navy would occasionally buy 1 ship per year under Alternative 1 and occasionally 3 ships per year under Alternative 3.) Under Alternative 2, however, purchasing would begin more slowly; the Navy would buy fewer than 1 ship per year until 2040 and would then alternate between 1 and 2 ships per year through 2052.

The Navy estimates that the average cost of the DDG(X) would vary from \$2.3 billion per year under Alternatives 1 and 3 to \$2.4 billion per year under Alternative 2. (The greater cost under Alternative 2 results from buying the ship more often at a rate of one per year instead of the higher rates under the other alternatives, which would decrease the benefit from the rate effect.) That estimate is about the same as the Navy's estimate in its 2020 shipbuilding plan.

29. Jason Sherman, "Navy Determines SPY-6 Radar Three Times Stronger Than Original Requirement," *Inside Defense* (May 3, 2019), <https://tinyurl.com/y4zyghq7>.

30. Ronald O'Rourke, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, Report RL33745, version 240 (Congressional Research Service, August 29, 2022), <https://go.usa.gov/xSKzG>, and *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, Report RL32109, version 264 (Congressional Research Service, August 26, 2022), <https://go.usa.gov/xSKzU>.

According to Navy officials, the new DDG(X)'s combat capabilities would be equivalent or superior to those of the DDG-51 Flight III; it would also have a larger hull, substantially more power, more stealth characteristics, and a greater capacity to accommodate the installation of new weapon systems and other capabilities in the future.³¹ In its recent shipbuilding plans, the Navy provided few details about the size the DDG(X). Previously, CBO estimated that the ship would displace 12,000 tons—about 2,000 tons more than the DDG-51 Flight III. Now, however, the Navy has indicated that the initial design prescribes a displacement of 13,500 tons. If that is the case, then the Navy's estimates imply that the DDG(X) would cost 10 percent more than the DDG-51 Flight III but would have a full-load displacement that is 40 percent greater.

Such an outcome, however, seems unlikely on the basis of the history of building new surface combatants. For example, in the 2000s, the Navy estimated that the Zumwalt class DDG-1000 guided missile destroyer would cost only slightly more than the DDG-51s that were then in production, even though the DDG-1000 was 50 percent larger than the DDG-51. Ultimately, costs for the DDG-1000 increased by about 45 percent (see Figure 10).³² However, the Navy contends that the case of the DDG(X) will differ from that of the DDG-1000 because the former ship would have a combat system and radar substantially similar to those of the DDG-51 Flight III and would only require designing a new hull and power system. In contrast, the DDG-1000 included new technology affecting every major aspect of the ship's design—its hull, power system, radar, and weapons, among other things.³³

31. Ronald O'Rourke, *Navy DDG(X) Next-Generation Destroyer Program: Background and Issues for Congress*, Report IF11679, version 27 (Congressional Research Service, August 29, 2022), <https://go.usa.gov/xSKSR>.

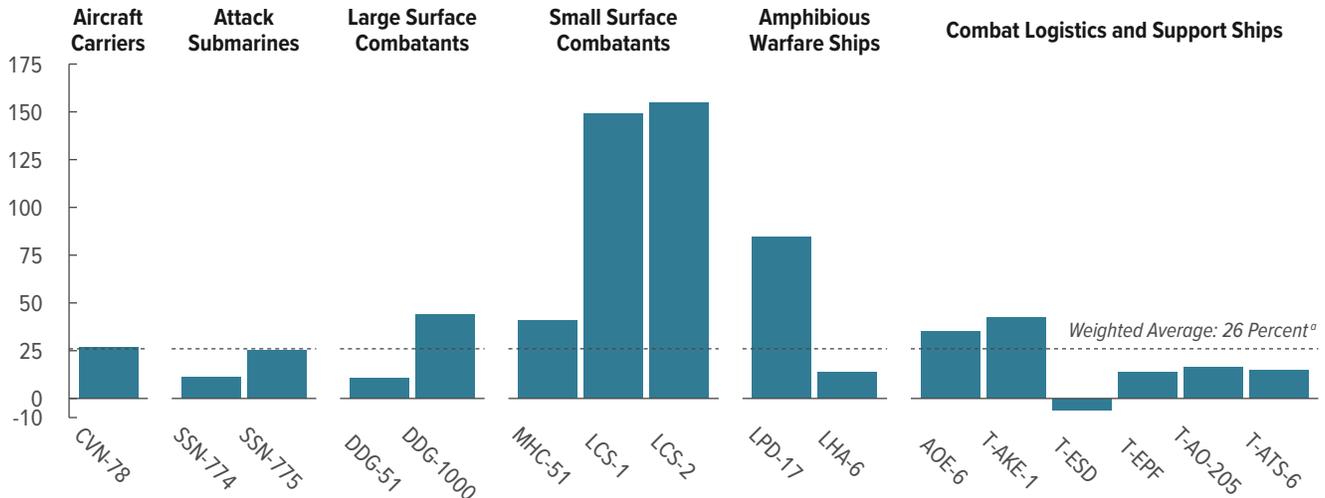
32. Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2020 Shipbuilding Plan* (October 2019), www.cbo.gov/publication/55685.

33. In the 1980s, the Navy sought to build a lower cost surface combatant, the DDG-51, by reusing the combat systems and propulsion train of the CG-47 cruiser while building a smaller ship. Using that technique, the Navy was able to build a less expensive ship, but the cost-to-weight ratio of the lead ships was roughly the same. Similarly, the cost-to-weight ratio of the last 11 cruisers was about the same as that of the 12 destroyers built after the lead ship.

Figure 10.

Cost Growth in Lead Ships, 1985 to 2020

Percent



Cost growth in lead ships of various classes almost always exceeds 10 percent.

Data source: Congressional Budget Office, using data from the Department of the Navy. See www.cbo.gov/publication/58447#data.

The lead ship is the first ship of its class. For most ships, CBO calculated cost growth using the first and last mentions of a ship in the books that accompany each year's budget: *Justification of Estimates, Shipbuilding and Conversion, Navy*. For AOE-6, MHC-51, T-EPF, and DDG-51, CBO relied on information papers provided by the Navy for the final estimates and on the Budget Appendixes for the years those ships were authorized.

AOE = fast combat support ship; CVN = nuclear-powered aircraft carrier; DDG = guided missile destroyer; LCS = littoral combat ship; LHA = amphibious assault ship; LPD = amphibious transport dock; MHC = coastal mine hunter; SSN = attack submarine; T-AKE = ammunition cargo ship; T-AO = oiler; T-ATS = towing, salvage, and rescue ship; T-EPF = expeditionary fast transport; T-ESD = expeditionary transfer dock.

a. CBO calculated the weighted average by adding the initial costs for all ships in the data set and comparing the result with the sum of all final costs for the ships in the data set. The unweighted average cost growth is 46 percent.

As a result of the increase in the size of the DDG(X), CBO estimates that its average cost would range from \$3.1 billion to \$3.4 billion under the Navy's three alternatives (or 34 percent to 42 percent more than the Navy's estimates), depending on which alternative is being compared. To fund the DDG(X) program from 2023 to 2052, the Navy would need \$125 billion under Alternative 1, \$99 billion under Alternative 2, and \$146 billion under Alternative 3, CBO estimates. Overall, the program represents roughly 30 percent to 40 percent of the difference between the Navy's and CBO's estimates of the total cost of the alternatives in the 2023 shipbuilding plan. The uncertainty about the ultimate size and capabilities of the next-generation destroyer suggests that its final cost could differ substantially from both the Navy's and CBO's estimates.

Small Surface Combatants

The Navy would purchase a similar number of small surface combatants under all three alternatives: 52 under Alternative 1, 55 under Alternative 2, or 57 under Alternative 3. The major difference between them is that, under Alternatives 1 and 3, the Navy would buy 17 FFG-62 Constellation class guided missile frigates, the type of frigate that is currently being built for the service, whereas it would buy only 11 such ships under Alternative 2. The Navy would then begin purchasing an upgraded version of the FFG-62, called the Flight II, starting in 2035 under Alternative 1, in 2029 under Alternative 2, or in 2033 under Alternative 3.

The inclusion of the FFG-62 Flight II represents a major difference between the 2023 plan and previous shipbuilding plans: In the past, the Navy referred to that follow-on ship as a future small surface combatant and provided no information about its design or capabilities.

The Flight II designation for that follow-on ship in the 2023 plan suggests that it would be roughly the same size as the FFG-62, displacing about 7,300 tons and equipped with upgraded combat and weapon systems. The Navy's estimated average cost for the FFG-62 (for both Flights I and II) under all three alternatives is about \$900 million per ship. CBO estimates that both types of ships would cost \$1.2 billion, on average.³⁴

Amphibious Warfare Ships

The Navy is preparing its new force structure assessment, in which it will reevaluate the size and composition of the amphibious warfare force. In the meantime, both the Chief of Naval Operations' *Navigation Plan 2022* and recent testimony by the Marine Corps Commandant called for a force of 31 large and midsize amphibious warfare ships, the size of the current force.³⁵ However, the Navy would maintain a force of fewer than 31 such ships under any of the alternatives in the 2023 plan.

The CNO's report calls for 18 light amphibious warships, and the Commandant's testimony calls for between 18 and 36 of them; there are none in the current fleet. By 2041, the Navy would have built and

would then maintain a force of about 25 LAWs under Alternative 1; under Alternative 2, it would have built and would then maintain at least 18 of those ships. Alternative 3 calls for a force of 35 LAWs but would not achieve that number until 2051.

Compared with estimates in earlier plans, the cost estimates that have changed the most in the Navy's 2023 plan are those for LHA-6 America class amphibious assault ships. In its fiscal year 2020 and December 2020 plans, the Navy's estimated cost for each LHA-6 was \$700 million less than CBO's. In the 2023 plan, the service substantially increased that estimate. As a result, CBO's and the Navy's estimates for the future versions of the LHA-6 are now similar. The Navy estimates that each ship would cost \$4.3 billion (in 2022 dollars), whereas CBO estimates they would cost \$4.5 billion under Alternatives 1 and 2, and \$4.2 billion under Alternative 3.

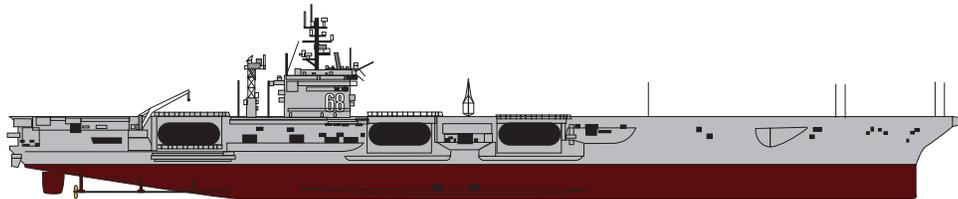
In contrast, the Navy's and CBO's cost estimates for the LPD(X), a new class of ships to replace the LPD-17s, remain far apart. The Navy estimates a cost of \$2.1 billion per ship, whereas CBO estimates a range of \$2.5 billion to \$2.8 billion per ship. Most of the difference lies in the fact that CBO's constant-dollar estimates account for historically observed real growth in the costs of labor and materials in the shipbuilding industry, but the Navy's estimates do not. Because the Navy would begin to purchase the replacement ships in the mid-2030s under Alternative 3, or in the 2040s under Alternatives 1 and 2, the effect of that real growth, which compounds over time, would be significant.

34. For a discussion of the differences between the Navy's and CBO's estimates of the costs of the FFG-62 class program, see Congressional Budget Office, *The Cost of the Navy's New Frigate* (October 2020), www.cbo.gov/publication/56669.

35. Chief of Naval Operations, *Navigation Plan 2022* (July 2022), p. 10, <https://go.usa.gov/xSnc8>; and Statement of General David H. Berger, Commandant of the Marine Corps, as Delivered to Congressional Defense Committees on the Posture of the United States Marine Corps (2022), p. 5, <https://go.usa.gov/xSncM> (PDF).

Appendix: 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

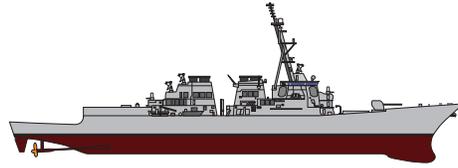


Virginia Class SSN-774

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, 26 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

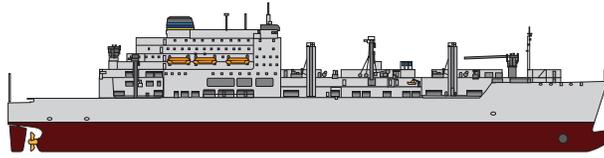


San Antonio Class LPD-17

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.

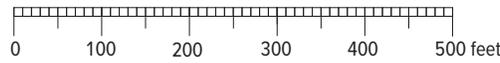


Combat Logistics and Support Ships



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.



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About This Document

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



Phillip L. Swagel
Director
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